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An Inspiring Achievement

YEAR after year, in city after city, the central-station company issues a financial statement for the information of its stockholders. Usually this statement consists of an abstract of the president's annual report, followed by the treasurer's list of assets and liabilities. To the average stockholder it is about as interesting as an ancient Assyrian inscription.

Only the accountant has understood these cryptic communications, published because the law compels it. But the interesting human story of the organization, its plans and its accomplishments, has not been told. At last, however, the inspiration has come. The Commonwealth Edison Company, shaking off the hobbles of tradition, has shown the way.

ON THE evening of Feb. 27 there were gathered together in Chicago about 1,500 customer-stockholders of the Commonwealth Edison Company. There they were, that mysterious throng that most executives have thought of so impersonally. President Samuel Insull talked to them there and to the other 23,000 absent shareholders, waiting to read about it in the morning papers.

He told them all about their company—what it has been doing, its organization, its properties, its plan. Other officials talked. The men of the company looked upon these men and women in the audience, and the stockholder *en masse* became more of a human personality. The shareholders received from them a human picture of the corporation, an easy understanding of its possessions, achievements, prospects and ideals.

The company then published and distributed among all its stockholders, not a cold, repelling tabulation of statistics, but a "Year Book" to carry by pictures and the printed page the same kind of a human story that the meeting provided through a personal contact. In it you find Mr. Insull's address and an intimate message concerning the Commonwealth Edison Company, so pungent with interesting facts and ingenious diagrams that it reads like a romance. Then comes the financial statement, each item clear in its meaning. How this is done is told on another page.

In short, the Commonwealth Edison Company has succeeded in discovering itself to its 24,571 stockholders by simply picturing itself in terms of common understanding.

ALMOST every utility corporation in the land is suffering today for want of this kind of an interpretation to the public and its customers. But up to now men have not hit upon the way to do it. The National Electric Light Association can render no greater service to the industry than to reprint this Commonwealth Edison "Year Book" and place it in the hands of central-station executives. It shows the way.

Thomas Duncan

A pioneer in the development of the electric meter, an inventor of prominence and a business leader.

THAT the electrical industry has made such rapid progress is largely accounted for by the fact that precise measuring instruments were early available. These meters gave accurate data on which to base estimates or to analyze performances. Even though ignorant of electrical theory, the ordinary business man early appreciated an accurate measuring instrument, gained confidence from its indications and was able to gage more accurately the value of his investments.

Thomas Duncan is one of the few men who have seen almost the entire development of the electric meter and been in intimate touch with all of its phases. He is both a maker and an inventor, for he holds upward of 200 patents on electrical instruments and is the owner and organizer of a large meter-manufacturing establishment. Among the most important of his contributions to this branch of the art has been the invention of a light-load-compensating device for maintaining light-load accuracy by compensating for the increase in friction brought about by an increase in the service age of meters.

The magnetic shield was introduced in meters by Mr. Duncan between the magnets and the series field coils to eliminate induction effects. He also built the first model of an alternating-current meter which had an aluminum-disk armature for both the motor and the retarding element. Bearing practice also received a decided stimulus from the contributions of Mr. Duncan, as he was the first to disclose, by patent, the present upper bearing used in alternating-current meters.

Born and educated in Scotland, Mr. Duncan first took up pharmacy, but with an eye on the electrical industry, then in its infancy. He came to America in 1883, seeking employment of an electrical nature, but it was not until the fall of 1886 that opportunity offered and he entered the works of the Sun Electric Company, Woburn, Mass., which then manufactured lamps, transformers and alternating-current generators. In 1887 he became connected with the Fort Wayne (Ind.) Jenney Electric Light Company and engaged in the manufacture of incandescent lamps and in 1890 entered the meter department of the Thomson-Houston Electric Company at Lynn, Mass., and became familiar with the two types of meters then marketed.

In December of the same year he returned to Fort Wayne to take charge of the meter-testing department of the Fort Wayne Electric Light Company. In 1893 several meter patents were granted to him. His first meters were put on the market in 1894.

In 1898 Mr. Duncan became meter engineer for the Siemens & Halske Electric Company of America and designed a complete line of alternating-current and direct-current watt-hour meters. After the General Electric Company absorbed the Siemens-Halske Company he organized the Duncan Manufacturing Company and, in 1901, began manufacture at Lafayette, Ind. He first produced direct-current meters and later, as business increased, developed a line of alternating-current meters and transformers. The work of Mr. Duncan will always be a milestone in the progress of the electrical industry, and his name ranks high in the list of its pioneers.

Mr. Duncan is a member of the American Institute of Electrical Engineers, the Franklin Institute of Philadelphia, the American Electrochemical Society and the American Association for the Advancement of Science, as well as a director in several of the leading industrial corporations of Lafayette.

Editorial Comment

Electrical World, July 1, 1922

Volume 80 Number 1

The Threatened Railroad Strike and the Coal Supply

BECAUSE of the reduction in wages ordered by the United States Labor Board, certain minor groups of railroad employees threaten to strike on July 1. Ballots have been distributed, and the vote is now being tabulated and counted. What the effect of a railroad strike at this hour will be time only can tell. That it will add to the troubles of electric public utilities is a foregone conclusion. All utilities throughout the country have been severely handicapped because of the long-continued coal strike, but fortunately the electric light and power companies have heeded repeated warnings and have managed to store sufficient coal to carry them over a strike of a few months. More enterprising companies have in addition added to their coal piles by judicious purchases from time to time and will thus be able to guarantee service for a longer period. The public, while it may appreciate such foresight, is more concerned in getting service and takes it for granted that all necessary steps to safeguard the service have been taken.

Coming on top of the three months' coal strike, a railroad strike will of necessity bring with it serious difficulties. We are certain, however, that there are enough skill and ingenuity in the electric light and power companies to meet and overcome these difficulties. So far, despite the coal strike, the record for electric service has been admirable. That the industry will weather a railroad strike just as successfully as it did the coal strike we are confident. Certainly nothing should be left undone to maintain the record for service so creditably established.

Forester Employed to Supervise Tree Trimming

ONE of the most troublesome and perhaps one of the worst mishandled of public utility problems in the routine of every-day work is that of trimming trees. Ordinarily the trimming is left to a line crew, whose only interest is to clear away as many obstructions as the state of mind of the property owner will permit. The knowledge of forestry possessed by the crew is usually a minus quantity. The result is too frequently a butchery of the trees and trouble with the public.

Last fall the Public Service Company of Northern Illinois brought a crew of technical experts in from a neighboring state. All the men were skilled foresters, and the leaders were known to be particularly skilled. The crew took entire charge of the work even to obtaining the necessary permits from individual owners and the municipalities. The result was so satisfactory that a trained forester has been added to the operating staff to assume entire charge of the tree-trimming problem. Whether this is the first instance of the employment of an expert in this capacity by a central-station organization is not definitely known. Several other cases have been noted where the step has been discussed and some cases where men who have some qualifications for the work have been employed temporarily.

The tree-trimming situation is constantly becoming more acute with the spread of lines to rural territory, and the practice of planting "memory" trees along highways is gaining enough ground to indicate that it may accentuate the problem in a comparatively few years. Where electric systems cover a wide spread of territory in which trees are a factor in line operation, the employment of specialists in forestry to handle tree trimming is well worth consideration.

The Assassination of Walter Rathenau

AN INTERNATIONAL leader in the electrical industry was removed when Walter Rathenau was assassinated in Berlin last week. His political and economic fame, while it eclipsed his success in the electrical industry, did not so completely overshadow it as to dim its glory. The Rathenaus, Walter and his illustrious father, Emil, were among the most conspicuous figures that industrial Germany has produced within the last two generations. Whether as manufacturers, industrial organizers or financiers, their fame reached beyond the borders of Germany and was worldwide.

First Emil, who was the founder of the powerful Allgemeine Elektricitäts Gesellschaft, backed by the most prominent and best organized banks of Germany, started to corral the electrical business of Europe, Asia, Africa and South America. There was practically no important city or large commercial and industrial center in the world outside of North America in which the "A. E. G." had no branch. The variety of its output exceeded even that of the General Electric Company of this country, and there were approximately sixty enterprises which were more or less closely associated or had entered into commercial agreements with it.

The elder Rathenau freely owned his indebtedness to America for many of his organization ideas. He visited this country at the time of the Centennial Exposition and returned to Germany determined to apply American methods to German business. To some it even appeared that he went us one better. His son, Walter, while he enlarged upon the work of his father, was different in inclination and temperament. The elder Rathenau was fundamentally an engineer and showed all the constructive genius of the engineer in welding together the great organization over which he presided. Walter Rathenau was primarily an organizer, manager and economist. His view of industry was much broader than that of his father. This was particularly shown in his relations with employees. He did not follow the German traditions of master and servant, but sought to democratize his organizations. His foremen were given a degree of freedom unknown under his father, but were held accountable for results. None regretted his severance from the company about a year ago, when he accepted a government portfolio, more than the employees of the "A. E. G." Germans probably will revere his name for his services to the Fatherland both during and after the war. This phase of his life's work naturally does not commend itself in as great a degree to citizens of countries with which Germany was at war. Nevertheless his efforts to get the Germans to live up to treaty obligations, particularly reparations, won for him commendation and respect outside of his own country. The assumption is that this work cost him his life.

Men connected with the electrical industry, however, are not so much concerned with the political activities of Walter Rathenau. They have watched with interest and admiration his work in handling and strengthening the great organization handed down to him by his father, and while their loss is not personal, they recognize that one of the outstanding electrical men of the world, one who has reflected glory on his industry and on his country, is now no more.

Will California Heed Its Own History?

HEGEL is credited with the statement that "history teaches us that the people never learn by history." Certainly the average man either knows little of history or disregards its plain teachings, and as for the politician he feels that history is all "bunk." This fall California is to vote on a water and power act involving the expenditure of the stupendous sum of five hundred millions as the minimum. With this appropriation the state plans to acquire all of the water and power rights within its borders and to embark on state socialism. People wonder and ask: "Has California gone mad? Is there any state in the Union that owes more to private initiative and enterprise, and particularly is there any state in which electricity under private ownership and public regulation has worked such marvels?"

Yet this would not be the first time that California has engaged in socialistic work. From 1885 to 1903 the state published and actually prepared the textbooks for its common schools. The textbooks were almost without exception poorly written and poorly printed, and so expensive was the experiment and so bad its effect on public education that in 1904 the Perry amendment to the constitution, annulling the law, was ratified by popular vote. Now, although textbooks must be manufactured within the state, the text need not be prepared in California. In spite of the great influx of population from the Middle West, there are those still living in that state who can vividly recall this incident, and it is hardly likely with its effect in mind that they will commit the state to another socialistic venture, the probable outcome of which would be more disastrous to the community than the previous escapade in the preparation and publication of school textbooks. Unfortunately to a large part of the population of California the history of the commonwealth is a closed book, and it is expedient that these be quickly and properly informed. It is hardly likely that any one who considers for a moment the enormity of California's obligation to its privately owned utilities for its growth and productivity would ever vote to permit the state to socialize these industries.

City Zoning Affords a Central-Station Opportunity

THE central-station industry can well afford to take an intelligent interest in the city zoning movement. Zoning is intended to restrain a city from "keeping its gas range in the parlor and its piano in the kitchen." It means the application of common sense and fairness to the public regulations governing the use of private real estate. It is a painstaking, honest effort to provide each district or neighborhood, as nearly as practicable, with just such protection and just such liberty as are sensible in that particular district. It avoids the error of trying to apply exactly the same building regulations to every part of a city or town regardless of whether it is a suburban residence section or a factory district or a business and financial center. It fosters civic spirit by creating confidence in the justice and stability of the protection afforded.

Because zoning is a good thing for the city it is a good thing for the public utility that serves the city, and every central-station executive in an unzoned town should post himself upon the purposes and trend of the movement and get behind the idea. The utility suffers many losses in the decadence of so-called blighted areas which zoning will prevent in the future. But there is another point of far greater importance. Zoning influences competition through setting up better standards of housing and better standards of living, and higher standards inevitably bring greater utilization and consumption of electricity.

European and American Cable Ratings

ARE high-voltage cables manufactured abroad superior to those produced in this country? When we consider the vast amount of attention and expense devoted by American engineers and manufacturers to the important problem of cable design and the experience gained from the enormous amount of cable in service, and when we recall the group of striking papers of a year or so ago describing research in all phases of the problem, an affirmative answer to the question above can hardly be expected. Yet frequently figures of rating and performance appear from the other side of the ocean which at least raise the question anew.

The most recent instance is the report, now available, of the international conference on large electric systems held in Paris last November, particularly the report of the committee on cables and its discussion. Figures are given from most of the European countries which are most striking in the matter of voltage rating. It will be recalled that conservative American opinion expressed within the last two years placed the limiting working stress in cables at 25 kv. per centimeter, with some advocates of an even lower value, and that this led to the conclusion that 35 kv. was about the limit of voltage so imposed when taken in relation to the size of available duct. Corresponding figures from the reports referred to show as common values 40 kv. to 60 kv. per centimeter for the maximum stress, and from 50 kv. to 60 kv. as the rating of three-phase cables guaranteed by the manufacturer. For single-conductor cables rated at 100 kv. and above are mentioned.

Two explanations of these differences between American and European practices suggest themselves. The first is in the matter of temperature. In the reports referred to 50 deg. C. is the conservative maximum permissible temperature mentioned. Discussion on this side, however, reckons on base or surrounding temperatures of 40 deg. C. and contemplates maximum temperatures of 75 deg. or more. Obviously, the higher the operating temperature the lower must be the voltage rating, and based on a maximum temperature of only 50 deg. C., American ratings could easily be substantially advanced.

A second possible explanation may lie in a greater conservatism of American engineers. The position taken by the advocates of a low-voltage gradient is that by this means ionization losses and hot spots will be excluded from the greater proportion of cables, recognizing the while that many single cables may come through which will stand up to much higher service. As is well known, reports are frequently heard of cables operating at unusually high voltage over long periods. Good and poor cables of the same manufacture and type will appear under the most careful attention to design, assembly and installation, and so long as this is the case it appears to be the opinion here that it is unwise to base the permissible maximum voltage gradient on the better cases. It would be more advisable to take due account of the general level of quality in specifying the maximum voltage at which cables shall operate.

Getting Down to Real Facts on Steel-Mill Electrification

NEARLY all steel men agree that the quantity of raw material and the direct labor required to roll a ton of steel is less with motor-driven rolls than with engine-driven rolls. Moreover, the electric drive has operating advantages such as more uniform torque, greater flexibility, smaller space requirements, reduced maintenance and repair cost and reduced power consumption, and, still further, it makes possible an accurate cost-accounting system through the use of electric meters.

On the other hand, the capital investment for motor drive is greater than that for steam drive. Hence when replacements are considered the item of capital looms large as the critical item in the decision and the question is frequently decided on the basis of first cost alone. However, there are many intangible benefits affecting cost that should also be considered, such as convenience, control, safety, flexibility, overload capacity and the fewer delays due to breakdown. If all these elements are considered, most of the doubts which may remain regarding the economy of replacing existing steam-driven mills with mills driven by electric motors will be removed.

Too frequently conservatism or the lack of accurate cost and operating data has handicapped the progress of electrification, and it is significant that we are able to present in the article by G. E. Stoltz in this issue some cost data from the highly competitive steel industry. Trade cost data are not essential secrets, and in fact, if kept under cover, they handicap progress and prevent economy.

Longer Spans as a Means of Cutting Rural Service Expense

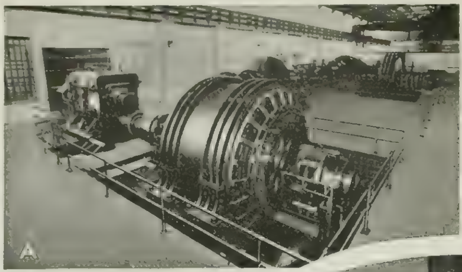
IN THE construction of rural or other lines reaching into territory where the mechanical loads on the line structures are small one of the practices on the Pacific Coast that lead to lower first costs is the use of long line spans. Spans up to average lengths of 300 ft. with No. 6 hard-drawn copper conductors are not uncommon, and practice in a great many instances is based on the use of spans averaging 250 ft. for entire lines or territories. Even longer spans have been used where copper-clad steel and taller and heavier poles are employed. Not only is the first cost in poles and insulators and all the items going into the construction reduced, but in the case of the higher-voltage distribution lines the reduced number of insulators means also a reduction in the cost of insulator maintenance.

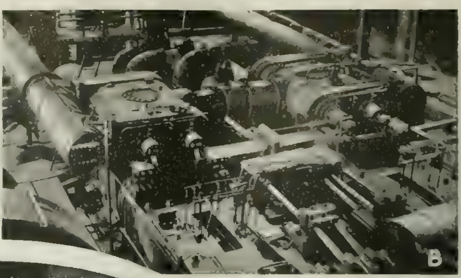
There has been a strong feeling that this practice could not be extended to the territory in the Middle West and the East, where climatic conditions are more severe. Last year, however, the rural-lines committee of the Empire State Gas and Electric Association boldly broke the bonds of precedent and put forth a specification that provided for long-span construction. New York State has some extremely severe winter conditions, but the committee found that a proper selection and arrangement of construction materials would permit the use of spans at least up to 250 ft. when the loads did not exceed the few conductors found on the average rural line. In several instances where new lines are being constructed in the Middle West this lead is being followed, and before the year is over a considerable mileage of such lines will undoubtedly be in operation.

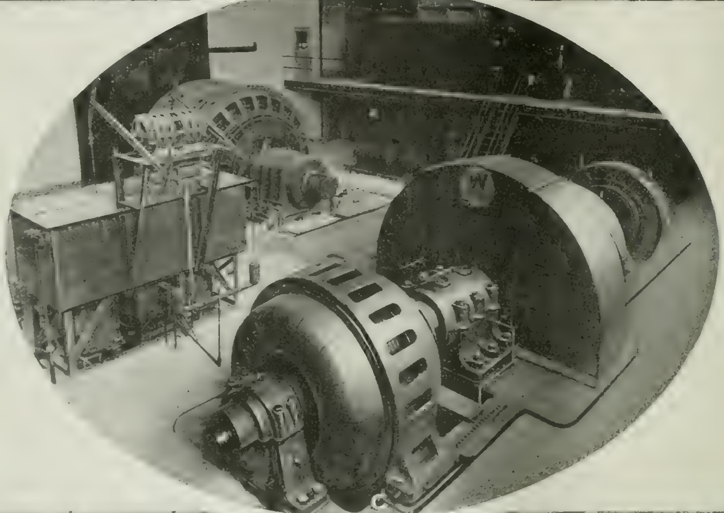
If the engineer has only light loads to handle and is willing to spend a little time on design studies, he will find a rather wide latitude in the exact type of construction while still staying within the limits of his structural and conductor stresses. When smaller conductors are used, the controlling conditions are those of the sag and of the conductor spacing required to prevent swinging contacts. Of course, the saving in the cost of poles and other line materials resulting from the use of long spans must be balanced against the excess cost of longer poles and cross equipment and the cost of heavier conductor fastenings. But careful study will reveal the possibility of materially increasing the span lengths over present Eastern and Middle Western line practice on a large mileage of new construction without unwarrantable increase of the unit stresses on either conductors or supporting structures.

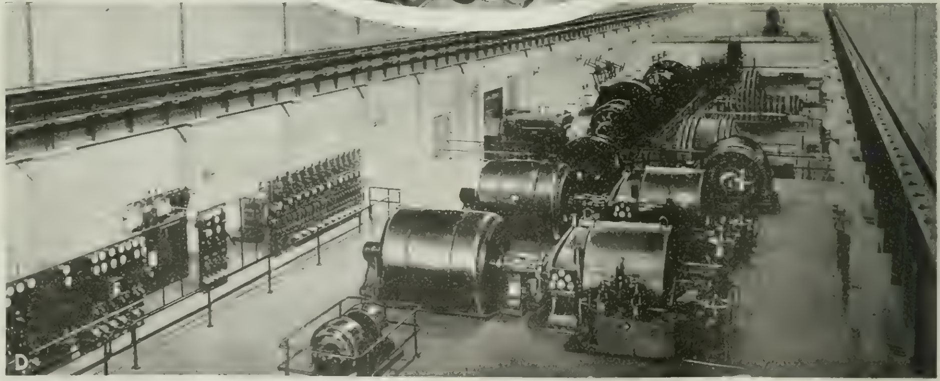
Another fact revealed by the Empire State committee is that it is easy to provide for situations where heavy lines later develop by choosing proper span lengths so that new poles may later be set to split the long spans in two when the heavier lines do develop. Heretofore, with most of the earlier construction work in the territory east of the Rocky Mountains, the certainty of a line's developing into a heavily loaded pole line has been great enough to make the use of long spans a doubtful expedient except on heavy high-tension transmission lines. But the development of large mileages of lightly loaded rural lines that is apparently ahead changes the situation, and for such lines long-span construction designed for more severe climatic conditions has become a real need.

Successful Performance of Steel-Mill Duty Is Sufficient Recommendation of Motor Drive for Any Industrial Application









CONTINUED application of motor drive to steel rolling mills which have had an opportunity to compare it with steam drive for output, continuity of service, flexibility of control and cost of operation should be the highest recommendation of electric drive that any one can expect. Additional support for this type of motive power will be found in the detailed performance data presented in the following pages.

In these data there is a lesson for more than the man who is interested in steel mill applications. The figures bespeak the value of electric drive in an industry which cannot be surpassed for severity of duty, importance of continuous operation and necessity of flexible control and economy. If more data of this kind could be pried loose from secrecy in this and other industries it would do more for progress than probably any other one thing.

Three electrified steel-mill installations which are justifying themselves are shown in the accompanying illustrations: In the foreground of A is a 40-in. reversing blooming mill; in the background is a 28-in. structural mill motor. B shows a steam-engine driving a 35-in. reversing blooming mill of the Atlanta (Ga.) Steel Company. This was replaced by the motor and flywheel-generator set in C. The motor room of the Inland Steel Company, Chicago, is illustrated in D. In the foreground are two 5,000-kw. turbo-generators and two 1,000-kw. motor-generator sets. Behind them is the driving equipment for a 40-in. reversing blooming mill, a 34-in. roughing structural mill and a 28-in. finishing structural mill.

Steel Rolled for Less on Electric Mills than with Steam Drive[1]

Records Show that Steam Mills Can Often Be Replaced by Electric Mills with Marked Advantages—Accurate Cost Accounting Is Possible with Electric Mills, and Labor and Maintenance Costs Are Reduced

By G. E. STOLTZ

Engineer in Charge Steel Mill Division Westinghouse Electric & Manufacturing Company

A NUMBER of important electric installations have been made in steel mills to replace the steam engine. While in some cases the steam engines were replaced because they were worn out, there are many cases where the change was made in order to obtain better economy and produce steel more cheaply than was possible with the steam drive. Records which have been taken indicate that the operating cost of producing steel by electric drive is one-half to one-third that of production by steam drive. Among the contributing factors to this economy are the lower cost of power itself, lower standby expenses, lower maintenance costs, and consequently less delay and better opportunity for measuring the power consumption and thus checking any faults which may develop in the equipment.

From the tables presented here and from other data it is shown that the operating cost of electric drive is considerably less than that of steam drive. Comprehensive records of costs of electrical operation prepared by E. S. Jefferies, electrical engineer with the Steel Company of Canada, are given in Table I. According to these figures the power and main-drive operating cost averages less than 17 cents per gross ton of steel on the blooming mill. The values are averages for the years 1913 to 1919 inclusive on a 34-in. reversing mill. In Table II and Table III the costs for electric drive are 0.253 cent and 0.225 cent. These costs compare very favorably with the costs shown in Tables IV, V and VI for steam drive, which are respectively 0.617 cent, 0.717 cent and 1.179 cents per gross ton. A comparison of these figures agrees very closely with the conclusions of Mr. Siebert, combustion engineer with the Bethlehem Steel Company, and Mr. Eppelschimer, chief engineer

Tables I to III—Power and Main-Drive Operating Cost of Rolling Steel Electrically

34-IN. REVERSING BLOOMING MILL

Ingots, 15 x 17—4,200 lb Blooms, 8 x 8; 6 x 6; 4 x 4.

Year	1913	1914	1915	1916	1917	1918	1919	Average
Months in operation	9	8	12	12	12	12	8	10.43
Tonnage*	119,230	92,622	174,460	238,050	297,224	276,778	155,515	†18,800
Kilowatt-hours	23.9	22.8	21.5	19.8	20.4	21.8	23.4	21.2
Power cost	0.1600	0.1530	0.1440	0.1330	0.1370	0.1460	0.1570	0.1445
Repairs and maintenance	0.0069	0.0092	0.0045	0.0102	0.0039	0.0030	0.0027	0.0058
Miscellaneous supplies	0.0045	0.0049	0.0025	0.0025	0.0029	0.0015	0.0051	0.0030
Labor in operation	0.0141	0.0161	0.0128	0.0100	0.0128	0.0147	0.0146	0.0132
Total cost	0.1855	0.1832	0.1638	0.1557	0.1566	0.1652	0.1794	0.1660

35-IN. REVERSING BLOOMING MILL

Ingots, 20 x 20—6,800 lb. Blooms, 8 x 6; 4 x 4; 5 5 x 22

Month	April	May	June	July	Aug	Sept	Oct.	Nov.	Dec	Jan	Feb
Year	1919									1920	
Tonnage*	13,441	15,467	18,738	28,049	26,733	11,402	10,658	20,808	26,965	30,461	27,160
Kilowatt-hours	25.5	23.6	22.2	22.1	22.1	25.5	18.4	20.8	19.9	19.9	21.4
Power cost	0.2300	0.2130	0.2000	0.1980	0.1980	0.2300	0.1880	0.1790	0.1790	0.2340	0.2570
Repairs and maintenance	0.0013	0.0012	0.0010	0.0006	0.0007	0.0016	0.0017	0.0009	0.0007	0.0006	0.0007
Miscellaneous supplies	0.0026	0.0023	0.0020	0.0012	0.0013	0.0030	0.0033	0.0017	0.0013	0.0013	0.0013
Labor in operation	0.0350	0.0305	0.0250	0.0168	0.0176	0.0412	0.0440	0.0226	0.0175	0.0154	0.0191
Total	0.2689	0.2470	0.2280	0.2166	0.2176	0.2748	0.2370	0.2042	0.1985	0.2513	0.2781

Month	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Average for
Year	1920										1919–20
Tonnage*	35,598	28,286	31,087	34,938	35,941	32,813	33,072	35,648	32,836	30,043	†26,700
Kilowatt-hours	19.3	22.3	22.6	20.3	20.6	23.1	19.2	21.0	18.8	18.0	21.3
Power cost	0.2310	0.2680	0.2710	0.2430	0.2470	0.2770	0.2300	0.2520	0.2260	0.2160	0.2320
Repairs and maintenance	0.0006	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0007	0.0007
Miscellaneous supplies	0.0010	0.0012	0.0011	0.0010	0.0010	0.0011	0.0011	0.0010	0.0011	0.0012	0.0014
Labor in operation	0.0146	0.0183	0.0167	0.0148	0.0145	0.0158	0.0157	0.0145	0.0158	0.0172	0.0186
Total	0.2472	0.2882	0.2894	0.2594	0.2631	0.2945	0.2474	0.2681	0.2434	0.2351	0.2530

40-IN. REVERSING BLOOMING MILL

Ingots, 22 x 24—9,600 lb; 25 x 25—11,500 lb; 25 x 30—13,500 lb Bloom, 6 x 6, bloom, 8 x 10

Month	Nov	Dec	Jan.	Feb	March	April	May	June	July	Aug	Sept	Oct	Average for
Year	1919		1920										1919–20
Tonnage*	12,334	23,878	31,956	31,902	40,192	16,375	32,175	37,363	33,434	20,838	32,750	10,741	†27,500
Kilowatt-hours	20.7	21.4	21.0	20.6	20.2	22.9	18.7	20.1	18.4	20.0	16.6	18.1	19.6
Power cost	0.2030	0.1780	0.1420	0.1870	0.2100	0.3200	0.2130	0.1780	0.1930	0.2600	0.2010	0.2540	0.2020
Repairs and maintenance	0.0125	0.0060	0.0000	0.0030	0.0050	0.0190	0.0010	0.0020	0.0000	0.0010	0.0020	0.0030	0.0035
Miscellaneous supplies	(Cost for this item included with "Repairs and Maintenance" above)												
Labor in operation	0.0210	0.0210	0.0190	0.0160	0.0190	0.0180	0.0190	0.0180	0.0190	0.0190	0.0190	0.0150	0.0188
Total	0.2370	0.2050	0.1610	0.2060	0.2340	0.3570	0.2350	0.1980	0.2120	0.2800	0.2220	0.2720	0.2250

*Finished tons (2,240 lb.) on the blooming mill. †Monthly average tonnage finished on the blooming mill over the entire period.
All costs are based on cost per ton (2,240 lb.) of steel produced.

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[1] The data on which this discussion is based have been presented at meetings of Association of Iron and Steel Electrical Engineers.

of the American Rolling Mill Company. The data submitted by Mr. Siebert indicate that a steam-driven mill requires two and one-half times the steam that would be required for electric drive, and from Mr. Eppelschimer's test the net steam required is three and one-half times that required by electric drive.

The tables show that the average cost of attending the electrical equipment is 1½ cents per ton, and that for the engine-driven mill it is 4 cents per ton. This labor covers that required in the motor room or on the engines themselves and does not include the pulpit operator. This charge applies to the main-drive equipment only, including the flywheel, reversing motor, switchboard control, exciter and blower for electric drive, and the engine itself in case of steam drive. Usually the motor room has other apparatus over which the same motor operator has supervision, so that not all of his time can be charged against the reversing equipment. In some cases the electric drive, because of its control features, eliminates one of the three men required on a mill.

A big advantage of electric drive is the difference in the cost of repairs, maintenance and supplies. On electric drive these average ½ cent per ton, while on engine drive they total 5 cents per ton. The fact that it costs ten times as much to repair and maintain an engine is an indication that the delay incurred is considerably greater for steam drive and emphasizes the

Tables IV to VI—Power and Main-Drive Operating Cost of Rolling Steel with Steam Drive

35-IN. REVERSING BLOOMING MILL

42-in. x 60-in. geared twin simple engine exhaust into low-pressure turbines. Ingot, 18 x 20—5,500 lb. Bloom, 4 x 4

Month	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Year	1918											
Tonnage*	13,783	22,175	28,756	29,576	30,680	29,080	29,846	28,314	25,347	29,246	26,765	27,538
Steam per ton	1,645	1,155	1,055	1,015	1,015	1,010	1,035	1,100	1,100	1,065	1,085	1,052
Power cost	0.7140	0.5200	0.4080	0.4500	0.4260	0.4140	0.4150	0.4650	0.4780	0.5100	0.5200	0.4780
Repairs and maintenance	0.0513	0.0201	0.0156	0.0099	0.0074	0.0177	0.0225	0.0155	0.0244	0.0277	0.0870	0.0657
Miscellaneous supplies	(Costs for this item included with "Repairs and Maintenance" above											
Labor in operation	0.0498	0.0411	0.0280	0.0316	0.0311	0.0310	0.0303	0.0351	0.0369	0.0422	0.0413	0.0412
Total	0.8140	0.5712	0.4416	0.5806	0.4645	0.4627	0.4679	0.5156	0.5393	0.5799	0.6483	0.5849

Month	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Year	1919											
Tonnage*	30,078	19,491	16,379	14,567	15,790	14,988	16,488	14,616	10,529		20,625	23,839
Steam per ton	1,010	1,240	1,415	1,435	1,520	1,270	1,023	1,382	1,010		1,100	1,165
Power cost	0.4870	0.6210	0.7520	0.6800	0.6780	0.5450	0.4530	0.5320	0.4340	Not	0.6070	0.6130
Repairs and maintenance	0.0282	0.0717	0.1387	0.3421	0.0749	0.0751	0.0114	0.0208	0.0376	Oper-	0.0255	0.0266
Miscellaneous supplies	(Costs for this item included with "Repairs and Maintenance" above									ating		
Labor in operation	0.0388	0.0497	0.0532	0.0630	0.0571	0.0518	0.0482	0.0471	0.0520		0.0454	0.0410
Total	0.5540	0.7424	0.9439	1.0851	0.8100	0.6719	0.5126	0.5999	0.5236		0.6779	0.6800

Month	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average for
Year	1920												1918-19-20
Tonnage*	28,493	27,683	31,295	19,962	22,859	25,731	26,306	26,716	25,403	29,081	29,924	28,958	†24,000
Steam per ton	1,040	990	950	1,085	1,170	1,110	1,048	1,070	1,111	1,020	1,005	1,050	1,040
Power cost	0.5940	0.4970	0.5310	0.5930	0.4840	0.5000	0.6000	0.6310	0.5580	0.5660	0.6370	0.6770	0.5350
Repairs and maintenance	0.0270	0.0298	0.0371	0.0377	0.0282	0.0205	0.0232	0.0358	0.0420	0.0231	0.0467	0.0281	0.0394
Miscellaneous supplies	(Costs for this item included with "Repairs and Maintenance" above												
Labor in operation	0.0367	0.0414	0.0389	0.0497	0.0465	0.0412	0.0429	0.0420	0.0444	0.0382	0.0387	0.0400	0.0397
Total	0.6577	0.5682	0.6070	0.6804	0.5587	0.5617	0.6661	0.7088	0.6444	0.6273	0.7224	0.7451	0.6170

36-IN. REVERSING BLOOMING MILL

50-in. x 60-in. twin simple engine exhaust into low-pressure turbine. Ingot, 22 x 24—9,600 lb. Bloom, 8 x 8

Month	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Year	1919											
Tonnage*	40,600	34,963	34,334	27,167	31,723	33,706	38,049	39,427	25,197	15,720	30,960	33,196
Steam per ton	1,632	1,578	1,564	1,709	1,790	1,747	1,619	1,413	1,692	2,624	1,680	1,683
Power cost	0.5070	0.4770	0.5320	0.5460	0.5310	0.5320	0.4850	0.4240	0.5230	0.9000	0.5810	0.6690
Repairs and maintenance	0.0800	0.0890	0.0950	0.0440	0.0570	0.0960	0.1190	0.0910	0.1650	0.0720	0.1140	0.1280
Miscellaneous supplies	(Costs for this item included with "Repairs and Maintenance" above											
Labor in operation	0.0280	0.0260	0.0280	0.0290	0.0280	0.0290	0.0270	0.0290	0.0340	0.0600	0.0410	0.0340
Total	0.6150	0.5920	0.6550	0.6190	0.6160	0.6570	0.6310	0.5440	0.7220	1.0320	0.7360	0.8310

Month	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average for
Year	1920												1919–20
Tonnage*	33,008	31,779	38,695	36,446	36,221	34,422	34,015	40,903	35,349	35,160	31,411	18,763	†32,900
Steam per ton	2,018	1,781	1,591	1,650	1,623	1,575	1,736	1,557	1,616	1,566	1,495	1,813	1,690
Power cost	0.7020	0.6940	0.6850	0.6710	0.6340	0.6940	0.8050	0.6530	0.7460	0.6230	0.8250	0.9200	0.6350
Repairs and maintenance	0.0150	0.0400	0.0140	0.0080	0.0120	0.0210	0.0180	0.0060	0.0180	0.0420	0.0140	0.0440	0.0427
Miscellaneous supplies	(Costs for this item included with "Repairs and Maintenance" above												
Labor in operation	0.0390	0.0400	0.0340	0.0350	0.0360	0.0380	0.0380	0.0330	0.0350	0.0380	0.0380	0.0380	0.0339
Total	0.7560	0.7740	0.7330	0.7140	0.6820	0.7530	0.8610	0.6920	0.7990	0.7030	0.8770	1.0020	0.7170

40-IN. REVERSING BLOOMING MILL

50-in. x 60-in. twin simple geared engine exhaust into low-pressure turbines. Ingot, 18 x 20—5,000 lb. Bloom, 7 x 4

Month	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Year	1918											
Tonnage*	13,450	10,283	17,325	19,868	19,808	21,380	18,961	19,708	22,172	25,040	22,319	18,929
Steam per ton	2,800	4,030	3,400	3,580	3,530	3,700	3,790	3,400	2,810	3,050	3,200	2,870
Power cost	1.4500	1.7300	1.2400	1.1550	1.1550	1.1750	1.3500	1.4400	1.2750	1.3000	1.3600	1.1500
Repairs and maintenance	0.0895	0.0960	0.0507	0.0290	0.0640	0.0465	0.0640	0.0503	0.0611	0.0538	0.0502	0.0691
Miscellaneous supplies	0.0070	0.0201	0.0055	0.0095	0.0035	0.0079	0.0090	0.0071	0.0039	0.0061	0.0068	0.0129
Labor in operation	0.0535	0.0539	0.0418	0.0537	0.0425	0.0415	0.0470	0.0470	0.0400	0.0400	0.0430	0.0480
Total	1.6000	1.9000	1.3380	1.2472	1.2650	1.2789	1.4700	1.5444	1.3800	1.4000	1.4600	1.2800

Month	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
Year	1919												1918–19
Tonnage*	16,712	15,088	14,774	15,808	14,755	14,026	17,767	18,657	17,422	20,278	19,544	19,717	18,075
Steam per ton	2,515	2,500	2,930	2,820	2,830	2,330	2,110	1,920	1,890	1,950	2,410	2,530	2,870
Power cost	0.8400	0.8350	0.9720	1.0150	0.9500	0.8220	0.6440	0.7000	0.6500	0.6830	0.8300	0.9350	1.0700
Repairs and maintenance	0.0330	0.0261	0.0122	0.0343	0.0440	0.0535	0.1035	0.0618	0.0330	0.0351	0.0962	0.0513	0.0547
Miscellaneous supplies	0.0075	0.0052	0.0033	0.0050	0.0075	0.0093	0.0085	0.0097	0.0068	0.0069	0.0113	0.0075	0.0072
Labor in operation	0.0474	0.0480	0.0542	0.0475	0.0545	0.0552	0.0490	0.0465	0.0053	0.0400	0.0443	0.0433	0.0462
Total	0.9479	0.9143	1.0417	1.1018	1.0560	0.9400	0.8050	0.8180	0.7351	0.7650	0.9818	1.0371	1.1790

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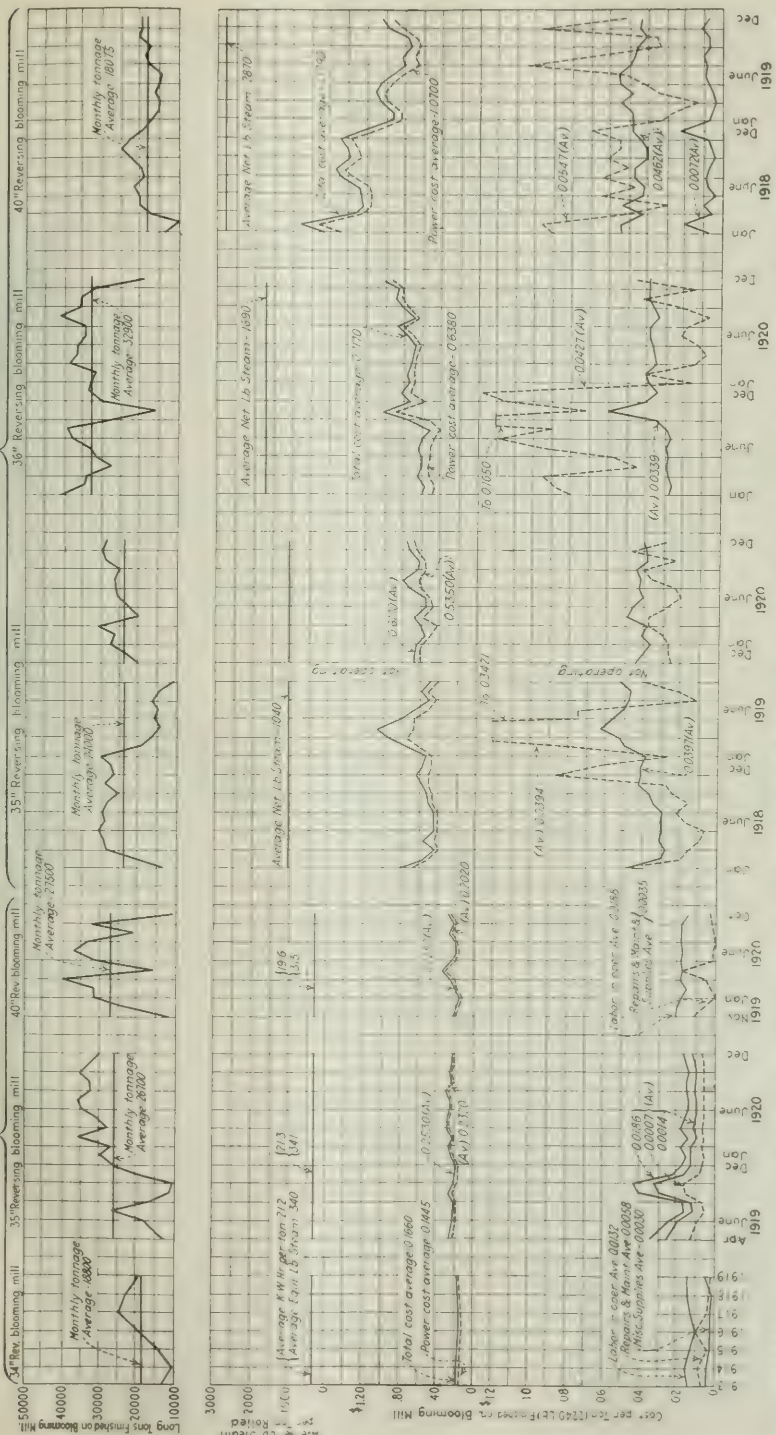
* Finished tons (2,240 lb.) on the blooming mill. † Monthly average tonnage finished on the blooming mill over the entire period.
All costs are based on cost per ton (2,240 lb.) of steel produced.

fact that electrical equipment requires very little Sunday work in comparison with that necessary on the steam engine. The variation in power cost resulting from working below rated tonnage is shown in Table VII. The first mill, which is the one showing the smallest increase in power cost per ton under light-load conditions, purchases central-station power. The reason for the low cost is that practically all stand-by losses are eliminated. The second mill listed, which also has a low power cost under small output, is supplied with power from a generated station installed in the mill, which furnishes energy to all the auxiliaries of the mill as well as to a number of large motor-driven mills each working in a large measure independently of the others. This makes it possible to diversify the loads on each mill, and when production on any one mill is suspended the stand-by losses of this mill are eliminated. When this mill stops, the amount of steam being generated in the boiler will be too great; but since this is part of a rather large assembly of mills, the full effect is not felt, as the demand of this mill is diversified with that of other units so that the total generating capacity is by no means equivalent to that of the connected capacity. A higher cost for low rate of production is shown for the third mill listed. This mill is supplied by generating equipment devoted almost exclusively to this



Relative Costs of Rolling Steel

The accompanying graphs are plotted from actual data obtained with three motor-driven and three steam-driven reversing blooming mills (see Tables I to VI). The monthly average tonnage rolled is shown at the top, while the equivalent steam per ton is indicated below. Total cost, power cost and itemized operating expenses per ton finished constitute the two lower sets of curves. In all these characteristics the motor-driven mill excels the steam driven and another electrically driven mill, the operation of which is dependent upon the first mill. In this case delays are costly because it is impossible to take advantage of the diversity factor obtained where electrification is more complete.

Although the power cost of the mill as shown in Table III indicates quite a saving over a steam-driven mill, it is evident that complete advantage has not been taken of electrification. The full merits of this method are not realized until all individual steam units with their steam lines and boilers are removed and the entire plant is electrically driven from a generating station which will in a large mill have one-third the rating of the connected load. Such an installation also makes it possible to meter all energy accurately, which cannot be done in a plant where part of the steam is utilized in steam engines driving main rolls.

Table VII—Significant Facts Taken from Tables I to VI

Item	Minimum Tonnage In Percentage of Average	Maximum Power Cost per Ton In Percentage of Average	Power Cost per Ton In Percentage of Total
1	60	111	87
2	40	119	92
3	40	158	90
4	43	140	87
5	49	141	88
6	55	161	91

The fourth mill listed is an engine-driven mill, but the operation is fairly constant. Credit is given the engine for the exhaust steam to the low-pressure turbine, and as there are a number of other steam-driven mills in this plant which roll independently of each other, the load on the boilers is diversified. The fifth and sixth mills shown are also engine-driven. No credit has been given to the fifth engine for the exhaust steam to the turbine, as it is sometimes necessary when the engine is not in operation to feed high-pressure steam into the turbine. The last mill shown could easily produce a greater tonnage than the average recorded. Credit is given to the last engine for exhaust steam which is used in low-pressure turbines. The steam cost is high on this mill, not only because a small tonnage is produced, but also because the demand for steam by this mill and another steam-driven mill in tandem with it forms a large part of the total load on the boilers.

It is interesting to note that the power cost in case of both steam and electric drive averages 90 per cent of the total operating cost. This is shown by the last column of Table VII. The mills represented in Tables III and V roll approximately the same product and are subject to the same method of accounting. They roll the same maximum tonnage, although the demand on the electrically driven mill has not been so regular as that on the steam mill. The difference in cost for rolling on these two mills is 50 cents per ton in favor of the electric mill, which on the basis of 30,000 tons per month would result in an annual saving of $180,000. This would easily pay for electrifying the steam mill, including the necessary boiler and generating equipment, in four and one-half years.

There is considerable satisfaction in knowing that the power consumption on the electrically driven mills is accurately measured, including all incidentals. In many instances there is too great an inclination to underestimate the losses incidental to steam-engine operation which in practice cannot be determined.

The use of motor-drive not only enables the operating engineer to keep accurate accounts of the cost of power, but also enables him to detect the influence of various methods of operating the equipment and the effect that any modification in the machinery itself may give. In addition it allows the detection of faults which may develop in the equipment. The influence of such things may be small, but the possibility of detecting these small differences is responsible in a large measure for the advance in economy which has been obtained by electric drive. The absence of this feature has been a great drawback to the improvement in the economy of operating mills with engine drive.

To show the speed with which electric drive may be substituted for steam, it may be well to cite the instance of changing over the 44-in. reversing blooming mill of the Steelton plant of the Bethlehem Steel Company. In this mill operation was resumed with the motor just twenty-four days after the engine rolled its last steel.

Some might argue that, even though operating charges favor the electric drive, fixed charges favor steam drive. R. B. Gerhardt has considered an isolated reversing blooming mill and tabulates first costs as follows:

	Steam Drive	Electric Drive
Boiler plant, including connections to engine	$500,000	....
Electric power plant, including boilers, turbines, wiring, etc., complete	......	$660,000
Engine drive, twin-tandem compound with condenser	200,000	....
Motor drive, complete	......	450,000
	$700,000	$1,110,000

With interest at 6 per cent, depreciation at 6 per cent and insurance and taxes at 3 per cent, the total fixed charge is 15 per cent. This would give $8,750 per month for the steam and $13,875 per month for the electric drive; assuring a monthly tonnage of 25,000 on either type of mill, the fixed costs per ton would be $0.35 on the steam and $0.555 on the electric. Adding these to the highest average operating costs for electric drive and lowest average operating costs for steam drive gives figures of $0.808 per ton for electric operation and $0.967 per ton for steam operation.

S. Kneass, Jr., has compared electric and steam drive on a 46-in. x 60-in. twin-tandem compound unit. From data obtained on the unit the cost of the steam based on 600 lb. per ton, with coal at $5.60, will be 30 cents. On the assumption that this is about 77 per cent of the cost, the total cost is 39 cents per ton. A motor drive doing the same work is assumed to use 1 kw.-hr. per ton, and at ¾ cent per kilowatt-hour the cost of the electric drive would be about 19 cents per ton of steel rolled to seven elongations. The advantage of the electric drive on a yearly output of 600,000 tons would be $120,000. If the motor drive is assumed to cost $500,000 and fixed charges are put at 15 per cent, the net saving of steam drive where replaced by motor drive would be about 11 per cent.

A 35-in. electrically driven blooming mill of the Sharon Steel Hoop Company has been in operation about three years and uses from 20 kw.-hr. to 22 kw.-hr. per ton of steel rolled at a cost of about 30 cents per ton. The mill rolls 20-in. x 22-in. ingots to a maximum section of 15-in. x 4-in. and a minimum of 4-in. x 4-in. and has turned out as high as 675 tons in a single eight-hour run.

How to Sustain Security Selling

What to Do When Stock Selling Begins to Fall Off After the Opening Campaign—Pressure Selling and Contest Selling—Guiding the Workers—Problem of Permanent Selling

By PERCY H. WHITING
Manager Securities Department Central Maine Power Company

AFTER the first enthusiasm for the new idea of security selling has passed, it is natural in every organization that interest should lag, the pressure of selling ease up and the volume of securities sold fall off. What should be done when that time comes? Plenty of people willing to buy will be found if they are properly approached and influenced. How can the attention of the employees be held to the purpose and made continually productive? Mr. Whiting has undertaken to answer these questions in this article, out of his experience in helping to organize and operate customer-ownership security sales for many central-station companies. In a former article, published in the *Electrical World*, April 22, 1922, he told how to conduct the initial campaign that introduces the securities of the local utility to the community. In another article to follow he will carry this thought still further in a discussion of how to maintain security selling on a permanent basis. It will appear in an early issue.

SELLING preferred stock through employees to customers in any considerable volume has this disadvantage: That it is up-hill all the way. The longer you keep at it the harder it gets. The reasons are that:

1. Many customers will buy stock only once—because they do not want all their money in one pocket.

2. Many are people of small means. Their funds are a shallow financial reservoir which, once drawn off, refills but slowly.

3. Employees sell first to the people they know. They start off like the "flash" insurance agent who sells to his friends and then gets another job. And while a few employees learn to sell, more of them don't—and their interest and enthusiasm rapidly wane.

Therefore, if a company sells only a relatively small amount of stock at any one time, it may sell easily for years. But, on the other hand, if it sells relatively large amounts of stock, it may soon find it necessary to increase the intensity of its effort in order to keep up the volume of sales.

TWO WAYS TO SELL

To put additional pressure on flagging employees and keep the volume of sales up after the first enthusiasm aroused by employee selling has died away two methods may be followed. You may use spurs or you may stir the enthusiasm of employees by getting them into a stock-selling contest.

The most effective way of applying the rowels is to obtain a recognition by employees of the fact that stock selling is company work. If this plan is to succeed, the general manager or the general superintendent or both must be 100 per cent believers and must themselves see that the "pressure" is applied.

This "pressure" method has worked. If from the start of company stock selling employees are subjected to propaganda to convince them that "selling is company work," many of them will drop into the scheme willingly and sell quite a little stock.

I have seen this plan both work and fail. In a small way several companies have put it over successfully. I know another company of fair size which has used it with steadily decreasing success. This company sold its first five thousand shares in a month, its second in six months, and is now floundering along on the third five thousand, with chances good that it will take six years to dispose of them. My own judgment is that flagging enthusiasm can best be stimulated by making a big contest or game out of stock selling. This can be done by offering many prizes, by pitting one district against another and one employee against another, by arousing a spirit of competition.

Before going into the detail of handling stock-selling contests, it might be well to mention some forms of stimulation that apply in either "pressure" or "contest" selling:

1. *Train your employees to be better salesmen.* This can be done by meetings, by correspondence and by correspondence courses. And remember that what you teach your employees about selling will profit you in more ways than merely the disposal of preferred stock. If employees understand the basic principle of salesmanship (which is "service"), they will be better employees. If they can be taught that their job is to "sell" the company to the public in all their dealings, they will iron out many wrinkles.

To teach your employees to sell, use a house organ. If your company is big enough, get out a weekly publication. If your company is smaller, get out stock-selling bulletins. You can get good material out of sales magazines, correspondence courses, books on salesmanship and matter published by the N. E. L. A. Write a brief correspondence course on selling your stock and send it out to all who are interested.

2. *Increase the number of employees who sell.* You will perhaps never get all your employees gunning for stock "prospects," but the more employees you interest the more stock you sell. Keep a list of employees who have never sold stock and work on them by letter or in person. Send lists of the laggards to department heads and get them to act as missionaries.

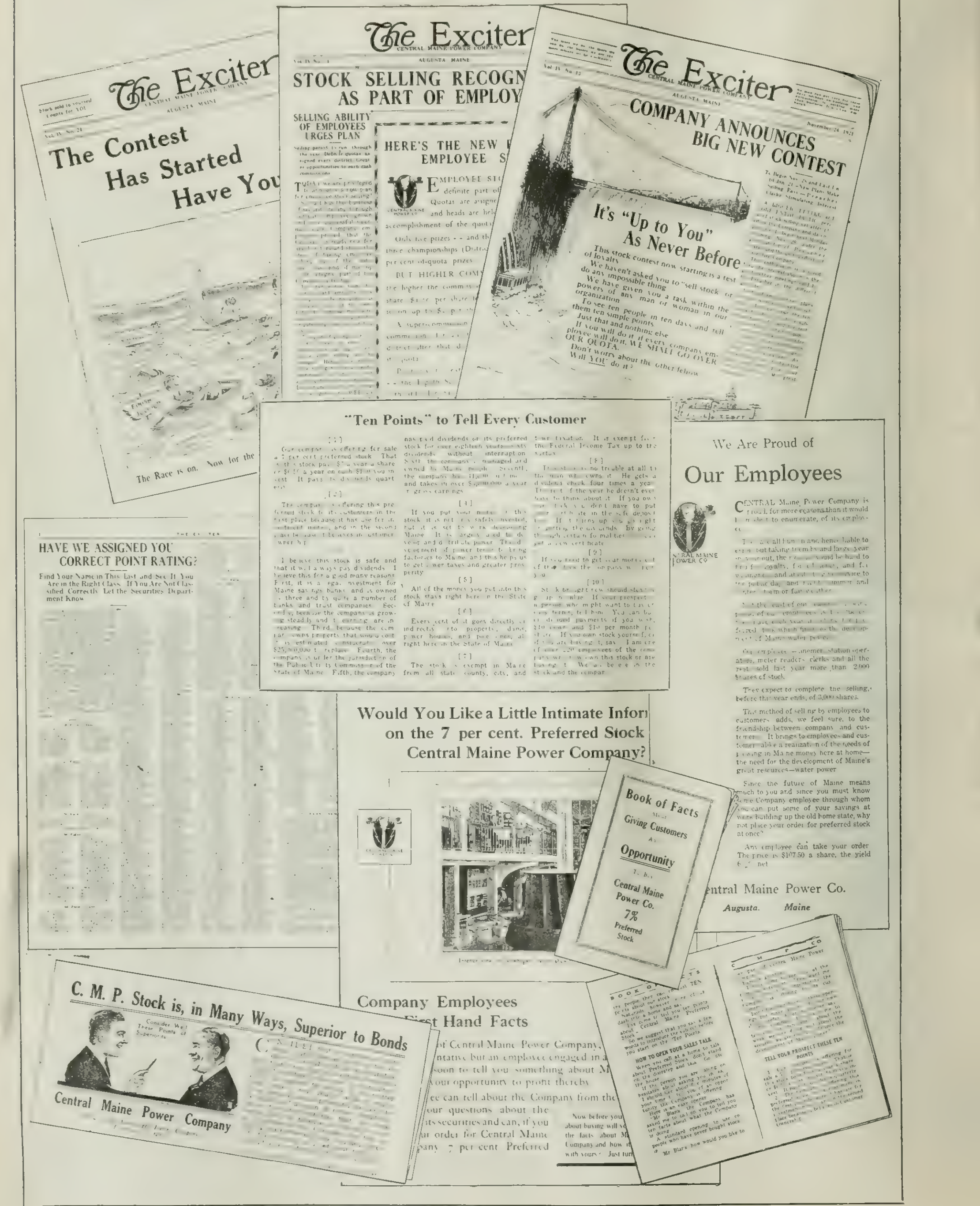
3. *Widen the field of prospects* by doing away with the restriction that you will sell to customers only. Sell to any one—in the territory or out.

4. *Put field managers to work.* Such men can work personally among employees, stimulate their interest, show them how to sell, close difficult sales and do much to produce results.

5. *Increase advertising.* This applies both to newspaper and direct-by-mail advertising.

Newspaper advertising is the very backbone of successful selling of securities through employees. A diagram published in the *Electrical World* some months

Publicity Matter Used to Sustain Employee Enthusiasm and Activity in Stock Selling to Customers



The Exciter
CENTRAL MAINE POWER COMPANY
AUGUSTA MAINE

The Contest Has Started Have You

The Race is on. Now for the

The Exciter
CENTRAL MAINE POWER COMPANY
AUGUSTA MAINE

STOCK SELLING RECOGN
AS PART OF EMPLOY

SELLING ABILITY OF EMPLOYEES URGES PLAN

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EMPLOYEE S

EMPLOYEE STO
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Quotas are assigne
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Only five prizes - - and th
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per cent-of-quota prizes

BUT HIGHER COM

The Exciter
CENTRAL MAINE POWER COMPANY
AUGUSTA MAINE

November 26, 1921

COMPANY ANNOUNCES BIG NEW CONTEST

To Begin Nov. 28 and Last Until Jan. 21—New Plans Make Selling Easy—Preacher Clarke Stimulating Interest

It's "Up to You" As Never Before

This stock contest now starting is a test of loyalty.

We haven't asked you to "sell stock" or do any impossible thing.

We have given you a task within the powers of any man or woman in our organization.

To see ten people in ten days and tell them ten simple points.

Just that and nothing else.

If you will do it, if every company employee will do it, WE SHALL GO OVER OUR QUOTA.

Don't worry about the other fellow. Will YOU do it?

"Ten Points" to Tell Every Customer

[1]

Our company is offering for sale a 7 per cent preferred stock. That is, this stock pays $7 a year a share or $7 a year on each $100 you invest. It pays its dividends quarterly.

[2]

The company is offering this preferred stock to its customers in the first place because it has use for money, and in the second place because it leaves its customers where ...

I believe this stock is safe and that it will always pay dividends. I believe this for a good many reasons. First, it is a legal investment for Maine savings banks and is owned by three and by quite a number of banks and trust companies. Secondly, because the company is growing steadily and its earnings are increasing. Third, because the company owns properties that would cost, it is estimated ... over $25,000,000 to replace. Fourth, the company is under the jurisdiction of the Public Utility Commission of the State of Maine. Fifth, the company has paid dividends on its preferred stock for over eighteen years ... dividends without interruption. Sixth, the company is managed and owned by Maine people. Seventh, the company has ... and takes in over $ ... a year in gross earnings.

[4]

If you put your money in this stock it is not only safely invested, but it is set to work developing Maine. It is largely used to develop and distribute power. The development of power tends to bring factories to Maine and this helps us to get lower taxes and greater prosperity.

[5]

All of the money you put into this stock stays right here in the State of Maine.

[6]

Every cent of it goes directly or indirectly into property, dams, power houses, and pole lines, all right here in the State of Maine.

[7]

The stock is exempt in Maine from all state, county, city, and town taxation. It is exempt from the Federal Income Tax up to the surtax.

[8]

This stock is no trouble at all to the man who owns it. He gets a dividend check four times a year. The rest of the year he doesn't ever have to think about it. If you own this stock you don't have to put your certificate in the safe deposit ... If it turns up ... by getting the dividends. By going through certain formalities ... get a new certificate.

[9]

If you need to get your money out of it ... ask the company ... for you.

[10]

Stock bought now should start ... If your prospect is a person who might want to buy on easy terms, tell him. You can buy it on ... payments if you wish, $10 down and $10 per month per share. If you own stock yourself, or if you are buying it, say "I am one of over 220 employees of the company who own this stock or are buying it. We ... believe in the stock and the company."

HAVE WE ASSIGNED YOU CORRECT POINT RATING?

Find Your Name in This List and See If You Are in the Right Class. If You Are Not Classified Correctly Let the Securities Department Know

We Are Proud of

Our Employees

CENTRAL MAINE POWER CO

CENTRAL Maine Power Company is proud, for more reasons than it would be modest to enumerate, of its employees.

They are all human and hence liable to err, but taking them by and large, year in, year out, the ... would be hard to find for loyalty, for ... and for ... and attention to service to the public day and night, summer and winter, storm or fair weather.

... the ... of our ... employees ... the development of Maine water power.

Our employees—linemen, station operators, meter readers, clerks and all the rest—sold last year more than 2,000 shares of stock.

They expect to complete the selling, before this year ends, of 3,000 shares.

This method of selling by employees to customers adds, we feel sure, to the friendship between company and customer. It brings to employees and customers alike a realization of the needs of keeping Maine money here at home—the need for the development of Maine's great resources—water power.

Since the future of Maine means much to you and since you must know some Company employee through whom you can put some of your savings at work building up the old home state, why not place your order for preferred stock at once?

Any employee can take your order. The price is $107.50 a share, the yield 6.5% net.

Central Maine Power Co.
Augusta. Maine

Would You Like a Little Intimate Infor
on the 7 per cent. Preferred Stock
Central Maine Power Company?

Book of Facts
About
Giving Customers
An
Opportunity
To Buy
Central Maine Power Co.
7%
Preferred Stock

Company Employees
First Hand Facts

of Central Maine Power Company,
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ee can tell about the Company from the
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its securities and can, if you
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pany 7 per cent Preferred

Now before you
about buying will y
the facts about M
Company and how i
with yours. Just tur

BOOK OF FACTS

So we suggest that you say a few words to introduce the subject before you start on the "Ten Points."

HOW TO OPEN YOUR SALES TALK

When you call at a home to talk about Preferred Stock don't stand on the doorstep and talk. Go into the house.

If the person you are calling on hesitates about asking you in, say "I should like about five minutes of your time to tell you of an opportunity the Company is offering."

Here is an easy opener:

"Mr. Blank, the Company has asked me to call on you to tell you ten facts about what the Company is doing."

A standard opening to use on people who have never bought stock is:

"Mr. Blank, how would you like to

C. M. P. CO.
Central Maine Power

TELL YOUR PROSPECT THESE TEN POINTS

C. M. P. Stock is, in Many Ways, Superior to Bonds

Consider Well These Points of Superiority

Central Maine Power Company

ago showed the advertising of the Pacific Gas & Electric Company in relation to the company's stock sales. When advertising was increased sales went up; when advertising was decreased sales immediately fell off; when there was no advertising there were virtually no sales.

That sales vary directly with advertising has proved true with us. In the first few months of our stock selling we made steady gains. Then sales began to fade. The situation cost me sleep at nights. Then I took account of stock and found that, in the hurry of building up a stock-selling organization, I had been neglecting to write and place the usual amount of advertising. We rushed out some copy to the papers and almost magically brought our sales up to the average again. Since that time whenever sales have fallen off we have for a while doubled up on our advertising. In summer, when the security business is supposed to wither up, we do more advertising than in winter and are thus able to harvest sales the year round.

Another valuable form of advertising is direct-by-mail advertising—letters, booklets, circulars, folders, broadsides. If a series of good mailing pieces are sent to prospecting customers, the work of the salesmen is lightened.

6. *Hold employee meetings.* If rightly conducted, they both teach and stimulate.

7. *Get up "prospect" lists.* Most undirected employee selling is random work. If it is systematized, it makes better results.

PROSPECT LISTS ARE VITAL

The value of prospect lists was exemplified in a New York State sale in which one district put it over all the others. We investigated and found that while employees in other districts were calling without plan or system, the superintendent of the successful district had gone over his customer cards and had prepared a list of good prospects. These he had passed out to the employees, who called on the prospects whose names were given to them, and on no one else. In consequence there was no crossing of wires and a much larger volume of sales.

In the preceding paragraphs have been given some of the possible sales stimulators for those who use "pressure." If you decide to stimulate flagging interest by conducting a selling contest or the "prize" method, I recommend the following plans that have been used successfully:

OUTLINE FOR SELLING CONTEST

1. *Length of contest.* Our experience is that the more contests you have the longer each succeeding one has to be—up to a limit of perhaps six or eight weeks. We find that now and then, when a contest is going strong, we can even push the closing date along for two or three weeks. Don't do it so often, however, that it becomes a habit.

2. *Preliminary announcements.* Since enthusiasm and the contest spirit must be aroused, much depends on getting the story graphically before the employees. Use your house organ, if you issue one weekly. If not, use letters, folders, broadsides or some mailing piece (I am assuming your company is so big that you cannot get your employees together without considerable trouble and expense). This advertising to employees will tell them why you are selling stock and what they get out of it. If the company is small, you can best accomplish the results by meetings.

In the preliminary announcement you will tell employees about:

(a) *Quotas.* Each employee and each district or department should have a quota. The individual quota is based on what you feel each employee has a fair chance to sell. The district quota is the sum of the quotas of the individuals.

(b) *Commissions.* As interest in selling dies down it frequently pays somewhat to increase the commissions. I have had good success with a commission of $1 per share for the first ten shares, $1.25 from eleven to twenty, $1.50 for twenty-one to thirty, $1.75 for thirty-one to forty and $2 for all over forty shares. We pay also an extra 25 per cent per share after a district has sold its quota.

(c) *Prizes.* Offer both weekly and contest prizes. Try to give as many small prizes as possible. Award your main prizes on "per cent of quota sold," especially your "individual championship" and "district championship." Then offer prizes for the most shares sold each week, for the largest single sale, for the most cash sales, for the most divided-payment sales—for anything you can think of. Be sure that, in addition to the prizes for men, there are plenty also for girls.

We have used both merchandise and cash prizes, with varying success. For the district or department championship we offered at first a loving cup, banner or some such trophy, but of late have offered a banquet at which we entertain every employee of the winning district.

Just before and during a contest it is desirable to run plenty of newspaper advertising, and on each advertisement it is well to have some such statement as: "Any company employee can take your order for this security."

If your papers will use it—and they generally will in the smaller cities—give them a story or two about customer ownership and the sale of company securities through employees. It is not desirable, however, to say anything about the "contest" plan or about "prizes."

THE PRELIMINARY MEETING

Before the sale contest starts it will be necessary to talk to all employees at a meeting or series of meetings. I have always had best success in putting the proposition before employees on the "ten-point" basis outlined in a previous article. If you can get every employee to call on ten people and if you can get them to tell these prospects ten points about your security, and if you send the people who are to be called on some good direct-by-mail matter, you will sell stock.

At the meeting of employees, require each one to turn in the names of ten prospects. Have a good mailing piece of some kind to send to all these prospects. This mailing piece should be a straight selling appeal. Don't just give a few generalities but get down to bedrock. Tell why the company is a good one to invest in and why the stock is a safe and satisfactory investment. Avoid "claims" and boasts and give facts and proofs. Be sure the story you tell follows through the natural stages of a sale: attracting attention, awakening interest, creating conviction, and arousing desire, and be sure it closes with some real reason for buying at once. You can afford to give much attention to this mailing piece because it will do most of the selling that is not accomplished by the newspaper advertising.

After the sale starts your work is largely a matter of meeting conditions as they arise. Be sure, when necessary, to put pressure on the executives. Require them to make their employees make the "ten calls."

If you have one or more field managers, keep them on the jump, holding group meetings of employees, making sales, inspiring laggards, answering questions and stimulating enthusiasm.

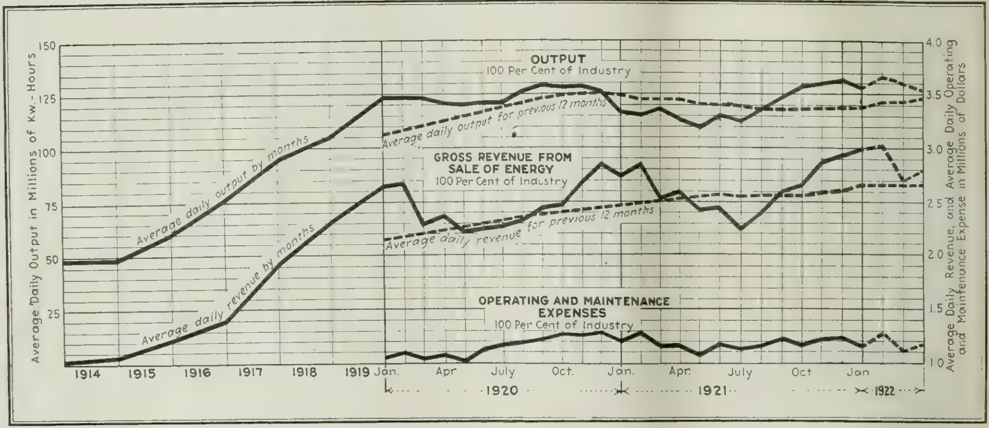
Get out a daily bulletin on a duplicating machine and mail it to all contestants. Give the standing of employees, prize winners, news of the sale and (in very moderate doses) inspirational matter.

If your company is large or scattered, much of the success of the sale will depend on the handling of correspondence in the home office. Employees in remote towns who make sales are not stimulated by the cold and stilted acknowledgments of the average treasurer's office—they want personal letters of thanks, congratulation and commendation. If they slow down, they need tactful prodding from the home office. The right kind of a letter writer in charge of all employee contest correspondence can make a lot of difference in final results.

If there be any who claim that these directions are rather incoherent, I can only say that "jazzing up" a fading employee security sale is an incoherent job. Handled with good common sense, by a man who will take advantage of opportunities as they arise, the jazzing-up plans are helpful. They can prolong greatly the productiveness of employee selling.

Ultimately, if my own experience is a fair criterion, there comes a time when employee selling cannot be depended upon for as much capital as a growing company needs. Then the management must turn to selling through regular security salesmen. How this can be done will be taken up in another article.

Output Decreased While Revenue Increased During April



REPORTS received by the *Electrical World* for the month of April from central generating and distributing companies representing 82 per cent of the installed rating of the country indicate that while the average daily output in the aggregate was considerably under that reported during March, yet the average daily gross revenue was slightly above that of March. Government reports indicate that only six primary manufacturing industries increased their activities above those of March and eight industries were operating below March, the leather industry as much as 8.2 per cent below. These curtailments in industrial power requirements account in large part for the decreased output during April. A most interesting fact, however, is that, despite this large drop in energy requirements, the gross revenue shows a slight gain over March. This would indicate that the drop in energy output was due largely to an extensive curtailment of the low-revenue or industrial power load, while the high-revenue or lighting load was on a par with or greater than that of March. The number of new lighting customers was undoubtedly largely increased during April throughout the country by reason of the large number of new houses being constructed and the spring campaigns of distributing companies to increase their domestic load. It is estimated that 1,231,000 domestic lighting customers will have been added to the central-station lines by the end of the present year, and it is probable that 75 per cent of this new load has been taken on during the first half of the year.

The Mountain and Pacific section was the only one which reported an output in excess of that during March. The irrigation load, which is a large factor throughout the West, was largely increased during April, and materially increased activities were reported in the metal-mining districts. These increased power requirements were apparently of such proportion as

TABLE I—CENTRAL STATION RETURNS FOR THREE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Installed	Revenue from the Sale of Energy (Companies Reporting)				Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase			1922 Thousands of Dollars	1921 Thousands of Dollars	Per Cent Increase	Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
														1922	1921	1922	1921	1922	1921
Feb.	77	2,864,047	2,556,563	12.0	72	$61,388	$57,513	6.7	Feb	54	19,110	19,522	-2.1	46.1	51.7	26.6	27.1	41.2	42.3
Mar.	78	3,157,133	2,781,799	13.4	72	60,857	55,990	8.7	Mar	55	19,216	19,893	-3.4	48.3	54.6	27.1	21.0	40.7	42.8
Apr	82	3,121,360	2,766,010	12.8	75	63,099	58,357	8.1	Apr	61	21,533	21,660	-0.6	48.3	53.9	25.3	27.6	34.8	47.7

more than to counterbalance any decreased manufacturing or lighting load, if such a decrease existed in that section.

Owing to the continuation of the textile strike in New England, energy requirements of that primary industry were greatly reduced, but in the Southern cotton-mill districts plants were reported as operating at full capacity. The shoe industry was operating in about 80 per cent normal basis, with some plants operating full time. The curtailments in energy required by the textile industry plus decreased lighting requirements of the New England Section resulted in an average daily output in that section of about 600,000 kw.-hr. under that reported for March.

One of the most interesting phases of the central-station operations in the New England States is the fact that the operating and maintenance expenses have dropped materially during the past few months. In February the operating expenses of the steam electric generating plants in this section were 18.6 per cent above those of February, 1921. The operating expenses of these plants dropped materially during March and still more during April, when they were 2.1 per cent below those of April, 1921.

Increased activity was reported in many of the basic industries of the Middle Atlantic States, with a resulting increased call for electrical energy. In the South Atlantic States, besides the textile industry, the chemical plants in general reported a higher rate of operation. Taking the Atlantic Section as a whole, the industrial load of the central stations was probably slightly increased over March, but the decreased lighting load was such as to make the average daily output about 1,000,000 kw.-hr. under March.

The gains made during April by the iron and steel industry were very marked in the North Central States. The automobile industry also increased operations. Several other basic industries, however, decreased operations, which, in conjunction with the decreased lighting load due to the advancing season, resulted in an average output of electrical energy of almost 2,000,000 kw.-hr. below that reported for March.

Industrial activity in the South Central States was apparently almost on a par with that reported for March. The domestic lighting was, however, slightly decreased, and the power requirements of the section in the aggregate were about 300,000 kw.-hr. per day below those of March.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States			Percentage of Installed Ratings Represented	Atlantic States			Percentage of Installed Ratings Represented	North Central States			Percentage of Installed Ratings Represented	South Central States			Percentage of Installed Ratings Represented	Pacific and Mountain States		
		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase
KW.-HR. OUTPUT:																				
Feb.	82	232,008	184,854	25.6	81	1,076,312	961,362	11.9	68	866,304	780,706	11.0	60	148,267	138,023	7.4	93	541,156	503,307	7.5
Mar.	82	258,142	210,107	22.8	81	1,176,591	1,023,654	14.9	70	972,475	861,962	12.8	60	159,222	145,996	9.1	94	590,703	540,080	9.4
Apr.	81	231,884	205,089	13.0	82	1,127,732	972,146	16.0	80	1,026,525	909,447	12.9	63	156,175	143,801	8.6	94	579,044	535,527	8.1
REVENUE:																				
Feb.	82	6,771	6,165	9.8	75	23,811	22,008	8.2	55	16,953	16,091	5.4	60	4,372	4,243	3.0	93	9,481	8,920	6.3
Mar.	82	6,366	5,947	7.0	75	23,924	21,615	10.6	57	16,929	15,701	7.8	60	4,249	4,034	5.3	94	9,389	8,693	8.0
Apr.	81	6,136	5,809	5.6	76	23,952	21,839	9.7	67	19,594	17,981	9.0	62	4,132	3,976	3.9	94	9,276	8,752	6.0
OPERATING EXPENSES:																				
Feb.	52	1,944	1,639	18.6	55	7,023	7,259	-3.2	36	4,797	5,196	-7.2	59	1,992	2,173	-8.3	92	3,354	3,255	3.0
Mar.	53	1,800	1,741	3.3	56	7,135	7,345	-2.8	38	4,907	5,201	5.7	59	2,088	2,312	-9.7	93	3,286	3,294	0.2
Apr.	53	1,621	1,655	-2.1	56	7,327	7,262	0.9	53	7,245	7,312	0.9	61	2,092	2,075	0.3	93	3,248	3,356	-3.2

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months	
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
Steam Plants:																				
February	58.6	54.8	58.7	66.9	44.1	48.9	51.6	57.1	45.9	55.8	53.9	62.5	45.8	54.6	50.7	55.7	43.7	48.0	50.5	55.3
March	54.6	62.1	58.9	66.6	48.0	52.0	50.9	56.8	47.8	57.5	52.8	62.4	47.2	52.7	50.3	55.8	47.3	56.3	49.0	55.0
April	49.5	62.5	57.5	66.5	47.2	51.5	50.7	56.7	48.7	55.2	52.3	61.9	50.6	54.7	50.0	56.0	47.4	54.5	48.4	55.0
Hydro Plants:																				
February	29.7	32.8	30.0	47.9	17.2	20.8	17.8	20.8	26.7	23.8	22.4	21.4	37.4	37.7	35.2	33.8	37.8	36.5	26.7	24.2
March	36.3	34.1	31.5	45.0	23.9	27.8	18.2	22.4	26.0	25.1	22.7	21.8	37.0	37.3	35.0	34.2	28.6	30.1	27.0	25.5
April	38.4	37.0	33.1	44.1	21.0	24.5	18.5	22.8	23.6	24.3	22.6	22.1	37.2	22.4	36.0	34.2	27.5	31.7	26.9	26.4
Combined Systems of Steam and Hydro Plants:																				
February	45.3	46.5	53.2	53.3	46.5	50.0	43.6	48.4	44.7	46.6	46.4	55.8	38.6	43.0	43.7	45.7	34.6	34.7	37.7	41.5
March	46.7	46.6	52.8	52.7	49.3	52.4	44.5	49.0	43.3	49.3	46.7	55.8	41.6	38.4	43.8	45.4	32.6	34.1	37.2	40.8
April	43.7	45.9	52.6	52.4	47.7	50.6	45.1	49.7	47.8	52.7	46.9	55.8	39.8	43.7	43.5	45.1	33.7	38.2	36.8	41.0

A Lingering Prejudice that Must Be Cured

Plea for Recognition of Utility's Heritage from Former Times and a More Active Policy in Overcoming It—Winning the "Man on the Street"

By H. S. Cooper
Dallas, Tex.

TIME WAS—and there is little use in these present days of denying these ancient facts—when most of the accusations and allegations of the politicians and demagogues against the utilities were largely true. There *were* "watered stocks" on which dishonest profits were desired. There *were* franchises obtained and used solely for the purpose of their financial exploitation. There *were* unreasonable and discriminatory rates and fares. There *was* a disposition to tell the customers and the general public to "mind its own business"—in the words of a popular poem of an earlier date, "All that we ask is to be let alone!"

It is as well for the utilities, when these facts are arrayed against them, to "acknowledge the corn." "Contrasts more clearly define differences" is an old and proved saying. Let the general—and generally hazy—objections of the present day be condensed into a few definite ones and these will generally be found to contain the accusations stated above, with, perhaps, a few explicit local ones. When so condensed all of these objections, accusations and criticisms answer and contradict themselves—the history of the utilities during and since the recent war, their control and regulation by public boards and commissions, their present attitude and condition of both finance and operating, are matters of public record easily available to every one, and thus the ancient accusations of reckless moneymaking and expenditure, contempt of the public and other crimes attributed to the utilities in times past can be conclusively shown not only to be non-existent but it can be proved that, under present conditions, it is actually impossible that they could exist.

The Proved Facts of the Case

Coming down to easily proved facts in detail: Commissions and courts in nearly all states have decided that a Niagara of water in the securities of any public utility company will have no effect whatever on the rates and fares and rules and regulations of that company so far as the consumer of its product or service are concerned. The only basis on which such rates and fares are formed and allowed is "the actual value of the property used or usable in the business."

Franchises also, it has been both judicially and legislatively decided, have nothing to do with the rates and fares except as they may specifically limit them.

Publicity as to the utility, in its every phase, is now not only the rule but it is the law universally. The property of the utility, its securities, its rates and fares, its methods and costs of operating, every small detail of the company from its charter to its last month's operations, are now public property, open not only to public officials and to the company's security holders but to its customers and to the public at large.

In every state of the Union the matter of discrimination in rates or fares is explicitly forbidden by legislation backed by judicial decision, and severe penalties are imposed for disobedience.

In regard to service the rules of the governing and controlling bodies are equally strict.

As to the rules and regulations issued by the utility for the use of its product or service, the laws of the various states are unanimous in prescribing that these must be "just, reasonable and not discriminatory."

Even the matter of extensions of service, and, in some cases, of increase or betterment of service, has been legally provided for.

In addition to all the above measures of public protection, there exists always the right of the individual, of groups, to appeal to their local, state or national courts for relief from what they may consider any illegal act on the part of the utility.

These facts are known—or should be known—to all the executives and administrators of every public utility in the land, but there have been numberless cases where it would seem that either they were not known or were not fully appreciated. It would also seem that there have been many cases where the dissemination of this information to the customers and the general public was not considered as the best publicity.

Why the Story Must Be Told

This is a vitally necessary item in favorable publicity for the utilities. The "man on the street," as Mr. Kennedy so aptly describes the average citizen and utility customer, reads but little of the published propaganda of the utilities or their friends the manufacturers and distributors. One reason for this is that a great deal of it is over his head. Another is that he considers all such publicity merely special pleas to cover or speciously excuse what he still mistily conceives as the shortcomings of the utilities.

It must be also remembered—and realized by the utilities—that that man on the street is not only a customer of one or more of his local utilities but that he is a customer from necessity and not from a desire for luxury. To keep up with his friends, to save himself and his family from unpleasant labor, to give himself and his family those things which custom and use have made the necessities of modern city, suburban and even country life, he feels compelled to use the product or service of his local utilities if they are in any way available. To him this product or service, its price and terms, its rules and regulations of purchase and use, the policy and practice, the operating methods and the standing of his local utilities are matters of personal and individual convenience, safety and comfort. His interest in the local utilities is purely a selfish and personal one. The failure of a utility he patronizes to make an adequate profit, its trials and tribulations are extraneous to his affairs, and he seldom considers that they affect him personally until he is personally and individually touched by increased rates or by a decreased or less satisfactory service enforced or threatened.

All this frame of mind is caused by the fact that this man on the street has not been made to *realize* what the utility truly is today—its place in the community and its relations to him personally. Most of the time the trouble with him is innocent ignorance of present-day utility conditions. In his mind still lingers the relics of conditions before the war. The cobwebs spun by designing politicians and self-serving demagogues still clog his clear perception and it needs the broom of plain, uncontrovertible facts, carefully and assiduously applied by a friendly hand, to clear away these cobwebs.

Niagara Falls Convention of A.I.E.E. Is Completely Successful

Attendance Doubles Expectation, the Quality of Technical Papers Is High and the Discussions Are Full and Animated—Queenston Plant a Center of Interest and Debate—Section Delegates Formulate Plans

A SPLENDID program was carried out at the annual convention of the American Institute of Electrical Engineers, held at the Clifton Hotel, Niagara Falls, Ontario, from Tuesday to Friday of this week. The attendance reached 650, exceeding expectations by 100 per cent. A free and full discussion of section activities was supplemented by technical papers of high merit.

The outstanding technical papers were those on the Baltimore tests of circuit breakers, where for the first time a generating system was utilized, in co-operation with manufacturing companies, under short-circuit conditions for testing oil breakers. Other interesting papers were devoted to technical discussions on cables and relays, and, to provide a diversity of interest, miscellaneous papers of high quality were presented.

A unique feature of the convention was the graded arrangement of the program. The more technical and specialized sessions were held in the early part of the week, thus allowing members unable to be present during the entire meeting to select the days on which the proceedings would hold most of interest for them.

Social features were provided for the ladies accompanying the delegates in the way of bridge parties, teas and scenic trips. Golf, tennis and baseball, combined with an inspection trip to the Queenston development of the Ontario Hydro-Electric Power Commission, very acceptably filled up the time of the men in the afternoons.

The president's address was deferred until Tuesday evening, when President McClellan addressed the members and guests at the president's reception. He spoke briefly on the topic "Why Does the A. I. E. E. Exist?" One of the best reasons, he said, was so that electrical engineers could have social gatherings like the one then under way. "But the Institute cannot exist just for pleasure," he continued. "There must be some big reason. I wish every younger member could know how the Institute had its beginning in intimate discussion and debate of problems directly confronting us then."

President McClellan went on to recount how first one field and then another broke off from the parent Institute, forming other societies; but he emphasized that these other bodies all have a business or commercial side, while the Institute still exists and grows stronger because it is the one place where electrical engineers, whatever may be their commercial connections, can keep the professional spirit of electrical engineering alive and untainted. It is a place where every electrical engineer may meet his brother electrical engineer on a professional basis. Now more than ever before, after the disturbing influences of the war, is the professional spirit needed, and all electrical engineers should get loyally back of the Institute. "What is this professional spirit?" Mr. McClellan asked. "It is integrity of purpose, honesty of effort; in short, it is typical of that which is at the bottom of our country's life. We must build even better in the future."

DELEGATES' SESSION NOTES

An innovation was made by the allotment of Monday to the activities of the section delegates. At previous conventions these delegates have held their meetings in the evening, but their importance in the Institute has increased so rapidly that an entire day was needed for their activities.

Arthur W. Berresford, past-president of the Institute and chairman of the sections committee, presided at the meeting of the delegates. President McClellan greeted them by saying that such contacts were very important and that the meeting of the delegates furnished a clearing house of ideas for developing the status of engineering. President-elect Frank B. Jewett said that industry was just at the beginning of an era of tremendous development brought about by the war stimuli and the recent inventions in engineering.

The delegates acted on several questions brought before them by the committee. The meeting opposed the use of the grade "junior" and seemed to agree that membership should be of two classes only—first, those whose work and livelihood lie in electrical engineering, and, second, those who are interested in electrical engineering but not dependent upon it for their livelihood.

President McClellan suggested the use of the terms "junior," "member" and "associate," the "junior" members to be the younger electrical engineers who would be compelled to become members or associates after a certain period of time.

The meeting voted that no restrictions be placed on the expenditure of section funds. It also voted to allow sections to act on any local matter without the permission of the board of directors of the Institute, provided that the policy of the Institute was not involved.

A suggestion that divisional meetings be held based on the vice-presidential districts was voted down for the present, as was also a mandatory provision for a yearly meeting of divisional executive committees, the members to have their expenses paid by the Institute.

The delegates voted to have future meetings on the Monday of the week of the annual convention.

At the afternoon meeting of the delegates a long discussion was held with the meetings and papers committee, of which E. E. F. Creighton is chairman.

RADIO DRAWS ATTENDANCE

Radio was the most popular topic at A. I. E. E. section meetings during the past year, according to a report made by L. W. W. Morrow to the section delegates. The forty-one sections of the Institute held 293 meetings in the twelve months and a radio topic was on the program at thirty-eight. Other popular subjects, classed in order of frequency, were industrial applications, general non-technical topics, electrical apparatus, general scientific topics, and local power plants or power projects. Nearly every section obtained the best results by having only one subject and one speaker on the program, and of the many different means employed to obtain speakers personal appeals from friends brought the most response.

Twenty-five sections favored some action by the Institute by which they could obtain better speakers and could use their funds as best suited their local conditions. The conclusions drawn by Mr. Morrow were that the technical quality of the section papers, on the whole, is poor because the speakers are not notified soon enough to afford time to prepare better papers, because the present audiences prefer a general and elementary presentation and because high-grade speakers are difficult to secure. He said also that no co-ordinated plan or arrangement exists for making good programs, that no systematic effort is made to insure participation of members in the discussion, and that the social success of the meetings is handicapped by lack of funds.

Recommendation was made that a competent man should devote all his efforts toward co-ordinating and promoting section activities. He could serve as a clearing house for speakers and could give to the sections advice based on general experience as to ways of stimulating their members. In addition, officers of the Institute should visit sections more frequently and restrictions on the employment of section funds should be removed.

The opinion was expressed in the report that sections should devote themselves to educating and interesting their members rather than to the production of papers of a caliber suitable for Institute publication.

FOUR ANNUAL CONVENTIONS

Mr. Creighton gave a résumé of the activities of the meetings and programs committee. He announced that four conventions each year would be held in the future. He also outlined the changed character of the *Journal of the A. I. E. E.* and told of the attempt to get for inclusion with each paper a summary of its contents, a bibliography and a prearranged discussion. He pointed out that unsolved problems involved such items as how to handle discussions, how to improve the character of the papers and how to handle mathematical papers. He stated also that discussions would be presented with papers in the *Journal* by 1923 and that the committee was trying in every way to co-ordinate and systematize the work before it.

In the discussion that followed the consensus of opinion was that a section secretary was needed to co-ordinate and help the sections. The sense of the meeting was that some programs should be devoted to developing younger members and that others should include addresses by men of national reputation. President McClellan said that, independent of the numbers present at meetings, the younger men should discuss and argue questions in which they are intensely interested.

The meetings were attended by delegates from forty sections and by many other members of the Institute.

In an address of welcome to the convention on Tuesday morning A. Monroe Grier, president of the Canadian Niagara Power Company, pointed out that electricity has aided in cementing the friendship between Canada and the United States. He stated that much energy is still available at Niagara Falls and that a larger program for future developments is under way. President McClellan, responding, said that the members felt no sense of being in a foreign country, because of the similarity in problems, sentiments and history.

A. P. M. Fleming brought to the convention a greeting from the Institution of Electrical Engineers and other British engineering organizations. He asserted that all engineers share the responsibility of rehabilitating the world.

President-elect Jewett outlined a progressive policy for the Institute during the coming year, after which two parallel technical sessions were held. The first session was devoted to miscellaneous papers, some of which are abstracted in this issue of the *Electrical World*. Abstracts of the others will appear next week.

In discussing the paper on the two-stage current transformer, James R. Craighead, Schenectady, showed slides and gave data for a line of current transformers of the ordinary type which gave evidence that no serious errors were introduced by ratio or phase-angle effects and that, inherently, errors were greater on 25-cycle than on 60-cycle designs.

The paper on dielectric tests on oils gave rise to much discussion which led to the general conclusion that variations in breakdown voltage were due to the inherent chemical properties of the oil. Dr. J. B. Whitehead, Baltimore, suggested using cylindrical conductors with corona breakdown for oil tests. Dr. Steinmetz told of several tests which tended to prove that the presence of air or moisture did not cause the variable breakdown limits. W. D. A. Peaslee, Huntington, W. Va., suggested filtering the oil between tests to study the effect of mobility of movement of the free electrons.

O. D. Wood, Pittsfield, Mass., maintained that the use of insulating barriers tended to prevent irregularity in breakdown limits, and F. W. Peek, Jr., Pittsfield, explained that, with barriers, the chances were removed that successive oil layers between electrodes would consist of oil of poor strength.

Prof. Vannevar Bush, Cambridge, Mass., pointed out that his paper described a new development of scientific interest whose commercial field was in the future. Dr. Steinmetz stated that the data introduced in the paper raised further doubt of the present theory of gaseous breakdown. Dr. Whitehead explained the action of the tube on the basis of a difference in mobility of positive and negative ions.

The paper on temperature measurements under service operation brought out a discussion in respect to the practice of others in making temperature measurements on service apparatus. In particular, probable sources of error in taking thermometer readings were pointed out.

The parallel session Tuesday morning was devoted to four papers on unrelated subjects. Some of these are abstracted in this issue and the others will be abstracted in next week's issue of the *Electrical World*.

In the discussion on automatic substations for direct-current railway distribution, moving pictures were used to great advantage to show in detail certain sequences of operation which were under discussion. D. W. Roper, Chicago, urged railways in their present position of financial ability to rehabilitate and catch up with the times—in contrast with the conditions prevailing in the past seven years—and to plan as many automatic substations, with the many resulting closely located feeding points, as possible, in order to reduce electrolysis as well as to increase economy.

W. E. Bryan, superintendent of power for the United Railways of St. Louis, again pointed out that variations in conditions make general conclusions difficult to determine and, more important, of doubtful value elsewhere. These same differences exist in different parts of the same city also. Comparing an annual distribution cost of $250,000, mentioned in the paper, for Cleveland, with $425,000 for St. Louis, Mr. Bryan argued that if 3,000-kw. substations are economical in the former case, the latter case would demand a larger number of smaller stations for best economy. By presenting considerable data as to cost, fixed charges, operating efficiency, etc., Mr. Bryan showed why he favors small automatic substations rather than larger ones.

M. J. Lowenberg, Boston, in discussing design for most economical layout and the use of Kelvin's law in that connection, pointed out that the permissible voltage drop is the controlling factor and should be determined at the outset. If first cost is the controlling factor (and a banker will usually say so when he is told that by using only 65 per cent as much copper the annual loss is only 10 per cent more), this voltage drop may be one-half—in the case of electric traction, of course, not lighting. In other words, one must "not use Kelvin's law to throw the burden on the stockholder." Another factor is the probability that standard practice or installation of standard cable sizes will frequently control the final design and upset the actual Kelvin law computation or modify it to a large extent as the governing factor.

SELLING SERVICE, NOT ENERGY

S. E. Doane, Cleveland, in discussing "Light Without Glare," points out once again that the electrical industry is selling light, heat and power and not merely electrical energy. The electrical industry has not completed its work, therefore, merely by connecting a customer and selling him energy; but there must be a selling of how to use the service, a study of "application from the customer's angle." There is a big gap, Mr. Doane declared, "between what little we know and what the public know." This must be bridged by demonstration, and demonstration of illumination is even more difficult and unusual than demonstration of vacuum cleaners, sewing machines, toaster stoves and other appliances. Prof. C. F. Scott, New Haven, said papers like Mr. Harrison's are a continuous revelation of how much is not known about light. While the whole electrical industry was at one time devoted to producing light, there was then no study of illumination. The work today he characterized as taking every-day commonplace things and putting them on a real and scientific basis.

Prof. V. Karapetoff, in discussing Bassett Jones' paper on how to install industrial motors, said that, in essence, the basis of Mr. Jones' paper was the use of the theory of probabilities in the application of motors to duty-cycle operation in large numbers. Recognizing the paper as a pioneer expression, welcoming intelligent application of mathematics to practical engineering, yet Professor Karapetoff warned against a probable influx of similar papers based on this one unless certain errors in the present paper were pointed out. He said that, after studying several hypothetical cases by Mr. Jones' theory and by the ordinary method of numerical averaging of currents as taken from the duty cycles, using ordinary judgment, he found that ocasionally Mr. Jones' method led to absurdities and at other times agreed exactly with results obtained in easier ways. For example, taking one problem quoted by Mr. Jones, in which the current obtained by the theory of probabilities was 300 amp., Professor Karapetoff showed that ordinary averaging of the currents under question also gave just 300 amp. Where such was the case higher mathematics was not needed to solve such problems.

QUEENSTON DEVELOPMENT

A very elaborate symposium on the new Chippawa-Queenston development of the Hydro-Electric Power Commission of Ontario was presented on Tuesday afternoon. The major engineering considerations involved in laying out and constructing the hydraulic as well as the electrical features* were covered quite extensively by F. A. Gaby, chief engineer of the commission, while

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*The electrical features were discussed in the June 24, 1922, issue of the *Electrical World*.

features of the generators and transformers were described by representatives of the Canadian General Electric Company, Ltd., the Canadian Westinghouse Company, Ltd., and the Westinghouse Electric & Manufacturing Company.

Throughout the preliminary study of the Queenston development, and later as the design progressed, continuous use was made of models of the various structures in order that the mathematical analysis might be reinforced by actual demonstrations under the assumed conditions, Mr. Gaby pointed out in his paper. From the hydraulic point of view the provisions for overcoming ice difficulties and for regaining the kinetic energy of the water entering the forebay and the studies involved in determining the most economical proportions of the canal were most interesting.

Two forms of intakes are used at the mouth of the Welland River near Chippawa—one the conventional or surface intake, consisting of a concrete boom with fifteen openings fitted with drop gates, the other the submerged intake, consisting of six gathering tubes or draft distributors, which are 675 ft. long. Water enters the tubes along a distance of 500 ft. through a slot on their upstream sides.

A wedge-shaped structure was used in the entrance to the forebay to regain the kinetic energy of the entering water. By thus providing a 10-deg. angle of flare in the entrance it was possible to utilize the velocity of the entering water to increase the head at the penstock entrances.

To prevent shutdown from collapse of rock structures, each penstock was provided with a modified bell mouth having three openings sealed by a curtain wall extending down to within 28 ft. of the forebay floor. Behind this wall are steel-lined gate checks for structural-steel gates. The racks, which are removable in two sections, consist of bars set on edge and held in checks in the concrete screen-house walls.

The penstocks, which are incased in concrete, are designed to withstand the pressure due to static head, namely, 305 ft., plus the pressure rise caused by complete closing of turbine gates in one and one-half seconds.

Among the features of the turbines, aside from their rating, are the use of labyrinth seals on the runner runs to reduce leakage, the arrangement for removal of runners through draft tubes, and the provision of an emergency connection between the governor system and penstock to prevent shutdown due to pump failure.

Notwithstanding the very large rated capacity of the 45,000-kva. generators for the Queenston power house their essential construction features are not different from those of much smaller rated generators, said B. L. Barns and F. Bowness, authors of one of the papers regarding the General Electric generator. The generators are of the vertical-shaft type with two guide bearings and a thrust bearing. The thrust bearing is located above the stator and carries the weight of the complete rotating elements of the generator and water turbine. Each generator is provided with a direct-connected exciter.

The flywheel effect required for satisfactory speed regulation of the turbines necessitated the use of auxiliary flywheels mounted on the shaft adjacent to the generator rotor. The rotor is constructed with a number of cast-steel wheels which together form the rotor spider for carrying the pole pieces. The pole pieces are made of punchings and are attached to the rotor with three dovetails per pole. The coils are made of copper strip wound on edge.

The stator windings consist of form-wound, diamond-shaped coils, each slot containing two coil sides. The coils are made of stranded conductor and are insulated with mica tape, which affords more or less flexible insulation. The ends of the coils are braced against the distorting effect of severe short circuits in a manner that permits expansion and contraction.

Owing to the size of the generators certain interesting problems were encountered in the design of the Westinghouse generators, R. A. McCarty and H. U. Hart pointed out. The more important of these problems dealt with the design of (1) the armature winding, (2) the upper bearing bracket and (3) the rotating spider. The solution of these problems was briefly discussed, and a tabulation of major dimensions and weights of the generators was given.

Forces Large in Transformers

Interest in the main step-up transformers centers largely about their great physical size and the heavy short-circuit currents to be dealt with. Physically they are the largest single-phase transformers in operation today. C. A. Price and M. E. Skinner of the Westinghouse company gave figures on the weights and dimensions of these transformers and their component parts as well as the performance calculated from test results. They also pointed out that the mechanical forces in 25-cycle transformers are inherently high because of the relatively large number of turns necessary to develop the voltage and because of their relatively low impedance to the flow of short-circuit currents. The nature and magnitude of the mechanical forces existing between current-carrying coils were discussed (1) for a single-turn coil in space, (2) for two single-turn coils arranged concentrically and lying in the same plane, (3) for two single-turn coils arranged coaxially and lying in parallel planes. The conclusion was reached that as long as primary and secondary coils are adjacent there is no limit on the shape of the coil from the mechanical point of view.

In his comment F. A. Gaby, chief engineer of the Ontario Hydro-Electric Power Commission, stated that five units were scheduled for operation by January, 1923, and that future units would have a rating of 80,000 hp. B. L. Barns, R. A. McCarty and M. E. Skinner described other interesting elements of the equipment, after which an animated discussion was held. B. A. Behrend, chairman of the electrical machinery committee, presided at the session and in opening the discussion briefly reviewed the developments at Niagara Falls. Messrs. Foster, Newbury, Behrend and Williamson then discussed the relative merits of solid and laminated rotor construction. Mr. Foster stated that the stresses at double speed should be less than one-half the elastic limit of the material and that conditions largely governed the type of construction to be used. Mr. Behrend stated that his experiences made him favor the built-up rotor type of construction.

F. D. Newbury, in discussing the papers, pointed out that the chief differences in the units made for the plant was that two methods of coil bracing were used and two types of insulation. One design used rings with the coils tied to the rings and the other used rigid brackets. One design used a flexible type of insulation in the straight part of the coil while the other used a rigid type.

Breakers Withstand Short-Circuit Tests

With Minor Modifications, All Types Ruptured Short Circuits Several Times in Succession Without Failure—Cscillogram Studies Made in Each Case—Ample Capacity Provided Back of Short Circuits

THE most extensive oil-circuit-breaker tests which have been conducted so far were the subject of three papers at the Niagara Falls convention of the American Institute of Electrical Engineers yesterday. The operators' viewpoint was expressed by H. C. Louis and A. F. Bang of the Consolidated Gas, Electric Light & Power Company and of the Pennsylvania Water & Power Company, Baltimore, respectively. These companies co-operated with the Westinghouse Electric & Manufacturing Company and the General Electric Company in the investigation. Observations of the manufacturers were presented by J. B. MacNeil of the Westinghouse Company and J. D. Hilliard of the General Electric Company.

Tests were made on the 13,200-volt, 25-cycle system of the Consolidated Gas, Electric Light & Power Company at the Canton substation, which is 7 miles from the Westport steam station of the company and 41 miles from the Holtwood hydro-electric plant of the Pennsylvania Water & Power Company. Generator, transmission line and cable capacities equal to or exceeding the normal operating conditions for the breakers were furnished.

CAPACITY OF SYSTEMS AND CURRENT OBTAINED

The rating in steam-driven turbo-generators was 127,500 kw., of which 87,500 kw. was usually available for tests. The hydraulic generating rating was 83,500, and there was also available on the system one 20,000-kw. steam-driven unit at the Pratt Street station in Baltimore. This brings the combined total generating capacity of the system up to 231,000 kw., and the maximum used in the test was 170,000 kw. The Canton substation is directly connected with the Westport steam station by four 26,000-volt submarine cables, banks of transformers being provided at either end, and is also tied to the city network by eight 13,200-volt cables through the Pennsylvania Water & Power Company, Highlandtown substation.

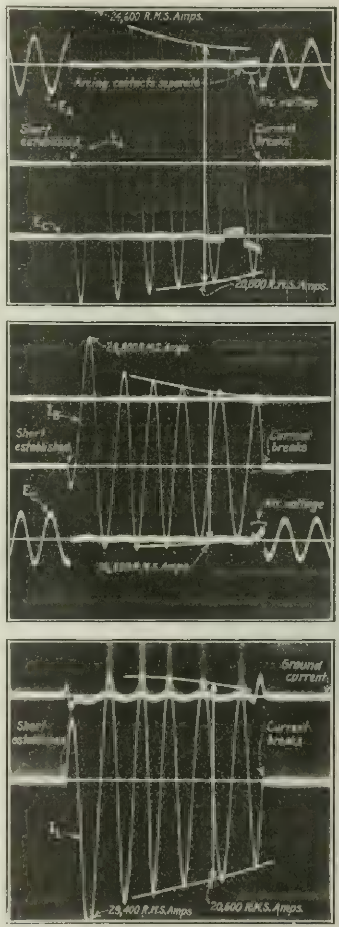


FIG. 1—PHASE VOLTAGES, PHASE CURRENTS AND GROUND CURRENT RECORDED DURING ALL TESTS

All short circuits were ruptured within three cycles to five and one-half cycles after establishment, depending on the character of the breaker, the actual period of contact separation or arcing being less than one cycle. In all except one case (Fig. 2) the current was interrupted at the zero point in the wave.

This group of oscillograms indicates the performance of an H-3 breaker on a three-phase short circuit reaching 29,400 r.m.s. amp. in one phase. As would be expected, when the "short" was established each phase voltage dropped to zero and was maintained there until the arcing contacts began to separate. From this point until actual current rupture, which was about one-half cycle, the phase voltage had a flat-topped arcing characteristic. During the "short" the ground current I_G had fundamental frequency.

As breakers of various capacities were tested, various values of short-circuit current were obtained by utilizing different numbers of generating units based upon short-circuit computations. It is remarkable to note that these computations give results within 5 to 15 per cent of the current actually obtained in the tests at the time of rupture.

All the tests were made at 13,200 volts, 25 cycles. Short circuits ranging from 950 to 30,800 initial root-mean-square amperes and from 750 to 23,700 ruptured root-mean-square amperes were obtained. The water-power station supplied about 30 per cent of the initial short-circuit current, 70 per cent being supplied either by Westport alone or by Westport and Pratt Street stations. The maximum instantaneous load on any of the generators did not exceed five times the normal load. Under the heavy short circuit, some cables carried from 2,000 amp. to 2,500 amp.

TEST ARRANGEMENTS FOR SAFETY

Most of the short circuits were made on three-phases to ground. A few were between two phases and ground, and several on one phase and ground only. After finding that two-phase and single-phase short circuits produced severe vibrations of turbo-generators, they were subsequently avoided. Since the Baltimore system has the neutral of all generators and transformers dead-grounded without any resistance, it was necessary for each individual phase of the oil circuit breaker to clear its own part of the short circuit without any help from the other phases. This might not have been required in an ungrounded or partly grounded system.

The general method of testing was to place the test breaker (set to open instantaneously) in series with two other oil circuit breakers, serving as protection in case of failure of the test breaker; they were set for delayed opening. A separate switch was used to act as a closing-in breaker exclusively. Hence, there were four breakers in all in the test circuit. Short circuits were established by throwing dead metallic short circuits on the entire connected system. Three oscillographs containing three elements each were used, thus making a total of nine elements and three films. Each of them generally recorded the current in one phase and corresponding voltage to ground. A timing curve was obtained by recording the voltage of the other phase. The third film also recorded the ground current.

Potential transformers were connected from each phase to ground at a point between the two protective breakers, thus providing a measure of voltage across each phase of the test breaker, showing in succession full voltage before the short circuit, zero voltage and arcing voltage during the short circuit, and the reestablished voltage after the short circuit was cleared.

For current measurement, the slip-over-type power transformers were used by one manufacturer and were put in the line between the two protective breakers. The other manufacturer used shunts to measure the current. These were arranged in the form of an equilateral triangle and put in the leads at the short-circuited and grounded end of the test breakers.

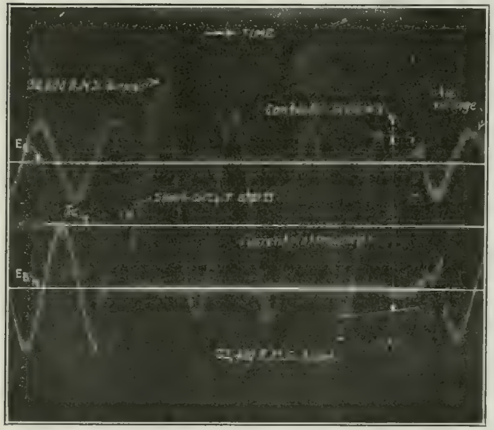


FIG. 2—IN THIS TEST THE CURRENT WAS NOT INTERRUPTED AT ZERO POINT OF WAVE

A study of the oscillograms indicated that the voltage of the short-circuited phase becomes zero the moment the short circuit occurs, but later reappears as a typical arcing voltage with the well-known flat arc characteristic corresponding to the arcing contacts separation. After a little more than one-half cycle of arcing, the current is ruptured, and practically normal phase voltage is established. The greater percentage of short circuits were broken at the zero point of the current wave, corresponding to the time at which the magnetically stored energy of the system is the minimum, but occasional exceptions are found to this rule.

In order to determine the root-mean-square value of current at any moment, the method described by Hewlett, Mahoney and Burnham before the A. I. E. E. in 1918 was used. This method combines at any moment the effective alternating-current component and the direct-current component by the square root of the sum of the squares. To determine the true root-mean-square value which the breaker interrupted, the component parts are taken from the films at the moment that the arc voltage first appears, that is, at the instant the arcing tips part. However, in most cases, the direct-current component of the current wave was usually negligible at this time. To determine the maximum root-mean-square obtained on the short circuit, the component parts were taken at the peak of either of the first two half waves, depending on which was the larger.

About 200 short circuits were placed directly on the Baltimore system at Canton many of which involved the largest short circuit obtainable at this place. Not a single breakdown of the equipment of the two operating companies occurred. Furthermore, only two serious disturbances resulted on the system, one being due to the opening of a disconnecting switch in the station and the other being caused by the burning open of one of the leads in the station at its terminal. The most sensitive equipment on the system seemed to be the rectifiers used for street lighting, which frequently would drop out. The reason that no serious disturbance occurred seemed to be that the time element was too short, the short circuit being permitted to continue only about one-quarter second and never more than one-half second. Besides, the short circuits were not made directly at the generating station, so there would always be some voltage left on the generators to maintain synchronism, and the system is equipped with a carefully designed and adjusted selective relay system.

CONCLUDES 20,000 AMP. CAN BE RUPTURED IN LESS THAN ONE CYCLE

The largest breaker tested by the Westinghouse company was the type "O-3." This breaker was subjected to eight short circuits varying from 16,000 r.m.s. amp. to 24,000 r.m.s. amp. The last seven short circuits were made in succession without inspection of the breaker and the time element between short circuits varied from one and one-half minutes up to thirty-five.

The arcing tip of this breaker opened three cycles after the short circuit was placed on the system, and the arc in all cases was completely ruptured within four cycles from the time the short circuit was placed on the system, the average being three and one-half cycles (0.14 second). The average time of arcing was one-half cycle (0.02 second), with a maximum of one cycle (0.04 second).

A modification of the type "CO-2" breaker was tested seven times in succession without inspection or alteration, with ruptured currents varying from 18,000 r.m.s. amp. to 22,000 r.m.s. amp. The arcing tip opened approximately three and three-quarters cycles (0.15 second) after the short circuit was thrown on and the circuit was completely ruptured, on the average, four and one-quarter cycles (0.17 second) from the time of short circuit. The time of arcing averaged one-half cycle (0.02 second).

A modification of the type "O-1" breaker was tested under short-circuit conditions twelve times in succession, the first five of these tests being made in a period of eighteen minutes and the last four in a period of four minutes. The others were made at varying intervals. The current rupture ranged from 19,000 r.m.s. amp. to 23,900 r.m.s. amp. The arcing tip parted, on an average, approximately three cycles (0.12 second) from the time of short circuit, and the circuit was completely ruptured, on an average, three and six-tenths cycles (0.144 second) from time of short circuit, making an average time of arcing of approximately six-tenths of a cycle (0.024 second).

A series of nine short circuits was placed on the type "OE-6" breaker, of which five were made in a period of eighteen minutes and the others at varying intervals. The current actually opened ranged from 16,300 amp. to 21,000 amp. The average time from the point of short circuit until the arcing tips parted was about three and one-quarter cycles (0.13 second), until the circuit was completely ruptured three and three-quarters cycles (0.15 second), and the period of arcing averaged one-half cycle (0.02 second). The oil was extremely black and muddy at the end of the tests. A modified type "E-6" breaker was subjected to a final test of ten short circuits, on which the current ruptured varied from 10,000 amp. to 11,800 amp. The average time from the moment of short circuit until the arcing tips opened was approximately three cycles (0.12 second). The average time until the circuit was completely ruptured was three and three-quarters cycles (0.15 second), and the average time of arcing was three-quarters of a cycle (0.03 seconds). The last five short circuits were made in a period of four minutes, or an average of less than one minute between short circuits. Approximately one-half gallon (1.8 liters) of oil was thrown from each tank through the oil separators on the ten short-circuit tests.

It seems probable that the rupturing capacity of a given breaker on 60 cycles is more than it would be on 25 cycles. The data show that on 25-cycle circuits with heavy current of the order of 15,000 amp. to 20,000 amp. the arc can be expected to go out in less than one cycle after the arcing tips part. On 60 cycles the energy liberated in the tanks per half-cycle is only two-fifths as much as on 25 cycles, and the opportunity for putting out the arc occurs more frequently on 60 cycles. Most of the breakers used in these tests were modified slightly as experience under test conditions proved valuable.

LIFE OF BREAKER—A FUNCTION OF COPPER IN ARCING TIPS

Referring to the tests on General Electric Company apparatus, Mr. Hilliard points out that the tests do not apply universally to all 13,200-volt, 25-cycle systems and circuit connections, and are conclusive only for the modified breakers employed on the particular system involved and under the specific conditions existing during the investigation. The tests were to determine the suitability of the breakers to handle five successive short circuits with all the power which the operating companies could deliver and were not begun until after the changes indicated as a result of preliminary tests had been made. The remodeled breakers consisted of the following types: FH-3Y, FH-6Y, FH-9Y and a single pole of an experimental type, FHD-17Y, the so-called dead-potential FH breaker.

The remodeled type FHY breakers differed from the standard type FH breakers in having heavier tops, contact rods, bolts and bolting members, also heavier internal baffle construction, and an external separating chamber of insulating material, leading from the top of each oil tank through which the gas is ejected and in which chamber any atomized oil vapor is retained by the condensing material contained in the tube, and returned to the oil tank.

The type FH-3Y breaker interrupted an average current of 20,600 r.m.s. amp. once without oil throw and an average current of 20,200 the second time without oil throw. At this second shot a defective lever arm on the mechanism broke and the breaker was not tested further. The type FH-6Y breaker interrupted five successive short circuits averaging 20,200 r.m.s. arc amperes. A few drops of oil was the extent of the oil throw in any of the tests. The type FH-9Y breaker interrupted five successive short circuits with an average current of 19,160 r.m.s. arc amperes. The oil throw was limited to a few drops except from a leaky gasket on one phase. The single-pole element of the type FHD-17Y breaker interrupted five successive short circuits averaging 17,670 r.m.s. arc amperes. During this period the oil throw was very small.

The burning of the contacts and contact rods for the five short circuits was small on all of the breakers tested and was substantially the same for all breakers—about ¼ in. (6.3 mm.) was burned from the end of each contact rod.

The results of the tests indicate unquestionably that it is possible, with proper design, to build oil circuit breakers which can be relied upon to interrupt large current on high capacity systems satisfactorily many times in succession without damage to the breakers, without throwing any oil and without change of oil or adjustment. Minor improvements in design will tend toward a decrease in the energy loss in the tanks, with improved control of gases, relief of pressure produced in the tanks and the entire elimination of oil throwing. It was observed that the life of the breaker and the number of times it can successfully and repeatedly open the circuit is a function of the amount of copper in the arcing tips. The condition of the oil in the breaker is not such a very important matter.

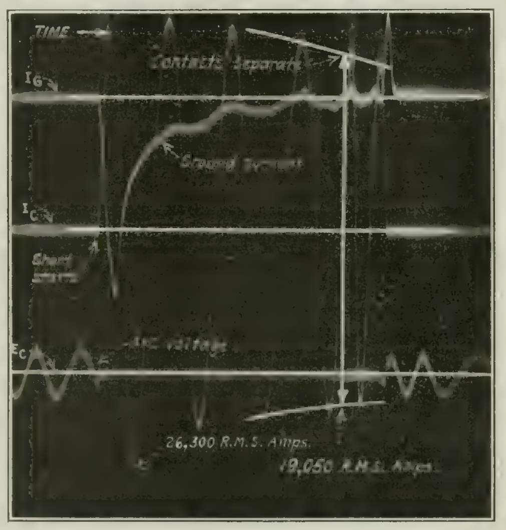


FIG. 3—A PECULIAR GROUND CURRENT I_G OCCURRED IN THIS TEST

The investigation proves that it is possible to conduct a series of tests directly on a modern system without damage to the equipment and without serious interference with its normal operation. This fact should encourage other companies to co-operate with manufacturers in the improvement in oil breakers of other designs and ratings.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Measuring Direct Current with Split-Core Transformer

To the Editors of the Electrical World:

In the April 15, 1922, issue of the *Electrical World* I note in the section entitled "Scientific Industrial Research" an article on the "Measurement of Large Direct Currents." The method described apparently is the same as I have developed in our testing laboratory.

I have used both a closed circular magnetic circuit and a split-core transformer for the measurement of direct current. If the alternating-current supply voltage is held constant, the magnetizing component of the alternating current is proportional to the direct-current ampere-turns.

If the magnetizing current is plotted as the ordinate and direct current as the abscissa (assuming one-turn conductor), the curve obtained has the same characteristic shape as the *B-H* curve of the material used as the core of the transformer. If a split core is used, interposing an air gap, the direct current, of course, reaches a higher value before the knee of the curve is reached.

One of the disadvantages of this method is that any variation in the alternating-current supply brings in an error in the measurements, but I find the loss in the transformer (I^2R and core loss) to be very nearly constant over a wide range of direct current.

G. L. HILL,
Assistant Engineer
Bureau of Tests and Inspections.
Pacific Gas & Electric Co.,
San Francisco.

Selectivity Between Stations More Important than Selectivity for Distance

To the Editors of the Electrical World:

In my opinion, the radio receiving sets which are being made by several of the manufacturers at this time will not give the best results to the users in or near large communities. This is probably due to the fact that a set with a large number of adjustments, each of which has to be just right for a signal to be received, would not perhaps be as popular as some of the present very simple sets. The sets referred to are very selective as applied to distant stations. They can be adjusted to receive from one station, and they will very satisfactorily cut out other distant stations operating on wave lengths differing only very slightly from the wave length to which the set is tuned. However, these sets are not selective as applied to heavy interference caused by sending stations of medium size near the receiver or by signals from sending stations of large size at relatively short distances from the receiver. To put the matter briefly, the sets are selective as between distant stations, but are not selective when there is a station near which can cause even reasonably heavy interference.

In my opinion, it will be necessary for the receiving sets to be able to tune out any reasonable interference if they are to serve their purpose in the future. There are a very large number of amateur and commercial stations in and around New York City, for instance, and the receiving set should be capable of tuning out to a large extent at least the local stations and be able to pick up signals from distant stations. Receiving sets have been designed which are very effective in this regard, although it is true that they have more adjustments and require more skill in their use than the sets which are now being sold by some large companies in very large volume.

In my opinion, the set which is selective between stations without regard to distance within reasonable limits is very much preferable to the set which is selective only with reference to distant or weak stations. While a few days might be required to get familiar with the more complicated adjustments, this should not detract from the sale of the sets, because any one using the set for a few days would soon learn that a certain setting on each of the dials and switches would bring in a given station, and after the setting was once found it would not be necessary to have to hunt for the station, as the dials would be set as had been found satisfactory before and the station would be received.

Sets of the kind recommended have been made which are at least equal to any of the sets now on the market as regards loudness of signal, and which very much exceed the majority of the receiving sets now sold in regard to selectivity under all conditions.

E. P. PECK,
General Superintendent Electrical Department.
Utica Gas & Electric Company, Utica, N. Y.

Energy Front of Electric Circuits

To the Editors of the Electrical World:

The object of discussion being an impersonal one and rather for the benefit of the common weal, may I be permitted to express an opinion that non-mathematical generalities bear a Faraday relationship to electrical science, whereas what is wanted is the Maxwellian or mathematical one? Otherwise how can one satisfy the particular Kelvin dictum "to understand is to calculate"?

Unfortunately there is considerable disagreement between the mathematical conclusions—at least as much as between the non-ether concept of Einstein's followers and the decidedly ethereal one of Maxwell, Heaviside and Hertz! It is difficult to reconcile the Steinmetzian view as expressed in the February number of the *Journal of the A.I.E.E.*

Then, again, with regard to bending wave fronts being due to resistance of an electrical circuit, it should be stated that in the case of open-ended coils Fleming showed and the writer proved mathematically (see *Electrician*, June 7, 1918) that the speed along a *pure inductance* could be but one one-hundred-and-fiftieth of that of light. Moreover, it is not clear what the surge impedance has to do with sustained oscillations on wires or aërials.

What, perhaps, is the most important difficulty is how, with the physical-mathematical methods ordinarily employed, to account for the substantially cylindrical wave front encircling an open-ended aërial for sustained oscillations. A constant current-phase constant-current amplitude along the aërial will not account for it. Even MacDonald on "Electric Waves" would agree to that. It should be remembered that in radio the sink S is not conductively connected to the source G. A. PRESS.

Washington, D. C.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Requisition Form Hastens Station Construction

TO FACILITATE work in the design and construction of substations, the Southern California Edison Company has devised a form headed "Request for Substation Design," which is now being used by the operating department of that company when making requests upon the engineering department for substations needed in the immediate future. This request really amounts to a requisition for a substation. The growth of the system and the need for building many substations at once, with the consequent necessity of speed both in design and in construction, are the primary factors that make such a form advantageous.

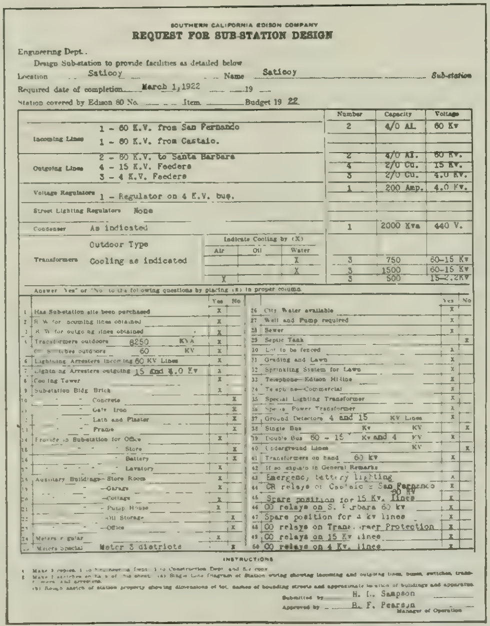
When it is seen that a new substation will soon be needed in a certain territory, the operating and the distribution departments get together to find out what equipment will be necessary at this particular location. When they have agreed upon their needs, the request is submitted by the superintendent of station maintenance and approved by the manager of operation. It is then submitted to the protection engineer for any advice regarding protective equipment such as relays and lightning arresters, after which it is finally submitted to the chief electrical engineer for corrections or approval. The request is then sent to the engineering department so that it may start on the design, and a copy of the request goes to the construction department, which can proceed to place orders with the manufacturers for machinery that will take some time to build. The construction department can also estimate how many men will be needed when the actual work of construction begins.

Studying the form, it is seen that the requirements necessary in the construction of the station are listed and that the form is made up so that the request for the station can be prepared with a minimum amount of work on the part of the operating department. Provision is made for entering the location, date of completion, character of the building, incoming and outgoing lines, capacity of transformers and rotating machinery, as well as other equipment needed. On the back of this form room is provided for a single-line diagram of the station and for a sketch showing its geographic location. These sketches are prepared by the operating department when the engineering department is asked to prepare the design and estimates.

It is not intended that this form shall cover all the minor details which may develop, and it is expected that these questions will be brought up from time to time as the detailed design and the construction progress, but the form places the requirements of the station on a definite basis and assists greatly in having the new substation in operation on schedule time.

It is interesting to note that the Southern California Edison Company found it necessary in the last few months to place a request with its engineering department for the construction of thirteen of these substations. The growth of the company's system necessitates that the majority of these stations be built simultaneously; consequently such a system as that outlined above will prove of considerable value.

E. R. STAUFFACHER,
Protection Engineer.
Southern California Edison Company,
Los Angeles, Cal.



SOUTHERN CALIFORNIA EDISON COMPANY
REQUEST FOR SUB-STATION DESIGN

Engineering Dept.
Design Sub-station to provide facilities as detailed below
Location Saticoy Name Saticoy Sub-station
Required date of completion March 1, 1922 19
Station covered by Edison 80 No. Item Budget 19 22

		Air	Oil	Water	Number	Capacity	Voltage
Incoming Lines	1 - 60 K.V. from San Fernando 1 - 60 K.V. from Castaic.				2	4/0 Al.	60 Kv
Outgoing Lines	2 - 60 K.V. to Santa Barbara				2	4/0 Al.	60 Kv.
	4 - 15 K.V. Feeders				4	2/0 Cu.	15 Kv.
	3 - 4 K.V. Feeders				3	2/0 Cu.	4.0 Kv.
Voltage Regulators	1 - Regulator on 4 K.V. bus.				1	200 Amp.	4.0 Kv.
Street Lighting Regulators	None						
Condenser	As indicated				1	2000 Kva	440 V.
Transformers	Outdoor Type Cooling as indicated	Indicate Cooling by (X)					
				X	3	750	60-15 Kv
				X	3	1500	60-15 Kv
		X			3	500	15-2.2Kv

Answer "Yes" or "No" to the following questions by placing (X) in proper column.

		Yes	No			Yes	No
1	Has Sub-station site been purchased	X		26	City Water available	X	
2	R. W. for incoming lines obtained	X		27	Well and Pump required	X	
3	R. W. for outgoing lines obtained	X		28	Sewer	X	
4	Transformers outdoors 8250 KVA	X		29	Septic Tank		X
5	Oil Switches outdoors 60 KV	X		30	Lot to be fenced	X	
6	Lightning Arresters incoming 60 KV Lines	X		31	Grading and Lawn	X	
7	Lightning Arresters outgoing 15 and 4.0 Kv	X		32	Sprinkling System for Lawn	X	
8	Cooling Tower	X		33	Telephone—Edison Hi-line	X	
9	Sub-station Bldg. Brick	X		34	Telephone—Commercial	X	
10	" " Concrete		X	35	Special Lighting Transformer	X	
11	" " Galv. Iron		X	36	Special Power Transformer	X	
12	" " Lath and Plaster		X	37	Ground Detectors 4 and 15 KV Lines	X	
13	" " Frame		X	38	Single Bus Kv KV		X
14	Provide in Sub-station for Office	X		39	Double Bus 60 - 15 Kv and 4 KV	X	
15	" " " Store		X	40	Underground Lines KV		X
16	" " " Battery		X	41	Transformers on hand 60 kv	X	
17	" " " Lavatory	X		42	If so explain in General Remarks		
18	Auxiliary Buildings—Store Room	X		43	Emergency battery lighting	X	
19	" " —Garage	X		44	CR relays on Castaic & San Fernando 60 Kv	X	
20	" " —Cottage	X		45	Spare position for 15 Kv. lines	X	
21	" " —Pump House	X		46	CO relays on S. Barbara 60 kv	X	
22	" " —Oil Storage		X	47	Spare position for 4 kv lines	X	
23	" " —Office		X	48	CO relays on Transformer Protection	X	
24	Meters Regular	X		49	CO relays on 15 Kv lines	X	
25	Meters Special Meter 3 districts		X	50	CO relays on 4 Kv. lines	X	

INSTRUCTIONS

Submitted by H. L. Sampson
Approved by B. F. Pearson
Manager of Operation

REQUISITION FORM THAT FILLS ALL NEEDS OF EQUIPMENT LAYOUT

Telephone Placed on High-Tension Power Line

A TELEPHONE circuit carried on the same cross-arms as a 110,000-volt transmission line of the Georgia Railway & Power Company has been giving satisfactory service for nearly a year. This 110,000-volt line was completed and put into operation during the month of September, 1921, and connects this company's system with that of the Alabama Power Company. The junction point of the two companies is at the Georgia-Alabama state line, about 17 miles from the Lindale station, a large substation of the Georgia company. This station also serves as the connecting link with the Tennessee Power Company. The interconnection was effected by tying in the Gadsden station of the Alabama Power Company with the Lindale station of the Georgia Railway & Power Company.

The line from the Gadsden station to the Georgia-Alabama state line is an H-frame construction on 50-ft. cresoted poles with No. 3/0 A.C.S.R. aluminum cable. The telephone circuit is carried on separate poles off the right-of-way with No. 12 copper for the conductor. From Lindale to the Georgia-Alabama state line the construction is also on H frames, using 50-ft. Western Red Cedar poles and a No. 4/0 A.C.S.R. aluminum cable for conductor. The telephone circuit in this case is carried directly on the power cross-arms, as shown in Fig. 1, and 5/16-in. extra-hard-drawn galvanized guy strand is used for the conductor.

Considerable doubt existed as to the conditions that would be encountered in the telephone circuit on the seventeen miles of line in Georgia, for with an exposure of from 5 ft. to 9 ft. from the power conductors it was predicted by some that the telephone line would not function at all. The telephone line is insulated for more than 22,000 volts, for the pin-type insulators used have a working rate of 27,000 volts. The dead-ends are insulated with two of the ordinary 10-in. disks. Transpositions are made on every third pole, which corresponds to a distance of from 1,500 ft. to 2,500 ft., depending on span lengths. At the Lindale station a 15-kva., 2,300-volt transformer was installed and a 25-kva., 2,300-volt transformer was placed at the state line. The 25-kva. unit is shown in Fig. 2. Both of these transformers are used for drainage coils—that is, the high-tension windings are connected across the telephone line with the middle point grounded. The low side is open.

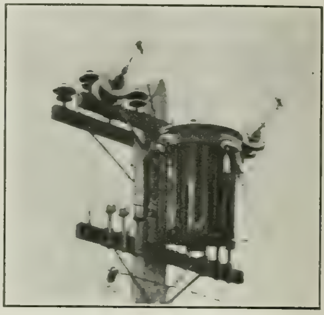


FIG. 2—STANDARD 25-KVA. TRANSFORMER USED AS DRAINAGE COIL

Voltage readings to ground were taken at the state line with drainage coil in at Lindale, and a reading of from 25 volts to 50 volts was obtained. The drainage coil at the state line was then added to the circuit, and the voltage was such that no reading could be obtained. A reading of 6 volts to ground was observed on the line in Alabama. The two telephone systems of the company were then put together, and since then very satisfactory service has resulted. The distance from Lindale to Gadsden is approximately 52 miles. Regular conversation is carried on over this telephone line from Atlanta, Ga., to Birmingham, Ala., a distance of more than 150 miles.

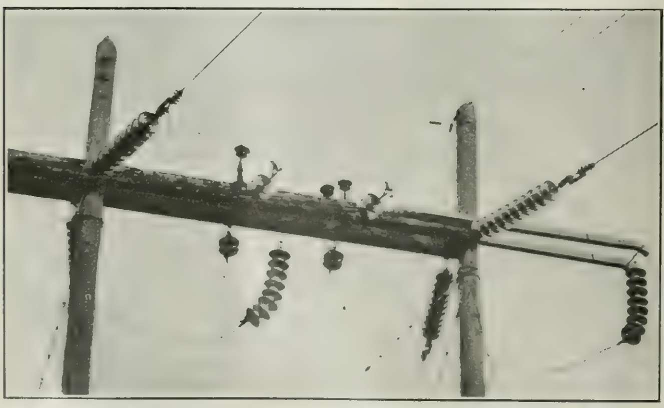


FIG. 1—BY USING DRAINAGE COILS AND FREQUENT TRANSPOSITIONS TELEPHONE OPERATES SUCCESSFULLY ON 110,000-VOLT CROSS-ARMS

P. C. HERAULT,
Superintendent Transmission.
Georgia Railway & Power Company,
Savannah, Ga.

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Inspection of Hydro-Electric Plants

HYDRO-ELECTRIC plants of long standing tend to get into a condition needing attention from the standpoint of safety. Very often an engineer who is not in daily contact with a plant can easily find imperfections and faults which escape the regular attendant. As a guide to others in checking bad conditions a few examples of defects noted in practice in small hydro-electric stations are presented here. Taken in group, they illustrate the importance of paying constant attention to the so-called "minor features" of apparatus service.

Danger of penstock collapse from sealed vents was threatened in one plant. These vents may in some cases become sealed by ice or other matter, and should an attempt be made to drain the penstock by closing the headgates and opening the turbine gates a collapse would easily be possible. Surge tanks may obviate this danger, but it is good practice to see to it that penstock vents are kept constantly open and protected when necessary by wooden traps. In connection with penstock installation where surge tanks are installed near the generating plant, window breakage has sometimes been experienced because of ice discharges from the tanks. One case of this kind resulted in the bombardment of an exciter generator inside the plant by falling ice. Strong screening of windows is prescribed in such locations.

Protection of station and substation wiring is very important in water-power plants on account of the possible dampness present and also because of the diversity of jobs required of operating forces. Adequate spacing between phase wires and between live conductors and adjacent apparatus and metal structures is worth working hard to accomplish.

BAD INSULATION ON GENERATOR LEADS SOURCE OF TROUBLE

In one plant inspected the generator leads were improperly protected where they entered the conduit at the machine base. Lightning trouble previously caused the insulation to burst on similar legs of the circuits from all generator switches to the 10,000-volt bus, yet these wires were not taped up and put in safe operating condition after the trouble occurred. The fused switches used were weak mechanically, besides threatening grounding on the penstock when fuses were being removed.

Secondary conductors from potential transformers were run too near the 10,000-volt wiring over the switch cells; the grounds on the arrester connections were indirect, with too many bends, and in one place the conduit for control wiring was not continuous. Control wires for bell alarms and switches in a local transformer and switch-house layout were carried across the tailrace in pipe conduit liable to injury from ice discharging from the surge tank of one of the penstocks. It was recommended by the inspecting engineer that these pipes be carried on a bridge or other rigid support and protected against possible damage.

In one plant the remote-controlled electrically operated switches took their energizing current from the exciter bus. When the station generating apparatus is all shut down, as is sometimes the case, since the station is tied into a high-tension network, the operator is obliged to go to the switch and operate it manually. Any delay in operating the switches in case of trouble may prove disastrous in such cases. It was recommended that a storage battery be installed to care for this situation.

The absence of a protective bell alarm system on some of the outgoing lines was another lack, and failure of the operating company to equip all incoming telephone lines with insulating transformers was also noted. Owing to the lack of means of heating the switch room in one plant visited, the oil in the switches at times became congealed in extremely cold weather. Some method of inclosing the tanks with asbestos board or other suitable material and the installation of electric heating coils, it was pointed out by the inspector, would obviate this objectionable feature. Another undesirable practice discussed was the mounting of an ordinary pin-type insulator in an inverted position to carry the high-tension transformer-bus cable. This tends to allow dirt and moisture to collect in the petticoats and thus reduce their insulating value considerably.

Horn gaps mechanically weak were found elsewhere. These were easily blown apart by the wind with resulting danger during storms. Proper lighting of arresters was also lacking.

E. S. LINCOLN.

E. S. Lincoln, Inc.,
Portland, Me.

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Pulverized Fuel Plant with High Efficiency

UNUSUALLY interesting information became available during the past year regarding the possible high operating efficiencies obtainable by the use of pulverized coal in large power plants. The new Lakeside plant of the Milwaukee Electric Railway & Light Company is now in full operation and some very interesting tests have been made there, according to the prime movers' committee report presented at the recent N. E. L. A. Convention at Atlantic City. The results of two tests are shown in the accompanying table. As shown in the first column, when the boiler being tested was brought up to a rating of 157.4 per cent the efficiency of the boiler, furance, superheater and economizer based on coal as received was 89.3 per cent. When the capacity developed was 204.2 per cent the efficiency was 89.001 per cent.

The Lakeside plant operated throughout the entire year without interruption and is regarded by the operating forces as a much more desirable type of boiler plant for efficient operation than the stoker plants hitherto accepted.

The experience of the past year seems to show that when a powdered-fuel plant designed along the best lines is compared with a stoker plant similarly designed the cost of maintenance and operation is found to be the same, while the efficiency obtained is 5 per cent in favor of the more modern method of fuel combustion. Engineers interested in pulverized fuel plants can make their own deductions from these figures.

Last year all the boilers in the Lakeside plant were equipped with the Lopulco system of feeders, burners and furnaces, and they are now in satisfactory operation, showing an efficiency during steaming periods of 85 per cent for the combined furnace, boiler, superheater and economizer.

The possibilities offered by pulverized coal—continuously high thermal efficiency, flexibility of furnace control, almost complete elimination of banking loss, and utilization of otherwise waste fuels—all of which have had ample practical demonstration, must now be seriously considered in the design of any steam plant of importance. In fact, a number of such plants constructed within a year past, although initially making use of the mechanical stoker, have been designed with a view to the possible ultimate adoption of pulverized coal.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

OBSERVATIONS MADE FROM TESTS AT LAKESIDE PLANT OF THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY

Test of Edgemoor boiler No. 1 to determine efficiency of boiler, furnace and superheater, using powdered-coal furnace with a combustion space of 9,057 cu.ft. Boiler has 13,057 sq ft. water heating surface. Illinois coal was burned

	Test No. 3	Test No. 4
Steam pressure by gage, lb per square inch	264.2	266.7
Temperature of superheated steam, deg. Fahr	584.7	596.1
Temperature of feed water entering boiler, deg. Fahr.	203	213.2
Temperature of feed water entering economizer, deg. Fahr.	132.3	130.5
Temperature of escaping gases:		
a Temperature of gas below fourth pass, deg. Fahr	470	526
b. Temperature of gas entering economizer, deg. Fahr.	436	464
c Temperature of gas leaving economizer, deg Fahr.	240	268
Evaporation per hour from and at 212 deg. Fahr., lb.	61,934	92,013
Boiler horsepower developed, hp.	1,795	2,667
Percentage of rated capacity developed, per cent	137.4	204.2
Water fed per pound of coal, as fired, lb	8.5	8.51
Equivalent evaporation from and at 212 deg Fahr per pound of dry coal, as fired, lb.	9.93	9.90
Calorific value of 1 lb. of coal as fired, per analysis, B.t.u.	11,449	11,581
Efficiency of boiler, furnace, superheater and economizer based on coal as received, per cent.	89.3	89.001
Coal Analysis (by T. M. E. R. & L. Co. Laboratory):		
Moisture, per cent	4.2	4.05
Ash, per cent	13.395	13.337
B.t.u. per pound of dry coal, B t.u	11,950	12,070
B.t.u. per pound of coal as received, B t.u.	11,440	11,581
Sulphur, per cent (separately determined)	3.81	3.422

A Few Timely Reminders on Industrial Lighting

IN THE choice of reflector fittings for lighting service consideration must be given to the class of work to be done, the area to be illuminated, location of operatives and machines, ceiling height and so forth. For a wide variety of industrial locations the "RLM" metal-dome reflector with the bowl-enameled or bowl-frosted lamp is very desirable and one of the most popular forms of equipment at the present time. This combination gives a direct lighting of full-illumination value, but with softened shadows and freedom from glare, and is the type of lighting particularly recommended for machine shops.

High Level of Illumination Relieves Contrast

Wherever possible local lighting should be avoided. In many instances it can be dispensed with entirely. This can be made easier by the advantage gained from the development of a more efficient overhead lighting system. Even when local lighting is necessary, a high level of general illumination relieves the contrast between the brightly lighted work and the remainder of the room, besides proving restful to the operatives' eyes. Care should be exercised in choosing the size of reflector equipment to get it suitable to the size of lamp selected. Reflectors with larger or smaller diameters than they should have will give poor light distribution.

The burning of lamps at undervoltage from any cause results in a decrease in wattage, and therefore a decrease in bills, but since this decrease in wattage is acompanied by twice as great a decrease in illumination, it really causes a net loss. In instances where a considerable increase in lighting intensity has been made or may be under consideration it is important to investigate the amount of voltage drop caused by the increased load. The voltage delivered at the service switch may be up to standard, but if the circuits are overloaded, poor illumination and decreased wattage will result. In any instance where the desire to cheapen the wiring installation results in the installation of insufficient copper the voltage drop will be excessive, the illumination decreased and the lamp efficiency impaired.

It is oftentimes found that individuals who do not fully appreciate all the effects are purposely using lamps with a rated voltage higher than the circuit voltage for the purpose of increasing the life of the lamps. In practically no case is such a practice justifiable, for the cost of the energy consumed by a lamp is so much greater than the cost of the lamp that it is not economical to sacrifice even a small part of the efficiency of the lamp for the sake of even a considerable decrease in the renewal cost.

To secure light efficiently purchase lamps of known quality and of correct circuit voltage. Lamps have an average life of a thousand hours and will maintain their luminous efficiency with but little variation.

Here is a single fact that would save hundreds of dollars if it were generally acted upon. The loss of illumination due to the coating of lamps and reflectors with dirt may equal 60 per cent or more. Think of what this means in energy consumption, loss of production, waste of materials and risk of accidents, and then realize that the saving can be made by a simple plan of cleanliness—a periodic cleaning of lamps and reflectors just with soap and water. Shop cleanliness is a matter of routine. Why not extend it to the lighting units?

Foot-Candle Meter Quickly Repays Its Cost

It is surprising to see the way in which lamps are neglected and new and larger units sometimes put into sockets where the only trouble was need for clean water. This is where the use of the foot-candle meter to check up lighting values is going to repay its cost.

Finally, there is the question of shadows. For satisfactory lighting there must be no sharp black shadows to confuse the vision. Shadows are usually present when the illumination is not uniform. It would need expensive equipment to eliminate shadows entirely, but this is not necessary or desirable, because a certain amount of softened shadow is requisite for the easy definition of objects.

Unfortunately, much indifference has to be overcome to make plain the fact that lighting plays an important part in modern industrial plants. There are many Topsy systems that have "just growed." Faulty and insufficient lighting costs in the end far more than efficient illumination. Poor lighting reduces production and increases shrinkage—a loss of time and money.

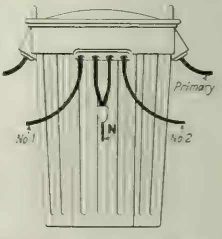
An increase of four times the lighting intensity will cost a sum that is but a fractional percentage of the payroll, and the sum spent will be well repaid by measurable increase in production. To insure more attention to illumination is only a matter of the possibilities of its service to industry being seen by responsible executives. Lighting has power to stimulate, and where it is adequately used there is little chance for error, accident or idleness.

F. H. Sweet.

Waynesboro, Va.

Simplifying Secondary Tagging

TO SIMPLIFY the tagging of secondary leads and wires, linemen of the Worcester (Mass.) Electric Light Company are furnished with loose-leaf data sheets, about 3¾-in. x 6¾-in. in size, showing the standard method of numbering used by this central-station company and illustrated herewith. The scheme is a simple one, but is complete and accurate, depending on numbering from left to right when facing the secondary side of the transformer. In balancing three-wire, single-phase systems it is convenient to identify the wires by numerals and the letter "N" for the neutral instead of attempting to follow the "left" and "right" designations. All data sheets prepared for the use of line crews, whether for overhead or underground work, are reduced to the simplest feasible terms, and only the essentials are illustrated in connection with cable and pole-line layouts, transformer location, etc.



DESIGNATING TRANSFORMER TERMINALS IN SIMPLE MANNER

Where it is necessary to tag the secondary wires of a system, use figures No. 1, N, and No. 2 instead of the words left, neutral and right.

A. D. Putnam.

Worcester Electric Light Company,
Worcester, Mass.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Interpreting the Central Station in a "Year Book"

Commonwealth Edison Company Issues Its Annual Report as an Illustrated Story of the Company's Condition and Progress

ONE of the most interesting developments of the Commonwealth Edison Company's customer-ownership program is a year book which has just been issued by the company so that its stockholders may be more full acquainted with the details of the property in which they now have ownership. This book, the cover of which is shown here, has been carefully prepared and contains a condensed record of the company's growth, telling the story of the service it renders in clear, understandable language.

Of particular interest is the manner in which the company's income account and balance sheet have been presented. The accounts which appear in the regular annual report are given in their usual order, but a notation under each item explains in detail just what goes to make up that particular charge. For instance, the company's operating revenue for the year ended Dec. 31, 1921, is shown thus:

Electric operating revenues.... . (This was the total amount paid by or billed to the 536,982 customers for electric services. The customers increased 62,200 during the year.)	$37,139,830 64
Electric operating expenses.. (This was the amount paid out as wages to the 5,969 employees, and the cost of coal, lamps and other materials and supplies used. It includes $2,900,758 set aside to cover wear and tear on the plants and machinery—depreciation.)	24,396,155 35
Net electric operating revenues . (This was left for payment of expenses other than those having to do directly with production, distribution and general expenses as outlined in the items to follow.)	$12,743,675 29

Following come the various items of incollectible operating revenue, taxes, municipal compensation, net operating income, other income, gross income, deductions from gross income, interest on funded debt, amount available for dividends, dividends paid and balance carried to surplus—each entry clearly and concisely explained in words that tell the story no matter how inexperienced the reader may be in studying financial reports—and the total surplus remaining is shown as follows:

Total surplus of the company (This was the total amount the company had providently laid by over a course of years as protection for its stockholders and also as a guarantee of efficient service to its customers. Having faith in itself, this has been reinvested in the company's assets, and represents an added invested interest each stockholder has in the property beyond the $100 par value of each share of stock. It represents an additional investment made for each stockholder, for instead of dividing the full profits through payment of larger dividends, part of this money is permitted to go back into the business. It is this reinvested surplus, as well as the good dividend rate, which gives Commonwealth Edison stock a much higher salable value than its $100 par value, as it gives added security to the investment.)	$9,183,217 26

The balance sheet is defined as "a statement of what the company owned and what it owed on Dec. 31, 1921," and these typical entries under "assets" illustrate how each item is made clear:

Cash............................... (This money was in the bank.)	$1,376,519.14
Special deposits.................. (This little item covered amounts that had been advanced in connection with improvement work and would be refunded.	9,059.09
Prepaid insurance (Insurance paid for in advance. The company partially insures itself by setting up a fund	83,063 90
Total assets . (This was the total value of the belongings of the company.)	$152,035,420 70

Under "liabilities" these are some of the interesting items:

Loans and notes payable (A growing business often needs money for various things it is doing and does not want to punish itself by drawing on its own resources, so it obtains temporary loans at the bank.)	$750,000 00
Total current liabilities ... (This was the total of debts of this character in process of being paid.)	$4,432,764 23
Premium on funded debt........ (This was the amount above par the company has received on the sale of its bonds.)	$20,478.68
Total liabilitie (This represented the total obligation of the company on Dec. 31, 1921, either for ordinary debts for fuel, materials, equipment, etc., or owing to bondholders, to the company itself or the stockholders. It balances with the total of assets.	$152 035,420 70

As can be seen from these entries each account is so explained that even though the reader may not be familiar with the form of a bare financial statement he can readily understand the report.

COVER OF COMMONWEALTH EDISON'S "YEAR BOOK"

In the introduction, President Insull's address to stockholders at the annual meeting is given. In this he pointed out matters of direct concern to the stockholders. In part he said:

"The Commonwealth Edison Company is distinctly a Chicago institution. It is not owned by just a few capitalists, but has 24,571 stockholders. Ninety-two per cent of these stockholders live right in Chicago, and only a little more than 4 per cent of them live in Illinois outside of the city. This ninety-six per cent of stockholders own upward of ninety per cent of the company's stock, so the company is essentially a home institution.

"We want to go on increasing the number of our stockholders. We want this property to be absolutely owned by this community as individuals. We do not want to see it owned by the community as a municipality. We do not believe that the best results in operating this or any other form of public utility service can be obtained under the extravagant methods that are incident to municipal management. We do believe that, if the community as individuals own our property and if every customer we have on our books is also a shareholder, the stability of our investment will be enhanced and the best interests of the community which we serve will be advanced."

Included in the "Year Book" are a number of interesting charts, illustrating a detailed description of the growth of the company, the volume of its business and economic aspects of the service which it is rendering.

The Commonwealth Edison Company in issuing this "Year Book" has hit upon an excellent method of laying its business before its stockholders and the public in a manner which is at once clear and understandable. It explains the public utility and how it works and should return big dividends in good will.

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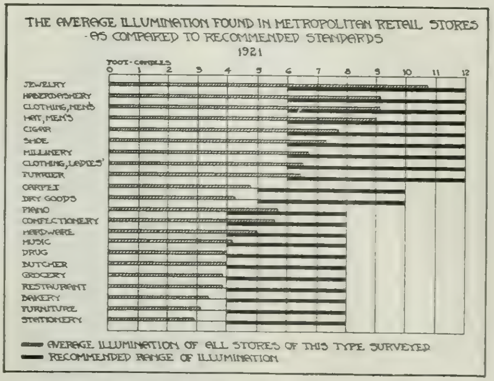
Possibilities in Better Store Lighting

INVESTIGATIONS of store lighting conducted during the past year by the Lighting Sales Bureau of the N. E. L. A., of which L. R. Wallis was chairman, have revealed enormous possibilities for increasing the central-station company's revenue from this source as well as increased sales of commercial lighting equipment. A survey of store lighting in the business center of Newark, N. J., shows results which are typical of conditions prevailing throughout the country. The accompanying composite chart shows the existing and recommended values of illumination in the various classes of retail stores. It is interesting to note in the chart that almost half of the stores shown do not even come up to the foot-candle value recommended.

An interesting sidelight on the commercial lighting situation is the attitude of the merchants regarding their existing installations. When approached, 20 per cent volunteered the information that they were dissatisfied with their lighting even before possible improvements were mentioned. Of the remaining 80 per cent the majority were satisfied, but this was only because they did not realize their lighting mistakes. The average storekeeper does not have to be "sold" the idea of better lighting, as he is too good a merchant not to appreciate the pulling power of light, but he must be taught just what constitutes good lighting.

Jewelry and haberdashery stores are well up in recommended values, and although their lighting equipment may be incorrectly placed or may be of an obsolete type, these stores will not ordinarily be good prospective customers for increasing merely the foot-candle illumination. The efforts directed toward such stores must be chiefly of an educational nature, without great immediate profits through sales of material or power, but of considerable value in the correction of glare and maintenance evils—in other words, the firmer establishment of the electric light and power utility as a true service company.



EXISTING AND RECOMMENDED STORE LIGHTING VALUES

Lower Prices Cause a Resumption of Range Sales

OWING to improvements in electric ranges and to reductions in prices from increases to which it took exception in the summer of 1919, the Hartford (Conn.) Electric Light Company has announced its reentry into the field of electric range merchandising. The withdrawal of the company from this field caused considerable comment in central-station and manufacturing circles at the time, and since then the company has confined itself to filling orders for ranges from customers who desired them regardless of the company's declining to push such sales under conditions then prevailing.

Ranges are being sold, if desired by the customer, on installment payments over a period of one year. Prices include installation and wiring. Many inquiries have resulted from the company's announcement, and it is looking forward to a healthy demand for ranges in the coming months. For the first time in nearly three years ranges are now being displayed in the company's show windows.

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What Other Companies Are Doing

Oklahoma City, Okla.—The Oklahoma Gas & Electric Company has signed contracts for electric service with the towns of Oilton, Jennings and Cleveland, and takes over the plant at Oilton on July 1. Eleven miles of 13,000-volt line will be built in time to operate the substation in Fairmont early in July.

Haverhill, Mass. — Seventy-two buildings with 110 electric meters were wired during the first eight weeks of a house-wiring campaign run by the Haverhill Electric Company, according to the Boston office of Charles H. Tenney & Company, managers of this utility. The campaign is being run on the basis of local newspaper and direct-by-mail advertising. Local contractors are being paid in cash direct by residence customers.

Mattoon, Ill.—The employees of the Central Illinois Public Service Company did not merely break their stock-selling record when they sold 2,635 shares of their company's preferred stock during the month of April, but more than doubled their previous high mark made in the month of March.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Murg Hydro-Electric Plant in Baden. —C. LIEBISCH.—Utilizing a head of 145 m., the present installation at this large plant comprises five 5,000-kva. Francis spiral turbines, consuming a total of 17½ cu.m. of water per second. As it is intended to add to the station in the near future further units of 20,000 kva. each, the generator voltage has been fixed at 10,000. A short distance from the high-head plant the discharge water is used again in a low-head station with two 650-kva., 3,000-volt generators. Two three-phase oil-cooled transformers of the core type, with a rating of 10,000 kva., 10,000 volts to 110,000 volts, energize the transmission line. For the supply of near-by consumers two 5,000-kva., one 1,000-kva., one 1,200-kva. and one 500-kva. transformer with secondaries of 10,000 volts and 20,000 volts are also provided. The entire transforming and switching apparatus is under roof. To be able to regulate the voltage of the departing 20,000-volt lines independently from the 110,000-volt lines, a 12,500-kva. induction regulator has been inserted into the 10,000-volt buses. — *Elektrotechnische Zeitschrift,* April 20, 1922.

Forestry and Hydro-Electric Development.—ARRIGO SERPIERI.—Account of a conference held at Milan on Feb. 9 between the Federazione Pro-Montibus (a national body devoted to forestry) and the Italian electrotechnical societies in which the relation of forestation to stream flow was discussed.—*L'Elettrotecnica,* April 15, 1922.

Generation, Control and Switching

Protective Apparatus for Turbo-Generators. — J. A. KUYSER. — The causes of electrical breakdowns on turbo-alternators and methods of preventing damage to the equipment when trouble occurs are discussed. A new system is described for eliminating some of the shortcomings of existing methods.—*Electrician,* May 5, 1922.

Use of Time Lags in Connection with Protective Gear.—MAJOR KENELM EDGCUMBE.—Time lags are usually introduced in relay protective apparatus to avoid opening the circuit at the moment of maximum fault current and to give discriminating action in the case of a number of circuit breakers connected in series at different points on the system. A consideration of the short-circuit current of a generator demonstrates the advantage gained by delaying the action of the circuit breaker by half or three-quarters of a second in that the current to be broken is during that time reduced to one-fifth of its peak value. Other points discussed are leakage protection, possible disadvantages of time lags and definite versus inverse time lags.—*Beama,* April, 1922.

Calculation of an Economic Reactor Without Iron.—J. HAK.—A formula is derived for the most economical current density in the copper windings of an air-core reactor. The influence of variable load and of the shape of the coil upon the economy of the reactor is investigated. Only cylindrical coils and round flat coils are considered, as it is impossible to find sufficient cooling surface in other shapes of coils. A numerical example of a cylinder coil is given to illustrate the method.—*Elektrotechnik und Maschinenbau,* April 16, 1922.

Transmission, Substations and Distribution

Electro-Agricultural Week at Stockholm.—T. HOLMGREN.—A brief résumé of the proceedings of the "electro-agricultural week" held in Stockholm, Sweden, in March of this year to discuss the economy and future of rural electrification. The main topics covered were the organization of rural distribution and the development of the rural power market. Several recent applications of electricity to farm work were discussed, among which were electric silos, electric plows, "earth milling machines," watering devices, etc. — *Teknisk Tidskrift,* April 1, 1922.

Power Factor in Transformers and Transmission Lines.—O. BURGER.—The amount of wattless current in transformers and long transmission lines is calculated, and the author shows that by proper compensation between inductance and capacity of lines it is possible to transmit large energies over long distances without any appreciable losses other than ohmic losses. The most favorable voltage depends then only upon the amount of transmitted energy. Such load and voltage ratios are, for example, 30,000 kw. with 100,000 volts, 60,000 kw. with 150,000 volts, 110,00 kw. with 200,000 volts, and 175,000 kw. with 250,000 volts. Considering transmission lines of very high voltage, it is pointed out and shown graphically that they must be operated at a high power factor in order to give satisfactory voltage regulation.—*Elektrotechnische Zeitschrift,* April 20, 1922.

Mechanical Stresses in Transmission Lines.—E. MAERKER.—Engineers dealing with transmission-line problems have long felt the need of a simple comprehensive chart applying to all cases which are likely to come up. The author has developed charts applicable for any ice and wind loading and any temperature for horizontal spans of 100 ft. to 1,500 ft. and supports at the same or different elevations. The charts developed are for copper wire only.—*Canadian Engineer,* April 25, 1922.

Units, Measurements and Instruments

Direct-Reading Ohmmeter. — C. DUFRÈNE.—The measurement of the insulation of direct-current distribution networks is made frequently either incorrectly or with an irksome amount of calculation. A method is suggested by the author based upon previous investigations made by Stubbings in England. In this method a portable instrument uses the current of the line itself and therefore permits the making of measurements on a live line. A high resistance is then placed across the supply line, with a sliding contact near its middle. A sensitive voltmeter is then connected between this contact and the ground. A point is found on the potentiometer which gives at the voltmeter the full-scale deflection. A fixed shunt resistor is then placed in parallel with the voltmeter, which reads now on the scale directly the total resistance in ohms to ground. A double-throw switch and an inbuilt auxiliary resistor give the instrument a direct scale as well as a one-tenth scale reading for higher voltages.—*Revue Générale de l'Electricité,* April 1, 1922.

Precision Measurements in X-Rays for Roentgenologists.—MONTFORD MORRISON.—The method of measuring electrical energy in an X-ray tube by reading a parallel spark gap at the tube and the milliamperes flowing through the tube does not give the correct measurements of energy or power. This is because of the wide change in the form of the voltage applied with different settings of the control. Means are outlined for the measurement of voltage and current and for obtaining their wave form.—*Bulletin of the International X-Ray Corporation,* Vol. 1, No. 2.

Illumination

Lighting of Factories and Mercantile Establishments.—H. D. SAYER. — The Industrial Code rules relating to factory and store lighting as recently amended are given. The intensities sanctioned for outdoor and indoor illumination in many industries are enumerated in table form.—*Bulletin No. 18, Department of Labor of New York.*

Ultra-Violet Light, Its Uses and Possibilities. — LLORA C. KRUEGER. — Utra-violet light is an artificial light produced electrically and has a different wave length from the visible spectrum, which means that it has different characteristics and applications from ordinary light. Some of the more important characteristics are dealt with.—*General Electric Review,* May, 1922.

Motors and Control

Sand-Filled Starting Resistances—Owing to the difficulty of obtaining oil and its high price, one company has developed a motor starter, the resistors of which are placed in a cast-iron container filled with fine sand. This gives an inexpensive, fireproof and leakproof construction.—*Elektrotechnische Zeitschrift*, April 20, 1922.

Single-Phase Commutator Motors.—N. PENSABENE - PEREZ. — The single-phase commutator motor is coming more and more into favor on account of certain characteristics that induction motors do not have and which are discussed by the author. These characteristics are powerful starting torque, moderately small current at starting, simple starting switch, good power factor and good range of speeds by simple control.—*Electrical Review*, April 28, 1922.

Heat Applications and Material Handling

Pneumatic Coal-Handling Plant.—A description is given of this type of coal-handling plant recently installed at the Bankside generating station of the City of London Electric Lighting Company. Although this method appears at first sight to be somewhat expensive, the system offers the advantage of enabling the fuel to be unloaded from barges with great rapidity, which more than compensates for the cost.—*Electrical Review*, April 28, 1922.

Electrophysics, Electrochemistry and Batteries

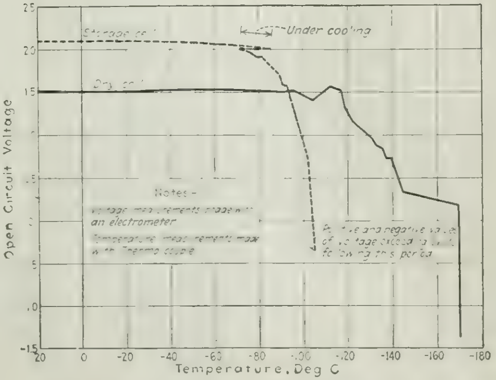
Electromotive Force of Cells at Low Temperatures.—G. W. VINAL and F. W. ALTRUP.—The practical importance of a knowledge of the electromotive behavior of dry cells and storage batteries at low temperatures has arisen from their use in the Arctic and at high altitudes. Measurements on dry cells and storage batteries artificially cooled to —170 deg. C. were made. The Gibbs-Helmholtz equation was applied to the observations, and excellent agreement between theory and observation was found. The results on the battery voltages over the wide temperature range covered are shown in the accompanying illustration. — *Scientific Paper No. 434 of the Bureau of Standards.*

Traction

Electric Locomotives Rated at **1,200** *Hp. for Metropolitan Railway.*—Twenty of these locomotives have recently been placed in service on the Metropolitan Railway Company's track in England. Each locomotive has four 300-hp. self-ventilated motors with an operating performance of 60 watt-hours per ton-mile guaranteed by the manufacturer.—*Engineering*, April 7, 1922.

The Question of Inductive Interference and Electrolysis Relating to Railroad Electrification. — CHARLES F. SCOTT.—It is generally agreed that inductive interference and electrolysis are matters which should be taken into consideration when an electrification is being planned. Provision should be made at this time to prevent difficulties arising during construction. On general principles the plan should be that which is cheapest, whether this means special arrangements in the power system or in the telephone system, or separation of the two.—*Electric Journal*, April, 1922.

Recent Improvements in Railway Electric Traction Equipment.—ROGER T. SMITH.—The author discusses the relative financial advantages in England of steam and hydraulic stations and shows that generally, for agricultural reasons, the former will continue to be used. He gives the details of a new machine for converting alternating to direct current and brings up to date the figures for the cost of haulage by electricity and steam which he had formerly compiled. — *Electrician*, May 19, 1922.



OPEN-CIRCUIT VOLTAGES OF DRY CELLS AND STORAGE BATTERIES AT LOW TEMPERATURES

Telegraphy, Telephony, Radio and Signals

A New Underground Telephone System.—A cable has recently been placed in service between London and Manchester, a distance of 183 miles, which is equipped with repeaters and loading coils. It has been possible to reduce the weight of copper in the conductor as compared with long-distance cables which are not similarly treated from 200 lb. to 40 lb. (90 kg. to 18 kg.) per mile. The recent development of underground telephone work in England is reviewed.—*Engineering Section, Times (London) Trade Supplement*, April 22, 1922.

Alternating-Current Bridge to Measure Apparent Resistance of Telephone Cables. — K. KUPFMÜLLER and P. THOMAS.—To measure the alternating-current resistance of telephone cables the bridge method is employed to great advantage. Difficulties arise, however, if cables already installed have to be measured, because the capacities of the current supply of the telephone and the other apparatus against ground affect the results in an uncontrollable manner. In such a case an improvement of the Wien bridge is suggested wherein an auxiliary resistance which duplicates the bridge branches makes the arrangement symmetrical against the ground. Results obtained with such a modified bridge indicate a great accuracy of measurements of capacity and leak current on cables. — *Elektrotechnische Zeitschrift*, April 6, 1922.

Modern Telephony Technically Considered.—J. G. HILL.—The author deals with the effect of loading and the use of thermionic amplifiers in providing efficient long-distance telephone communications by means of small-gage conductors in underground cables. A review of the theory of superposed circuits worked at audio frequencies is given.—*Electrician*, April 7, 1922.

Miscellaneous

Electricity and Safety First in Factories.—W. H. SEAL.—The article is written to stimulate interest in the important problem of how safety can best be insured in factories. The author suggests a code of safety rules and calls attention to the legislative difficulties which prevent the full development of "safety first" measures. Certain precautions desirable in using electrical machinery are discussed in detail.—*Electrician*, May 26, 1922.

The Theory of Water Hammer.—CARLO FOSSA MANCINI.—A mathematical treatment, with tables and diagrams, outlining a method of calculating the maximum force of water hammer in a given installation.—*L'Elettrotecnica*, April 15, 1922.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

Congress Votes to Continue Work at Muscle Shoals

The House of Representatives on June 24 agreed to concur in the Senate amendment to the War Department appropriation bill which appropriates $7,500,000 for the reopening of construction work on the Wilson Dam at Muscle Shoals. The vote carried with it, however, approval of an amendment by Representative James of Michigan which provides that no portion of the $7,500,000 is to become available before Oct. 1. The Senate on June 27 concurred in the House amendment, and President Harding's signature is all that is now required to make the appropriation effective.

◆

Coal Production Again Increases

Prompt recovery from traffic congestion, which had interfered with placement of cars at mines in Kentucky and West Virginia, resulted in a sharp increase in bituminous coal mined during the week ended June 24.

The tragic happenings at the Herrin (Ill.) mines have led to increased talk of intervention by the federal government. A statement given out at the White House on Tuesday said: "In the coal strike the government has hitherto worked along the lines of persuasion and voluntary adjustment. If that does not produce results looking toward settlement, a very much more pointed and drastic course may have to be taken."

President Harding on Wednesday invited representatives of the operators and miners in the unionized districts of both the bituminous and anthracite coal industries to meet with him at the White House on Saturday morning "to devise methods upon which negotiations for the settlement of the coal strike can be initiated."

◆

Murder of Rathenau Blow to German Electrical Interests

In the assassination of the statesman and financier Walter Rathenau, Foreign Minister of the German Republic, the electrical manufacturing interests of Germany have suffered a heavy loss, for Dr. Rathenau, who was a noted economist and company executive as well as a public man, had exercised a powerful interest in the control of the Allgemeine Elektricitäts Gesellschaft since the death of his father, Emil Rathenau, in 1915. The senior Rathenau was long the head of the A. E. G., as the company is commonly known, and amassed a great fortune, partly through the ownership of European rights in Edison patents. His son succeeded him in control, resigning official connection with the company when he entered political life.

Walter Rathenau was born near Berlin Sept. 29, 1867. After attending the gymnasium he went to the Charlottenburg Technical College, and later took advanced degrees at the universities in Strasbourg and Berlin, where he distinguished himself by his scholarship. He studied philosophy, physics, chemistry and engineering, becoming also an accomplished linguist. He came into political prominence in 1914 and at the time of his death was an outstanding figure in the efforts put forth by the German government to adjust the question of reparations with the Allies. He was regarded as the leader of those opposed to Hugo Stinnes and the nationalist reactionary faction.

◆

Bill to Extend Salt River Power Leases

A bill extending from ten to fifty years leases of surplus electric power on the Salt River reclamation project in Arizona has been passed by the House of Representatives. Provision is made that the charges for power may be readjusted at the end of five, ten or twenty-year periods. In support of the bill Representative Hayden of Arizona pointed out that it was designed to equalize conditions on the Rio Grande project in Texas and New Mexico and that the federal power act authorized fifty-year leases. Mr. Hayden explained that certain mining companies, in order to bring surplus hydro-electric power from the Salt River project, had advanced $430,000 for the construction of transmission lines. Under contract approved by the Interior Department the companies will be reimbursed for this outlay within ten years by taking pay in power.

Development of other power units is now planned, and the expense will be so great that a longer period of time is necessary in which to repay the cost, explained Mr. Hayden. He added that the proposed legislation would allow $1,000,000 or $2,000,000 to be expended on the power plants and transmission lines, title to which will remain in the government as security for the $9,000,000 which the water users have promised to pay the United States.

Radio Testing Methods Are Approved in Outline

The Bureau of Standards of the Department of Commerce and the Electrical Testing Laboratories of New York have approved in outline a method for immediate use in the testing of complete receiving sets manufactured for receiving radio-telephone broadcast messages or programs. Improvements on these methods or new methods used in testing the equipment submitted by the National Retail Dry Goods Association will be subject to approval of the Bureau of Standards, which will co-operate with the Electrical Testing Laboratories in the establishment of these methods as standard procedure.

◆

Engineering Societies of Boston Affiliate

Nine engineering societies with a total non-duplicating membership of about 3,500 have completed organization as the Affiliated Technical Societies of Boston and have established headquarters at 715 Tremont Temple, in the premises formerly occupied by the Boston Society of Civil Engineers and the New England Waterworks Association. The affiliation was granted a charter by the State of Massachusetts on June 12 and is the outgrowth of various informal meetings during the past year designed to accomplish more effective co-operation and advancement of interests in the engineering profession in eastern New England. The participating organizations consist of the Boston Society of Civil Engineers, which is the oldest engineering organization in America; the Boston sections of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Mining and Metallurgical Engineers, the New England Waterworks Association, the Plant Engineers' Club, the Northeastern Section of the American Society of Civil Engineers, the Massachusetts Chapter of the American Society of Heating and Ventilating Engineers, and the Boston Chapter of the American Association of Engineers.

The objects and functions of the affiliation include the concentration of a united membership on questions of engineering importance to governmental, public and professional interests; the correlation of local group activities to eliminate former overlapping activities, conflicts of effort and duplication of meetings; improvement of the standing of technically trained men, and promotion of acquaintance, furtherance of technical activity and increased esprit de corps among organization members.

Headquarters will be maintained for the benefit of resident and non-resident technical men, with facilities for meetings and correspondence, with an employment clearing bureau and extensive reference library of engineering books and periodicals. The officers of the affiliation council are: Chairman, Leonard Metcalf; vice-chairmen, Alfred S. Kellogg and Alexander Macomber; treasurer, Charles L. Hammond; clerk, W. G. Starkweather; executive secretary, J. B. Babcock.

St. Lawrence Commission Favors Further Investigation

The International Joint Commission on Boundary Waters, which is the body investigating the feasibility of the St. Lawrence waterway and power project, has given out for publication the final report and recommendations that it makes to the two governments interested. The recommendations, eleven in number, are favorable to the project and suggest a method for dividing the work and the cost between the United States and Canada.

One paragraph in the report, however, meets with the approval of those opposing the plan—a recommendation for further investigation before final action is taken. This paragraph recommends "that the proposed works between Montreal and Lake Ontario be based upon the report of the engineering board accompanying this report, but that before any final decision is reached the report of the board, together with such comments, criticisms and alternative plans as have been filed with the commission, be referred back to the board, enlarged by other leading members of the engineering profession, to the end that the question be given that further and complete study that its magnitude and importance demand."

Iowa Convention Considers Many Subjects

Inductive Interference, Group Insurance, Selling Securities to Customers, Readiness-to-Serve Rates, Rural Service and Electric Cooking Discussed

The discussion of the inductive-interference problem at the meeting of the Iowa Section of the National Electric Light Association at Lake Okoboji, Iowa, last week, briefly referred to in the *Electrical World* for June 24, was opened by J. M. Drabelle, past-chairman of the inductive interference committee, who presented a report on the present status of the work. Austin Burt presented the report of the general joint committee representing the N. E. L. A. and the American Telephone & Telegraph Company. Both speakers urged the utmost support for the work that the joint committee is doing.

John Reed of Cedar Rapids spoke of the ease with which it had been possible to handle the problems with the Bell Telephone Company in a co-operative way and asked that every effort be made to extend that co-operative effort to the independent telephone companies in the state.

Characterizing brain power, muscle power and good will as the marketable assets of the man who works with his hands, Peter F. Bouquet of St. Louis presented group insurance as a means of bringing good will into the brain and muscle work of the employee so that he will be of greater value to himself as well as to the employer. His assertion that group insurance is a valuable asset in an organization was strongly backed by F. J. Hanlon of Mason City, who cited instances of its utility in business establishments in which he is interested.

E. E. Sanford, Northern States Power Company of Minneapolis, discussed the sale of securities to customers. He did not point to it as a cure-all in public relations, but said that it can be made of great usefulness. He urged the need of care in selling, stating that securities on which dividends might by any possibility be suspended should not be sold. The need of protecting the market and establishing a resale market was urged by Mr. Sanford and also by President Dows.

That the readiness-to-serve form of electric power and lighting rate is desirable as a matter of justice and policy was the view expressed in a paper by Prof. J. B. Hill of Iowa State University. This form of rate is just, Professor Hill asserted, because the costs involved in the service are properly set up and allocated, so that each class of consumers carries its proper share with no shifting of costs to other classes. He also said that from the viewpoint of policy this form has all the good points and none of the bad ones of the minimum-charge form, which always leads consumers to limit consumption strictly. The readiness-to-serve charge had been attacked as a form of meter rental, but the courts had not sustained this contention.

The slogan of "Service at cost," advocated in the report of the committee on electric service rates, raised a protest because of the assertion that no item of profit is to be found in any of the costs entering into the various rates for service and that the item of return on investment should be referred to as the interest rate earned on the value of the property. Those protesting against this statement did so on the ground that the public, if rightly informed, would accept a reasonable profit item in the rates.

N. T. Wilcox of Keokuk supported the readiness-to-serve form of rate schedule, and John A. Reed of Cedar Rapids called attention to the demand for the adjustment of the rates downward, which, he said, must come as soon as the cost of coal reaches a lower point, and to the increase in cost to the smaller consumer which this form of rate would bring about.

The report of the rural-lines com-

DELEGATES AND GUESTS OF THE PACIFIC COAST DIVISION, N. E. L. A., mittee reviewed the ground already covered in committee work and followed the report of the committee of the National Electric Light Association in its analysis of the features of various plans. The risk of the business falling off because of migration from the country to the cities was alluded to, and the fact that the high costs of the service as compared with the same service in the cities would bring a slow development and a possible loss in the development period was dwelt upon. It was also held that financing from the proceeds of stock sales to the prospective customers was in effect the same thing as if the utility advanced the cash and, in fixing rates, should be treated in the same way.

N. T. Wilcox of Keokuk, in a discussion of the essentials of electric cooking rates, said that the average residence lighting customer yields an annual gross income of about $20 and indicated the possibility of increasing this figure to a total of more than $100 per kilowatt of station demand by encouraging the use of the electric range. Arthur Huntington of Cedar Rapids cited an experience in one Iowa town of about 500 population in which forty-eight ranges are installed with twenty hot plates. With the secondaries interconnected he said that a diversity factor of eight to one is certain. The town is served from a 40-kva. transformer connected to a high-tension line and the maximum load with all the ranges in service has been less than 40 kva.

In reviewing legal decisions of interest to the Iowa utilities, John A. Reed of Cedar Rapids took occasion to point out that the decisions of the courts had not been of a character to justify any one in saying that any one method of arriving at property values could be accepted to the exclusion of all others. He said that no mathematical formula had been developed and that original cost, the five-to-ten-year average, present market prices, depreciation and all other plans were indicated by court decisions as factors.

The officers elected for the coming year are: President, C. N. Chubb, Davenport; first vice-president, C. A. Sears, Keokuk; second vice-president, Don Sterns, Humboldt; treasurer, M. G. Linn, Des Moines.

A. M. E. S. at Spring Lake

Bad Weather Shortens Meeting One Day —The 660-Watt Rule—Legal Aspect of Trade Associations

With the co-operation of the weather, the Associated Manufacturers of Electrical Supplies finished the work of the annual meeting so promptly that the meetings of the final day were canceled. About 250 members were in attendance at the Hotel Essex and Sussex, Spring Lake, N. J., June 19 to 23. It rained so continuously that golf was greatly interfered with, and the sections continued their sessions through the afternoons and evenings, making it possible to advance the general meeting to Thursday.

President Shiras Morris, in his address, voiced the happier frame of mind of the membership since the last annual gathering, when the manufacturers were much depressed over the business outlook. "Most of us," he said, "have been happily surprised at the rapidity of readjustment, and we are apparently again on the upgrade."

A very interesting presentation of the record of the Electrical Manufacturers' Council was made by S. L. Nicholson, chairman of the council. He sketched the history of the council and of the earlier influences which led to the organization of the three member associations, and outlined in detail the work which has been accomplished by the council in contact with the Department of Commerce, the American Safety Council, the Fire Insurance Underwriters and the National Electric Light Association, as well as in the field of cost-accounting statistics, tariff and simplification. He discussed at length the recent acceptance of the code by the American Engineering Standards Committee and the influence which this should have on the development of the code as an American standard, under the control and guidance of all the interests naturally concerned. The success which has come through conducting co-operative activities with other associations through the appointment of special joint committees was described and heartily approved.

The association indorsed the revision of the 660-watt rule in the code to permit the wiring of twelve outlets as a branch circuit without regard to the possible number of sockets to be installed, provided that protection is afforded by a 10-amp. fuse.

Judge Debevois discussed the present legal aspect of the trade association and announced that the celebrated Mennen case has been appealed. He urged that members of the association contribute their statistics for clearance through the Department of Commerce. A new basis for the assessment of dues was proposed and adopted to provide more money in order that the work of the A. M. E. S. may be further extended. The following new directors were elected to serve for three years: S. L. Nicholson, Westinghouse Electric & Manufacturing Company; Waldo C. Bryant, Bryant Electric Company; C. E. Corrigan, National Metal Moulding Company; Edward Sawyer, Atlantic Insulated Wire Company, and W. H. Bliven, Harvey Hubbell, Inc.

American Society for Testing Materials Reports Progress

Meeting at Atlantic City on June 26 to June 30 on its twenty-fifth anniversary, the American Society for Testing Materials listened to an address by its president, C. D. Young, general supervisor of stores, Pennsylvania System, in which he gave a brief outline of the society's history and work.

"Since the establishment by the society of standardized methods and specifications," said Mr. Young, "increasing recognition has been given us as the authoritative body not only in a few,

AT ANNUAL CONVENTION IN LOS ANGELES, MAY 31-JUNE 3 but on all, subjects relating to materials engineering. Such great strides have been made that the society has produced standards covering nearly all of the important materials generally used in engineering construction. These standards, together with those which are now contemplated and are in course of development, will, when completed, afford to the engineer the necessary guides in engineering practices. In the preparation of these standards the fullest co-operation has been obtained from manufacturers and producers, and the standardization thereby effected has enabled the buyer and the seller to speak the same language. In overcoming the prejudice against standardization, the manufacturer has learned that it is possible for him to produce a far better quality of product and at the same time greatly reduce his expenses through mass production. This lower cost makes it possible not only to offer to the public better materials at lower unit prices, but also to maintain higher wages for labor."

Mr. Young advocated the reestablishment of an international association of testing engineers on a basis that will not involve the handicap imposed by the limitations of the original international association that has gone out of existence.

National Research Council Elects Division Chairmen

Announcement is made by the National Research Council of the election of the following division chairmen for the year 1922-23:

Foreign Relations—Robert A. Millikan, California Institute of Technology, Pasadena, Cal.

Educational Relations—Vernon Kellogg, permanent secretary National Research Council.

Research Extension—W. M. Corse, formerly general manager of the Monel Metal Products Corporation, Bayonne, N. J.

Research Information Service—Robert M. Yerkes, National Research Council.

Physical Sciences—Prof. William Duane, Harvard University Medical School.

Engineering—Alfred D. Flinn, secretary Engineering Foundation, New York.

Chemistry and Chemical Technology—Prof. Edward W. Washburn, University of Illinois.

New Orleans Reorganization Approved

The New Orleans Railway & Light Company is to be rechristened the New Orleans Public Service Corporation, and its outstanding capitalization is to be reduced from approximately $70,000,000 to between $45,000,000 and $50,000,000. This is in accordance with the reorganization plans adopted on June 12 by the several committees representing various classes of security holders.

The reorganization plan is the outcome of more than three years of negotiations between the city and the security holders to put the company on a sound financial basis and to improve its service. It represents a final agreement between the different mortgage holders of the company.

Many Water-Power Projects Seek Permits

Pacific Coast, Alaska, Idaho, Pennsylvania, North Carolina and Other Regions Contain Sites Desired—Louisville Has Municipal Scheme

A FIFTY-YEAR license has been granted by the Federal Power Commission to the California-Oregon Power Company for a 100-mile transmission line from Prospect to Springfield, Ore., to form the connecting link between the transmission systems of California and the Pacific Northwest. The line will be constructed for 66,000 volts and changed later to 110,000 volts.

A preliminary permit for one year has been issued by the commission to the Northwestern Electric Company of Portland, Ore., covering a power development on the Lewis River. The Lewis River Hydro-Electric Power Company of Vancouver, Wash., had filed a conflicting application which was denied. The project as presented covers three separate developments on the north fork of the Lewis River, though there is now a market only for the power which would be made available by the lower one. The permit covers this part of the project only.

A preliminary permit for two years has been granted to Joseph B. Leighton of Miles City, Mont., for a project on Yellowstone River at Buffalo Rapids. The applicant proposed to install 15,000 hp. and to use the power for pumping for irrigation and for public utility purposes.

A similar permit, but for power purposes only, has been granted to R. G. McDonald of Williams, Cal., covering a project on Condict Creek in that state. The applicant proposes to use three small lakes as storage reservoirs and to construct two power houses in the canyon below.

To the city of Wrangell, Alaska, a permit covering the development of power on Mill Creek, near that city, has been granted, and to Frank L. Ballaine one covering a project on Kenai River, 50 miles north of Seward, Alaska. J. G. Galvin has received a permit for a project on Aarons Creek, 20 miles southwest of Wrangell.

The city of Louisville, Ky., has applied for a preliminary permit covering a power development at the United States dam in the Ohio River at the Falls of Louisville. The dam and the lock have been recommended for reconstruction. Primary power to the extent of 28,000 hp. would be available at that point, it is estimated. The city plans, however, to install equipment capable of generating 50,000 hp.

Thebo, Starr & Anderton, Inc., of San Francisco have applied for a permit covering a project on the American River, 15 miles northwest of Placerville, Cal., the power to be used for public utility purposes. The primary power available is estimated at 25,000 hp., but it is the intention of the company to install equipment capable of generating 50,000 hp.

The Enterprise Electric Company of Spokane, Wash., has applied for a permit for a project on the east fork of the Allowa River, Oregon. It is expected that 1,200 hp. will be developed.

The construction of a dam near Branson, Mo., across the White River, a navigable stream, is awaiting the approval of the commission. The dam would create a reservoir with an area of 75 square miles, and the object is to increase the power capacity of the Ozark Power & Water Company's project near Forsyth, Mo.

No action will be taken at this time by the commission on applications covering the development of power on Sultan Creek, Washington, because of conflicting applications for these rights. One application has been made by the city of Everett and another by the Sound Power Company. The question will figure in the municipal election next November.

The Northern States Power Company, with offices at 208 South La Salle St., Chicago, has applied for a preliminary permit to cover the construction of a reservoir and three dams on the St. Croix River. This project has been separated from an application made Sept. 20 because it was thought advisable to cover the St. Croix project with an application of its own rather than group it with the Mississippi River development planned by the Northern States Power Company. The primary power available at Kettle Falls on the St. Croix is estimated at 11,000 hp. The company intends to install 27,000 hp.

F. A. Bryan, Indiana & Michigan Electric Company, South Bend, Ind., has applied for a preliminary permit covering a dam and power house on the St. Joseph River, 6 miles above its mouth, in Berrien County, Mich. The primary power is estimated at 800 hp., and it is planned to install 1,000 hp.

The Molybdenum Company of America, 1008 Empire Building, Pittsburgh, has applied for a license covering three dams, conduits and power houses on the Red River and Columbia Creek in Taos County, N. M. The primary power is estimated at 1,000 hp., and 1,350 hp. may be installed. The power is to be used for mining purposes.

The Murtaugh (Idaho) Irrigation District has applied for a preliminary permit to cover a power project which involves the construction of a diversion dam in Snake River just above Auger Falls. A second diversion dam is to be built in Rock Creek from which the water will be carried to the power house 1½ miles distant. The power is to be used for pumping purposes to supply the Hansen-Butte irrigation project.

The Mutual Power Association of Weiser, Idaho, has applied for a preliminary permit to construct a diversion dam in Crane Creek in Washington County, Idaho, and to construct a canal from that point to a power house 3 miles distant on the same stream. It is the intention to conduct the power by transmission lines to three pumping stations on Snake River. The power is for pumping purposes on irrigation projects.

The Clarion River Power Company, in care of C. B. Hawley, Munsey Building, Washington, D. C., has applied for a preliminary permit covering the erection of a power house on the Clarion River and the building of a dam to a height of 240 ft. at a point 2 miles above the mouth of Mill Creek, near Ridgway, Pa. It is estimated that these works will make available 120,000 hp. of primary power. The plan is to install equipment sufficient to generate 175,000 hp. The power is to be used for public utility purposes.

The Carolina Power & Textile Company, Asheville, N. C., has applied for a preliminary permit to cover five power projects in the Pisgah National Forest, in Henderson and Transylvania Counties, N. C. Three of the projects are on the South Fork of Mills River, one on Rocky Fork of the same river and the fifth on the Davidson River. The application also calls for permission to erect a transmission line to Asheville. Five thousand horsepower of primary power will be developed at the five projects, it is estimated. The intention is to install 10,000 hp. The power is intended for use in the operation of a cotton mill and a brick factory.

The Coming World Power Conference

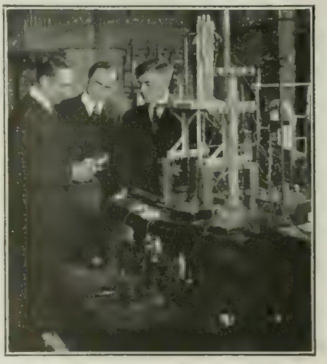
For the projected world power conference to be held in London in 1924, which is being promoted by the British Electrical and Allied Manufacturers' Association in connection with other organizations in Great Britain and other countries, and to which reference was made in the *Electrical World* for April 22, page 795, a preliminary program has been issued, in which the object of the conference is thus stated:

"The purpose of the world power conference will be to consider how the industrial and scientific sources of power may be adjusted nationally and internationally: By considering the potential resources of each country in hydroelectric power, oil and minerals; by comparing experience in the development of scientific agriculture, irrigation and transportation by land, air and water; by conferences of civil, electrical, mechanical, marine and mining engineers; technical experts and authorities on scientific and industrial research; by consultations of the consumers of power and the manufacturers of the instruments of production; by conferences on technical education to review the educational methods in different countries, and to consider means by which existing facilities may be improved; by discussions on the financial and economic aspects of industry, nationally and internationally, and by conferences on the possibility of establishing a permanent world bureau for the collection of data, the preparation of inventories of the world's resources, and the exchange of industrial and scientific information through appointed representatives in the various countries."

It is the intention of the promoters of the conference, of which D. N. Dunlop, British Electrical and Allied Manufacturers' Association, is organizing director, to appoint secretaries, where possible, in the following countries: The British dominions, the United States, France, Germany, Switzerland, Belgium, Italy, Spain, Portugal, Holland, Denmark, Norway, Sweden, Russia, Greece, the central European states, the Near East, Japan, China and the South American and Central American republics.

Marconi Visits Schenectady and Sees Radio Plant

Guglielmo Marconi spent a busy day at the Schenectady plant of the General Electric Company on June 26 inspecting the works and conferring with the wireless experts of the company and of the Radio Corporation of America.



MARCONI TALKS TO AMERICAN SCIENTISTS

The greater part of the distinguished inventor's visit was occupied in inspection of the radio-manufacturing division of the company, its broadcasting station and the research laboratory. The illustration shows Marconi standing with Dr. W. R. Whitney and Dr. Irving Langmuir in the laboratory.

At a luncheon held at the Mohawk Golf Club the toastmaster was E. W. Rice, Jr., and the speakers included Owen D. Young, chairman of the board of directors; Dr. Whitney and Dr. Langmuir.

In responding to a toast in his honor Mr. Marconi spoke of the influence which radio is having and is destined to have on human relations by facilitating communication between the nations of the world. Prediction was made that the encircling of the globe by wireless was a possibility in the not distant future.

Musquash (N. B.) Hydro-Electric Plant Finished

Work on the hydro-electric power station at Musquash, New Brunswick, has just been completed by the provincial government, which has been pursuing a policy of water-power development. Energy from this station will be distributed to cities and towns in southern New Brunswick, including St. John, Fairville, St. George, St. Andrews, St. Stephen and Milltown, as well as Moncton, Sussex and Sackville. A dispute is being waged as to whether the New Brunswick Power Company, which operates the street railway and supplies light and power in St. John, shall distribute the energy in that city or whether the city shall itself do so. This will have to be fought out in the Legislature.

Indications are that the International Paper Company of New York will start work on the hydro-electric station at Grand Falls during the present summer. This company has the water-power privileges at Grand Falls granted by the New Brunswick government on condition that the powers were developed and pulp and paper mills constructed. It is a matter of conjecture what will be the action of the provincial government if the company proceeds with work on the station and abandons the mill project, as it is said it may do on account of labor troubles. There are many cities and towns of small size within easy reach of Grand Falls and on both sides of the international boundary that would be expected to buy hydro-electric energy developed there.

Permanent Water-Power Conference Formed at Asheville

A permanent organization for the study of the water-power resources existing in the southern Appalachian region and their relation to industrial growth and navigation was formed as the result of the first water-power conference for that region, which was held at Asheville, N. C., last week. This organization will embrace Virginia, North and South Carolina, Georgia, Alabama, Florida, Mississippi, Tennessee, Kentucky, West Virginia and the District of Columbia.

O. C. Merrill, executive secretary of the Federal Power Commission, called the conference to order. A survey of what has been accomplished and the vast possibilities awaiting future development of the stream resources of the Southern mountains was made in addresses by N. C. Grover, chief hydraulic engineer of the United States Geological Survey; Col. Joseph Hyde Pratt, director of the North Carolina Geological and Economic Survey; T. W. Norcross, chief engineer United States Forest Service; Col. T. C. Williams, vice-president Columbia Railway & Navigation Company; Prof. C. E. Ferris, dean of the engineering school, University of Tennessee, and others. Pleas for closer co-operation between states and federal agencies and on the part of private and corporate interests to effect greater conservation as well as utilization of the water-power resources were made.

W. S. Lee, chief engineer of the Southern Power Company, referred to the flood which occurred in the Catawba River valley in the summer of 1916. Had the impounding reservoir which his company has since built at the headwaters of the Catawba River existed at that time, he said, the overflow of the Catawba might have been restrained, saving enormous crop and property damage.

Officers were elected as follows: President, Col. Joseph Hyde Pratt of Chapel Hill, N. C.; vice-president, Lincoln Greene, vice-president Southern Railway Company; secretary, J. A. Switzer; assistant secretary and treasurer, Prof. Thorndyke Saville of the University of North Carolina.

Less Utility Financing During June

During the month of June stocks and bonds amounting to $64,530,000 were offered investors by electric light and power companies. This figure represents a decrease of more than $4,000,000 under the sum reached in May, when the highest figure of the year was recorded. The decrease is not, however, inconsistent with public utility financing of a year ago, when the total dropped from $34,824,000 in May to $19,939,263 in June. The average rate of return yielded the investor declined to 6.22, as compared with 6.74 for the month of May and 6.50 for April.

Special attention is called to the two 5 per cent issues offered at a premium—the Newburyport Gas & Electric Company bonds at a premium of one and a half points and the Turner Falls Power & Electric Company bonds at a premium of three points. The largest single offering was the Tennessee Electric Power Company's issue of $12,150,000.

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S. P. E. E. Elects Officers

Prof. Charles F. Scott of Yale University was re-elected president of the Society for the Promotion of Engineering Education at its convention last week held at the University of Illinois, and Prof. D. S. Kimball of Cornell University and Prof. F. G. Higbie of the University of Iowa were elected vice-presidents. M. W. Alexander of the National Industrial Conference Board was elected as a member of the council, an innovation for the society. The other new members of the council, with the universities they represent, are as follows: Edward Bennett, Wisconsin; H. S. Evans, Colorado; E. A. Hitchcock, Ohio; H. T. Hughes, Harvard; C. E. Magnusson, Washington, and G. C. Shaad, Kansas State.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Offered at	Per Cent Yield
Cincinnati Gas & Electric Co.	$6,000,000	Thirty-nine year	Prior lien and refunding mortgage sinking-fund gold bonds, series B	To be applied to payment of notes falling due and to provide for additional capital expenditures	5½	98½	5.60
Tennessee Electric Power Co.	12,150,000	Twenty-five year	First and refunding mortgage gold bonds, series A	To provide for certain maturing obligations and all floating debt of the properties and to make extensions possible	6	96	6.30
Newburyport Gas & Electric Co. (Mass.)	650,000	Twenty-year	First mortgage gold bonds, series A	Refunding	5	101½	4.87
Turners Falls Power & Electric Co. (Mass.)	3,000,000	Thirty-year	First mortgage gold bonds, series A	To retire notes falling due	5	103	4.80
Great Bend Water & Electric Co. (Kansas)	200,000	Five-year	Gold notes		8	100	8
Southern Oklahoma Power Co	1,380,000	Twenty-year	First and refunding mortgage gold bonds, series A		7	Par	7
Union Public Service Co. (Minn.)	230,000	Fourteen-year	First mortgage gold bonds	Proceeds will be used to pay off current liabilities and for additions	6	91½	7
Consolidated Gas, Electric Light & Power Co. of Baltimore	10,000,000	Thirty-year	First refunding mortgage sinking-fund gold bonds, series A		6	99	6.05
West Penn Company	2,500,000	Three-year	Gold debentures		6	98	6.75
Scranton Electric Co.	693,000	Fifteen-year	First and refunding mortgage bonds		5	95	5.50
Public Service Corp. of New Jersey	4,000,000		Cumulative preferred stock	To acquire a substantial controlling interest in other public utility property	8	106	7.50
Newport News & Hampton Railway, Gas & Electric Co.	1,200,000		Cumulative convertible preferred stock		7	93	7
Community Power & Light Co.	500,000	Twenty-year	First mortgage collateral sinking-fund gold bonds, series A		7½	100	7.50
Manchester Traction, Light & Power Co. (New Hampshire)	2,059,000	Thirty-year	First refunding mortgage sinking-fund gold bonds	Refunding	5	99¾	5.40
Public Service Co. of Northern Illinois	7,000,000	Forty-year	First lien and refunding mortgage bonds, series A	To retire maturing obligations, for additions, betterments and new property and to reimburse treasury for capital expenditures	5½	92½	6
Chippewa Power Co. (Wis.)	1,800,000	Twenty-five-year	First mortgage sinking fund gold bonds, series A	To retire present outstanding notes and all other obligations and to provide part of the funds necessary for additions	6	98½	6.12
Vermont & Quebec Power Co.	300,000	Twenty-year	First mortgage sinking-fund gold bonds		8	100	8
Columbus Electric & Power Co. (Ga.)	1,500,000	Twenty-five-year	First and refunding mortgage gold bonds, series A		6	97	6.25
	2,000,000		Cumulative first preferred stock, series A		7	96½	7.25
Kansas Electric Power Co.	3,000,000	Fifteen-year	First mortgage series A gold bonds	To refund bonds for the acquisition of properties and for the building of additions, extensions and improvements	6	97	6.30
Twin States Gas & Electric Co.	2,000,000		Prior-lien stock		7	100	7
Toledo Edison Co.	768,000	Twenty five-year	First mortgage gold bonds		5	91	5.68
Danville, Champaign & Decatur Railway & Light Co. (Ill.)	1,000,000	Sixteen-year	Bonds		5	90	6
Orange County Hydro-Electric Corp. (New York)	600,000	Twenty-year	First mortgage sinking-fund gold bonds, series A		7	100	7
Total	$64,530,000						

Association's Technical Executive Committee Meets July 12

A meeting of the national technical executive committee of the N. E. L. A. has been called for July 12 and 13 in Madison, Wis. This meeting, headquarters announces, will be of extraordinary importance, the purpose being to work out the details of the plan for making the Technical Section of greater service and of dollars-and-cents value to all member companies through the geographic divisions' organization.

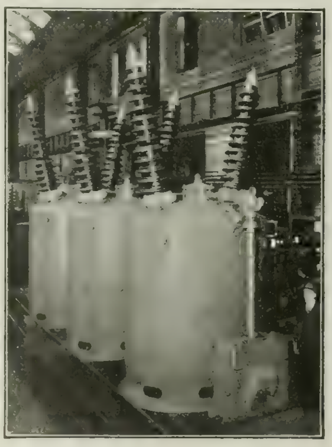
Other News Notes

Harnessing the Jordan.—Concessions for a hydro-electric development on the Jordan River, in Palestine, have been granted by the British government, which holds a mandate giving it control in that country, to Pinhas Rutenberg, a Russian, who is now in the United States endeavoring to raise capital for the project. Especial appeal is made to those back of the Zionist movement, and it is reported that Jewish capitalists in this country have already subscribed nearly a million of the five-million-dollar total needed for the completion of the first part of the development as it is planned. According to the promoters of the plan, the engineering problems involved in harnessing the water power of the Jordan are unique because of the fact that the river, when it falls into the Dead Sea, is 1,290 ft. below sea level. The first stage of the project, however, involves the utilization of the upper waters of the Jordan. The springs of the Jordan start in the watershed of the Hermon range in Palestine. These mountains rise to a height of 4,000 ft. above sea level, so that the total fall of the Jordan is more than 5,200 ft. The river is 140 miles long. Opposition to the concession has been voiced in the British House of Commons based on Mr. Rutenberg's alleged political views. The government has, however, denied that he is a supporter of the Bolshevik régime.

Hoover Asks for Dam to Protect Imperial Valley.—Prompt construction by the federal government of a dam at Boulder Canyon for the protection of Imperial Valley, California, against the flood waters of the Colorado River was urged recently by Secretary Hoover befor the House committee on irrigation of arid lands. Mr. Hoover, speaking as chairman of the Colorado River Commission, stated that he earnestly recommended action by Congress upon the project without waiting until the commission could report a comprehensive plan for irrigation and power plants at other places situated along the Colorado River.

Discontinued Telegraph Route from Europe to India to Resume Operation.—It is announced that the Indo-European Telegraph Company's service, which has been completely interrupted since the outbreak of the war in 1914, is to be resumed before long, concessions having been obtained from Germany, Poland and the Soviet government of Russia and progress having been made in the restoration of lines and poles that were destroyed during the hostilities.

Westinghouse Builds Largest High-tension Oil Circuit Breaker.—The Westinghouse Electric & Manufacturing Company has just shipped to the Pacific Gas & Electric Company for its Mount Shasta development what is believed to be the largest high-tension oil circuit breaker ever built. The breakers were built for the 220,000-volt Mount Shasta development and are for use on a 220,000-volt system having a solidly grounded neutral. The breaker is good for a 350-kv. wet test. The gross shipping weight of the breaker, including oil, is 45 tons. Its net weight, erected on foundation, is 37½ tons. The breaker requires 2,000 gal. of oil for each pole, and exclusive of oil it weighs 15 tons. The height of the breaker from the ground to the top of the bushing is 17 ft. 6¼ in., and its height from the ground to the top of the tank is 9 ft. 8½ in. The long diameter of the tank is 8 ft. while its short diameter is 5 ft. 8 in.



Alaska Cable Will Not Give Way to Wireless.—Replacement of 1,000 miles of the 2,670 miles covered by the Seattle-Sitka cable will be undertaken by the War Department when Congress authorizes an appropriation of $1,500,000 for that purpose. The present cable was laid nineteen years ago and is worn to such an extent that 95 per cent of the current escapes. Officers of the Signal Corps, asked if wireless could not be substituted, said that this could not be done economically or efficiently and maintained that cables will not go out of existence as a result of radio development.

Associations and Societies

Michigan Electric Light Association.—Plans are being made for the annual convention of the Michigan Electric Light Association, to be held at Ottawa Beach, Mich., Aug. 21-23. Much attention is to be given to the subject of rural lines, the coal situation is to be presented from the various angles which concern the utilities, and radio, the organization of central stations for selling appliances, safe and adequate wiring for modern lighting, decorative and domestic service, the relation of the electric utility to the development of the state and public relations will also be subjects of discussion.

Georgia Electrical Association.—With more than 100 delegates, representing every section of the state, in attendance, the Georgia Electrical Association, organized last year in Macon, held its first annual convention in Savannah June 16. The following officers were elected: President, L. W. Roberts, Atlanta; vice-president, P. R. Bomeisler, Waycross; secretary and treasurer, W. C. Drake, Atlanta. Executive committee: Henry Morton, Atlanta; Joel Wier, Athens; Norton Frierson, Savannah; George Shane, Atlanta.

Southwestern N. E. L. A.'s New President.—The secretary of the Southwestern Electrical and Gas Association, E. N. Willis, calls attention to the fact that the new president of the Southwestern Geographic Division of the N. E. L. A. is E. H. Kifer, vice-president and general manager San Antonio Public Service Company, not R. J. Irvine, as stated in the *Electrical World* for May 13. Mr. Irvine was elected, as the item in question correctly noted, president of the Southwestern Electrical and Gas Association. The treasurer of the Southwestern Electrical and Gas Association is F. J. Gannon, not F. G. Ganno, as previously printed.

Coming Meetings of Electrical and Other Technical Societies

Ohio Eectric Light Association—Cedar Point, Ohio, July 11-14. (For program see issue of June 24, page 1290.)

A. I. E. E., Pacific Coast Convention—Vancouver, B. C., Aug. 8-11.

Michigan Electric Light Association—Ottawa Beach, Aug. 21-23.

International Association of Municipal Electricians — New Bedford, Mass., Aug. 22-25.

N. E. L. A. Geographic Divisions—New England, New London, Conn., Sept. 5-7; Rocky Mountain, Glenwood Springs, Col., Sept. 18; Great Lakes, French Lick Springs, Ind., Sept. 28-30.

Association of Iron and Steel Electrical Engineers—Cleveland, Sept. 11-15.

American Electrochemical Society — Montreal, Sept. 21-23.

Illuminating Engineering Society—Boston, Sept. 25-28.

National Association of Railway and Utilities Commissioners—Detroit, Sept. 26.

Telephone Pioneers of America—Cleveland, Sept. 29-30.

Recent Court Decisions

Patents Cannot Be Issued to Land Under Navigable Water.—Dicta on title to riparian lands were laid down by the Court of Appeals of Maryland in Linthicum vs. Shipley as follows: (1) A patent to land under water may not be issued if the water is navigable; (2) a grant by the owner of the bed of a non-navigable stream of land bounding thereon conveys, even without express language, ownership to the middle of the stream; (3) the prima facie presumption is that riparian proprietors of non-navigable streams own the soil covered thereby to the middle of the stream; (4) a boundary on a natural pond or lake, as well as a non-navigable stream, carries title to its center. (116 At. 817.)*

Recovery of Damages from Fire Said to Have Been Due to Central-Station Ash Pile Permitted.—Three plaintiffs (Davenport, Morgan and Hilbert) brought suit for damages against the Intermountain Railway, Light & Power Company to recover for loss caused by a fire alleged to have been communicated from an ash pile negligently kept and maintained by the defendant. The Supreme Court of Nebraska, which affirmed the judgment for the plaintiffs in two of the three suits, declared that it was not erroneous to admit evidence as to the manner of handling the ashes and tending to prove that fire had been seen in the ash pile at various times before the fire which caused the damage and that this condition of the ash pile was continuous. (187 N. W. 905.)

United States Supreme Court's Finding in Interstate Water Appropriation Suit.—In the suit brought by Wyoming against Colorado to determine title to water power on the Laramie River (see issue of June 17, page 1237) the findings of the United States Supreme Court have now become available in their entirety. They cover thirty-four printed pages. On the main points in dispute the court says: "We conclude that Colorado's objections to the doctrine of appropriation as a basis of decision are not well taken, and that it furnishes the only basis which is consonant with the principles of right and equity applicable to such a controversy as this is. The cardinal rule of the doctrine is that priority of appropriation gives superiority of right. Each of these states applies and enforces this rule in her own territory, and it is the one to which intending appropriators naturally would turn for guidance. The principle on which it proceeds is not less applicable to interstate streams and controversies than to others. Both states pronounce the rule just and reasonable as applied to the natural conditions in that region, and to prevent any departure from it the people of both incorporated it into their constitutions. It originated in the customs and usages of the people before either state came into existence, and the courts of both hold that their constitutional provisions are to be taken as recognizing the prior usage rather than as creating a new rule. These considerations persuade us that its application to such a controversy as is here presented cannot be other than eminently just and equitable to all concerned. In suits between appropriators from the same stream, but in different states recognizing the doctrine of appropriation, the question whether rights under such appropriations should be judged by the rule of priority has been considered by several courts, state and federal, and has been uniformly answered in the affirmative. One of the cases came to this court and the judgment below was affirmed. These decisions, although given in suits between individuals, tend strongly to support our conclusion, for they show that by common usage, as also by judicial pronouncement, the rule of priority is regarded in such states as having the same application to a stream flowing from one of them to another that it has to streams wholly within one of them. The contention of Colorado that she as a state rightfully may divert and use, as she may choose, the waters flowing within her boundaries in this interstate stream, regardless of any prejudice that this may work to others having rights in the stream below her boundary, cannot be maintained. The river throughout its course in both states is but a single stream wherein each state has an interest which should be respected by the other. A like contention was set up by Colorado in her answer in Kansas vs. Colorado and was adjudged untenable."

Rebate of Overcharges Ordered.—In passing upon an appeal of the Muskogee Gas & Electric Company against the Oklahoma Corporation Commission because a temporary order of the commission increasing rates had been rescinded and a lower scale imposed, the Supreme Court of Oklahoma sustained the commission in its finding that the rates first allowed, which were in effect from October, 1918, to May, 1919, were more than enough to yield a proper return. The Supreme Court ordered that the difference between the revenue collected by the company since the latter date and the revenue that would have been received under the commission's order should be refunded, the commission to constitute a court of record to determine the amount of rebate and to whom it should be paid. In this case the company held the revised rates to be confiscatory and to have been made without a proper valuation of the company's property. The court found that the company had not asked for a valuation and pointed out that a proceeding could be instituted. (206 Pac. 242.)

Commission Rulings

Taxes as a Factor in Fixing Municipal Rates.—Asserting that municipal utilities which are tax-exempt should turn over to the general fund of the municipality annually a sum of money equivalent to the amount of the exemption, and that it has always given consideration to the question of taxes in every case which has been before it involving rates of municipal plants, the Wisconsin Railroad Commission refused to accede to an application from the city of Kaukauna for a higher rate for the service it supplies to Little Chute than is allowed in Kaukauna, the ground for the application being that the municipality's property in Little Chute is taxed while its property in Kaukauna is not.

Lack of Co-ordination Between Head Office and Local District Agents Criticised. — In a recent survey of the service conditions of the San Joaquin Light & Power Corporation the California Railroad Commission criticised a lack of co-ordination between the head office of the company and its local district agents. This, the commission said, "has not been conducive to the greatest efficiency," and it recommended that the company should "establish the practice of holding meetings monthly at which its district managers will meet and where they may be acquainted and kept in constant touch with the proper application of rules and practices of the company and the policies affecting public relations."

Unremunerative Service.—In a recent hearing upon a petition of the Idaho Power Company to discontinue service on a short rural-line extension, the Idaho Public Utilities Commission said: "A public utility cannot be required to render service unless such rendering will afford a revenue which will pay the operating expenses and taxes, provide proper depreciation reserve and afford a fair return on the investment judiciously made and required in the service of the public. Although this is generally a correct statement of the law, we are not disposed to take the position that each individual class of service afforded by a utility or each particular unit of the system of a utility standing alone shall afford a revenue sufficient to meet its pro rata of the revenue required to pay operating expenses and taxes, provide proper depreciation reserve and afford a fair return, so long as the business of the utility as a whole meets such requirement." This, however, holds true only when a unit or class of service is so interwoven with the system of the utility or general plan of development of the territory served as to be a part of the general system or general development plan.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Burchard Elected President and Chairman of Board of I. G. E.

Anson W. Burchard, vice-chairman of the board of directors of the General Electric Company, has been elected president and chairman of the board of the International General Electric Company, succeeding Gerard Swope, its former president, who was recently chosen president of the General Electric Company, and Charles Neave, former chairman of the International General Electric Company, who has resigned.

A. W. BURCHARD

Mr. Burchard brings to the presidency of the International company a wide experience in foreign affairs cultivated by personal familiarity with international engineering, commerical and financial problems. He has contributed largely to the development of the manufacturing facilities, financial resources and sales methods of foreign manufacturing and sales agencies in such a way as greatly to stimulate the expansion of the electrical industry abroad.

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R. J. Russell, recently elected president of the Electric Power Club, is vice-president and secretary of the Century Electric Company of St. Louis. A detailed sketch of Mr. Russell's activities in the electrical industry will be found in the July 2, 1921, issue of the ELECTRICAL WORLD.

Prof. Jacques Cavalier, rector of the University of Toulouse and a leading authority on metallurgical chemistry, sailed recently from New York for France. Professor Cavalier came to America a year ago as French exchange professor, delivering a series of lectures at the seven co-operative institutions which are making this exchange a permanent arrangement as a part of the general plan to promote closer relations between the engineering professions of France and America.

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Stanley A. Dennis Is Editor of "Electrical Retailing"

Stanley A. Dennis, who for four years has been associate editor of *Electrical Merchandising*, has resigned that position and his connection with the McGraw-Hill Company in order to locate in Chicago and develop certain editorial and other work in which he is interested. Mr. Dennis is now the editor of *Electrical Retailing*, published by the Rodger Publishing Company, Chicago. He has also accepted editorial assignments from a few business papers in New York and Chicago. Prompted by his interest and investigations in distribution, especially in the electrical industry, he plans also to assist a number of manufacturers in making extended marketing surveys, and perhaps to develop his own organization of marketing surveyors. To his new work in this economic field and especially to his new responsibilities as editor of *Electrical Retailing* Mr. Dennis carries an extended and specialized knowledge of merchandising problems, gained while he was director of the bureau of business standards of the A. W. Shaw Company, publisher of *System* and *Factory*, and during his four years with *Electrical Merchandising*.

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John Fritz Medal Awarded Senator Marconi

The John Fritz medal, one of the highest distinctions bestowed by the engineering profession in this country, has been awarded for 1922 to Guglielmo Marconi. "The medal is awarded to you for the invention of wireless telegraphy," said the communication to Mr. Marconi from the chairman of the Fritz medal board of award. This medal will be formally presented to Marconi at a gathering of engineers from all parts of the country at the Engineering Societies Building, New York City, on Thursday, July 6.

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Dr. Arthur E. Kennelly, professor of electrical engineering at Harvard University and the Massachusetts Institute of Technology, who has just finished a successful year as exchange professor to France, has been honored with the cross of the Legion of Honor by the French government.

Prof. Parker Heads Brooklyn Edison Engineering Staff

John C. Parker has been appointed electrical engineer of the Brooklyn Edison Company. Mr. Parker comes to this position after seven years as professor in charge of the department of electrical engineering at the University of Michigan.

Mr. Parker was born in the city of Detroit in 1879 and was graduated from the University of Michigan in 1901. Upon graduation he entered the testing department of the General Electric Company and subsequently occupied the position of instructor in the newly formed electrical engineering school at Union College, Schenectady, N. Y. From Union College he went to Niagara Falls as engineer in charge of the plant of the Ontario Power Company and while in this position he had much to do with the construction of the transmission line of the Niagara, Lockport & Ontario Power Company, as well as in designing and installing the system of receiving stations and substations. In 1907 he became connected with the Rochester (N. Y.) Railway & Light Company as mechanical and electrical engineer, resigning that position in 1915 to become professor of electrical engineering at the University of Michigan.

J. C. PARKER

During Mr. Parker's seven years at that university he spent much time on the development of a general economic theory of engineering design with particular reference to power plants and transmission lines. Mr. Parker is a past-vice-president of the Great Lakes District of the A. I. E. E. and a past-member of the power survey committee of the Great Lakes Section of the N. E. L. A.

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Thomas A. Edison was among those honored by Rutgers College, New Brunswick, N. J., at its one hundred and fifty-sixth annual commencement. Mr. Edison was given the degree of bachelor of science.

C. E. Allen, manager of the central-station division of the Chicago office of the Westinghouse Electric & Manufacturing Company, has been appointed manager of the St. Louis office of the company. Mr. Allen entered the employ of the General Electric Company after graduation from the Virginia Polytechnic Institute. After taking the apprenticeship course he was transferred to the engineering department, where he was engaged in the design of transformers. In 1909 he became head of the transformer division of the supply department for the Westinghouse Electric & Manufacturing Company. He later was made assistant to the manager of the supply department, and in 1915 was made manager of the supply division of the Chicago office. A short while later he was appointed manager of the central-station division of that office, holding that position until his present promotion.

C. E. ALLEN

Charles B. Kendall has been appointed purchasing agent of the Hart Manufacturing Company, Hartford. Conn. Mr. Kendall has been with the company for the greater part of the past eighteen years.

J. W. Hartman has been appointed Southwestern manager for Eccles & Smith, with headquarters in Los Angeles. Mr. Hartman was for many years with the Le Blond Machine Tool Company.

Ira Cushing, formerly of the sales engineering staff of the Condit Electrical Manufacturing Company, Boston, has joined the sales organization of Arthur H. Abbott, New England selling agent for the Bush Electric Company, Electrical Development & Machine Company, Sweitzer & Conrad, Inc., Sundh Electric Company, Ohio Electric & Controller Company and other manufacturers. His headquarters will be at Boston. Mr. Cushing was for some time attached to the Boston office of the General Electric Company and is a past-chairman of the Boston Section of the American Institute of Electrical Engineers.

Gray Jones of the Tubular Woven Fabric Company, who was recently stationed at Pittsburgh, will hereafter have his headquarters at Cincinnati and will take care of southern Ohio, southern Indiana, western Pennsylvania, West Virginia and Kentucky.

C. P. Eldred has resigned the professorship of electrical engineering at Rensselaer Polytechnic Institute and has accepted a position with the John A. Manning Paper Company and the Manning Abrasive Company of Green Island, N. Y.

A. W. Baker has been appointed new-business manager of the Danbury & Bethel Gas & Electric Light Company of Danbury, Conn. Mr. Baker comes to this position after some seven years' service with Henry L. Doherty & Company.

George M. Ogle has become connected with the Public Service Electric Company of New Jersey as electrical engineer. Mr. Ogle comes to this new position after thirteen years of varied experience in public utilities in electrical construction in engineering.

Walter S. Goll has been appointed manager of the Fort Wayne (Ind.) works of the General Electric Company to succeed F. S. Hunting, who recently resigned. Mr. Goll comes to this new executive position after about twenty-five years of activity in the manufacture of electrical apparatus and machinery.

James E. Wilson, for the past six years secretary of the Massachusetts State Association of Electrical Contractors and Dealers, is retiring from this work July 1 and on Aug. 1 will open an office in Boston as a manufacturers' agent. Mr. Wilson is widely known in New England electrical circles. He was identified with the early days of telephone development at Boston, and he served ten years each as field representative of the Pettingell-Andrews Company and of the Stuart-Howland Company of Boston.

Col. N. C. Hoyles has been appointed district manager of the St. Louis sales office of the Pittsburgh Testing Laboratory. Colonel Hoyles is a graduate of Queen's University, Kingston, Ontario, and took a post-graduate course at the University of Toronto. Immediately upon graduation he entered the service of the Pittsburgh Testing Laboratory as inspector at the Birmingham office. In 1912 he was promoted to manager of that office and in 1914 was transferred to the Vancouver office. At the opening of the war he entered the Canadian army, serving with the British Pioneer Engineers Corps in France and receiving decorations from the French and British governments. Upon release from the army in 1919 he was appointed assistant sales manager at Cleveland. Since that time he was in succession assistant sales manager in New York and manager at Cincinnati until his appointment to his new position.

John F. Schurch has been elected a vice-president of Manning, Maxwell & Moore, Inc., in charge of their department of sales, with headquarters at the Chicago office.

W. L. Frost has been recently advanced from the position of assistant to the vice-president to that of manager of the consumers' department of the Southern California Edison Company.

C. D. Adsit has been elected a vice-president of the Georgia Railway & Power Company by the board of directors of that company. This position has been vacant since the resignation some months ago of W. H. Glenn.

Dr. Howard M. Raymond has been elected president of the Armour Institute of Technology. Dr. Raymond comes to this high position in the field of technical education after twenty-seven continuous years as an instructor and professor in the institution of which he is to be the head.

Joseph E. Perkins has been appointed selling agent for the Ward Leonard Electric Company of Mount Vernon, N. Y. Mr. Perkins will cover the territory of Maryland, Virginia and that part of Pennsylvania known as the Susquehanna Valley as far north as Harrisburg and will have his headquarters at Baltimore.

Obituary

Charles F. McGilvray, past-president and recently elected chairman of the board of directors of the Robins & Myers Company, died at his home in Springfield, Ohio, on Tuesday, June 27. He was seventy-three years of age. Mr. McGilvray had been with the Robbins & Myers Company for many years, and as president he built the company up to a point of eminence in the production of electric fans as well as small motors.

C. F. McGILVRAY

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Summer Lull Advantage to Radio Business

The Basis of Radio Popularity—How a Quiet Summer Will Help Fall and Winter Business

By Wendell L. Wright
Stuart-Howland Company, Boston

MANY men right now are disturbed about conditions in the radio business. How serious is the slump to be?—they wonder. Is summer atmospheric interference to prove so serious that people are going to be disgusted with radio? Is it something that the dealer and the jobber and the manufacturer should worry about? We feel that, on the contrary, there is such a distinct advantage in the very presence of the hot-weather lull that every man interested in radio should have it in mind and organize it into his plans.

How Radio Appeals

In the first place, radio is no fad.

Men of affairs come meekly and with apologetic humility to ask simple technical questions of radio experts. It is surprising to see how many owners of radio sets are interested in the technical side. Shall we attribute it to the boy in every man, welling up from unknown depths, this desire to know "how"? Office boys, clerks, executives, clergymen, street-car conductors, college professors, all are represented. This in itself shows how deeply the roots of radio have penetrated the soil of popular America.

The public has had but a taste, a small sample of what radio is like or what can be done with it. That taste has left a desire for more.

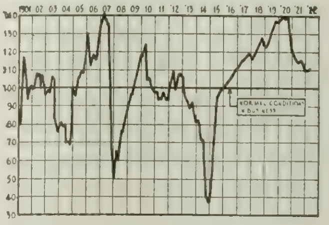
People literally have been forced to read radio news topics. Once shown the way, they have followed largely. Newspapers all over the country are incorporating columns in their daily "forms" about radio which range from rudimentary to highly technical information. Thanks to these newspapers, the public knows in a general way how wireless works. It is safe to assume that the universal interest in radio is not alone in concert reception, but in theoretical operation of the set as well.

Radio today is not quite in a perfect state. Some perplexing scientific and merchandising problems are present. What are we going to do about heterodyning at audio-frequency beat between two regenerative receiving sets? What about satisfactory and cheap elimination of storage and dry batteries and expensive tubes in receiving equipments? How about lower prices on complete equipments? Who is going to pay for broadcasting services? To what type of retail store will retail sales gravitate?

Every radio man knows these and many other problems, but with the best scientific and business minds in the country at work upon these remaining difficulties it will be only a short interval before present-day radio difficulties are ironed out. This we know: Although radio is still in the experimental state, it has reached that point where practicality predominates—that is, where the electrical novice may naïvely enter the field and expect results.

The recent radio boom was too mushroom-like, too rapid, to be for the best interests of both manufacturing and merchandising. Popular radio was like a plant growing in a dark place—very, very delicate. Selling has now slowed down in a satisfactory manner and without artificial retardation. The frail radio plant is out in the sun now and in a fair way to become hardy and strong. Nature herself may be thanked. Balmy, moonlight summer nights are not conducive to wearing head telephones. People are going out of doors. They are going to forget about radio.

Trend of Business Cycles



HERE is a picture of the business cycle as it has afflicted this country through the past years. The question is, How much can each unit of industry contribute co-operatively to neutralize these influences?

Let us, the trade, help them forget.

They Come Back Strong

One of the peculiar kinks in the make-up of men is that of recurring mania. You are widely interested in a thing. Forget it for three months, then become interested in it again, and your interest is many times stronger than it would have been had you had no interval of forgetfulness. Why should we not apply this characteristic to radio sales?

The summer lull is introducing a period of forgetfulness. For three months radio will fill few thoughts. Then, in the fall after the evenings are chilly and the cold settles down, our radio man will wake with a start.

As every one knows who has seen the "radio bug" bite, the injected serum is powerful stuff. The inoculated one must have a radio set at once, no matter what or how. Last season our novice had already started the long climb, rung by rung, up the ladder toward the best set. Then summer came. He relinquished his attacks upon the vibrating ether while golf, seashore and mountains claimed his time. With the beginning of long evenings he will come back to radio just as sure as a carrier pigeon comes home. He will hunt around and dig up the old set, dust it off and try it out. Faults which before were overlooked will stand out as prominently as sore thumbs. He will scarcely be satisfied to come back into the game with his old equipment.

This coming fall will see an

enormous amount of radio business done. There will be no scarcity of supplies, no scrambled deliveries, no long delays and cancellations. For the various manufacturers ought to catch up on their orders by September. When the business done this year far exceeds last season's there will be less talk about it, simply because there will be no shortage over which to tear one's hair. We are looking forward to an unprecedented radio activity beginning in September. It will be a prosperity built not upon the shifting sands of popular fads and fancies, but rather extending its foundations down to the bedrock of solid, substantial manufacturing and merchandising principles.

Chain Stores—Their Growth and Significance[*]

BY DR. PAUL H. NYSTRON
Director Retail Research Association, New York City

THE chain-store system of distribution is a normal development of the evolution of business. Department stores and mail-order houses began to appear simultaneously about sixty or sixty-five years ago. Chain stores came soon after. The department stores resulted naturally in large cities from the development of modern advertising methods, rapid transit and the use of telephones. Mail-order houses resulted from rapid spread of population over great areas with which ordinary methods of distribution could not keep up and from the use of modern advertising methods, and they were coincident with the development of easy and safe means of transportation and the improvement of the mail service, rural free delivery and so on. Chain systems followed the tendency that has been dominant in nearly all lines in the last fifty years toward concentration and consolidation of enterprise.

The department store consolidates ownership and management of many lines of merchandise under one roof. The chain store consolidates the ownership and management of many units within the same line of merchandise, with decentralized location.

HOW MUCH THEY SELL

Grocery chains, including tea and coffee retail distributors, were the first in the field. During the eighties and nineties the five- and ten-cent stores, together with their prototypes, the "ninety-nine-cent stores" and the "racket stores" and "novelty stores," came into existence. Since 1900 the chain-store idea has spread to a great variety of lines, including tobacco products, confectionery, drugs, haberdashery, clothing, dry goods, automobile supplies, restaurants, bakeries and barber shops. There are now probably more than 2,000 chain-store systems in existence in this country, with a total of over 100,000 retail outlets. Probably more than 5 per cent of all goods sold to consumers in this country pass through chain stores.

One of the principal points of competition between chain stores and independent stores is the competition of management between chain-store experts operating indirectly through assistants and the independent store managers who operate directly and in personal contact with their businesses. That some independent store managers are outdistanced in this race is not surprising when one considers the lack of training many of them have when entering the business. Many independent store managers are quite content under the stress of such competition to sell out or give in to the chain and become lieutenants or rank and file men under the direction of the chain-store experts. On the other hand, the chain store sometimes meets defeat. I have heard chain-store executives say, "I never locate a store in a community in which there is a live independent dealer," and "Sometimes we make a mistake and get into a community where there is a live merchant or where one who formerly was more or less dormant began to adopt up-to-date merchandising methods on our arrival. When we discover it we pull up our store and sell our lease."

That neither the chain-store nor the independent-store management has a monopoly of the best methods of management is sufficiently proved. The profits go to the better managers whether they are in chain stores or independently owned stores. When we come to buying, however, the chain stores seem to enjoy a decided advantage over most independent stores because of their power to buy in large quantities.

The reasons for a lower price to a purchaser of larger quantities is well known. Producers' sales costs are reduced or entirely eliminated in such sales. On large orders of a single item production can be standardized, most economical machine processes can be introduced, and manufacturing costs are thereby cut down. The manufacturer with such large orders in his possession can in turn frequently procure raw materials at a substantial reduction, further reducing the costs of manufacturing. The elements of speculation for the producer are largely eliminated, and the necessary margin to cover insurance against market losses may be omitted.

Buying advantages are almost certain to be equalized between the chain stores and the independent retailers through the gradual development of associated effort among the independent retailers themselves. Such co-operative associations grow slowly. Independent retailers, in common with all other masses of people, learn by degrees and costly experience. One reason why chain stores have been successful in the immediate past is because the independent retailers have been so slow in getting together for mutual interest. But the reaction is soon to come.

HERE TO STAY

Chain-store systems are here to stay undoubtedly. They came into existence because there was a definite field of service for them not adequately covered by any other type of retail institution. Most of the chains have made their successes by offering a more limited type of service than is given by most independent retailers, and also by specialization in merchandise. The chain organizations, by reason of the necessities of their organization, have developed certain phases of retail distribution to a very high degree of efficiency and have thereby taught important lessons to all store managers of all classes of stores, for example: more complete and more intelligent retail accounting, better methods of arrangement and display of merchandise, and the value of securing the best possible locations. Finally, the chain stores have taught the retailers the great lesson of getting together in buying.

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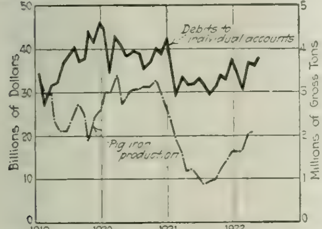
[*] A recent address before the Chamber of Commerce of the United States.

Review Shows Business Progress

Brief Paragraphs and Three-Year Curves Indicate Prevailing Conditions that Affect Cost and Volume in the Electrical Industry

Revival in business is getting on more substantial grounds, figures received by the Department of Commerce up to June 20 indicate. Among favorable features may be mentioned sustained activity in the building industry, marked increase in production of automobiles and trucks, lower interest rates and increasing demand for money, increase in employment, and decline in business failures.

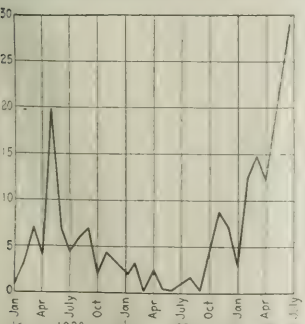


DEBITS TO INDIVIDUAL ACCOUNTS MEASURE GENERAL BUSINESS ACTIVITY WHEN COMPARED WITH PIG IRON PRODUCTION

Debits to Individual Accounts.—A large corporation recently requested a good curve showing general business activity, against which its own business might be plotted. Bank clearings were the first thought, but still better is the aggregate of checks drawn by individuals on their bank accounts. This new barometer is published for the benefit of electrical manufacturers who may wish to check their activities against the swing of general business.

Gasoline production in April, the latest figures available, amounted to 472,920,000 gal. and sets another new high record. Stocks of gasoline also increased nearly 40,000,000 gal. in April, thus breaking the high records established in each of the two preceding months. Stocks are now nearly 100,000,000 gal. greater than any record made before the first of this year.

Pig-iron production continued to increase in May, with a total of 2,306,679 tons, or 234,565 tons more than in April. This figure is still below the 1913 monthly average, but is the largest output for any month since January, 1921.



RAILROAD FREIGHT-CAR ORDERS.—FIGURES COMPILED BY "IRON TRADE REVIEW"

Steel ingot production in May, computed to 100 per cent of the industry, amounted to 3,099,155 tons, or about 300,000 tons greater than in April. Unfilled orders of the United States Steel Corporation at the end of May totaled 5,254,228 tons, or 157,000 tons more than the month before.

Hollow-ware sales in the St. Louis district, while showing some increase over previous months, are about normal for this time of the year. As wedding presents, percolators are favorites. Curling irons are above average demand because of the prevailing mode in hairdressing. Flatirons are meeting a very popular demand, and sales are reported to be 10 to 25 per cent greater than a year ago. In the Portland (Ore.) district demand for hollow ware is somewhat slow. It is appreciably better than for the same period of May this year, but shows very little improvement over June, 1921.

Consumption of cotton increased in May, compared with low figures in April, but the total of 495,674 bales is still below the consumption in the closing months of 1921 or in January and March of the present year. Exports of cotton in May totaled 469,397 bales, compared with the high April figure of 612,659 bales.

Continuation of the coal strike, with no immediate prospect of settlement, constitutes an unfavorable feature which has so far seemed to cause little uneasiness. Stocks of coal are ample, although demands caused by greater industrial activities are using them up at a more rapid rate.

Coal production in May remained near the low level set in April, with a total output of bituminous of 20,506,000 tons. Outside of a little river dredging of steam coal there was no anthracite production. The production of by-product coke increased 330,000 tons, compared with April, while beehive coke production again declined.

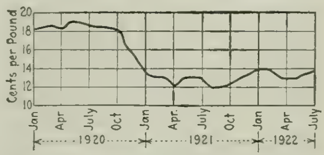
Wholesale prices of bituminous coal increased during May, as did price of coke. There were no quotations on anthracite coal reported by the Bureau of Labor Statistics. Retail prices of all coal remained practically stationary, with slight recessions from the April figure.

Suspension of anthracite mines since April 1 has cost Pennsylvania operators $52,780,000 and the miners $41,979,600, Clifford B. Connelley, Pennsylvania State Commissioner of Labor and Industry, declared in an address before the Scranton Rotary Club last week.

Production of kerosene increased slightly in April, but the output of gas and fuel oil, as well as of lubricating oil, declined. Stocks of all three products increased slightly.

Zinc output and movement in May showed a larger volume than for many months past. The same was true of receipts and shipments of lead. Prices of both metals increased compared with a month ago.

New York Stock Exchange activity continued to be marked during May, although the total sales of both stocks and bonds were less than in April. Prices of all classes of securities continued to advance. Debits to individual accounts in New York City increased but outside debits were less than in April.

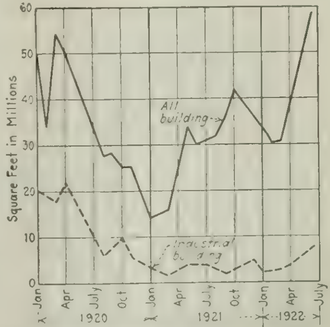


PRICES OF ELECTROLYTIC COPPER DELIVERED —FIGURES COMPILED BY "DAILY METAL TRADE"

Cost of living on May 15, 1922, was 54.9 per cent above that in July, 1914, studies by the National Industrial Conference Board show. Between April and May, 1922, the cost of living rose one-tenth of 1 per cent. As compared with July, 1914, food prices are 30 per cent, clothing 56 per cent, rent 65 per cent, fuel and light 74 per cent and sundries 74 per cent higher.

Ten thousand civilian employees in navy yards and stations will be laid off without pay early in July, 1922, to meet restricted appropriations.

Production of most building materials, so far as reported, also increased in May. This was particularly true of cement. The May output amounted to 11,176,000 barrels and shipments totaled 12,897,000 barrels, thus establishing new high records in this industry.



MONTHLY CONSTRUCTION SHOWING ALL BUILDING AND INDUSTRIAL BUILDING. —FIGURES COMPILED BY F. W. DODGE CO.

Revenue Freight Loadings Near 1922 Record

Loading of revenue freight during the week ended June 10 totaled 846,002 cars, compared with 750,645 cars during the previous week, or an increase of 95,357 cars, according to reports received from the railroads of the United States by the American Railway Association. This increase was largely due to the fact that the previous week included a holiday. There was an increase, however, of 24,871 cars compared with the week before the holiday. The loading for the week of June 10 also came within thirty-five cars of the largest loading for any week this year preceding the coal strike.

WEEKLY CAR LOADINGS

Week ended	1922	1921	1920
June 10	846,002	787,283	930,283
June 3	750,645	693,903	828,907
May 27	821,121	795,335	898,169
May 20	792,459	770,991	862,074
May 13	777,359	751,186	843,145
May 6	755,749	789,776	843,184
April 29	758,286	721,084	800,900
April 22	714,088	704,632	717,777
April 15	706,713	702,116	601,695
April 8	714,268	694,881	801,559
April 1	827,011	663,171	858,827
March 25	846,035	686,567	895,386
March 18	823,369	691,396	855,060
March 11	829,128	700,440	819,329
March 4	803,255	711,367	811,106
February 25	735,286	659,242	783,295
February 18	780,924	692,007	772,102
February 11	788,412	687,867	786,633
February 4	753,886	699,718	762,680
January 28	743,728	701,605	803,332
January 21	738,275	708,658	804,866

Compared with the corresponding week last year, there was an increase of 58,719 cars, but compared with the corresponding week in 1920 the total for the week of June 10 represented a decrease of 84,974 cars. Increases compared with the corresponding period last year were shown in the loading of all commodities except grain and grain products and coal. Merchandise and miscellaneous freight, which includes manufactured products, totaled 563,640 cars, an increase of 93,988 cars compared with the corresponding week last year, and 35,702 cars more than the corresponding week two years ago. Comparisons by weeks since January for three years are given in the accompanying table.

Business Failures Decreased Slightly in Week

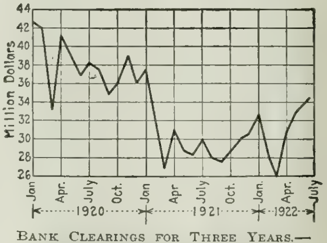
The decrease in the number of business failures continued last week, when 391 defaults were reported to R. G. Dun & Company, as compared with 407 a week ago. The figure for the corresponding week a year ago was only 276.

Last week's figure for insolvencies involving $5,000 or over in each instance shows, however, a continuation of the increase in the ratio of such failures to the total. Last week's figure is 227 and the percentage 58, compared with 231 and a percentage of 56.7 the week before and 55.2 per cent the week before that. A year ago the number of similar failures was 137, being 46 per cent of the total.

Canadian failures also show a decrease, fifty-eight being reported this week, compared with sixty-one last week. A year ago the figure was thirty-nine. Of defaults with liabilities of $5,000 or more in each case, twenty-four were reported this week. A week ago there were thirty.

Bank Clearings Show Large Gains Over 1921

An enlarged volume of bank clearings is noted this week, an aggregate of $7,170,780,000 at twenty cities in the United States, as reported to *Dun's Review*, representing an increase of 22.2 per cent over the $5,866,267,177 of a year ago. Last week there was a gain of 9.0 per cent over last year's figures, and the reduction this week from the total for 1920 is 6.4 per cent, against a decrease of 11.9 per cent last week. Excepting Cleveland, Minneapolis and Kansas City, where small losses appear, this week's clearings at points outside of New York which are included in the statement show increases in every instance, and the aggregate for the outside centers—$2,533,580,000—is 18.3 per cent in excess of that of a year ago.



Bank Clearings for Three Years.—Figures Compiled by "Financial and Commercial Chronicle"

Large Transformers Are in Good Demand

Sales of transformers in the larger sizes have been improving greatly during the past few months, and one manufacturer stated recently that his orders in the first half of 1922 surpassed in total rating those for any other corresponding six months in the company's history. The demand for transformers has centered chiefly in units for important power transmission projects here and abroad, and in one plant with which a representative of the *Electrical World* was in touch last week it was stated that the average unit sold in the first half of this year was rated at 4,000 kva. This has been accompanied by a much appreciated reduction in labor cost per unit of output.

Overseas transformer business has been booked from both France and Japan, and interest abroad in hydro-electric development is active. There seems to be little if any difficulty at present voiced by manufacturers as to the supply of material for transformer construction. Labor is paying more attention to efficiency in production, and as business increases the more skilled employees are being taken back and employed for longer hours in the factories where it had been necessary to lay off a portion of the force or to run on part time.

Interest in very high-voltage transformers is widespread among the larger power companies, and manufacturers are now prepared to supply apparatus to meet much severer conditions than hitherto. Distribution transformers are moving less rapidly in proportion to the total market, but the expansion of the building industry in various parts of the country is having some effect on demand.

New England Collections Tighten Slightly

Collections in New England are slower than last month, though nothing disquieting is apparent in jobbing circles. Open accounts are being closed in sixty to ninety days with the former limit predominating. Bill discounting is being done by some of the larger central-stations, contractor-dealers and industrial plants. Railroad payments for electrical material are coming in better. The contractor-dealer accounts are being watched very closely in districts where industrial plant strikes are hampering trade, and new accounts are being sharply scrutinized.

Metal Market Situation

Copper prices are firm with sales comparatively small both in the domestic and foreign market. A moderate amount of metal has been sold at 13⅞ cents delivered for August, but current price is somewhat lower from both second hands and some of the producers. Little improvement in buying is expected until the new freight rates are announced and until it becomes more certain as to whether or not there will be a railroad strike. Foreign buying appears to be awaiting a better indication of the trend of European affairs.

NEW YORK METAL MARKET PRICES

Copper	June 21, 1922	June 28, 1922
London, standard spot	£ s. d. 63 2 6	£ s. d. 63 2 6
	Cents per Pound	Cents per Pound
Prime Lake	14 00	14.00
Electrolytic	13.62½	13.62½
Casting	13.37½	13.25
Lead, Am. S. & R. price	5.55	5.55
Antimony	5.05	5.00
Nickel, ingot	36.00	36.00
Zinc, spot	5.70	5.62½
Tin, straits	31.37½	31.12½
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00–11.50	11.00–11.50
Brass, heavy	5.50– 5.75	5.50– 5.75
Brass, light	5.00– 5.12½	4.87½–5 00
Lead, heavy	4.62½–4.70	4.62½–4.70
Zinc, old scrap	3 00– 3 12½	3 00– 3 12½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

REPORTS from all over the country say the electrical market is steady with few price changes. Wiring demand is normal and from the present outlook should hold up well throughout the summer. Quotations for wire are holding steady, although some price cutting has been reported. Demand for industrial and residential meters is well maintained, though little increased demand is to be noted. Telephone equipment stocks are becoming low as a result of recent heavy movements in all items. Jobbers handling farm-lighting apparatus report increased activity due to improved conditions in rural districts.

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New York

Demands Are Reported Steady With Prices Firm—Lower Quotations for Soldering Irons

Demand for wiring supplies is fairly steady and from the present outlook, should hold up well throughout the summer. Quotations are holding steady, although some price cutting has been reported. Effective July 1, two of the leading heating-appliance manufacturers have announced a revision of their schedule of prices, but these, for the most part, do not amount to more than 25 cents on each appliance. Prices on industrial soldering irons have been lowered from $1.50 to $3.

Rigid Conduit. — Conditions and prices show no change. The following prices are quoted this week: For ½-in. black pipe in 2,500-ft. lots, $44.50 to $46.58; ¾-in., $58.10 to $59.57, and 1-in., $82.79 to $84.66 per 1,000 ft. Quotations on galvanized pipe in the same sizes and quantities were $50 to $51.68, $64.50 to $66.47 and $92.20 to $94.86 per 1,000 ft.

Rubber-Covered Wire.—Quotations are holding firm, but there is a general belief that prices will be higher. No. 14, single-braid, rubber-covered, sells for $6.20 to $6.50 per 1,000 ft. in 5,000-ft. lots.

Flexible Armored Conductor.—Demand is steady and sales are in moderate size quantities. No. 14, two-wire, single-strip, is quoted at $43 per 1,000 ft. and double-strip at $45 per 1,000 ft., both in that quantity.

Sockets.—In standard-package lots, pull sockets are at 33 cents, key sockets at 18 cents and keyless at 16 cents each. Demand is active, but there is some price competition.

Metal Molding.—In 5,000-ft. lots the three-wire size is quoted at $4 per 100 ft. For quantities of 1,000 ft. or less the price is $4.30 per 100 ft.

Fans.—Sales are easing off. Jobbers are well satisfied with volume of business.

Heating Appliances.—Two of the leading manufacturers of domestic heating devices have announced a revision of prices effective July 1.

Flashlamps.—Increased sales are reported.

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Chicago

Wire Prices Stiffen—Conduit Stocks Are Lower—Active Pole Business—Fans Are Slow

Business in the electrical market, while sustaining its past record, is just holding its own in this district. No pronounced change can be noticed, although prices on wiring materials are gradually stiffening. Some dealers state stocks of conduit are running low and report that manufacturers are running behind in shipments. The pole industry has been moving steadily with few changes, although a slight revision of freight rates on July 1 may alter prices.

Wire.—Demand for rubber-covered wire is still steady and prices are unchanged. No. 14 sells between $6.15 and $6.25 per 1,000 ft. in 5,000-ft. lots. Few variations in the price of bare and weatherproof wire were noticed, but it ranged from 16½ to 17 cents a pound.

Flexible Armored Conductor.—Jobbers report few changes in the call for armored conductor, and the price is $42.50 per 1,000-ft. for No. 14, two-wire, single-strip, in 5,000-ft. lots. Stocks are in fair condition.

Conduit.—Prices are steady. The ½-in. black pipe is quoted at $43 per 1,000 ft. in 5,000-ft. lots.

High-Tension Equipment.—One company received orders for a 44,000-volt, 1,500-kva., steel-tower substation for New York State and a 33,000-volt, 900-kva. substation for the Middle West. A good volume of business on farm-line equipment is reported.

Poles. — Extensions and replacements on the part of public utilities are the biggest features of the pole business. Prices are unaltered. The 7-in.-top, 30-ft. Western red cedar sells for $7.80 f.o.b. Chicago, while the same size in the northern white cedar is quoted at $8.40 f.o.b. Chicago.

Pole-Line Hardware. — The movement of this equipment is induced by a fair call for poles. Prices are firm and stocks ample.

Cross-Arms.—Few changes in the cross-arm market occurred during the past month.

Boston

Loom Sales Dull—Fixtures Are Active—Inquiries for Electrical Trucks Reported Increasing

Electrical supply jobbers are very active along wiring material lines. Deliveries of rigid conduit are being maintained with some difficulty. Appliance sales are rather spotty. It is announced that a million dollars will be expended soon in new residence construction in the Arlington suburban district. Financial conditions are stronger in this territory and preparations among electrical manufacturers are active for a vigorous fall business. Employment is increasing widely.

Rigid Conduit.—Deliveries are barely meeting requirements. Building operations are absorbing large quantities of this material, chiefly in the smaller sizes. Fittings are in plentiful supply. Prices are steady, ½-in. black in 500-lb. to 5,000-lb. lots selling at $51.89 per 1,000 ft. and the same size in galvanized at $56.99.

Flexible Armored Conductor.—Sales continue brisk, with satisfactory deliveries as related to present demand. Prices range from $44.20 per 1,000 ft. in 5,000-ft. lots to $41 in 25,000-ft. orders.

Loom.—Local sales are rather dull, barring a fair demand from Maine, which is a large user of this material. Prices are quiet, the 5,000-ft. lot quotations Monday being $14.75 per 1,000 ft. on $\frac{7}{32}$-in. and $17 on ¼-in. Deliveries are easy.

Tape.—Increased wiring work is causing the movement of moderate quantities of tape, the current price ranging from 35 to 40 cents per pound in 100-lb. lots, according to quality.

Wire.—Considerable activity is apparent in rubber-covered and weatherproof wire, but sales of bare copper wire are dull. No. 14 rubber-covered sold Monday at $6 to $6.25 per 1,000 ft. in 5,000-ft. lots. Triple-braid weatherproof sold Monday on the basis of 18.5 cents per pound in 200-lb. lots and over, sizes No. 4/0 to No. 8 slow-burning wire being quoted at $19 per 100 lb.

Starting and Lighting Sets.—Business has improved materially during the past month or two. A leading manufacturer reports the largest May earnings in his history, with good prospects for summer. Automobile headlamps are moving well.

Industrial Electric Trucks.—Light sales feature the market, but inquiries are increasing, and some replacement business, either of complete units or repair parts, is being booked. Prices are steady for both trucks and batteries.

Fixtures.—Sales for residential and office building service are very active, and mercantile installations are absorbing considerable modern lighting material. Industrial requirements are not so much in evidence.

Atlanta

Meter Sales Are Holding Well—Farm-Lighting Outfits Are in Greater Demand

A number of transmission lines are being projected in new territory, and this in turn will stimulate the sales of transmission-line material, as well as distribution material for low-tension systems.

Up to date no shutdown of plants or curtailment of operations has been felt as a result of the coal strike, and little uneasiness is expressed in regard to the outlook. The threatened rail strike is looked upon as more serious, but so far nothing has developed to cause any definite reaction among manufacturing interests.

White-Way Lighting Equipment.—More interest than for some time past is being displayed by municipalities. All jobbers report an increasing number of inquiries, though few orders have materialized to date.

Meters.—Sales in this line are holding up well, particularly in the 5-amp. and 10-amp. sizes, though little increased activity is to be noted. Stocks are ample to meet all demands.

Telephone Equipment. — Jobbers handling this line of material report a good movement in all items, with the result that stocks are rather low.

Exhaust Fans.—The movement in this item has not showed up as well as was expected, though a fair activity is reported in 22-in. to 30-in. sizes.

High-Tension Transformers. —Several large power companies in this section are planning high-tension line extensions which will tend to increase very materially the volume of sales in this line. Local stocks in the popular sizes are satisfactory.

Farm - lighting Outfits. — Jobbers handling this specialty report an increased activity due to improved conditions in the rural districts.

Conduit.—All jobbers report an excellent movement in this line in practically all sizes, both black and galvanized and stocks are rather low.

Armored Conductor.—This line is showing a very brisk movement, and stocks have fallen to a low ebb. Present quotations for No. 14, two-wire, in lots of 5,000 ft., are $51.80 per 1,000 ft.

St. Louis

Flatirons and Vacuum Cleaners Active—More Calls for Porcelain—Fuse Market Improving

Business has been active here this week, though it was not up to the level of last week. Warm weather and vacations are resulting in a seasonal slackening. Fan business is not quite so active, but a good volume is being maintained. Flatirons, washing machines and vacuum cleaners are good sellers, and wiring business is particularly strong.

Fans.—Cooler weather has caused fan sales to slacken.

Flatirons.—One dealer is conducting a special-offer campaign and selling in exceptionally good volume. Stocks are in excellent condition.

Porcelain.—Demand is more active. Representative prices are: "Nail-it" knobs, $15 per 1,000; $\frac{5}{16}$-in. x $2\frac{1}{2}$-in. tubes, $3.73 per 1,000; $\frac{5}{16}$-in. x 3-in. tubes, $4.50 per 1,000; split knobs, $10.70 per 1,000; unglazed cleats, $10.70 per 1,000—all in barrel lots.

Fuses. — Considerable improvement, due chiefly to better demand from the industrials, is noted. Non-renewable cartridge fuses, 250-volt, in standard package lots, are priced as follows: 0-amp. to 30-amp., $4.60 per 100; 35-amp. to 60-amp., $6.90; 65-amp. to 100-amp., $20.70; 110-amp. to 200-amp., $46; 225-amp. to 400-amp., $82.80; 450-amp. to 600-amp., $126.50.

Wire.—Sales have been quite active this week, especially in No. 14 rubber-covered. Larger sizes of rubber-covered are beginning to move in something like satisfactory volume. Weatherproof purchases by the utilities remain strong. Representative prices are: No. 14 rubber-covered, $6.25 to $6.50 per 1,000 ft.; No. 10 rubber-covered, $12.50 to $12.90 per 1,000 ft.; No. 6 weatherproof, 16 cents per pound for 500 lb. or more; base on bare, 17 cents per pound. Stocks are still sufficient to meet requirements.

Portland–Seattle

Conditions Improving—Washing Machines and Vacuum Cleaners Moving in Fair Volume

Business conditions continue to improve. Stocks and bonds show an appreciable decline in demand. Real estate is suffering a decline at the present time, although building activities continue at a rate well in excess of the same period last year.

There is now under construction or ready for immediate construction in Portland well over $3,000,000 worth of large projects.

Seattle's water-borne commerce for the first five months of 1922 shows an increase of 28.5 per cent over the same period of last year. Lumber production continues to exceed normal and is still somewhat under new business. A reduction in freight rates effective July 1 will undoubtedly have some effect on business, although it is not expected that it will be reflected in prices except in the case of large orders, such as carload lots of wire conduit or appliances.

Contractor-dealers are enjoying a business which continues to gain from week to week. Fixture business is very active. Few if any skilled electricians are now unemployed. Electrical jobbers report business good. Prices are stable, although in some lines a tendency to stiffen is apparent.

Ironers.—The demand for ironers is weak at the present time.

Household Appliances.—The movement is good, and the demand for percolators, grills and irons is particularly strong.

Ranges.—The demand for electric ranges continues to be very good.

San Francisco

Weatherproof Wire Advances 50 Cents—Summer Business in Lamps Holds Well

Business from power companies continues very good. Collections are better, although still running around fifty days. Credits are easier. There is very little unemployment reported, for even unskilled labor is required just now for fruit and agricultural ranchers and packers. The threatened railroad strike has not appreciably increased the amount of westbound freight. It seems to be the general belief that this strike will not materialize. Lower freight rates recently announced will be very welcome to rail shippers, although a larger proportion of boat shipments is in evidence.

Weatherproof Wire.—Increase of 50 cents per 100 lb. is announced. The present schedule for coils of three-braid solid-base sizes is $21.50 per 100 lb. Local stocks are in good shape.

Switches.—Present prices on push switches are as follows: Commercial-grade push switches, single-pole, $17.75 per 100, and three-pole, $25.25. Local stocks are good and the demand very steady in hundred lots and in hundred gang lots.

Lamps.—Summer business holds up well. The larger amount of private building has helped to increase dealers' contracts, and the reopening and preparation of packing plants for the season has affected the interior accounts.

Salt Lake City–Denver

Electric Iron Dealers Well Stocked and Find Market Responsive to Intensive Sales Efforts

Steady improvement in general business conditions is reported from every part of the Intermountain region. Although recovery here lags slightly behind the return to normal in the East, there are sure indications of better times. May showed a remarkable increase in the sale of electrical merchandise.

In the electrical market the country districts have a considerable lead over the larger cities, according to jobbers' records. More merchandise of various kinds is being sold to rural families than to city families.

Electric Irons.—Increase in sales week by week is satisfactory. Dealers are well stocked and are finding the market responsive to intensive sales efforts. Several inferior brands have recently come on the market but are making no headway against the standard products. Six-pound irons, selling in the neighborhood of $5, are moving readily.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

New Security Issue for Tenney Companies

New preferred stock of the issue value of $1,535,100 at $85 per share is being offered stockholders of the North Boston Lighting Properties for the purpose of paying for 4,761 shares of Malden Electric Company stock and 6,179 shares of Malden & Melrose Gas Light Company stock, and also to retire $300,000 four-year 6 per cent notes of the North Boston Company maturing Dec. 15. Stockholders have the right to subscribe for one new share for every six shares of either common or preferred stock now held, the rights expiring July 5. The new issue will bring the North Boston capitalization to 87,704 shares of preferred and 30,376 shares of common stock. Upon completion of this financing the company will have no bonded debt. The company is a voluntary association owning or controlling the Malden Electric Company, Malden & Melrose Gas Light Company, Suburban Gas & Electric Company, Salem Electric Lighting Company and Eastern Massachusetts Electric Company, which operates the inter-utility transmission tie-line system between Salem, Malden, Revere and other points connecting with the Boston Edison system. These properties are managed by Charles H. Tenney & Company of Boston.

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Stresses the Need of Greater Residential Construction

Despite the increased building activity in the United States during the last six months, the housing shortage for the country as a whole has been estimated as somewhat more than two and a half years' production by John Ihlder, manager of the civic development department of the Chamber of Commerce of the United States, speaking before the National Conference of Social Work.

According to Mr. Ihlder, the situation is not the same in all American cities. In some cities the shortage is estimated as nearly four years' production, he said, while in others it is approximately one and a half years, or even less.

"This means," he explained, "that many thousands of American families are still living in cramped quarters, well-to-do as well as poor. More significant, it means that a considerable proportion of these families are becoming accustomed to this cramped living, accepting it as normal. I have heard of an admiral of our navy who, with his wife and two sisters, occupies three rooms in an expensive apartment house and has his meals prepared on an ingenious little electric stove in the hall and of a comparatively well-to-do woman who occupies one room and bath and has her clothes washed in the bathroom. When one goes from such people to the poor, he finds the old overcrowding accentuated and unsanitary conditions worse than they were before the war."

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Chicago Lamp Shade Company in New Location

The Model Lamp & Shade Company has moved from 1104 South Wabash Avenue, Chicago, to 736 Tilden Street. T. P. Weinstein, the president, speaking with a representative of the *Electrical World*, said that this arrangement brought the factory and office into the same building. Although no increase in floor space was obtained, better unity of action can be developed with the two departments under the same roof, he pointed out.

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Los Angeles Gas & Electric to Sell $5,000,000 Bonds

The Los Angeles Gas & Electric Corporation has been authorized by the Railroad Commission of California to issue and sell at not less than 92.25 per cent of their face value $5,000,000 of series "E" 5½ per cent twenty-five-year general and refunding mortgage bonds and to use the proceeds to reimburse its treasury and finance new construction. The bonds are redeemable on June 1, 1932, at a premium of 7½ per cent and on the first day of each year thereafter at a premium computed at the rate of one-half of 1 per cent each year of the unexpired term. The company reported at the hearing that it must expend $10,750,000 during the current year for additions and extensions. Of this amount, applicant announced that it expected to finance $6,473,250 through the sale of bonds and the remainder through the sale of stock and the investment of earnings.

Compensation for the electric distribution system and gas property in the city of Oroville, Cal., which that city plans to take over from the Pacific Gas & Electric Company, was fixed by the Railroad Commission. The values are determined as of Aug. 15, 1918, the date of the application. For the electric system, including lands, property and rights, compensation is placed at $90,861. The gas property is valued at $50,000. Severance damages are put at $6,177 if the city takes over only the electric system and at $1,954 if the city should acquire both properties.

Special Service Sales Starts Business in Los Angeles

The Special Service Sales Company, 502 Delta Building, Los Angeles, has been established as a manufacturers' agency for southern California and has secured representation for the Morganite Brush Company, Inc., New York City; Electric Power Equipment Corporation, Philadelphia, and Flexible Woven Cable Company, Boston. Arthur A. Barbera is manager.

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Lockwood, Greene & Company Reincorporated

Under the name of Lockwood, Greene & Company, Inc., the business of Lockwood, Greene & Company of Boston has been reincorporated under the laws of Massachusetts, capitalized into $1,500,000 of 7 per cent cumulative preferred stock, $1,740,000 common stock and $200,000 class B stock. The National Shawmut Bank of Boston is the transfer agent. Shares of this preferred stock are being issued at par, $100, and accrued dividend from July 1, with a bonus of 15 per cent in class B stock, through the banking house of Jackson & Curtis, Boston.

The company began business in 1832. Its primary business, including subsidiaries, is engineering and management for industrial plants. The engineering business, while prominently identified with textiles, is not dependent on any one line of activity, but has been prosecuted throughout the entire industrial field of the country and to a certain extent abroad. There will be no change in the directors and principal officers of the corporation. Edwin Farnham Greene is president.

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Buyers Ask Performance Tests for Radio Sets

"Ever-increasing public interest in radio has added to the troubles of department-store buyers and others handling such equipment," says a report just issued by the Department of Commerce. "Because of the rather technical problems involved, actual and prospective sellers of 'etherwave' receiving devices say they are up against it in their efforts to satisfy the trade. Finding no information available to use in selecting good or rejecting bad apparatus and fearing the loss of good will, appeals have been directed to the Bureau of Standards of the Department of Commerce to devise standard testing methods.

"Performance test methods for immediate use by a commerical testing laboratory were recently agreed upon in an outline by representatives of the Bureau of Standards, the Electrical Testing Laboratories of New York and the National Retail Dry Goods Association. Suggestions regarding improvements on these methods, or new methods for testing the equipment submitted by the National Retail Dry Goods Association, will be subject to approval of the Bureau of Standards. The tests outlined include an examination as to the materials and workmanship of construction, the mechanical and electrical design, simplicity of adjustment, ruggedness, sensitivity, sharpness of tuning, wave-length range and faithfulness of reproduction.

"The investigating committee of the National Retail Dry Goods Association has suggested that from a commerical standpoint it would be of assistance to its members if responsible manufacturers would plainly mark their equipment, indicating the receiving radius of each instrument under every atmospheric condition. Owing to the large number of factors which enter into the determination of the range over which signals can be received with a given set, this is a very difficult problem, impossible to overcome at present by a brief statement or mark."

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R. W. Lillie Corporation Awarded Large Contract

The R. W. Lillie Corporation, sales engineers for the Electric Power Equipment Corporation and the Jefferry-Dewitt Insulator Company, have been awarded a contract by the Buffalo General Electric Company to furnish all disconnecting switches and bus supports for its new outdoor substation.

The design of switches and type of insulators was a matter of most serious consideration, as this station will be tied in on one of the main transmission lines of the Niagara Falls Power Company. The possibility of heavy short-circuit stresses and high-power flashovers was taken into serious consideration.

It is interesting to note that this station, which will be one of the largest outdoor types in the country, will be equipped throughout with mechanically operated switch poles gaged together so that simultaneous opening and closing of all poles is positive. Switches may be locked in both opened and closed position.

Jeffery-Dewitt heavy-duty flanged-type insulators were selected, it being feared that cement involved in other designs would crack and crumble away under vibration and mechanical impacts, as switches will be operated frequently. Flanged insulators of the Jeffery-Dewitt design can be readily removed and new units added. All switches will be upon flanged insulators, and buses will be supported by Jeffery-Dewitt suspension-type insulators.

It is interesting to note that these engineers recognized the difficulty encountered in trying to open the ordinary type of stick-operated disconnecting switch at night or under hurried conditions. Mechanically operated switches eliminate the possibilities of operators pulling the wrong switch under load and assured quick and positive operation and control of all three phases at once. Incoming lines are rated at 66,000 volts stepped down to 35,000 volts.

Electrical Development Abroad Is Reported by Department of Commerce

The Department of Commerce, reviewing the situation affecting sale of electrical goods abroad, notes that plans for the forthcoming electrification of the Southeastern & Chatham Railway to London are awaiting signatures on the company's agreement with the Trade Facilities Advisory Committee and a treasury agreement which involves a guarantee of £6,500,000, principal and interest, for twenty-five years under the trade facilities act.

There are upward of fifty hydro-electric stations in the state of São Paulo, Brazil, which supply energy to 236 cities, towns and villages, with a total development of 122,000 hp., an average of 2,400 hp. per station. In the district around Ribeirao Preto energy is supplied to more than 10,000 hp. in motors in the coffee industry.

Hydro-electric power in Italy as of Jan. 1, 1922, is reported as 1,191,797 hp. In addition to hydro-electric plants now in operation, new ones are in course of construction, of which those in Lombardy will produce 121,934 hp., and those nearing completion in Piedmont will produce 109,386 hp. Of other concessions granted, totaling about 50,000 hp., those in Umbria will produce 30,136 hp., and new central stations in Liguria will produce 688 hp.

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Boston Engineering Firms Move

Effective July 1, the offices of Fay, Spofford & Thorndike, consulting engineers, 15 Beacon Street, Boston, are transferred to 200 Devonshire Street. Charles T. Main, consulting engineer, formerly at 201 Devonshire Street has also relocated at 200 Devonshire Street.

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The American Abrasive Metals Company of 50 Church Street, New York City, manufacturer of "feralun," "alumalun," "vulcalun" and "bronzalun" "antislip" treads, announces its appointment by the Carborundum Company of Niagara Falls to act as United States sales representative through whom will be marketed the carborundum "antislip" tile.

The International Radio & Ignition Corporation, 225 North Michigan Avenue, Chicago, has been formed with capital stock of $100,000, with B. C. Lindly as president. The corporation's activities will consist of the manufacture and distribution of automotive ignition systems and ignition parts, radio broadcasting and receiving sets.

The Connecticut Instrument Company, Inc., Stamford, Conn., which will manufacture radio head sets and various radio and engineering devices, has leased the factory of the Lounsbury & Soule Company, of the same city. The officers of the new concerns are: R. E. Gillmor, president and treasurer; J. B. Allen, vice-president and factory manager; G. M. Fisher, secretary and sales manager; G. B. Crouse, chief engineer.

The Dryden Rubber Company, Chicago, announces that E. H. Young and H. E. Lavelle have been appointed exclusive Eastern representatives for the sale of Dryden "Double-Wear" friction tape and splicing compound in the New England and Middle Atlantic States. Their headquarters are at 18 Vesey Street, New York City.

The Black & Decker Manufacturing Company, Towson Heights, Baltimore, builder of portable electric tools, announces the establishment of a new Detroit office in the General Motors Building. C. G. Odell, assistant to the president of the company, will use this office as his base, in addition to which it will provide headquarters for the local Detroit representative.

The Wright Battery Company, manufacturer of storage batteries at Flint, Mich., is planning to increase production in its present plant to 400 batteries a day, with a view to increasing to 2,000 batteries a day in a year's time.

The J-E Battery Company of the Pacific Coast has leased quarters at 221-225 Bay Street, San Francisco, and is installing equipment for the manufacture of storage batteries, battery plates and lead parts. A department will be opened for the manufacture of battery boxes and separators. The plant is under the management of J. E. Nottingham.

The National Enameled Wire Company has been organized in Toledo, Ohio, to manufacture automobile lamps and enameled cotton-covered wire. Officers of the company are: Earl J. Sutton, president; Joseph J. Rappey, vice-president and general manager, and Harry M. Pingen, secretary.

The Westinghouse Electric & Manufacturing Company, Philadelphia, is receiving bids for the erection of a ten-story reinforced-concrete building, 95 ft. x 191 ft., at Thirtieth and Walnut streets, to be used as district headquarters, for sales, office and general operating service.

The General Electric Company will soon construct a new building, to be known as No. 99, at the Schenectady Works. This will make 311 buildings grouped within 438 acres of land. The new structure, which will be of steel, will be used exclusively for storing electrical machinery originally begun for the Navy Department. Contracts for this apparatus were recently canceled under terms of the disarmament program.

The Postal Telegraph-Commercial Cables System has purchased from the government of Newfoundland the submarine cable extending from Canso, Nova Scotia, to Newfoundland, according to an announcement just made by Clarence H. Mackay, president of the Company.

Robert O. Craig, for the past three years with Michael & Bivens, electrical contractors of Gastonia, N. C., announces that he has severed his connection with that firm and has purchased the business of Lineberger & Thomasson of the same city.

Foreign Trade Notes

NEW INDUSTRIAL PLANT IN SHANGHAI, CHINA.—A new enterprise known as the China International & Engineering Manufacturing Company, Ltd., has been organized at Shanghai to manufacture electrical machinery and supplies. The company is capitalized at $300,000 and is a purely Chinese enterprise, and its products are to be marketed in China. American and German machinery and equipment are said to be have been ordered.

EXTENSION OF ONTARIO HYDROELECTRIC SYSTEM TO MUNICIPALITIES.—Last year the Ontario Legislature passed an act authorizing the government to bear 50 per cent of the cost of extending primary distribution lines of the Hydro-Electric Commission in rural districts, but in a bill introduced this year, the *Electrician* states, this privilege will be extended to municipalities that may be in a position to purchase energy from private companies. It is not intended to allow a rebate to a private company that may be erecting rural primary lines, but a township or a group of farmers may build primary lines and own them, the government paying 50 per cent of the cost. A bill has also been introduced into the Ontario Legislature dealing with the construction and operation of municipal electric railways, which provides that the corporations of two or more municipalities in any locality in which electrical energy is supplied by the Hydro-Electric Commission the latter, as the agent of and at the expense of such corporations, may investigate the cost and the advisability of constructing the desired railway.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A mercantile firm in Sweden (No. 2,575) wishes to purchase electrical articles, agricultural machinery, etc.

An agency is desired from manufacturers by a firm in South Africa (No. 2,583) for the sale of X-ray apparatus and wireless telegraphic equipment.

The purchase is desired by a company in England (No. 2,584) of twenty-five wireless receiving sets, less valves and telephones.

A company in England (No. 2,623) desire to secure an agency from manufacturers for the sale of a complete radiotelephone receiving apparatus.

An engineering firm in Finland (No. 2,625) wishes to purchase an agency for all kinds of electrical materials, machines, copper, porcelain, etc.

An American firm organized for trade promotion in India (No. 2,643) desires to be placed in communication with manufacturers and exporters for the sale of steam power plants, electric generators and motors, pumps for water supplies and irrigation works, oil engines, mechanical specialties, etc.

A municipality in Canada (No. 2,659) is in the market for 3,500 ft. of vitrified six-hole conduit, or 21,000 ft. fiber, one-hole conduit, and accessories for underground street wiring; twelve manhole covers; 105,000 ft. of No. 2, 50,000 ft. of No. 4, 25,000 ft. of No. 6, and 25,000 ft. of No. 8 lead-covered copper standard cable.

A firm in Sweden (No. 2,670) desires to secure agencies for the sale of all articles in the electrical line, machine tools, etc.

A merchant in Italy (No. 2,675) desires to secure an agency for the sale of insulating material, etc.

PROPOSED EXTENSIONS TO ELECTRIC PLANT AT JOHANNESBURG, SOUTH AFRICA.—The corporation of Johannesburg, according to the *Electrician*, has decided to extend the electric transmission lines to the suburbs, involving an expenditure of about £35,000.

ELECTRIC PLANT FOR SALISBURY, SOUTH AFRICA.—The Municipal Council of Salisbury, South Africa, the *Electrician* states, has raised a loan of £70,000, of which £30,000 will be used for improvements to the electric generating plant.

PROPOSED ELECTRIC PLANT FOR CALEDON, SOUTH AFRICA.—Tenders will be received by the Municipal Council, Caledon, Cape Province, the *Electrical Review* states, until Aug. 9 for the installation of an electric lighting system, for which plans were prepared by Prof. Bohle of the University of Cape Town.

EQUIPMENT FOR ELECTRIC PLANT AT ROBERTSON, SOUTH AFRICA.—Tenders will be received by the municipality of Robertson, South Africa, according to the *Electrician*, until Aug. 14 furnishing and installing two 75-kw. steam-driven generating sets and equipment for power station (Contract No. 1); one 300-amp.-hr. battery (Contract No. 2), and material for outside distribution system (Contract No. 3).

New Apparatus and Publications

"UNA-FLOW" STEAM ENGINE.—The second edition of "The Una-Flow Steam Engine" has been published and is a complete revision of the first, little of which remains. It contains 319 pages, in which a scientific proof from an objective point of view is given of the accomplishment of the "Una-Flow" engine as well as a description of its development. Prof. J. Stumpf, Berlin, is author of the book, which was translated by the Stumpf Una-Flow Engine Company, Inc., Syracuse, N. Y.

RADIO APPARATUS PARTS.—The Ajax Electric Specialty Company, Ajax Building, 1011 Market Street, St. Louis, announces that it has placed on the market a line of radio apparatus.

RADIOPHONE HEAD SET.—The Delta Electric Company, Marion, Ind., has recently developed a new radiophone head set known as the "Delta Gold Stripe."

SMALL STEAM TURBINES.—The Allis-Chalmers Manufacturing Company, Milwaukee, has issued bulletin No. 1,123, entitled "Small Steam Turbine," covering its line of turbines suitable for driving condenser auxiliaries, exciters, small generators, etc.

POLYPHASE TRANSFORMERS.—The Pittsburgh Transformer Company, Pittsburgh, Pa., is distributing bulletin No. 2,015, describing its new polyphase transformer.

TRANSFORMER LOAD INDICATOR.—A transformer load indicator for determining the load of distribution and for many other purposes is being manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

ELECTRIC REFRIGERATOR.—The Icenomor Electric Refrigerator Company, Evansville, Ind., is distributing an eight-page pamphlet describing the "Icenomor" electric refrigerator.

MICARTA GEARS AND PINIONS.—Circular 1,579-B, issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., contains general information regarding "Micarta," a non-metallic material, developed by the company for gear and pinion application.

OIL CIRCUIT BREAKER.—A new type of oil circuit breaker, known as type O-1, has been brought out by the Conduit Electrical Manufacturing Company, Boston, 27, Mass. These breakers are built for 15,000 volts to 25,000 volts, up to and including 600 amp.

RADIO TELEPHONE RECEIVERS.—The Roller-Smith Company, 233 Broadway, New York City, is distributing bulletin No. 20, covering its "Universal" radio telephone receivers, type "A," 2,700 ohms per pair, and type "B," 2,000 ohms per pair.

New Incorporations

THE ELK UTILITY COMPANY, Clay, W. Va., has been incorporated with a capital stock of $25,000 by Parley D. Barry, S. W. Brant and James Reed.

THE OCEAN BEACH (N. Y.) GAS & ELECTRIC CORPORATION has been incorporated with a capital stock of $50,000 by J. A. and J. A. Wilbur and J. H. Hallock.

THE HOLDCRAFT ELECTRIC COMPANY, Hazard, Ky., has been incorporated with a capital stock of $20,000 to construct and operate an electric plant in a town in the southeastern part of Kentucky. A. D. Holdcraft is president and manager.

THE SCHIFFL RADIO & ELECTRIC CORPORATION, 156 Market Street, Newark, N. J., has been incorporated to manufacture radio sets and parts. The officers are: Charles Schiffl, president; Frank Schiffl, vice-president; Paul D. Potter, treasurer; Ogden Childe, secretary, and George Henry Nolte, chairman of board.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 6, 1922)

1,418,671. Electrically Controlled Heater; C. E. Patterson, San Francisco, Cal. App. filed Nov. 17, 1920. Room heater.

1,418,702. Annunciator; W. T. Dippel, New York, N. Y. App. filed May 5, 1920.

1,418,707. Constant-Current Generator for Arc Welding; Klaus L. Hansen, Milwaukee, Wis. App. filed June 27, 1921. Auxiliary winding for distorting main field.

1,418,726. Electric Current Controller; E. Naether, Veney, Switzerland. App. filed April 4, 1921. Prevents using more than a predetermined amount of power.

1,418,729. Portable Radiating System; A. A. Oswald, East Orange, N. J. App. filed April 25, 1919. Wireless antennas for airplanes.

1,418,739. Oscillation Generator; E. O. Scriven, New York, N. Y. App. filed June 4, 1917. Vacuum-tube oscillator.

1,418,764. Attachment for Telephone Hook Switches; H. L. S. Williams, Montreal, Que., Can. App. filed Nov. 19, 1920. For rural-service lines.

1,418,773. Metallurgical Furnace; W. K. Booth, Chicago, Ill. App. filed Dec. 3, 1919. Lining composed of molded cylinder.

1,418,779. Dynamo-Electric Machinery; F. Creedy, Ilkley, England. App. filed Feb. 11, 1919. Phase-changing apparatus.

1,418,833. Trolley Wheel; F. N. Russell, Elmira, N. Y. App. filed Nov. 2, 1921. Flanges separate from main body.

1,418,834. Manufacture of Grid Resistances; L. Satchwell, Burry Port, Caermarthen, Wales. App. filed Oct. 18, 1920. Produced from stamped sheet metal.

1,418,856. Dynamo-Electric Machine; R. B. Williamson, Milwaukee, Wis. App. filed May 2, 1919. Insulating of armature coils.

1,418,857. Dynamo-Electric Machine; R. B. Williamson, Milwaukee, Wis. App. filed April 5, 1920. Slip-ring connections for revolving field.

1,418,903. Electromagnetic Wave Bath; W. S. Benson, Newark, N. J. App. filed Sept. 14, 1921. For treating cells of body.

1,418,917. Electric Heater; W. W. Hale, Cleveland, Ohio. App. filed Jan. 31, 1920. Corrugated element between insulating sheets.

1,418,969. Call Annunciator; H. F. Plumb, Drumheller, Alberta, Can. App. filed Oct. 15, 1918. Gives visual and audible signal.

1,418,977. Electric Locomotive; L. Schon, Essen-on-the-Ruhr, Germany. App. filed Dec. 7, 1920. Gasoline electric car.

1,418,984. Electric Furnace; F. W. Sperr, Jr., and H. J. Rose, Pittsburgh, Pa. App. filed March 14, 1921. For heating and testing coal samples.

1,418,989. Electrical Connecting Device; G. C. Thomas, Jr., Elizabeth, N. J. App. filed Nov. 21, 1919. For connecting conduits to outlet boxes.

1,418,990. Connector for Electrical Conduits, Etc.; G. C. Thomas, Jr., Elizabeth, N. J. App. filed Nov. 10, 1920. For connecting conduits or cables to outlet boxes.

1,419,010. Repeater for Gyrocompasses; S. G. Brown, North Acton, England. App. filed April 17, 1919. Operated from master compass by air jet.

1,419,063. Apparatus Applicable to the Receivers of Telephones; F. S. Lamadrid, Madrid, Spain. App. filed May 23, 1919. Protects receiver against interference.

1,419,071. Self-Regulating Continuous-Current Dynamo; A. H. Midgley, Acton Vale, England. App. filed Dec. 21, 1918. Armature conductors under lagging pole tips shorted by brushes.

(Issued June 13, 1922)

1,419,153. Process and Apparatus for Bending Lamp Filaments; A. Lederer, Vienna, Austria. App. filed Dec. 30, 1914.

1,419,173. Electric Iron; J. M. Seche, Philadelphia, Pa. App. filed Jan. 24, 1922. Attachment on heel to raise iron when not used.

1,419,178. Controller for Electric Motors; H. W. Stevens, Milwaukee, Wis. App filed Dec. 26, 1919. For dynamic braking.

1,419,208. Storage-Battery Cover; Earle A. Berry, Kansas City, Mo. App. filed April 21, 1922.

1,419,225. Water Heater; W. Colebrook, Durban, Natal, South Africa. App. filed Sept. 20, 1920. Water heated in continuous stream.

1,419,241. X-Ray Cabinet; E. L. Edwards, Indianapolis, Ind. App. filed Jan. 24, 1919. Protective inclosure and dark room for developing negatives.

1,419,256. Electric Light Display System; J. H. Hammond, Jr., Gloucester, Mass. App. filed Dec. 27, 1916. Produces effect of moving pictures.

1,419,309. Electrical Heating Device; T. C. Russell, Chicago, Ill. App. filed March 23, 1921. Grill plate.

1,419,330. Electric Heater; F. G. Van Dyke, Detroit, Mich. App. filed Dec. 19, 1921. Room heater.

1,419,360. Electrolytic Light Source; John Coulson, Wilkinsburg, Pa. App. filed Nov. 3, 1917. Electric current passed through electrolyte and film of aluminum hydroxide.

1,419,365. Trolley Harp; M. P. Enyeart, Girard, Ohio. App. filed Aug. 11, 1921. Wheel always parallel to wire.

1,419,376. Wireless Control Apparatus; J. H. Hammond, Jr., Gloucester, Mass. App. filed Nov. 27, 1909. Controlling vehicles, vessels, etc., from a distance.

1,419,377. Radiodynamic Occulting System; J. H. Hammond, Jr., Gloucester, Mass. App. filed Aug. 1, 1913. Varying path of artificial light emissions by radiant energy.

1,419,396. Storage Battery; F. G. Manwaring, Campgaw, N. J. App. filed May 25, 1920. Each plate in perforated stone compartment.

1,419,403. Lockout Mechanism for Intercommunicating Telephone Systems, T. H. Nelson, Chicago, Ill. App. filed Oct. 21, 1918. Combined selecting, switching and lock-out mechanism.

1,419,409. System of Telegraph Distribution; L. M. Potts, Baltimore, Md. App. filed Feb. 5, 1920. Single-trunk line for independent communication between selected pairs of stations.

1,419,421. Anti-Hunting Regulator System; S. A. Staege, Pittsburgh, Pa. App. filed April 9, 1919. To maintain constant load on pulp-grinder motor.

1,419,422. Anti-Hunting Regulator System; S. A. Staege, Pittsburgh, Pa. App. filed April 18, 1919. To maintain constant load on pulp-grinder motor.

1,419,458. Voltage Regulator System; Edwin Lehr, Wilkinsburg, Pa. App. filed June 25, 1919. Auxiliary transformer with two floating coils replacing induction regulator.

1,419,460. Combined Key and Switch; F. Lowenstein, Brooklyn, N. Y. App. filed Nov. 29, 1918. Wireless key rotates over number of contacts for sending different wave lengths.

1,419,493. Electric Regulation; J. L. Creveling, White Plains, N. Y. App. filed March 8, 1916. For train generator-storage battery system.

1,419,494. Electric Regulation; J. L. Creveling, White Plains, N. Y. App. filed May 2, 1916. For train generator-storage battery systems.

1,419,511. Sealing Structure for Storage-Battery Terminal Posts; P. E. Norris, Wilkinsburg, Pa. App. filed March 9, 1921. Gasket and flange arrangement wedged around post.

1,419,513. Telephone Mouthpiece; Herman G. Pape, New York, N. Y. App. filed Sept. 11, 1919.

1,419,523. Method of and Means for Jointing Electric Current Conductors; J. F. Schleper, Amsterdam, Netherlands. App. filed April 20, 1922. Twisted conductors placed in clamping cap.

1,419,528. Electron-Discharge Device; H. W. Weinhart, Elizabeth, N. J. App. filed Oct. 25, 1918. Electrode support for electron tube.

1,419,530. Thermionically Active Substance; William Wilson, East Orange, N. J. App. filed Aug. 12, 1918. Electron-tube filament of nickel coated with strontium and barium oxides.

1,419,547. Electronic Apparatus; C. D. Ehret, Philadelphia, Pa. App. filed Nov. 12, 1918. Tubes for radio circuits.

1,419,551. Telephone Accessory; J. Fleischman, New York, N. Y. App. filed May 22, 1920. Head set for desk telephone.

1,419,559. Electromagnetic Devices; Harold W. Goff, New York, N. Y. App. filed Feb. 6, 1919. Electromagnetic relays and step magnets.

1,419,561. Switching System; J. B. Harlow, Upper Montclair, N. J. App. filed June 24, 1919. Submerged vibration detector.

1,419,562. Modulator or Detector; R. V. L. Hartley, East Orange, N. J. App. filed Sept. 29, 1919. Balanced modulator using two-three electrode tubes.

1,419,569. Telephone Exchange System; C. W. Keckler, Newark, N. J. App. filed Oct. 30, 1917. Central-energy type.

Construction News

Projects, Plans, Bids and Contracts,
Contemplated or Under Way

New England States

MONTPELIER, VT. — The Vermont & Quebec Power Corporation has issued $300,000 in bonds, part of the proceeds to be used for extensions, etc.

AMESBURY, MASS. — The Amesbury Electric Light Company has applied to the State Department of Public Utilities for permission to issue $81,000 in capital stock, part of the proceeds to be used for extensions, etc.

LOWELL, MASS.—Mayor Brown has requested the Lowell Electric Light Corporation to draw up a plan for extending the ornamental lighting system into some streets surrounding the "downtown" section of the city.

MONSON, MASS.—Ricketts & Shaw contemplates building a power plant in connection with their local woolen mill. Reeds & Thorpe, Prospect Street, Hartford, Conn., are architects.

NORTON, MASS.—The Norton Power & Electric Company has petitioned the Department of Public Utilities for approval of an issue of $310,000 in capital stock to be used to pay for extensions to its plant.

WINCHENDON, MASS.—The Winchendon Electric Light & Power Company has petitioned the Department of Public Utilities for permission to issue $53,000 in capital stock, the proceeds to be used to pay the cost of extensions, etc.

MILFORD, CONN.—Plans are under consideration for the installation of ornamental lamps on Bridgeport Avenue from Avon Street to the bridge.

TORRINGTON, CONN.—The Torrington Electric Light Company is planning the construction of a boiler room.

Middle Atlantic States

COHOES, N. Y.—Bids will be received by the Superintendent of Public Works until July 10 for equipment for the proposed power house at Crescent Dam, Cohoes, including two hydraulic turbines, with governor equipment; two waterwheel-driven generators and auxiliary equipment.

NEW LEBANON, N. Y.—A franchise has been granted to the Lebanon Valley Lighting Company, Canaan, to supply electricity in New Lebanon.

NEW YORK, N. Y.—The New York Edison Company will build a substation at 454 East Twenty-seventh Street, to cost about $25,000.

TRENTON, N. J.—The Public Service Electric Company will build a station on North Olden Avenue, to cost about $25,000.

GREENVILLE, PA. — Negotiations are under way for a merger of the Mercer County Light, Heat & Power Company, the Pennsylvania-Ohio Electric Company and the Northwestern Electric Company, Erie, Pa. A system of transmission lines will be erected, including a line from Greenville to New Wilmington, and to other sections in Eastern Ohio.

HAZLETON, PA.—The Wilkes-Barre & Hazleton Railway Company has contracted with the Pennsylvania Power & Light Company for electricity to operate its interurban lines from Hazleton to Wilkes-Barre.

PHILADELPHIA, PA. — A one-story power house will be erected at the new iron-working plant at Erie and D Streets, to be established by Horace T. Potts & Company, 316 North Third Street.

PITTSBURGH, PA. — The West Penn Company has issued $2,500,000 in bonds, the proceeds to be used for acquiring the property of the Monongahela Power & Railway Company and also for plant extensions, etc.

TEXAS, MD. — The Maryland Calcite Company, P. O. Box 102, will construct a power house in connection with its proposed mill for the manufacture of whiting, marble flour, etc. R. L. Lovell, president.

FAIRMONT, W. VA.—The West Virginia & Maryland Power Company is considering the erection of an electric transmission line in the Winfield district.

HUNTINGTON, W. VA.—The Consolidated Light, Heat & Power Company contemplates building a 50,000-kw. substation in the east end of the city, to cost about $90,000.

MORGANTOWN, W. VA.—Power plant equipment, electric pumping machinery, etc., will be installed in connection with the proposed new sewer system, to cost about $750,000.

NITRO, W. VA.—The Charleston Paper Manufacturing Company is preparing plans for the construction of a power house at its proposed local paper mill. Charles G. Hartje, Steubenville, Ohio, is president.

PEACH CREEK, W. VA.—The Chesapeake & Ohio Railroad Company, Richmond, Va., will build a power plant in connection with its local shops. F. I. Cabell is chief engineer.

LURAY, VA.—The Page Power Company, which recently purchased the property of the Luray Light & Power Company, is preparing to build a hydro-electric plant on the Shenandoah River at Newport, 10 miles south of Luray. The proposed plant will have a capacity of 1,800 hp. and will supply electricity in Elkton, Shenandoah, Stanley and Luray. The cost of the project is estimated at $200,000. M. E. Roundabush, Stanley, is president and treasurer.

RADFORD, VA.—Plans are being prepared for the construction of a municipal electric light plant, for which $115,000 in bonds have been voted.

ROANOKE, VA. — The National Soap Stone Company, First National Bank Building, will build a one-story power house at its plant.

SCOTTSVILLE, VA.—The Big Ben Power Company has engaged the Ambler Engineering Company, Richmond, to prepare plans for its proposed hydro-electric power plant on the James River, to cost about $750,000, including transmission system. A reserve reservoir and system will be built to cost about $1,000,000.

WASHINGTON, D. C.—Bids will be received by the purchasing agent, Post Office Department, until July 5 for 4,000 sets of commutator wire assemblies.

North Central States

CASEVILLE, MICH. — The Council has authorized the installation of an electric distributing system. Service will be furnished by the Central Power Company with line connection at Bad Axe.

DOWAGIAC, MICH. — Extensions are being made to the municipal electric light plant, to cost about $10,000.

HOLT, MICH.—The Consumers' Power Company contemplates extending its lines to the town of Holt to supply electrical service.

ST. JOSEPH, MICH.—The Indiana & Michigan Electric Company contemplates the construction of a dam at King's Landing, 5 miles above St. Joseph. The proposed dam will be 17 ft. high and 500 ft. long and will flood about 2,000 acres.

THREE RIVERS, MICH.—The Michigan Gas & Electric Company has completed plans for a local power plant, to cost about $125,000. The power plant at Constantine will also be enlarged at a cost of about $45,000.

YOUNGSTOWN, OHIO. — Arrangements have been made whereby the Pennsylvania-Ohio Power & Light Company will erect 15 miles of transmission lines to supply electricity in the towns of Vienna, Hartford and Brookfield.

GREENUP, KY. — The United States Engineers, District No. 2, Room 513, Government Building, Cincinnati, Ohio, will soon ask for bids for the construction of a power house on the Ohio River at Dam No. 30, to cost about $50,000.

PRINCETON, IND.—The Indiana Power Company, Vincennes, is negotiating for the purchase of the property of the Princeton Light & Power Company. The city lighting plant at Oakland, Ind., will also be acquired by the Indiana company. Both properties, it is understood, will be extended and improved and connected with the main transmission system.

AURORA, ILL.—The Chicago, Burlington & Quincy Railroad, 546 West Jackson Boulevard, Chicago, will take bids at once for the construction of a power plant at Broadway and Washington Street, to cost about $100,000. William T. Krausch is architect.

URBANA, ILL.—Bids will be received at the office of James M. White, supervising architect, 256 Administration Building, Urbana, until July 17 for heating, and ventilating, plumbing and electrical work on the new agricultural building to be erected for the University of Illinois.

WAUKEGAN, ILL.—The Public Service Company of Northern Illinois, 72 West Adams Street, Chicago, is preparing plans for the first unit of a new steam-driven electric plant here, to cost about $1,000,000.

MADISON, WIS.—The erection of a large chimney, to cost about $14,000, is under consideration by the Madison Gas & Electric Company.

MELLEN, WIS.—An ornamental lighting system will be installed on Main and Bennett Streets.

PESHTIGO, WIS.—Improvements will be made to the plant of the Peshtigo Electric Company, including rebuilding a portion of its dam, erection of an addition to power house (to provide space for an additional unit, etc.). The cost is estimated at $60,000.

SHEBOYGAN, WIS.—Bids are being received by E. A. Juhl, architect, 805 North Eight Street, for a power station and engine house on Twelfth Street, for the Phoenix Chair Company, to cost with equipment about $40,000.

STURGEON BAY, WIS. — Surveys are being made by the Wisconsin Public Service Company, Green Bay, for the erection of an electric transmission line from Sturgeon Bay to Ellison Bay. The plans call for the organization of a company, to be capitalized at $50,000, to supply electricity to towns along the line, including Egg Harbor, Fish Creek, Sister Bay and Ellison Bay.

WAUSAU, WIS.—The Wisconsin Valley Electric Company is planning to replace the present lines between Wassau and Mosinee and between Stevens Points and Junction City (a total of 67 miles) with heavier copper wire to provide for the increasing demand for electricity for power purposes. The cost is estimated at about $20,000.

CANBY, MINN.—The Union Public Service Company will begin work at once on rebuilding its local plant, to cost about $200,000.

EVELETH, MINN. — The Minnesota Utilities Company has acquired property and water rights on the Kawishiwi River, near Ely, where it will construct a hydro-electric plant to develop about 12,000 hp. The cost of the proposed plant and transmission system is estimated at about $1,750,000. R. M. Heskett is secretary and manager.

DUBUQUE, IOWA—Council has authorized plans for extensions and improvements to the electrically operated pumping station at the water works, to cost, including equipment, about $135,000. Mead & Seatone, Madison, Wis., are engineers.

MANCHESTER, IOWA.—The Iowa Electric Company will build a hydro-electric plant in Manchester to supply electricity to a number of towns in Delaware County. The cost is estimated at $40,000.

MEXICO, MO. — The Missouri Utilities Company is planning to erect a transmission line from Mexico to Paris and Hallsville.

ST. LOUIS, MO.—A power house will be constructed at the convent of the Little Sisters of the Poor, 3,400 South Grand Avenue, to cost about $30,000. Lee & Rusch, Syndicate Trust Building, are architects.

SPRINGFIELD, MO. — The Springfield Gas & Electric Company is preparing plans for the erection of a steam-driven electric plant, to cost about $1,000,000. Sanderson & Porter, 52 William Street, New York, are engineers.

WHITE RIVER, S. D.—The local electric plant has been taken over by the town, to be owned and operated by the municipality.

BEAVER CITY, NEB.—The Council will make extensions and improvements to the municipal electric system.

OMAHA, NEB.—The Metropolitan Utilities District will install electric pumping machinery and make improvements in present pumping equipment, to cost about $250,000, in connection with extensions in the local water works, to cost about $1,500,000. F. D. Wead, chairman.

WAHOO, NEB.—A bond issue of $30,000 has been voted for extensions and improvements to the municipal electric system.

ARKANSAS CITY, KAN.—The Arkansas Valley Interurban Railway Company contemplates the construction of a substation in connection with the extension of its line to Ponca City, Okla.

KANSAS CITY, KAN.—The Baum Packing Company will build a one-story addition to its power house, 28 ft. x 40 ft.

LANSING, KAN.—Plans have been completed for a one-story power house at the State Penitentiary.

LEAVENWORTH, KAN.—The Kansas Electric Power Company has issued bonds for $3,000,000, part of the proceeds to be used for extensions and improvements.

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Southern States

ASHEVILLE, N. C. — The Carolina Power & Textile Company, recently organized, contemplates the construction of a series of five hydro-electric plants for textile mill service, three to be located on the South Fork of the Mills River, one on the Davidson River, and one on Rocky Fork. The plants will have a combined capacity of about 12,000 hp. and cost about $200,000.

CUMNOCK, N. C. — The Rocky River Power & Light Company, High Point, is having plans prepared for the first unit of a hydro-electric power plant on the Rocky River, to include the erection of a 13,000-volt transmission line. A second unit will be installed at an early date. Mees & Mees, Kinney Building, Charlotte, are engineers.

GASTONIA, N. C.—An electric power plant will be installed by the Ruby Cotton Mills, Inc., in connection with its proposed local mill. James A. Page, Clover, S. C., is president.

ATHENS, GA. — The Wellman Cotton Mills Company will build a power house in connection with its proposed local mill. Shelby Fletcher is president.

TALLAHASSEE, FLA.—The West Florida Power Company has applied to the Secretary of State for a charter. The company is to be capitalized at $1,000,000 and it proposes to develop water power on the Ocklocknee River to generate electricity. Its headquarters will be in Tallahassee. The incorporators are B. H. Hardaway, Sr., B. H. Hardaway, Jr., C. A. Mees and Guy L. Winthrop.

KNOXVILLE, TENN. — The Silk Tie Knitting Company will erect a power house in connection with its new local mill. V. H. Spruill is president.

DOTHAN, ALA.—Bids will be received by the Mayor and City Council until Aug. 15 for the construction of a hydro-electric project at High Bluff, on the Choctawhatchee River, about 8 miles from Hartford, which include an earth dam, power house, furnishing and installing turbine, generators, transformers and auxiliary power equipment for an installation of about 3,000 hp. capacity in two units and a 44,000-volt transmission line 21½ miles long. The Ludlow Engineers, Inc., Winston-Salem, N. C., are engineers.

BRISTOW, OKLA.—The installation of an ornamental lighting system in the business district is under consideration by the Chamber of Commerce.

KETCHUM, OKLA. — The Grand River Electric Company, it is reported, has started preliminary work on its proposed plant in Ketchum. The plans provide for a development of 135,000 hp., to cost about $20,000,000.

WILBURTON, OKLA.—Bids will be received by the City Clerk until July 10 for electrical equipment in connection with waterworks extensions, as follows: Additions to power house; one 125-kw. oil-engine generator set, complete with switchboard, wiring, etc.; resetting one 500-gal.-per-minue motor-driven high-service centrifugal pumping unit; two 500-gal.-per-minute motor-driven low-service centrifugal pumping units, and one 350-gal.-per-minute high-service pumping unit, installed complete. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

BROWNFIELD, TEX.—An election will be held July 21 to vote on the proposal to issue $16,000 in bonds for the installation of an electric lighting system.

DALLAS, TEX.—The Board of Commissioners contemplates the installation of an ornamental lighting system in the Oak Cliff section. Concrete standards are being considered. Ornamental lighting systems will also be installed on Jefferson and Beckley Avenues.

KAUFMAN, TEX.—The Council contemplates the installation of a municipal electric plant.

LEAGUE CITY, TEX.—James E. Matthews and J. E. Berry have applied to the Board of Commissioners of Galveston County for a franchise to erect and operate an electric transmission line from the plant of the Houston-Galveston Interurban Railway Company to League City to supply electricity here.

QUANAH, TEX.—The Quanah Light & Ice Company will make extensions to its electric plant to cost about $30,000. A transmission line will be erected to Eldorado, where a contract has been secured for electrical service.

TIMSON, TEX.—Work will soon begin on the construction of a municipal light and power plant.

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Pacific and Mountain States

OLYMPIA, WASH.—Bids will be received by the City Clerk until July 5 for the installation of an ornamental lighting system on Main Street.

PORTLAND, ORE.—The Portland Railway, Light & Power Company will construct a two-story substation at 310 Knott Street. The Hurley-Mason Company, Gasco Building, is architect.

ROSEBURG, ORE.—The City Council has decided to install a new lighting system in the business district to replace the cluster lamps now in use. Ornamental standards mounted with single lamps will be used.

GLENDALE, CAL.—A power house will be installed in connection with the proposed vocational and manual arts building at the new Union High School, to cost about $600,000. John C. Austin, Baker-Detwiler Building, Los Angeles, is architect.

LOS ANGELES, CAL.—Bids will be received by the Public Service Commission, Public Service Building, until July 14 for motor-generator sets and oil switches for municipal power plants. (Specification No. P-275.)

MARYSVILLE, CAL.—Arrangements are being made by the Yuba Development Company for the construction of a dam and power house at Bullard's Bar, to cost about $900,000.

OAKLAND, CAL.—The Pennzoil Company will build a power house in connection with its proposed oil works on Powell Street near San Pablo Avenue.

MINIDOKA, IDAHO. — The Minidoka Mutual Electric Company has recently been organized to supply electricity in Minidoka and vicinity. The company proposes to purchase electricity from the United States Reclamation Service for distribution.

BOULDER, COL.—The Western Light & Power Company contemplates the construction of a new transmission system to Estes Park, also other line extensions and improvements.

DENVER, COL. — The Denver & Rio Grande Railroad will rebuild the power house at its Burnham shops, West Denver, recently damaged by fire.

DURANGO, COL.—The Western Colorado Power Company has appropriated $150,000 for extensions to its system in the southwestern part of the state.

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Canada

CHARING CROSS, ONT.—The installation of a municipal electric lighting and power distribution system, to cost about $30,000, in Raleigh Townships is under consideration. A. Lawlor, 190 University Avenue, Toronto, is engineer.

CHIPPAWA, ONT.—The Hydro-Electric Power Commission of Ontario is planning to rebuild the local transformer station, recently destroyed by fire, causing a loss of about $200,000. Prices, it is said, are wanted on five transformers.

GLENCOE, ONT.—The Wabash Railway Company, Exchange Building, St. Louis, Mo., contemplates the erection of a water filling station, 3 miles of pipe line and electrically driven pumping equipment here. O. W. Carrick, care Wabash Railway Company, Decatur, Ill., is engineer.

KIMBERLEY, ONT.—The Consolidated Mining & Smelting Company, Ltd., Montreal, Que., has contracted with the East Kootenay Power Company for power supply to operate its new concentrating plant in the vicinity of Kimberley. Service will be furnished from the Bull River power plant.

MERLIN, ONT.—Preparations are being made by the Hydro-Electric Power Commission for the erection of a new transmisssion line to Merlin.

NEW SARUM, ONT.—Plans are being prepared for the erection of a municipal electric light and power distribution system in Yarmouth Township and a transmission line from New Sarum to St Thomas, to cost about $27,000. A Caughell, office of Hydro-Electric Commission of Ontario, St. Thomas, is engineer.

PEMBROKE, ONT.—The Pembroke Electric Light Company has awarded contract for the construction of a dam at High Falls on the Black River.

TARA, ONT. — The officials of Derby Township are considering the installation of an electric light and power distribution system, to cost about $35,000. A. Purcell, 190 University Avenue, Toronto, is engineer.

Directory of Electrical Associations

Printed in the First Issue of Each Volume

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co., Birmingham, Ala.

American Association of Engineers. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

American Association of Operating Engineers. Secretary. H. C. Bristol, Calderwood, Tenn.

American Electric Railway Association. Executive secretary, J. W. Welsh, 8 West 40th St., New York City.

American Electrochemical Society. Acting secretary, A. D. Spillman, Lehigh University, Bethlehem, Pa.

American Engineering Standards Committee. Secretary, P. G. Agnew, 29 West 39th St., New York City.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 143 Liberty St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

American Society for Testing Materials. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

American Welding Society. Secretary, M. M. Kelly, 29 West 39th St., New York City.

Arkansas Utilities Association. Secretary, R. I. Brown, Little Rock Railway & Electric Company, Little Rock, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York City.

Association of Edison Illuminating Companies. Secretary, Preston S. Millar, 80th St. and East End Ave., New York.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

Association of Municipal Electrical Utilities of Ontario. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Room 413, C. & N. W. Terminal Station, Chicago, Ill.

British Columbia Electrical Co-operative Association. Field manager, R. E. Chatfield, 108 B. C. Electric Bldg., Vancouver, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer pro tem., J. Coffey, Southern Canada Power Co., Montreal.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, Miss Minnie B. W. Baker, 900 15th St., Denver, Col.

Electric Hoist Manufacturers' Association. Secretary-treasurer, E. Donald Tolles, 165 Broadway, New York City.

Electric Power Club. Executive secretary, S. N. Clarkson, 506 Laclede Gas Building, St. Louis, Mo.

Electrical Manufacturers' Club. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

Electrical Manufacturers' Council. Executive secretary, Frederic Nicholas, 522 Fifth Ave., New York City.

Electrical Safety Conference. Secretary, Dana Pierce, 25 City Hall Place, New York City.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton, Chicago, Ill.

Electrical Supply Jobbers' Association, Atlantic Division. Secretary, E. Donald Tolles, 165 Broadway, New York City.

Electrical Supply Jobbers' Association, Pacific Coast Division. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

Electrical Trade Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla.

Great Lakes Geographic Division, N. E. L. A. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

Illinois State Electric Association. Secretary-treasurer, R. V. Prather, 305 Illinois Mine Workers Bldg., Springfield, Ill.

Illuminating Engineering Society. General secretary, Samuel G. Hibben, 29 West 39th St., New York City. Sections in New York, Philadelphia, Chicago and Boston. Chapters in San Francisco, Cleveland and Toronto.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind.

Institute of Radio Engineers. Secretary, Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N. E. L. A. Secretary, W. G. Linn, Des Moines Electric Co., Des Moines, Iowa.

Kansas Public Service Association. Secretary-treasurer T. T. Parker, Kansas Electric Utilities Co., Emporia, Kan.

Kentucky Association of Public Utilities. Secretary, E. F. Kelly, Louisville Railway, Louisville, Ky.

Michigan Electric Light Association. Secretary, Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

Middle West Division, N. E. L. A. Secretary-treasurer, Horace M. Davis, Bankers' Life Bldg., Lincoln, Neb.

Mississippi Electric Association, affiliated with the N. E. L. A. Secretary, W. A. Sullivan, Gulfport & Mississippi Coast Traction Co., Gulfport, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 315 North 12th St., St. Louis, Mo.

National Association of Electrical Contractors and Dealers. Secretary, Farquson Johnson, 15 West 37th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Also members in Canada and unorganized states.

National Council Lighting Fixture Manufacturers. Secretary, Chas. H. Hofrichter, 23 Gordon Square Bldg., West 65th St. and Detroit Ave., Cleveland, Ohio.

National Association of Electrical Inspectors. Executive secretary, T. H. Day, 59 Deerfield Ave., Hartford, Conn.

National Association of Railway and Utility Commissioners. Secretary, James B. Walker, New York Transit Commission, New York City.

National Electric Light Association. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Chairman of electrical committee, Dana Pierce, 25 City Hall Place, New York City. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, Horace M. Davis, Bankers' Life Bldg., Lincoln, Neb.

New England Electrical Credit Association. Secretary, James A. Loring, 161 Devonshire St., Boston, Mass.

New England Geographic Division, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

New Mexico Electrical Association. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

New York Electrical Credit Association. Secretary, W. J. Kreger, 47 West 34th St., New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York City.

North Central Electric Association, Geographic Division N.E.L.A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis.

Northwestern Geographic Division, N. E. L. A. Secretary-treasurer, J. F. Orr, Idaho Power Co., Boise, Idaho.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Oklahoma Utilities Association. Acting secretary, O. D. Hall, Oklahoma City.

Ontario Association of Electrical Contractors and Dealers. Secretary, J. A. McKay, 24 Adelaide St. West, Toronto, Ont.

Pacific Coast Geographic Division, N. E. L. A. Secretary, S. H. Taylor, 527 Rialto Bldg., San Francisco, Cal.

Pennsylvania Electric Association. State Section N. E. L. A. Secretary, H. M. Stine, 212 Locust St., Harrisburg, Pa.

Public Service Association of Virginia. Secretary, R. M. Booker, Newport News & Hampton Railway, Gas & Electric Co., Hampton, Va.

Public Utilities Association of West Virginia. Secretary, A. Bliss McCrum, Charleston, W. Va.

Radio Club of America. Secretary, Renville H. McMann, 150 Nassau St., New York City.

Rocky Mountain Geographic Division, N. E. L. A. Treasurer, A. C. Cornell, Denver, Col.

Society for Electrical Development, Inc. Assistant to the president, W. L. Goodwin; secretary, Theo. E. Burger, 522 5th Ave., New York City. Annual meeting second Tuesday in May; directors' meetings second Tuesday in May and November; executive committee meetings every sixty days.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Southeastern Geographic Division, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

Southwestern Geographic Division, N. E. L. A. Secretary, F. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Southwestern Electrical and Gas Association. Secretary, E. N. Willis, 403-4 Slaugher Bldg., Dallas, Tex.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

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Our Unknown Customers

ONE of the big advertising agencies gave utterance the other day to the interesting thought that whereas the advertiser perpetually tells his story to the public, the public never tells its story to the advertiser. So the manufacturer cries out: "We wish you could visit our factory and see our product being made!" If the public could talk back in the same way, it would probably answer: "We wish that you would visit our homes and see why some of us don't buy your product."

There is a very pertinent message here for the electrical industry.

BECAUSE our beginning was small and because electric light made such a strong and universal appeal, the electrical industry came into being and developed for years without a selling problem. People have wanted electric service and bought electrical goods as fast as we could comfortably provide them. As a result, we have never really had to know our customers.

Manufacturers of motors are coming to realize this. They see more and more that it is not enough to sell a machine and trust to the buyer or his contractor to apply it properly. If a squirrel-cage motor goes into a grist mill and clogs up with dust, the miller cannot blame the manufacturer. But it hurts the good name of electric motors just the same. And so we hear more about "application engineering" these days. For, after all, it is continued use and customer satisfaction that count.

Just so, the maker and the seller of a vacuum cleaner may feel that it is no concern to them if some housewives use theirs but once or twice a month instead of daily. But it is. And the grill, flatiron, fan or other device that reposes fogotten on a closet shelf is both a loss and a liability to the electrical business. It injures the central station, the dealer, the contractor, the jobber and the manufacturer. For people buy these electrical things not as ornaments but to use, and if they do not use them—and use them properly and profitably—there is something wrong. And it is our fault.

WE DO not really *know* our customers—we electrical men. We have not been compelled to study them enough. Why do some homes buy and others not? And why do some who buy use their appliances habitually and some only at first or but occasionally? And why do some households use twice as much light as others of like size? We do not know.

We say that "people are different." But that's not the answer. For we are dealing in common comforts and necessities of life. Is the fault that we are trying too much to sell to every kind of people in one way? We do not know. Some knowledge has been gained, but it is as nothing compared with our lack of actual information.

Henry Ingraham Harriman

Engineer and banker, whose vision and creative energy place him among the leaders in American hydro-electric development.

TO DISCERN and accomplish great electric service possibilities in a comparatively new section of a country is no small achievement, but to see opportunities for development on a great and advanced scale in an old and settled territory, and in the face of heavy obstacles to build a superb system for regional operation, is in some respects an even greater accomplishment. Fifteen years ago central-station companies in New England were supplying largely an insular service. With few exceptions, water powers were utilized only in their immediate neighborhoods. Transmissions and interconnections were extremely restricted, and the wholesaling of hydro-electric energy was little practiced. The "old-line" utilities were growing, but mostly for local markets. Kilowatt-hours by the hundred million were running to waste in the streams.

Into this situation came a man of thirty-four from the textile machinery industry. The possibilities of hydro-electric development for wholesale supply of energy over large areas, combined with reciprocal power contracts with customers already operating generating equipment, appealed to him with tremendous force. Henry I. Harriman entered into business association with Malcolm G. Chace of Providence, R. I., and threw himself with might and main into the upbuilding of the great system now forming the New England Power Company and affiliated organizations. A pioneer station of 20,000 kw. rating was built on the Connecticut River at Vernon, Vt., and 66,000-volt lines were constructed into central Massachusetts. Vigorous opposition from the older utilities arose, but in the celebrated Fitchburg and Worcester appeals the Massachusetts commission authorized Mr Harriman's company to wholesale energy in the disputed territory. Other plants were built on the Deerfield River, with large storage facilities, and today the New England Power system trunk lines extend from southern Vermont into Rhode Island, total more than 300 miles of transmission, interconnect with nearly every central station in central New England, and serve about 200 municipalities wholly or in part and many large industries. The present plants aggregate 95,000 hp., and these interests control additional power and reservoir sites capable of contemplated further development to 200,000 hp. As a partner in Chace & Harriman, Inc., and president of the New England Power Company, Mr. Harriman has been intimately concerned with every step of the system's advance. It is believed to be the largest hydro-electric development in the United States east of Niagara Falls.

Mr. Harriman was born in New York in 1873 and was educated at Wesleyan University and at the Law School of New York University. He became manager of the Stafford Company, loom manufacturer, at Hyde Park, Mass., after a short period of employment elsewhere. His rapid rise in the electrical world has been accompanied by election to various utility directorates and by a two-year presidency of the Boston Chamber of Commerce, he being the first head of that organization to be re-elected for a consecutive term. Mr. Harriman's influence has been exerted for high-grade engineering throughout his career in the hydro-electric field, and he has long championed durability in construction as opposed to makeshift methods. He is an enthusiastic advocate of the St. Lawrence waterway development.

Editorial Comment

Electrical World, July 8, 1922

Volume 80

Number 2

Faithful Guardians of Electric Service

CONGRATULATIONS are due the electric light and power companies of the country for the splendid service they have rendered during the coal strike and for the wonderful foresight displayed in checkmating the railroad strike. The National Electric Light Association has just completed a coal survey and is greatly heartened by the discovery that the privately owned electric utilities of the country, if they did not receive another ton of coal, can continue to operate at normal output for over two months. It has been well said that next in importance to doing the right thing is to let people know you are doing it. We suggest, therefore, that the achievements of the last few months and the precautions taken to guarantee electric service during the months to come be brought to the attention of every user of electric service throughout the country. The electric light and power industry has a right to glory in this accomplishment and it is only proper that the public be reminded that, notwithstanding the coal strike and the railroad strike, electric service is being rendered as usual.

A. I. E. E. Program at Niagara Falls Sets a New Standard

FOR well-balanced selection of subjects, sequence of consideration and excellence of discussions, the Niagara Falls convention of the A. I. E. E. last week excelled all others of that organization, at least within recent years. No one phase of electrical engineering was overplayed; the subjects which were scheduled were allotted a period in keeping with their importance. The grouping of the electro-physical, general and miscellaneous papers highly technical in character at the first day's session afforded the persons most interested in those particular subjects alone a short, snappy and exclusive convention, in effect. Besides, this arrangement had the advantages of attracting a large attendance. By devoting each session to closely related subjects, the discussions were greatly enhanced this year.

This improvement was in no small measure also due to the more consistent attempt to hold authors of papers to a limited time in abstracting their papers, and also those who discussed the papers to the constitutional five minutes. In the not far distant future, possibly the formal presentation or extended abstract of papers can be entirely dispensed with by providing the membership with copies far enough in advance to study them. Then entire sessions can be devoted to discussions, which, after all, are the principal reason for attending convention sessions. This millennium will be brought nearer to the extent that authors of papers make it a point to get their papers in to the publication committee at the time specified.

One other opportunity for improvement at future conventions is to compensate for the poor acoustic properties of the convention hall, or halls, by providing loud-speaking or speech-amplifying equipment. With Colonel Jewett as president of the A. I. E. E. and the meetings and papers committee always ready to listen to suggestions, we feel quite certain that future convention delegates will not have the difficulty in hearing speakers which they experienced at the Niagara Falls meeting.

An Important Job for this Hot Weather

HOT weather is here, but probably more than ever before, manufacturers, jobbers, contractors, dealers and central station commercial men are keeping on and doing business. The slogan "No sales slump this summer" is taking hold. Prizes are being offered for the best hot weather selling record. And it is developing that it is not difficult, if you "sell hot weather goods in the hot weather way"—another good line. There is prospect, therefore, that this summer season will be exceedingly productive and carry on the even progress of business acceleration in the electrical industry.

The coming of autumn will bring still further stimulus undoubtedly and greater opportunities will unfold as the vacation season ends and selling activities will be further speeded up. The countrywide movement for business development will be in full swing. Plans will have been made to boom everything electrical. But when will these plans be made? That is a vital bit of work that must be done this month and next.

This movement for business development will be great or small according as the individual puts his heart and head into the planning of his part of it. Much will depend on what the interested central station men, contractors, the dealers, manufacturers and jobbers, through these hot weeks, separately decide to do, and the definite plans which they work out as their participation. It is to be a great co-operative movement, yes, but each man will have to know what he can and will do in this co-operation.

Public Interested in Purchasing Securities

TWO WEEKS ago the New York Telephone Company announced the sale of $25,000,000 6½ per cent cumulative preferred stock to its patrons at par. The stock could be acquired for cash or by monthly payments of $5 or any multiple thereof for each share. Not more than twenty shares would be allotted to any applicant. So great was the demand that the sale was brought to a halt the day it began. On June 29 between 9 a.m. and 5 p.m. more than 70,000 telephone users applied for stock and it became necessary to decline further applicants, the entire issue having been heavily oversubscribed.

This indicates a widening public interest in the securities of utilities and shows the opportunities that are still available to electric light and power companies who have not yet embarked into the realms of customer-ownership.

Certainly the securities of electric light and power companies, especially of those companies that are located in metropolitan districts, are every whit as attractive and salable as those of the telephone company. The electric light and power companies were the first to appreciate the importance of customer-ownership and have made remarkable strides in that direction during the past two years. It is no doubt due in some measure to the development work of the electric public utilities in popularizing utility securities that the telephone company was enabled to dispose of its first issue in so short a time. However, all the credit should go to the New York Telephone Company for the magnificent way in which it handled the publicity and other work incident to the sale of these securities.

The lesson to electric public utilities is plain, and if in its first attempt a telephone company can have an issue of $25,000,000 greatly oversubscribed, it would appear that the electric light and power companies might secure considerably more funds through customer-ownership campaigns. The cause and the security are both excellent and managers should show more boldness in bringing them to the attention of the public, which from all indications is willing to purchase utility securities in preference to others less stable and the return on which is no higher.

Italy Seeks to Develop Her Water Power

DURING the war, when Italy was borrowing fabulous sums of money from this country and purchasing coal with part of it at $50 a ton, we suggested that the United States would confer an everlasting benefit on the Italian people and at the same time conserve its own resources of coal and money if it insisted on the development of the Alpine water powers of Italy and the electrification of her industrial centers. It now appears that while Italy recognizes the necessity and benefits of water power development and is more than willing to undertake such development, the funds with which to purchase the work are lacking. In other words, Italy seeks and invites American capital to develop her water powers and electrify her industries. As an earnest of her good intentions, she has dispatched an electrical engineer to make a ten months' survey of hydro-electrical development in this country. John W. Lieb, who has just returned from an extended trip to Italy, also corroborates this report of a desire for hydro-electrical development, but points to the lack of funds which are available in Italy with which to carry on the work.

Here is a wonderful opportunity for American capital and American engineers in an excellent cause. Heretofore Italy, sometimes through the aid of Germany and Switzerland, has been able to take care of this work herself. A wonderful market for export business is now open to us provided American capital will interest itself in Italian hydro-electrical developments. Only recently a $7,000,000 hydro-electric development was started in Manitoba, Canada, the money having been advanced chiefly by the United States. Work of this kind is commendable, and while we wish to encourage rather than to discourage investments in Canada, American financers and engineers should not shut their eyes to opportunities in other countries.

Architectural Values in Illumination

PERHAPS the most critical task in arranging the illumination of a public building is to adjust the character of the lighting and the fixtures which contain it to the general architectural requirements. In this matter more than anywhere else has illumination suffered from bad precedents, since in very many instances the lighting of a building in the past has borne no relation whatever to the architectural harmony of the whole. Lighting fixtures have been regarded too often as things to be judged alone and not in company with their surroundings. Hence it has happened many times that fixtures beautiful in themselves considered merely as objects of art have been put in very inappropriate situations, or, on the other hand, fixtures possessing no particular merit have been thrust into service from merely utilitarian motives. From long custom and a slavish regard to ancient precedent, however bad, people have come to tolerate inharmonious treatment of lighting fixtures. For example, the exaggerated pendent lights of the mosque of St. Sophia, decorative enough individually but hanging from absurdly long and conspicuous rods, have served as a motive for an infinite amount of bad church lighting.

A decidedly interesting case of modern lighting in which the fixtures have been worked into the general design of the structure with unusually good results is considered in this issue. The main problem was lighting a big arched arcade, with a gallery floor filled with stores and shops as well as the ground floor below. The method taken to obtain powerful and effective lighting without throwing glare into the gallery was a very effective extension of cove lighting at the cornice. The coves served as housings for silvered-mirror reflectors which did the actual work, and the contour of the cove was such as to provide effective light without exposing the sources. Another unusual feature of the illuminating design was the provision for uniform window lighting while also allowing color effects to be freely used when especial displays were necessary.

Throughout the offices, which take up a considerable part of the arcade in its upper levels, indirect lighting units were installed to provide a uniform equipment easily kept up. Strictly speaking, the fixtures have a material similarity to some semi-indirect fixtures in that a diffusing glass shield on the under side of the fixture is given surface brilliancy high enough to avoid having a dark spot against a bright ceiling. Fixtures of this character are worth more study than has usually been given them, for they seem to form a class almost by themselves, as distinguished on the one hand from pure indirect fixtures with opaque reflectors and on the other from the more or less dense bowls in which the transmitted light is a somewhat important factor in the general illumination.

Gradually we are learning how to adapt modern fixtures to modern needs, and eventually the result will be a class of fixtures artistic, sound and practically useful. But we think these will, on the whole, be products of the evolution of the twentieth century and not adaptations from the sixteenth or seventeenth. These last have an undeniable artistic value in the period decoration of suitable rooms, but the big needs of modern buildings demand something more nearly to scale. The real problem is not how the Renaissance artists used candles, but how Cellini or da Vinci would have treated a single source of a thousand candles to the glory of his art.

Relative Effectiveness of Relay Systems Needs Thorough Analysis

WITH a world-wide distribution of light and power systems operating under different climatic and load conditions, and with different arrangements and types of equipment, is it any wonder that diversified protective practice exists? Each system has been treated as a unit and each group of engineers has developed a solution. Enthusiasm may have caused the installation of too many untried relays and protective devices, their very newness and number introducing costs and hazards that are unwarranted. In other cases they have not been subjected to the duty for which they were installed, so that no actual data are available as to their effectiveness. The diversified relay practice in this country is very clearly indicated by the report of the protective devices committee of the A. I. E. E., which also presents evidence that there is much room for improvement. On the other hand, a study of the results accomplished since the last report shows clearly that the art of relay protection is advancing by leaps and bounds and that the near future should see the solution of this most difficult problem.

To hasten this solution we must have a thorough analysis of the relative effectiveness of different methods of protection on different types of electric service systems. The proposed study is not beyond the capabilities of ingenious investigators.

Central-Station Men Should Inform Themselves on Rural-Lines Problem

RECENT discussions with central-station men in various parts of the country indicate a regrettable lack of information on the rural electric service problem. In many cases men who have been suddenly called on to face an active demand from their own rural territory did not know that extensive information had been published describing some of the efforts to solve the problem. As a result they have made the mistake of trying plans already discredited in the experience of others. All of the principal plans and studies for handling the service which have so far been definitely advanced have been published in the technical press. This year the rural-lines committee of the National Electric Light Association published the principal reports and sets of rules as an appendix to the committee report and included in the report an important analysis of the main features of the various schemes. There is no longer excuse for ignorance of the work that has been accomplished. There are strong indications that the farm bureaus, the farm press and other agencies representing agricultural interests are recognizing the problem as a vital one and are preparing to take part in its study. Central-station men ought to have so thorough a grasp of the situation that an intensive co-operative study of the situation can be undertaken with these agencies and the problem worked out in a friendly rather than a controversial way.

The national committee in its short existence has already taken steps in this direction, but that committee cannot do the entire job. It can lead and keep the work going in the right direction, but each individual having a specific rural-service problem must establish relations with the other interested agencies in his territory and carry on a local study that will be educational to the farmers and equally so to himself. This work can be made to tie into the work of the national committee. In the present state of the work the central-station operators are as much in need of education as the farmers. This education can only be obtained by hard effort and an honest endeavor to see all sides of the problem.

Baltimore Breaker Test Records Lacking in One Particular

NOTHING but the highest appreciation and credit can be extended the Consolidated Gas, Electric Light & Power Company and the Pennsylvania Water & Power Company, of Baltimore, for allowing their systems to be used for the elaborate short-circuit tests of oil breakers reported in last week's issue of *Electrical World*. The whole industry is indebted to them and to any other companies which will permit such tests on their system and will make public the results.

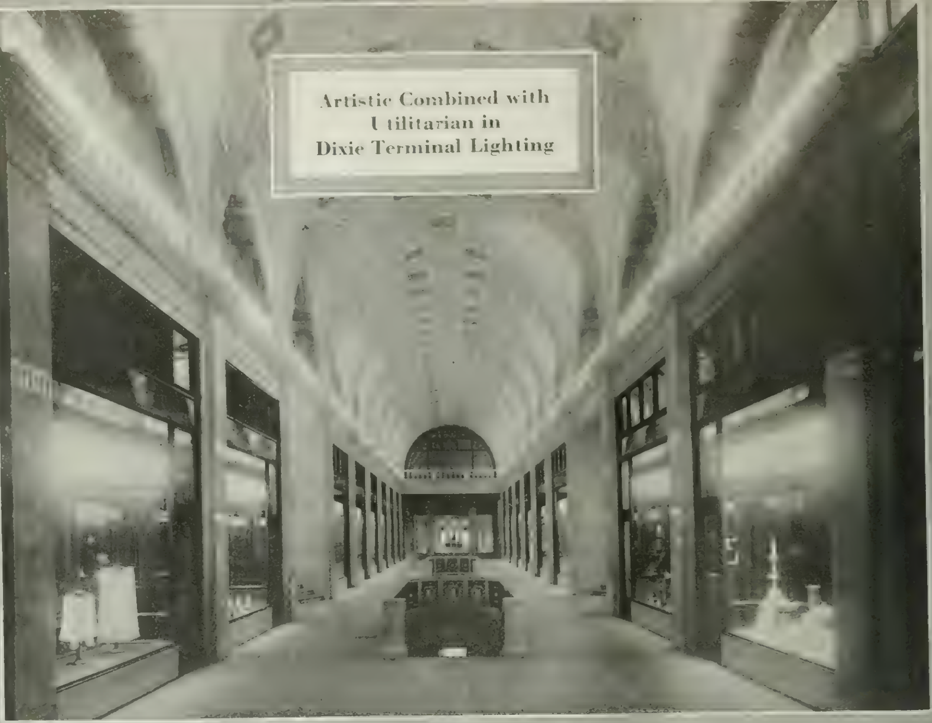
However, considerable criticism was heard around the A. I. E. E. convention hall last week that the industry has been waiting two years for the results of these tests and then had to be disappointed by not hearing any definite information on the effect of the short circuits on the mechanical condition of the circuit breakers, nor on the ways in which existing breakers can be modified to strengthen them against short-circuit operation. It is true that the manufacturers presented some interesting observations regarding currents interrupted, time of breaker operation, etc., but it can hardly be conceived that no damage occurred during such severe tests as those to which the breakers were subjected. Divulging such information should not harm the manufacturers so much as concealing it because the average engineer is likely to believe that such serious trouble occurred that the manufacturers did not wish to make it public. On the other hand, if the operating engineers around the country knew exactly what occurred, they would be less uneasy about their own switches and would be in a better position to strengthen their existing breakers.

Judging from this and other similar situations which have arisen, it seems that the best way to secure the information desired is to have future tests of general interest conducted under such auspices that the complete results will be made public.

If other tests are conducted, and surely some other large companies will volunteer their co-operation, it is hoped that some of these questions will be answered. In addition it would be interesting to know what pressures are exerted in switch tanks during short-circuit, what distortion is noted in the switch mechanism, what damage to contacts is observed, and what is the effect of unsymmetrical short-circuit, unstable operation of generators and low power factors on rupturing performance? When future tests are made it will also be advisable to consider testing the performance of all protective equipment at the same time.

The results of the Baltimore tests should give a feeling of confidence to those who are in position to co-operate with the manufacturers in carrying out such tests. In spite of the severity of the tests no equipment on either system was damaged. There has been a fear of tests of this kind on the part of operators because of the possibility of damage to equipment. That such tests can be safely carried out if proper precautions are taken has been proved and other companies should co-operate with the manufacturers in the effort further to develop and improve oil circuit breakers.

Artistic Combined with Utilitarian in Dixie Terminal Lighting



MODERN LIGHTING has been very effectively harmonized with the architecture of the Dixie Terminal, Cincinnati, by adapting available lighting equipment to the architecture prescribed instead of making the usual mistake of trying to fit in fixtures which are artistic in themselves but entirely incongruous with their surroundings. Therein lies the lesson for making future installations attractive. As expressed editorially on page 58: "The real problem is not how the Renaissannce artists used candles, but how Cellini or da Vinci would have treated a single source of a thousand candles to the glory of his art."

The method employed to illuminate the main arcade sufficiently without producing glare was to use cove lighting from the cornice. Show-windows and offices were also effectively lighted as shown.

Indirect Lighting in City Office Building

Dixie Terminal Building in Cincinnati Uses System with 8 to 15 Foot-Candles—Arcade Illumination Eliminates Hanging Fixtures—Aids to Maintenance Included in Design

By **G. F. EVANS** and **J. W. MORRISON**
National X-Ray Reflector Company

THE Dixie Terminal Building, which was built to relieve the traffic congestion in downtown Cincinnati, embodies some features of lighting which may find application elsewhere. Of particular interest are the extensive use of indirect illumination for the arcade as well as office spaces and the show-window lighting. Among other things worthy of attention are the arrangement of electrical outlets, the painting in relation to illumination and the provision for maintenance.

The general architecture of the building and the arcade is of the Italian Renaissance period. The arcade, shown in the illustration on the opposite page, presents a high arched interior with medallions in shallow relief featured in the vaulted ceiling. It was desired to keep this ceiling free from all hanging fixtures, while at the same time the gallery floor with its rows of stores and shops had to be protected from any glaring type of lighting. The eyes of observers on the gallery floor, particularly on the far side of the arcade, had to be similarly protected. Cove lighting at the cornice at the foot of the balcony rail seemed to be the only practical method of accomplishing this, and it was adopted. Figs. 1 and 2, showing cross-sections of the cornice equipment, clearly indicate the arrangement of the reflectors with their relation to the sight lines from the gallery level.

The cross-section drawing of the cornice equipment (Fig. 1) is misleading unless the problem the engineers had to solve in accomplishing the proper distribution of light from the equipment along each side of the arcade is clearly understood. At first glance it would seem that a considerable amount of light is sacrificed by the way in which the edge of the sheet metal housing cuts off the light distribution. The housing was designed to minimize this loss of light and at the same time to act as a screen to keep the direct view of the reflector from the line of vision of persons on the gallery floor on the opposite side of the arcade. A total of 354 silvered-mirror reflectors with 75-watt type C "Mazda" lamps are used. The sheet-metal housing containing the reflectors is provided with semi-dust-proof glass covers. The various sections in the cornice are wired to permit of three intensities of illumination. The short sections in front of the columns, on a separate circuit, are used for low-intensity lighting after the late evening traffic is over. The sections between the columns are arranged on two circuits to allow for variation as may be required.

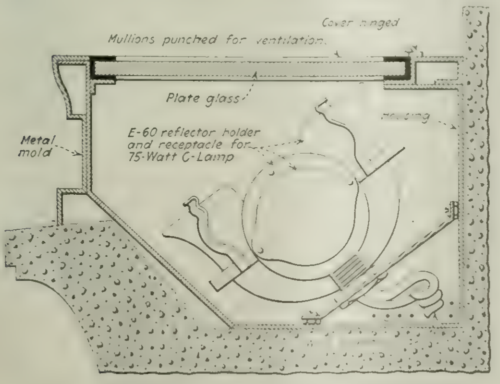

Cover hinged
Mullions punched for ventilation
Plate glass
Housing
E-60 reflector holder and receptacle for 75-Watt C-Lamp
Metal mold

FIG. 1—CROSS-SECTION OF CONCEALED LIGHTING UNITS AND MOUNTING IN THE ARCADE

The need of protecting the eyes of observers on the gallery floor across the arcade has resulted in an arrangement that apparently cuts off more light than necessary. The design is intended to provide the necessary screening and reduce the losses of light to the minimum.

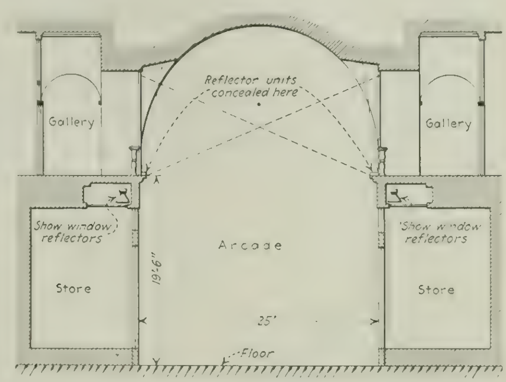


FIG. 2—ARRANGEMENT OF CONCEALED LIGHTING IN THE ARCADE

The units are arranged to give the proper illumination and at the same time avoid glare in the eyes of observers in the gallery.

Another feature of the lighting arrangement in the arcade is the illumination of the show windows in the shops in the first-story and second-story levels. The reflectors for the lighting of the show windows are arranged above the bulkhead of the windows (Fig. 2). Hinged sash with diffusing glass having a low coefficient of absorption are placed beneath the reflectors. Sufficient space is left between the bottom of the reflector and sash to permit the reflector to be equipped with a color-lighting device for special displays or occasions. Uniformity of the windows, not only as to light but also to trim and arrangement, were insisted upon by the manager of the building. As all of the windows are of standard size and trim, this simplified the design of the lighting system, and the illumination intensity in the windows of all the shops is uniform.

On entering the arcade or main entrance the observer's attention is held by a large glass and bronze globe (Fig. 3A) suspended from the arched ceiling of the entrance. The ball represents the "Globe of the World," with narrow bronze bands denoting the lines of latitude and longitude, between which are panels of opal cathedral glass. A cast-bronze band encircles the globe and is ornamented with signs of the zodiac.

The managing director was called on to select the office-lighting system. After a complete study of the requirements of office building lighting, he made trips to all the larger cities, consulted the building managers, called on other illuminating engineers, and equipped a suite of rooms with the various types of fixtures to give them a thorough test under actual working conditions. The result was the adoption of a totally indirect system in the offices, using a fixture known as the luminous-bowl type.

Proper quality was insured by attempting to produce artificial illumination with characteristics as nearly as possible like those of daylight. The matter of light direction was a simple problem, as the indirect system, because of its diffusion and absence of sharp shadows, was especially attractive for desk work. Glare seemed to be the chief thing to be overcome in planning a higher standard of lighting intensity. It was found from observation and tests that illumination of from 8 to 15 foot-candles for general office and drafting-room work would meet the conditions in this building.

The arrangement of the electrical outlets for the offices received much consideration, and the outlets were spaced so that changes, like moving old partitions or installing new ones, could be arranged to suit the requirements of the tenants without radical change in the electrical wiring.

Light ivory color for the ceiling, with a shading of the side walls to very light buff, was used. It is claimed by the manufacturers that it can be washed without any appreciable loss in the reflection factor.

Maintenance was put under the charge of the building superintendent, who is held absolutely responsible for the carrying out of the regular maintenance work. It was suggested that the fixtures be cataloged by card index or similar system, with the outlets of each floor numbered and the type of fixture indicated, in addition to data on the replacement of the lamps, the average life of each and the days of the month that the fixtures are to be cleaned.

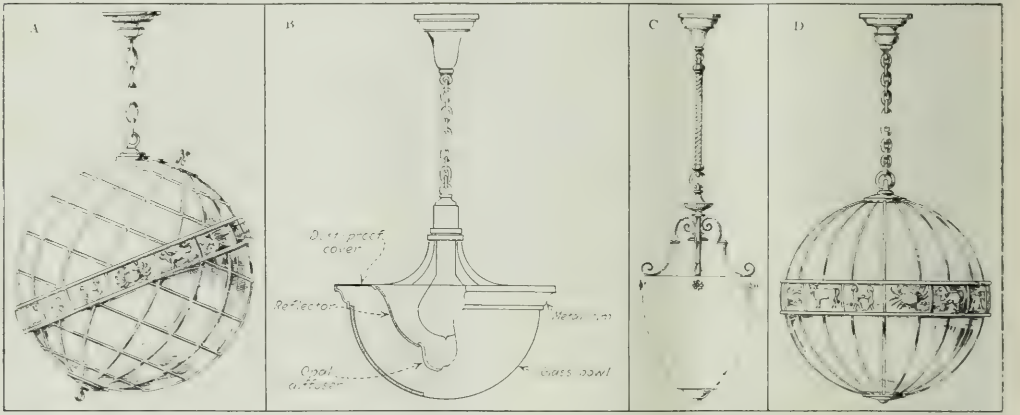


FIG. 3—TYPE OF FIXTURES USED IN THE DIXIE TERMINAL BUILDING

A—The "Globe of the World" at the main entrance of the arcade. B—The general illumination in the office building is arranged with a view to ready cleaning. The bowl drops down and swings on two of the supporting arms. This throws the lamp out of position and in position for cleaning without removing. A dust-proof cover is provided. C—Fixtures for the stores off the arcade balcony. These are of a semi-indirect unit with a "Monax" glass stalactite and bronze hanger. D—The corridor fixture.

The design of the fixture selected for the general illumination of the office is shown in Fig. 3B. The managing director's idea of a unit having all the merits of a totally indirect-lighting system yet with a surface brightness on the outer glass bowl higher than that common to the usual type of indirect unit was carried out. The construction consists of a plain-spun metal canopy, with single chain hanger and husked receptacle which partly hides the lamp neck from view, and three supporting arms hooked into a metal rim supporting a "Monax" glass bowl. A dust cover of metal fastens into the inner top of the supporting rim and serves as a support for a mirrored-glass reflector which is provided with an oversize opal-glass diffuser under the lamp. This prevents dust or dirt from settling in the outer glass bowl. Cleaning of the fixture is accomplished by unhooking one of the arms and allowing the bowl to swing into a downward position on the two other arms. This drops the lamp out of position so that it can be cleaned without removing.

The corridors and lobbies were constructed of Tennessee and Bottacino marble. A special design of corridor fixture, using the same plain "Monax" glass as is used for the units, but of a slightly different design, was selected. On the lower-floor levels and lobby corridors which are generally used by the public a more elaborate architectural treatment has been used, and the fixtures are of a more expensive type. In these instances the design consists of a globe made of narrow bronze bands with a wider band encircling the globe at the center. This center band serves as a rim for a pan containing mirrored-glass indirect reflectors—thus making a totally indirect fixture out of the unit.

Special fixtures (Fig. 3C) for the stores off the arcade balcony were provided. These consist of a semi-indirect unit with a "Monax" glass stalactite and decorative bronze hanger.

Harry L. Linch, managing director for Garber & Woodward, architects, and the firm of Walter G. Franz, consulting engineers, are responsible for the designs and the engineering work of all kinds.

To Untangle Our Distribution Snarl

Ten Things the Jobber Should Do to Restore the Balance of His Economic Function—How the Trouble Started Thirty Years Ago—How the Rest of the Industry Can Help

By EARL E. WHITEHORNE
Commercial Editor Electrical World

IN THIS article an attempt has been made to set down on paper some of the definite steps which inevitably will have to be taken by the jobber of electrical supplies before he can expect to have an end to the troubles which have been bedeviling him through the last few years. Certain practices and trends have upset the logical, orderly progress of distribution in the electrical industry with great loss of profits and injury to peace of mind. The question is what should be done to overcome these influences.

Mr. Whitehorne presented this paper informally before a group of prominent and representative jobbers during the recent meeting of the Electrical Supply Jobbers' Association at Hot Springs, Va. Each of these recommendations was voted upon unofficially and indorsed by the majority of those present as an economic principle fundamentally sound. It was agreed that the jobber himself must take the initiative and—

1. Buy in larger quantities.
2. Sell in larger quantities.
3. Reduce the number of factory shipments.
4. Restrict himself to wholesale business only.
5. Confine his activities to his natural territory.
6. Organize his appliance and radio departments to pioneer and merchandise or let them alone and concentrate on staple supply lines.
7. Provide distribution for all worthy goods in so far as possible without unduly duplicating stock.
8. Stop fostering and nourishing his own competitors by selling goods at a cut profit to imitation jobbers.
9. Undertake the selective development of his contractor-dealer customers and quit building up competition for them indiscriminately.
10. Stabilize demand by developing regular customers who buy practically their entire requirements from the one distributor.

TAKING the matter in its larger aspects, there are three basic causes for the present inadequacy of the distribution machinery of this country. These three causes are overcapacity, overproduction and overcompetition. Thirty years ago we had a condition where the cost of production was high and the cost of distribution was low. because small factories were turning out the goods for local or a limited regional sale. Today we see the case reversed, and we have a low production cost and a very high cost of distribution, because everywhere there are large factories operating at high efficiency but endeavoring to sell on a national scale with an overexpanded distribution system.

The result is a keen price competition and an endless duplication of stocks, personnel and service costs. Overcapacity has induced overproduction, and overproduction has in turn induced overcompetition. Consumption being naturally limited by the needs of the populations, we have as a result a distribution glut in which the retailer is turning over his stock from two to eight times, whereas it should be twenty-four times or more.

THE NEGLECT OF DISTRIBUTION

We know also that we have long specialized as a people on the refinement of production processes and let the distribution system grow up by itself, until today we face the astounding fact that it costs more to distribute goods in America than to produce them. And this, of course, is not all the fault of the distributor or the manufacturer. It has been in large part induced by modern American standards and habits of living, which demand an extravagant degree of service.

This unhealthy and unhappy tangle in our distribution system is not the jobber's problem alone. The jobber functions not for himself but for the industry, providing a channel for the goods to flow through from the factory to the consumer. And if the goods do not flow freely and rapidly and by the most convenient and economical route, with adequate compensation to the distributor, everybody suffers. The cost goes up and the service breaks down. Distribution is vital to the manufacturer, vital to the central station, vital to the industrial plant and vital to the contractor and dealer.

The point is that our scheme of distributing has got into a jam that is slowing up the industry, running up costs and making waste, confusion and hard feelings. So every industry is now grappling with the problem. The hope is that a real study will develop a way to combat some of these wasteful trade customs and to perfect our processes of distribution to a point where we shall not only manufacture and mine and grow efficiently, but transport our products as economically to their markets.

But how is it going to be done? Not by discussing generalities, but rather by probing around to find the definite causes of the specific kinds of trouble. We have got to go at it and systematically quit doing the things that are economically wrong and begin doing the things that are economically right, even though at the outset it may hurt. This is precisely the prospect in the electrical industry.

This distribution tangle of our own will never be unsnarled until the jobber himself does a number of definite things that he has felt that he could not do. And the manufacturer who sells to this jobber and the central-station companies, industrial plants and contractor-dealers who buy from him have got to do other specific things which they won't find it either easy or convenient to do. But it must be their contribution to the cleaning up of this mess that all men are so eagerly clamoring for somebody else to straighten out.

CONDITIONS THIRTY YEARS AGO

What these things are is not hard to set down. First, however, consider this simple background picture of the true underlying origin of the present predicament among our own jobbers.

Thirty years ago all the jobbers sold practically all the products of all the manufacturers, with the exception of the larger apparatus. It was an ideal condition. There were only a few manufacturers. Jobbers were established with their warehouses in the centers of distribution, and they provided stock to all the retailers, who in turn served the consumers. It was a perfect set-up and everything was merry. But the electrical industry insisted on growing.

One day there came a new salesman from a new manufacturer and knocked on the jobber's door. The jobber examined the samples he brought and said to himself: "The stuff looks all right. But it is going to compete with Tom. Good old Tom! I've sold his switches (or sockets, or wire) for seven years. I'm not going to carry this new stuff that's going to worry Tom." And all the other jobbers felt the same way, so they all turned the salesman down.

DUPLICATING DISTRIBUTION

But the industry kept on expanding, and more salesmen came along with more new duplicating lines, and all the "old-line manufacturers" hustled around to see the "old-line jobbers" and signed them up on contracts, written or oral, under which they agreed to sell no competing goods. Together they built up a wall against the upstarts that they began to call the "outside manufacturers."

And what did these "outside manufacturers" do? Why, being independent American citizens, they naturally said, "All right, you 'old-line' jobbers. We'll just whirl in and build up a set of brand-new jobbers for ourselves." Which they did—and year after year, line after line, it has gone on until today. I understand that there are no less than ninety-seven concerns in New York City alone which consider themselves electrical jobbers and are recognized as such by one or more manufacturers. Probably there are not more than twenty of them that are actually performing the economic functions of a jobber by warehousing goods, publishing a catalog, sending out traveling men, extending credit and rendering the other kinds of essential jobber service. Most of them are able to exist because of their low overhead and the fact that they combine both wholesaling and retailing and catch many chance pennies.

When you get right down to it, therefore, it is the jobbers themselves who are at bottom to blame for having incited the propagation of excess jobbers by deliberately walling out new manufacturers with parallel lines from the use of the established channels of distribution. They overlooked the fact that the jobber has a responsibility to his industry as well as to the manufacturers whose goods he sells, and an obligation to the public to provide distribution for all worthy goods in so far as possible for the better service of the market.

WHAT THE JOBBER SHOULD DO

There comes a time, of course, when no jobber can take on more new goods that duplicate his stock because parallel lines eat up his profit. But this barring them out entirely led to the establishing of new jobbers with incomplete stocks, and these new jobbers sought more lines, which in turn encouraged more manufacturers to enter the field, and so the snowball that the jobbers started has gone on rolling up until today it has grown bigger than the baby.

That is the situation which confronts the industry. Now the question is, What can be done about it? There are ten things to be done by the jobber, I believe, before he can ever pull himself out. There may be more, but these are fundamental and offer him at least a place to start. And the manufacturer who sells to him and the utilities and industrial plants and contractor-dealers who buy from him must take hold with him and do their constructive parts also to make it possible. But the jobber himself must make the move by setting courageously to work to put his house in order for himself in these ten ways. He must:

1. Buy in larger quantities.
2. Sell in larger quantities.
3. Reduce the number of factory shipments.
4. Restrict himself to wholesale business only.
5. Confine his activities to his natural territory, within which he can operate intensively at minimum expense.
6. Either organize his appliance and radio departments so that he can constructively pioneer and merchandise these specialties or let them alone and concentrate on jobbing staple supply lines.
7. Provide distribution for all worthy goods in so far as possible without unduly duplicating stock.
8. Stop fostering and nourishing his own competitors by selling goods at a cut profit to imitation jobbers for resale by them at wholesale.
9. Undertake the selective development of his contractor-dealer customers by supporting them in their local situations and not building up competition for them indiscriminately.
10. Stabilize demand by the development of regular customers in the trade who buy practically their entire requirements from the one distributor, by giving special service in recognition of the economic advantage of such a relationship.

He should also render conscientiously the full functional service of a jobber, which is as follows:

A. *Service to the Manufacturer.*

1. Catalog all products in one book to make the purchaser's selection easy.
2. Carry these diverse products in large local stocks and give the manufacturer a nearness to the market that he could not maintain unaided.
3. Reduce his selling expense through the activities of the jobbers' salesmen.
4. Assume responsibility for quality, vouching for the distant manufacturer to many local customers.
5. Assume a credit responsibility, carrying a great many small scattered accounts.
6. Buy in large quantity and standard packages and assist the manufacturer to a uniform production and lower costs.

B. *Service to the Central Station, Industrial Plant and Contractor-Dealer.*

1. Function as a purchasing agent by selecting and gathering from reliable sources the full variety of the materials they require.
2. Enable these purchasers to satisfy all their needs from one convenient point without the delay and detail of buying from any distant factories.
3. Relieve customers from carrying large assorted stocks in their own warehouses.
4. Provide through a catalog a practical directory to aid in purchasing.
5. Travel the local territory intensively and bring the market to all doors.
6. Render emergency credit, selling and operating assistance and advice through a staff of specialists—especially in times of stress.

MUST HANDLE LARGER QUANTITIES

Men, of course, will shake their heads at much of this and argue different points. The objections will come, but I believe the answers are clear.

1. The jobber *should* buy in larger quantities because he is in the wholesale business. He must provide

volume to the manufacturer in standard shipments. He has no right to order in retail quantities. That is not his job. And if he cannot finance larger orders and larger stock, his first move had better be a visit to his banker. The manufacturer has been much to blame. During the war, when he was hard pressed to make deliveries, he was willing to make small shipments, but the practice is not now necessary; it is wasteful, and he must close down on it.

2. By refusing to continue filling orders for a twelfth of a dozen the jobber *can* sell in larger quantities. He must maintain his position as a wholesaler to his trade. The inclination is to meet all calls for accommodation, but it cannot be done at a profit, because it costs money to break up standard packages. If it cannot be done at a profit, it should be discouraged and discontinued, and the customer who asks for these small orders must realize that it is as wasteful for him to buy this way as for the jobber to sell this way. He must stop demanding it.

3. By recognizing the fact that the jobber is not supposed to be a broker but a wholesaler and a warehouser, factory shipments *can* be reduced. Where large unit shipments can be more economically routed direct from the factory to the customer, the practice is economically sound. But this should not be habitually done for the purpose of avoiding the jobber's legitimate handling costs by indiscriminately "wishing" small shipments on the manufacturer. The fact that the summary of jobbers' costs recently published by the jobbers' association showed 25 per cent of all the sales of these five houses to have been shipped direct from the factory indicates how general the practice has become.

4. The jobber *can* restrict himself to wholesale business only, by simply cutting out all retail selling and all contracting—which is not his function—and ceasing to compete with his own customers. Many jobbers have done it. All jobbers can do it if they honestly want to be jobbers and will make the rule and stick to it.

SPECIALTIES AND TRADE PRACTICE

5. The jobber need not quit the appliance and radio business, if he will carry it on in a constructive and creative basis, but otherwise it will be profitless. He cannot make money with any spread that possibly could be provided. What is the use of talking about discounts and percentages of profit when the volume of the business is decreasing steadily in so many jobbing houses? Discounts will mean nothing unless the jobber will organize to do the business in the only way it can be done, which is by actively pioneering and merchandising these specialties in co-operation with the retailer. On this basis it can grow and prosper, but on any other basis the business cannot succeed. If it cannot succeed, it had better be dropped and full attention given to staple lines.

As to the other points suggested, they have proved themselves in many industries as economically sound. A straightforward policy of sustaining a proper standard of prices should make the jobber unwilling to sell to the imitation jobber in the next or the same town, with a sacrifice of all his profit save perhaps the cash discount. Yet it is being done extensively. A good rule to make is that no goods shall be sold except for resale at retail or for the purchaser's own use, as in the case of the contractor and industrial plant and utility.

Likewise a forward-looking policy of service and market development will guide the jobber in the selection of good dealers as his retail outlets and will steer him away from the "curbstoner" and "fly-by-night" who sets up an unmeetable competition against his established and prosperous trade. And it will encourage him to establish permanent connections with customers who depend on him for the bulk of their business year after year on a basis that entails the minimum of selling and service costs.

NOT A PLEASANT DUTY

It will not be pleasant for the electrical jobber while he is setting up these rules and fighting for them, but conditions in his business are not particularly pleasant now. And the only way to stop losing money on every bad business habit is to quit the habit, and the only way to better the situation is to make it better. It is a job to be done, and the men who sell and buy from each jobbing house will have to do their parts also—not just to help the jobber, but because they themselves are in this distribution problem up to the neck and will be compelled to work their way out of it too!

And, mind you, I am not saying that the adoption of these policies will automatically eliminate the imitation jobbers from the field and reduce the excess duplicating distribution. Only time and the stresses of hard competition can do that. There are too many jobbing concerns today to make it possible for all to live and prosper. Therefore, those who cannot live will die. But I do say that it will be the influence of right economic policies and practices like these that will determine who shall survive. It is the best business men who will ride out the present bad weather, the jobbers who are conducting their enterprises in accordance with the fundamental economic principles which no man can long defy.

Cost of Fuel and Power in Industrial Plants

IT APPEARS from data recently issued by the Interstate Commerce Commission that in most industries the cost of fuel and rent of power constitutes about 25 per cent of the total cost of production. The glass industry reports that only 10.7 per cent of the total cost of production may be attributed to fuel and rent of power. On the other hand, as is to be expected, the manufacturing of illuminating gas calls for a very high expenditure in fuel and rent of power. The accompanying data give detailed figures on these and other industries.

PERCENTAGE WHICH COST OF FUEL AND POWER CONSTITUTE OF TOTAL COST OF PRODUCTION IN VARIOUS INDUSTRIES

	(a) Total Cost of Production	(b) Total Cost of Materials	(c) Fuel and Rent of Power	(d) Percentage C Is of A	(e) Percentage C Is of B
Brick and tile, terra-cotta, and fire-clay products	$110,039,370	$42,723,178	$23,753,969	21.6	55.6
Lime	15,113,390	7,557,670	3,534,377	23.4	46.8
Cement	78,737,724	51,986,798	20,271,662	25.7	39.0
Gas, illuminating, heating	134,498,941	76,779,288	53,894,193	40.1	70.2
Glass	102,103,449	46,016,504	10,934,928	10.7	23.8
Ice, manufactured	40,479,189	17,555,004	11,340,469	28.0	64.6
Iron and steel; blast furnaces, steel works and rolling mills, forgings not made in steel works or rolling mills	1,143,358,961	870,016,649	145,862,858	12.8	16.8

Trend in Relay Protection

Protective Devices Committee of the A. I. E. E. Finds that Differential Schemes Are Becoming Most Popular—All Classes May Be Grouped Under Four Divisions—Great Diversity in Practice Found

DIFFERENTIAL relay schemes are coming to be used more and more for the isolation of defective circuits, according to the analysis which the protective devices committee of the American Institute of Electrical Engineers has made of operating practices. Greater dependence on trouble or fault current to operate relays rather than on time and current settings is evidently due to the increase in size of systems, the enlarged area covered and the consequent number of stations operating in parallel. The greatest development seems to be in the use of the differential-current and differential-power principles, this method insuring that a defective line shall be disconnected instantaneously and that the equipment on one section shall not be affected by trouble in another section.

Considerable attention has been given to disconnecting grounded feeders. This problem has become especially important because of the more general practice of grounding systems, particularly where a comparatively high ground resistance is used, resulting in ground currents which may be less than full-load value. It has been necessary to devise schemes which will disconnect the grounded lines before the trouble develops into a phase-to-phase short circuit. Another problem which has resulted in the development of a very effective scheme is that of detecting and disconnecting a grounded feeder on systems having an ungrounded neutral. In many instances it is found impracticable to ground a delta system, and this development offers a simple and inexpensive solution of the problem of grounds which might later develop into cross short circuits, ordinarily resulting in serious interruptions.

Classification of Relays

All the schemes of relay protection may be placed in one or the other of the following classifications: (1) Over-current and directional relays in combination; (2) differential current; (3) differential power; (4) ground-relay, and (5) over-current and under-voltage relays in combination.

Protecting Parallel Lines.—One company uses a two-coil differential-current relay scheme which for proper functioning must have more current flow in the faulty line than in the healthy line. One solenoid of the differential-current relay and one induction-type overload current relay are connected in series with a current transformer. Each set of contacts on the differential relay is connected in series with the contacts of the corresponding over-current relay. The contacts of the over-current relays, however, are normally short-circuited by pallet switches in the circuit breakers when the breakers are closed. Thus the differential relay will discriminate between lines in case of a short circuit or ground involving only one line.

The advantages of this scheme are the elimination of potential transformers in time settings, but the relay scheme will function properly only where an unbalance of current is assured under all faulty conditions.

CALIBRATING TIME-LIMIT RELAYS IN A STATION

Another type of differential relay used on outgoing parallel circuits consists of three coils whose plungers are attached to the ends and middle of a balance arm on which the contacts are mounted. Current through the two end coils tends to hold down their plungers. The center coil is differentially connected or wound, and with a current of equal value in the two windings no force is exerted on the plungers. The plunger of this coil has an adjustment for pick-up value. When a fault occurs on one line, the force in one end coil and in the middle coil increases, so that the one end coil holds down that end of the arm while the middle coil raises its plunger and pivots the arm about the end coil, thus making contact in the proper direction to trip out the defective line. A modification of this type of installation is the inclusion of a fourth similar relay connected in the same manner to the neutral lead of the current transformer to operate more sensitively in case of a ground. This method has been extended and modified to the protection of three or more lines in parallel.

The same selective differential principle can be used with the induction-type relay which makes use of one differential relay connected between the two lines with an over-current relay in each line, so that the system will be sectionalized even if trouble should occur on the bus. The differential relay does not directly trip the circuit breaker, but is arranged to decrease the time setting of the proper over-current relay, thus allowing this latter relay to trip out its circuit breaker. The over-current relay is of the induction type, equipped with the so-called "torque compensator" for the purpose of giving it a definite time of operation. This torque compensator is short-circuited by the operation of the differential relay, thus allowing the over-current relay to operate very quickly. When one line is out of service the differential relay is disconnected and the over-current relay will operate in the time for which it is set.

One company has thirteen pairs of lines protected on both ends by these relays, some of which have been in service for three years. There have been about fifty correct operations and no interruptions to service due to incorrect operation. The scheme has the advantage of being quick in operation, does not require the use of potential transformers and is particularly useful on tie lines between generating stations. It has the disadvantage of requiring interlocking circuits between the circuit breakers to prevent operation when only one line is in service. Likewise, it cannot be used on the substation end of duplicate lines unless there is an additional source of power in the substations.

Another company reports the installation of a differential-current system for the protection of three or more parallel lines. This is a scheme particularly adapted for clearing a defective line instantaneously on account of the extremely sensitive character of the synchronous load on the system. It is based on the principle that the current of the line becomes unbalanced relative to the same phases of other parallel lines when a fault occurs on it, whereas the currents in the other parallel lines will remain balanced with respect to each other. Therefore, an arrangement of differential relays coupling a feeder with other parallel feeders and having the trip circuits of these relays interconnected in such a way that their joint action will trip the unbalanced feeders will be able to select and clear such a faulty feeder without disturbing the remainder of the system. The action of the relays will occur either simultaneously at both ends of the line or in succession, depending upon the location of the fault. The relays used are of the magnetic differentiation type, that is, relays with two independent current coils normally buckling each other. The same action can be obtained with electrical differentiation by connecting the current transformers in series and shunting the relay across them.

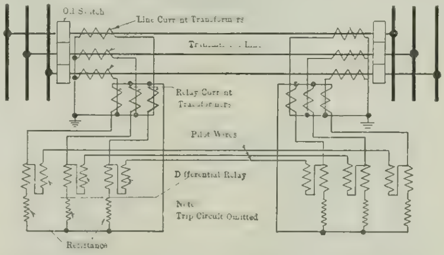
Split-Conductor System Satisfactory.—The so-called split-conductor method of protection gives promise of disconnecting a defective line at an earlier stage in the development of a fault and more quickly than is possible with over-current and differential relays. Results from the installations, however, indicate that the cost of the cable and the fact that it is difficult to obtain extra lengths in cases of emergency obviate many of the advantages. All of the split-conductor installations have proved satisfactory. One company reports that this method does not require tapered time settings for selectivity, and thus there may be any number of substations in a loop or in tandem. Neither does it require the calculation of short-circuit currents for relay setting, and it is applicable to any number of lines. Additional lines may be added without any change in the wiring or relay settings of the lines in service.

The system is more expensive by about 20 per cent than standard cable with over-current and directional protection, and it requires special apparatus. It does not protect against bus short circuits, and therefore over-current relays must be used if such protection is desired.

One company tried out a pilot-wire scheme on the balanced-voltage principle, but after a thorough test superseded it by using another pilot-wire system on the balanced-current principle. This system makes use of a special differential relay having two coils with equal currents and connected so that under normal operation the current through these two coils will be equal but in opposite directions.

A pilot-wire scheme using three pilot wires will operate no matter what may be the nature of the fault. It is estimated that fully to protect a 10,000-ft. (3,000-m.) length of cable by three pilot wires the cost would be 170 per cent of the cost of a directional relay installation. The scheme has been put on sixty lines using two pilot wires and on four lines using three pilot wires, and in many ways a great many advantages have been realized, the only disadvantages being high cost and operating difficulties in the case of long-distance lines.

Differential Duo-Directional Relay Scheme.—Several companies reported installations of differential duo-directional relays. No special equipment is required, standard over-current directional relays with double-throw contacts on the over-current element being used. If protection against balanced or bus faults is desired, over-current relays may be inserted in each transformer secondary circuit. Experience with these schemes tends to indicate that it is necessary to install locking relays which will make inoperative for a definite time the circuit-breaker trip on one line when the relays are actuated to trip the other line of the pair.



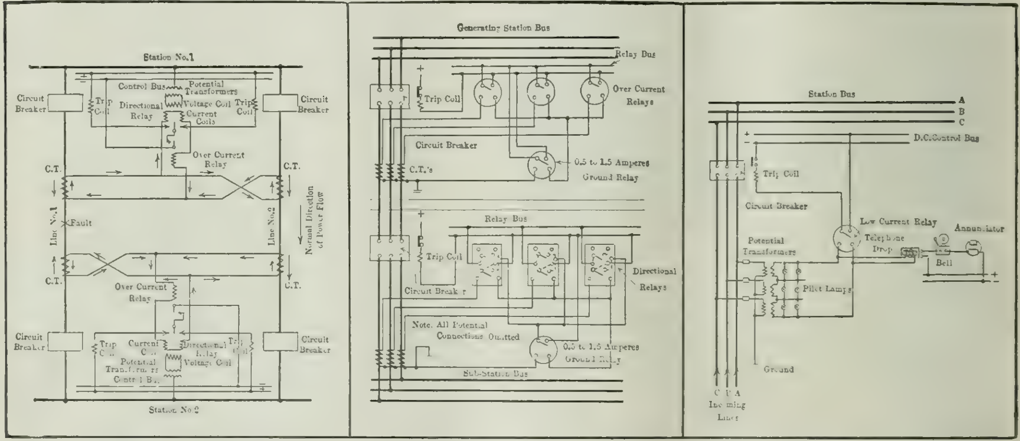
THREE PILOT WIRES WITH DIFFERENTIAL RELAYS REQUIRE NO SELECTIVE TIME SETTINGS OR SHORT-CIRCUIT CURRENT CALCULATIONS

Selective Ground Relay Protection.—When a system neutral is grounded through a comparatively high resistance the usual over-current relay set for short-circuit protection may not be able to operate in case of a ground fault. In such instances it appears to be accepted practice to connect a residual relay in the neutral lead of the current transformer secondaries. This relay will be energized only in case of a ground on the system and accordingly may be set for a very much lower value than the phase relay. To these residual relays time and current grading may be given in the same manner as to the phase relays. The general practice is to use phase relays in each of the three phases and residual relays in the neutrals.

On a 23,000-volt cable system looping frequently through substations and further interconnected into a network so extensive and complicated as to involve rather high and difficult settings the pilot-wire protective ground scheme has been installed in five of the shorter sections and operated with good satisfaction. Another company reported a trial installation of a selective ground relay scheme with the expectation that faults of slow development would be cleared at an earlier stage than is possible with phase relays, thus preventing trouble from being communicated to nearby lines and the system from being subjected to severe shocks.

The installation was made on five lines with a voltage of 26,400, with neutrals solidly grounded at the generating station. The ground relay is connected in the neutral of the current transformer bank, and where over-current relays are used their contacts are paralleled with those of the ground relays. When the over-current directional combination is used the ground relay contacts are arranged to short-circuit the over-current element, thus leaving the wattmeter element to discriminate as to direction of power flow. No special equipment is necessary except that the directional relays are equipped with an extra terminal which taps the trip circuit between the contacts on the two elements. Even after the system was grounded to a 150-ohm. ground resistance it still operated with satisfaction.

Potential Ground-Relay System.—A unique new ground-relay system has been devised to protect underground three-conductor lead cable from excessive potential strains upon the conductor insulation of the other phases when a ground develops on one phase. This was placed in operation on a 15,000-volt system with each line isolated from the other parts of the system. Since the system is undergrounded, virtually no ground current flows when a ground occurs, but the potential between the other conductors and sheath is raised from star to line voltage. No special equipment is used, all apparatus being standard and the relay is of the over-current induction type with a minimum operating current range of 0.5 amp. to 1.5 amp. When a ground occurs on one phase the potential transformer on that phase becomes short-circuited, since the primary side of the potential transformers are connected in star and the neutral grounded. This in turn causes a current of low value to circulate through the potential transformer secondaries, which are connected in delta through the over-current relay. Thus the relay will operate for a ground occurring on any phase and clear the defective line at once.



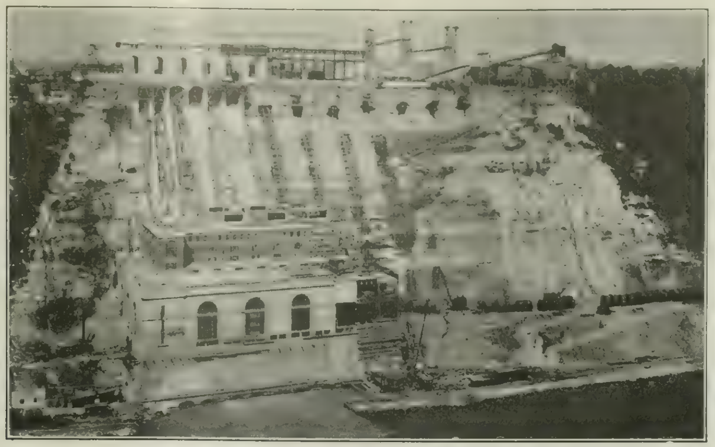
LEFT—DIFFERENTIAL DUO-DIRECTIONAL RELAY SCHEME IS BEING TESTED IN PRACTICE. CENTER—GROUND RELAYS SHORT-CIRCUIT THE OVER-CURRENT ELEMENT WHEN THE GROUND OCCURS SO THAT THE WATTMETER ELEMENT CAN ACT. RIGHT—POTENTIAL GROUND RELAY TO PROTECT UNDERGROUND CABLES

This system operated very satisfactorily, but has been abandoned in favor of the scheme which will discriminate between lines and thus permit paralleling. This installation has a threefold advantage in that it is simple in detail, is quick to remove trouble and functions without requiring any appreciable current in the fault; but it has one great disadvantage in that in case of a ground all the apparatus which it protects is disconnected, and therefore it prevents paralleling of feeders.

On 80 miles (128 km.) of underground 12,000-volt system and the same amount of overhead distribution, all ungrounded, a ground selector relay scheme was installed. Since the system was delta-connected, grounding transformers could not be used except at excessive cost, and after thorough study it was decided to adopt the ground-selector scheme. The principle of this scheme is that any ground occurring on the system will immediately be developed into a short circuit by automatically grounding another phase of the base station and artificially completing a short-circuit path through to the second phase.

Short-circuit current will then flow out into the fault operating the phase relays and clearing the defective feeder in the same manner as if it was short-circuited. The artificial ground is made at the base station bus through an oil circuit breaker which is automatically opened as soon as the defective feeder is cleared, thus restoring the system to normal condition. The circuit breaker is connected to ground through a very low-resistance water rheostat which does not appreciably affect the magnitude of the fault current under the most limited current conditions, but has the advantage of sustaining the busbar voltage in case of grounds near the base station, thus helping to keep the synchronous load in step.

This scheme has effectively cleared a total of eighty-six grounds and has proved very satisfactory. The method of automatically sectionalizing transmission lines by making use of under-voltage and over-current relays described in the protective devices committee report submitted in 1919 has been utilized by one company, and the operating performance has been about 85 per cent perfect, although conclusive data are not as yet available.



The hydroelectric power plant at Queenston in June—a visit to this plant was one of the interesting features of the convention.

A. I. E. E. Focuses Attention on Machine Rating and Breaker Performance

Characteristics of Cable Insulation, Fundamental Requirements of an Engineering Education and Lighting Without Glare Also Draw Forth Intensely Interesting Discussions—Other Subjects Round Out One of the Most Unusual A.I.E.E. Programs

WHAT constituted, in the opinions of many delegates present, one of the most intensely and widely interesting conventions ever assembled by the A.I.E.E. was held at Niagara Falls, Ontario, last week. The attendance of 955 persons almost equaled that of the Chicago convention in 1911, which holds the record so far. No one phase of electrical engineering was overstressed, the chief topics of interest at this time were considered, and the sequence of presentation was very well arranged. The most striking thing was the unanimous acceptance of the electric machinery sub-committee's recommendation regarding rating of rotating machines. The discussions on this subject and on performance of circuit breakers, cable insulation and engineering education constituted the high points of the convention, aside from what was reported in the last issue of the *Electrical World*. Abstracts of important papers and discussions follow.

Rating and Temperature Allowance

A RECOMMENDATION from the elcetric machinery sub-committee was presented by F. D. Newbury that 80 deg. C. (measured by embedded detectors) be adopted as the A. I. E. E. standard for allowable temperature rise of turbo-generator stator coils having class B insulation. This recommendation, Mr. Newbury pointed out, is a compromise result which was worked out in recent committee meetings composed of representatives of all those interested.

The unanimous accord which was given the electric machinery committee's proposal was the most remarkable feature of the discussion on rating of rotating machinery. Not a single expression of opposition was raised among the several hundred delegates attending the discussion. As B. A. Behrend pointed out, this subject of permissible temperature rise had seemed almost impossible of settlement* two or three days prior to the convention but had finally been cleared up in subsequent committee meetings by the broad-minded co-operation of representatives of all interests concerned. Nothing but commendation of the electric machinery committee's proposal was heard on the convention floor, it being heartily indorsed by such men as W. J. Foster, L. T. Robinson, R. B. Williamson, H. L. Wallau, H. G. Reist, B. A. Behrend, W. F. Dawson, F. D. Newbury and Philip Torchio. Several persons referred to the happy conclusion as the result of Philip Torchio's persistent and tireless effort to secure a modification of the present A. I. E. E. ruling.

Practically the only comments presented were warnings to use caution in applying this or any other temperature allowance. For example, W. McClellan pointed out that too early standardization might hinder progress, while both he and H. G. Reist raised the question of whether it is advisable to standardize on the maximum allowable temperature. In line with this comment, James Lyman maintained that reliability is the most important consideration, but W. F. Dawson declared that a user must not be so conservative that he sacrifices the return he can obtain from his investment.

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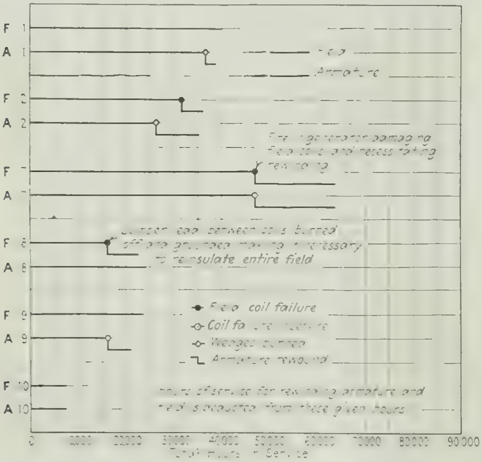
*This will explain any discrepancies between this discussion and abstracts of papers which follow under separate headings and which were prepared prior to this discussion.

H. G. Foster warned about distinguishing between long and short cores in applying the proposed allowance and also declared that one cannot depend on a 15-deg. difference existing between hot-spot and observable temperature. To this warning C. E. Skinner added that the temperature of solid conductors may be greater than the permissible value if based on the allowable observable temperature due to eddy current losses.

To relieve any impression that temperature detectors are erratic in their indications, Philip Torchio cited tests on four large machines in which the maximum difference in reading between resistance detectors similarly placed in the same machine was only 4 deg., while that of thermocouples was only 3½ deg. As observations of ambient temperatures in New York during one year had been cited during the discussion as averaging about 20 deg., H. L. Wallau warned against any one's assuming that this condition exists generally. He pointed out that the average is much higher in many parts of the country—more nearly the adopted standard. L. T. Robinson called attention to the need of distinguishing between machine rating and operating capacity when considering allowable temperature rise.

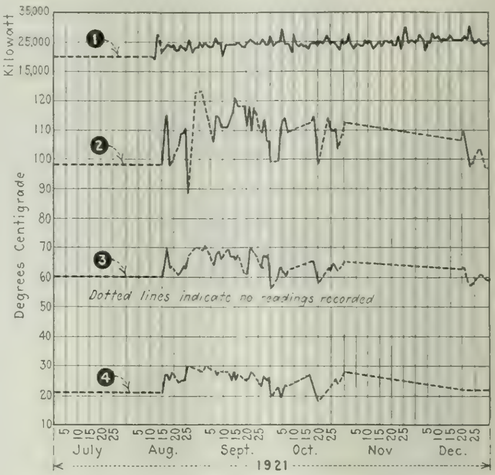
Too much regard is held for laws of material and too little for those of human nature, said R. F. Schuchardt. In line with this remark, R. B. Williamson, H. L. Wallau and F. D. Newbury emphasized the fact that temperature alone should not be the only consideration. Equally and possibly more important are the effects of vibration, expansion and contraction and ionization. More observations of actual performance under these conditions are absolutely essential before definite conclusions can be reached, Messrs. Newbury, Foster and Schuchardt contended, those presented by Mr. Torchio being cited as of a most valuable nature. Another factor which needs consideration, observed W. F. Dawson, is the aging of steel due to temperature.



LENGTH OF UNINTERRUPTED GENERATOR SERVICE IN CLEVELAND, INDICATING FINAL CAUSE OF SHUTDOWN (WALLAU)

Based on his experience with transformers, he declared that non-alloy steel will not withstand 150 deg. C. without increase in core loss.

Since a number of speakers mentioned their pleasure at returning to a temperature-rise basis of rating, H. M. Hobart took the entire assembly to task in his usual entertaining way by catechizing those present on their knowledge of the present A. I. E. E. basis of rating. He pointed out that it is already founded on temperature-rise and will merely need slight changing in words. Temperature is only one small consideration in design, he declared. So far only one class of machinery has been considered and only one-half of that, namely the stator. If rapid progress is not made in attacking the remainder of the problem, the character of insulation may be entirely changed and all the deliberation will be for naught.



FIELD TEMPERATURE WAS THE LIMITING FACTOR IN GENERATOR OPERATION AT CLEVELAND (WALLAU)

Defending the committee for what it has already accomplished, W. F. Dawson said if it had not originally overshot the allowable limit of temperature in its desire to be progressive, the A. I. E. E. might always have felt that the limit could be raised still higher and standardization might have been ten years off instead of an accomplished fact.

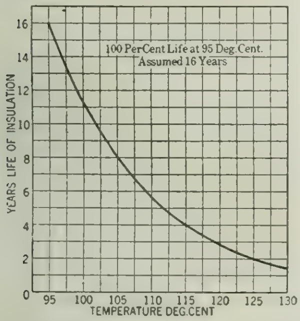
Closely related to the subject of allowable temperature rise were some figures which H. L. Wallau presented on the performance of machines at Cleveland. Four of the older generators have operated from four and six-tenths years to nine and one-half years apiece without any trouble, while the more recently installed machines have operated from one and seven-tenths years to five and one-half years without trouble. According to some temperature measurements made on these machines, field temperatures as high as 109 deg. C. (resistance method) have been observed. The maximum armature temperature rise observed has been 69 deg. Of the armature trouble which has been experienced, practically all has been caused by pulverization of insulation from vibration or expansion and contraction and ionization due to air pockets.

The effects of overloads on the internal temperature of rotating machines and on the life of insulation and the bearing on the relative merits of single and double rating were discussed by Jean Canivet, one of the representatives of the French National Committee of the International Electrotechnical Commission. He pointed out that an increase in copper temperature due to load is not accompanied by a proportionate increase in observable temperature as measured by a thermometer on the core. In fact, the difference may be so great that it may be hazardous to the insulation to allow overloads without carefully checking the relation to observable temperature. Hence the temperature limit will have to be fixed to prevent overheating.

While he referred to Italian laboratory experiments indicating that insulation can be subjected to temperatures 10 to 20 per cent higher than is allowed by the International Electrotechnical Commission recommendations, he said that the French tolerance is the same as that of the I. E. C. No overload or double rating is allowed. As a result of this practice the number of breakdowns has been reduced more than could be attributed merely to improvements in insulation. He concluded by saying that French engineers are strongly in favor of the I. E. C. rules on this subject.

Reliability the Criterion for Generator Rating

DESIGNERS of high-voltage turbo-generators must approach the problem of rating from the standpoint of producing machines of highest reliability. To this end, Philip Torchio asserted, central-station engineers should co-operate with the manufacturers in standardizing for all bidders the same limit of temperature and thus place competitive business on equal terms. The present Institute rule, which specifies 85-deg. copper rise for mica installations but also allows 110 deg. C. subject to special guarantees is, in the opinion of Mr. Torchio, not correct. Only one standard should be adopted in the best interest of all. The limiting copper rise of 85 deg., which corresponds to the present conventional limiting temperature of 125 deg., for the conventional 40-deg. standard ambient temperature appears to be the maximum safe limit dictated by reasons of both economy and safety. With this conventional limit of 125 deg. it should be understood that in practice the temperature of the inlet air expected would be about 20 deg. instead of 40 deg., so that the actual operating temperature would be about 105 deg.



OPERATION AT LOW TEMPERATURE INCREASES LIFE AND RELIABILITY (TORCHIO)

While nominally a machine designed for cool temperatures is somewhat more expensive to build than a machine designed for high temperatures, Mr. Torchio said, the slightly increased cost is more than balanced by the greater service reliability and efficiency. The insulation is the weak point in most generator ratings, and its life is affected by voltage, temperature and time, and vibration and mechanical stresses. Since any of these three elements may cause insulation breakdown, the life of insulation is very largely determined by the specific conditions. A tentative life curve of insulation based on many researches would roughly indicate that, with fibrous insulation and other things being equal, a machine operating at 105 deg. will have a life half that of a similar machine operating at 95 deg. Similarly, if a machine is operated 90 per cent of the time at 95 deg. and the remaining 10 per cent of the time at 115 deg., the life of the machine will be 77 per cent of the virtual life at 95 deg. for 100 per cent of the time. Because of these relations it will be seen that the double rating may have practical advantages.

According to similar studies on mica insulations, there appears to be no doubt, excluding the influence of ionization due to voltage and mechanical stresses, that they can safely withstand almost indefinitely high temperatures, probably as high as 200 deg. But from research and experience Mr. Torchio has reached the conclusion that safe operation requires that the copper temperature shall not exceed 105 deg. for mica insulation in high-voltage turbo-generators and that temperatures around 150 deg. are unsafe.

Temperature Allowances Apply Only for Specific Conditions

EXPERIENCE in developing standards of machine rating has shown that it is impossible to specify a single temperature allowance (i.e., the difference between the hot-spot temperature and the highest temperature that it is practicable to measure) that will satisfy all the practical situations which can arise. As a result F. D. Newbury and other members of the sub-committee on rotating machinery of the standards committee have attempted to determine an exact value for a particular method of measurement when applied to a given class of alternating-current machine stator windings for given temperature limits. The work involved the measurement, in machines of various sizes and voltages, of copper temperatures inside the coil insulations, observable temperatures between the two coil sides in a slot and an investigation of the importance of various factors such as insulation thickness, eddy-current losses, core length and core temperature. This study was accomplished by using a small model in

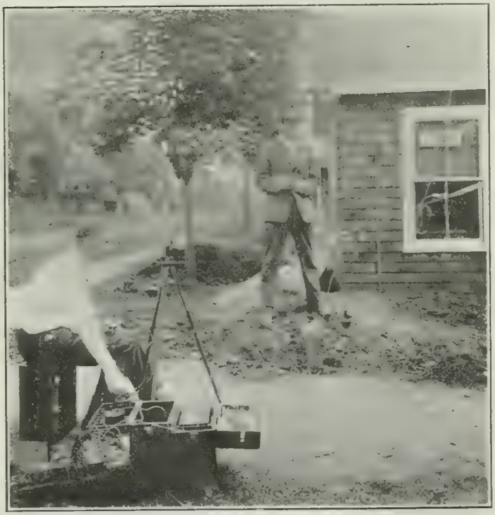
FALL OF POTENTIAL RESISTANCE MEASUREMENTS SERVE AS CHECKS ON TEMPERATURE READINGS which these several factors could be very conveniently studied.

It was concluded that the conventional allowance can be calculated with a fair degree of accuracy for any machine when the following data are available: (1) Observed temperature rise by detector between coil sides; (2) observed temperature rise of tooth by detector at side or bottom of slot; (3) ratio of copper loss to coil surface (watts per square inch); (4) eddy-current losses; (5) thickness of insulation; (6) length of core. The investigation also indicates that the conventional allowances which have been proposed for use in arriving at limiting temperatures are inadequate.

In connection with this paper Mr. Newbury presented some questions relating to standards of rating for machines using class B insulation. Most of his discussion was on the basis for eliminating the present statement regarding conventional allowances and substituting 90-deg. rise in place of the double rating existing in the present rule, which allows an 80-deg. rise for a 125-deg. hot-spot temperature and 105-deg. rise with a 150-deg. hottest-spot limit.

Measuring Temperature of Apparatus Under Operating Conditions

THE procedure for determining the temperature of equipment of large public utilities was described by E. J. Rutan, who also discussed the relative merits of measuring devices. He declared that the thermometer method is the simplest and most convenient to use and may be divided into the types corresponding to the different kinds of thermometers, such as the indicating (mercury or spirit), the recording, or the maximum and minimum indicating of the constricted and Six type. Mercury indicating thermometers of the gas-filled type are preferred for most work. Spirit thermometers are calibrated for full immersion and are used where air or low temperatures are desired and where there is danger from high voltage. The resistance thermometer or thermocouple is used where apparatus is inaccessible or where there is hazard from high voltage. In general test work the thermocouple has proved more useful than the resistance thermometer. Acceptance tests should be made on the thermocouple wire when received, and precautions must be taken to see that the temperatures desired are accurate to within one degree.



FIELD TEMPERATURE MEASUREMENTS ON CABLES REQUIRE CARE

For circuit breakers the thermometer method seems best to use; for cables a combination of thermometers and thermocouples together with direct-current fall of potential-resistance measurements are used to obtain a knowledge of the internal temperature conditions. In places where it is desired to obtain the maximum internal temperature the thermocouple is the best method. This method also proves best for measuring the temperatures of air-blast transformers and for studying the temperatures in the various parts of an underground transmission or distributing system.

Experience with thermocouples has shown that the thermocouple wire must be rubber-covered; that a stranded copper conductor must be used with the constantan wire in making up the couple in order to avoid breakage, and that special care must be taken to secure a strong and high-grade insulation on the thermocouple wire.

Insulating Materials and Temperature Ratings in England

MOST researches in England on insulation have been directed to extending knowledge of its behavior under varying physical conditions, improving its quality, developing better processes, defining the requirements of users and standardizing test methods, according to a paper presented by A. P. M. Fleming, of the Metropolitan-Vickers Electrical Company, Manchester. Moreover, the tendency in machine rating on a temperature basis is to discard the present practice of basing rating on total temperature and to use temperature rise as the basis. Experience also shows that tests on temperature rise should be made under service, not laboratory, conditions if reliable results are desired.

During the war the demand for insulating materials brought about much research of a co-operative nature, and now most research is carried on through the Electrical Research Association, a co-operative body of makers and users of electrical machines and equipment. Work has been done in investigating fibrous materials, composite insulating materials, porcelain, mica, insulating oils, synthetic resins and dielectrics in general as affected by heat.

In industrial machines class A insulating materials are largely used, with some mica in the slot portions. No great advance in quality is expected, but a better and more uniform product is available. Types of pressboard have been perfected and varnished cloth has been produced of a superior quality. It is felt that class A materials have reached their physical limits under the conditions of present practice.

For turbo-alternators the tendency is to use class B materials. Some manufacturers do this only to a limited extent in stator windings. In transformers class A material is largely used, and great progress has been made in getting specifications for a non-sludging transformer oil through refining processes.

In regard to ratings based on temperature, no definite or fixed limits are set. It is felt that accurate data based on service operation must be obtained before progress can be made. However, most engineers feel that rating should be based on temperature rise and not on total temperature as is the present practice.

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Rating of Motors for Use on Random-Duty Cycles

A PRACTICAL method for accurately determining the rating of motors to be used on random-duty cycles was presented in a paper by Bassett Jones. The method is based on the determination of the average value of the operating factor for the group of motors under consideration, where the operating factor is the ratio of the average time the motor is running to the average-duty cycle. This may be determined from an average or from a graphic instrument record. After having established a method of rating the carrying and protecting devices handling the input to a group of motors, it is necessary to determine the heating value of any given intermittent-duty cycle in terms of a continuous duty having equal heating value.

A method is also proposed for rerating current-carrying devices for other than continuous-duty operation.

Breakers and Control

Meagerness of Data Regarding Condition After Test

GREAT appreciation was expressed by all speakers of the courage and broad-minded attitude of the Consolidated Gas, Electric Light & Power Company and Pennsylvania Water & Power Company in conducting the extensive rupturing tests of circuit breakers reported in the July 1 issue of the *Electrical World*. The chief criticism made against the manufacturers' reports on the results was the meagerness of data regarding the condition of the breakers after the test and the troubles which were experienced. While some speakers maintained that the tests were conducted under very severe conditions. at least one contended that the results would have been much more valuable if they had been made under the conditions of unsymmetrical short circuits and unsuppressed disturbances caused by re-establishment of generator voltage and out-of-phase operation of generators. The effects of stored magnetic energy in generators and of the time of switch action on rupturing duty were also discussed.

Emphasis was placed on the value of strong switch tanks and the desirability of definite data on the pressures produced within tanks during short circuits. In this connection it was suggested that future tests of this character be made to include tests on all protective equipment in order to determine the effect of short circuits. Since considerable diversity of opinion still exists regarding what constitutes the duty cycle of a circuit breaker, it was announced that questionnaires would soon be mailed out to the entire A. I. E. E. membership asking for opinions on whether the duty cycle should start by closing the circuit breaker on short circuit or not. Among other things brought out were the increasing rupturing requirements which are developing as a result of extensive high-voltage line construction and concentration of power and the need of information on how to modify existing switches so that the rupturing capacities will be increased.

In announcing the intention of the sub-committee on oil circuit breakers to issue a questionnaire regarding the definition of duty cycle, B. G. Jamieson said that it had been agreed that the duty cycle shall end with the breakers in the open position. However, he contended that it would be preposterous to withdraw the specification saying that oil breakers shall be originally closed on short circuit to start the duty cycle.

The opinion of every speaker who followed was embodied in Mr. Jamieson's remark that "Great credit is due the [above-mentioned] operating companies for the courage shown in permitting their stations to be used and to the manufacturers for co-operation in the tests and their courtesy in making public the results."

OSCILLOGRAPH RECORDS OF BALTIMORE OIL CIRCUIT BREAKER PERFORMANCE WERE MADE HERE (LOUIS AND BANG)

In order that new devices may be made available to compensate or be substituted for breakers beyond their limitations, it was suggested that the functional capacity of oil circuit breakers be definitely determined. Furthermore, there should be no uncertainty as to how a breaker will perform if it is closed on short circuit. Since a dead metallic short circuit is an extreme condition seldom met with in operation, and since the conditions imposed thereby are not comparable with normal ones, it was suggested that considerable benefit would result from making short-circuit tests under single-phase or unsymmetrical short circuits and by allowing the re-establishment of generator voltage and out-of-phase operation of the paralleled generators. Unless more definiteness is given to the effects of such conditions, the rating of circuit breakers on average arc amperes at normal voltage may be brought into question. When other tests such as the Baltimore ones are conducted, Mr. Jamieson urged that other protective equipment be tested at the same time. At present most generating stations are woefully lacking in devices for recording system conditions during disturbances. He concluded by saying that the problem of oil breaker development will be greatly reduced if solid grounding close to the switches is eliminated.

Quite a difference in stored magnetic energy exists in generators when heavily loaded and when lightly loaded, declared A. A. Meyer, who said that this will have considerable effect on the rupturing duty of circuit breakers. In commenting on some extensive tests which were made five years ago at Detroit where rupturing duties as high as 700,000 kva. were encountered, the speaker said that the results did not indicate that standard switches behave as well as one would be led to believe by the Baltimore tests.

Owing to the large ratio of rupture current to normal current in the 4,600 circuits at Cleveland, H. L. Wallau announced that it was necessary to adopt a light high-speed switch mechanism which would open the circuit promptly. These have been successful in rupturing 19,000 r.m.s.amp., he declared. While he, too, commended the operating Baltimore companies for their courage in conducting the circuit breaker tests, he expressed the feeling of a number of other speakers when he said that the manufacturers have not told much about the troubles experienced. Furthermore, he expressed a desire to know how to modify existing circuit breakers so that the rupturing capacity could be increased.

Strong switch tanks were considered by A. H. Hull as being the most important factor in obtaining reliable switch operation, the low-tension and high-tension tanks at the new Queenston plant (see the *Electrical World* for June 24, 1922) having been tested for hydrostatic pressures of 250 lb. and 500 lb. per square inch respectively. Question was raised regarding the pressures which occurred in the Baltimore circuit breakers during test and what happens during phase-to-neutral short circuits.

Because of the short time in which the switches functioned during the Baltimore tests, A. F. Bang said that they were subjected to extremely severe duty. Where the time of operation is extended, rupturing is greatly facilitated, because the current and re-established voltage are reduced thereby and because the synchronous apparatus may drop off and thereby reduce the switch duty. E. R. Stauffacher pointed out that the Pacific Coast switching conditions are becoming almost as severe as in congested Eastern districts because of the high voltages and large power which must be handled. On the new 220,000-volt lines it is expected that as much as 6,000 amp. will have to be ruptured in some cases.

The hope that other operating companies will offer their systems for further circuit-breaker and similar tests was expressed by F. C. Hanker, who differed from Mr. Meyer regarding the effect of stored magnetic energy in generators, Mr. Hanker holding that it influences only the re-established voltage.

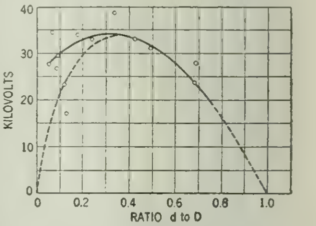
Large parallel feeders are imposing very severe duties on oil circuit breakers, H. H. Dewey asserted. He announced that short-circuit values of 1,000,000 kva. to 1,500,000 kva. must now be considered. The question is whether the duty of the circuit breaker is directly proportional to the kva. or to the kva^2. The cost of oil circuit breakers per kva. depends on the kva. rating of the system, the speaker said, it now being $20 or $30 per kva. compared with $1 to $2 per kva. several years ago. In answer to an oft-repeated question, the speaker said that the rupturing capacities of existing circuit breakers can be easily increased at little expense by making small modifications.

Closing of oil circuit breakers on a short circuit should be incorporated in the duty cycle of circuit breakers, according to M. J. Lowenberg. He said that this had happened twice in succession on one system; hence it is an emergency that must be provided for. He also emphasized the importance of inspecting the circuit breakers immediately after short circuits and pointed out that the very satisfactory performance obtained by the Interborough Rapid Transit system is chiefly due to its systematic maintenance. He also declared that there should be a better balance between heating and rupturing capacity in the old types of circuit breakers.

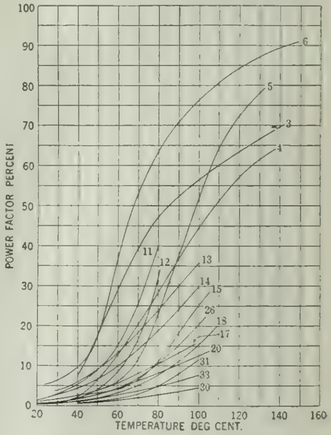
Cable Insulation—Dielectric Strength

Great Stress Laid on Dielectric Loss

FACTORS determining dielectric gradient and losses and their effects on cable breakdown were the chief subjects of discussion at the cable session of the convention. Both commendation and criticism of American and European cable practice and performance were expressed. Reduction of insulation thickness was another subject much dwelt on. The discussion seemed to bring out quite emphatically that there is no such thing as a definite dielectric stress or gradient at which solid insulation will break down. It was also emphasized that a radical improvement in cables will have to be made if the number of failures per unit of length is to be reduced to a satisfactory degree.



RELATION BETWEEN RUPTURING VOLTAGE AND RATIO OF CONDUCTOR TO INSULATION DIAMETER. (MIDDLETON, DAWES AND DAVIS)



DIELECTRIC LOSS CURVES OF 12,000-VOLT CABLES

The highest power factors are from cables impregnated with rosin oil compounds. The lowest losses are from cables impregnated with a mineral oil compound. The intermediate curves are from cables with various mixtures of the two compounds. (Roper)

F. W. Peek, Jr., pointed out that the maximum stress at breakdown is variable, the gradient depending on the distance from the conductor. In solid conductors it is equal to $100\,[(1 + 1.1)/\sqrt{r}]$ where r is the distance from the center of the conductor. This gradient can be modified by various means. J. B. Whitehead declared that when the cause of the breakdown is being sought the components of the gradient should be separated to determine what they indicate. Breakdown voltage may vary as much as 25 to 35 per cent between 25 deg. and 30 deg. C., said A. M. Hamann. Before failure can occur, declared R. W.

Atkinson, the critical voltage stress must exist over a finite portion of the insulation for a finite time. On the other hand, Dr. C. P. Steinmetz contended that breakdown voltage of solid insulation is solely a function of the volt-ampere characteristic of the material. Up to a certain voltage the current may be proportional, then it may increase more rapidly for a period, and finally at a higher voltage may increase so rapidly that breakdown will occur unless retarded by limiting the energy released. This characteristic Dr. Steinmetz proposes to discuss more in detail later, but he pointed out that it offers an interesting opportunity for research.

In reply to Charles F. Scott, who declared that American cable development has not been so rapid as that in other apparatus, and also to the remarks in D. W. Roper's paper which placed European cable manufacturers above American manufacturers in some respects, H. W. Fisher and R. W. Atkinson both declared that many public statements regarding European cable performance had been unfounded. Many so-called high-voltage cables had been operating at less than their rated voltage, said Mr. Fisher, and he also pointed out that the dielectric loss in some foreign 33,000-volt cables is so high that American engineers would not use them. The thin insulation used abroad, Mr. Atkinson said, would not fill American requirements. The performance that European manufacturers are able to obtain is due chiefly to their supervision and control over the methods of installing the cables.

44,000-VOLT THREE-CONDUCTOR CABLES ARE COMMERCIALLY POSSIBLE

B. Welbourn, a British engineer, declared that 33,000-volt cable had been in operation at rated voltage on a 10-mile stretch for some time with a copper temperature of 140 deg. Fahr. and a dielectric loss of only 2 kw. per mile. The dielectric stresses range from 4,400 volts to 5,530 volts per millimeter. The speaker declared that three-conductor, 44,000-volt cables are a commercial possibility and can be guaranteed to operate at less than 1 per cent power factor over the entire operating temperature range, with a maximum conductor temperature of 130 deg. Fahr. The minimum stress theory of breakdown has never been accepted by his company, he said. Since very little attention has been devoted to thermal resistivity, it was urged that the subject have more consideration. Attention was also called to current-loading tables which British engineers expect to present soon applying to cables rated up to 10,000 volts and operating under various conditions.

As indicating what American cable manufacturers might do, D. W. Roper referred to a reduction of 25 per cent in thickness of 22,000-volt-cable insulation. The total thickness is only a trifle more than that on the 12,000-volt Chicago cables. One installation of this cable has been operating satisfactorily for several years.

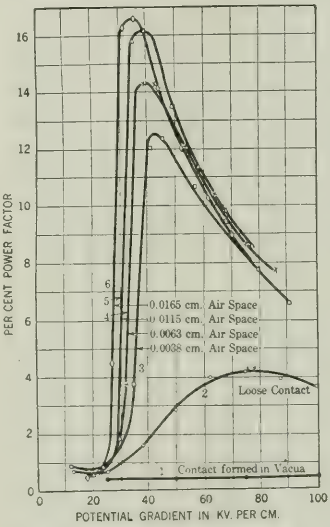
A written discussion from C. F. Proos, a Dutch engineer, pointed out that the wattage divided by E^2 is constant up to a certain voltage, then increases owing to ionization until saturation occurs, when the value again becomes constant. With the cables he was considering the minimum dielectric loss occurred at 37 deg. C. Since cable characteristics depend on the previous operating conditions, it was recommended that tests be made after a cable has been operated at its rating.

W. H. Cole contended that too much stress has been laid on dielectric loss and that other important factors, like the absorption of impregnating or joint-filling compounds, are overlooked. He also referred to a 25,000-volt cable which had withstood 50,000 volts alternating current on test but had broken down during a kenotron test at 16,000 volts direct current.

NEED OF RADIATION CURVES

A need for radiation curves showing the temperature gradient between cable sheath and ambient soil was expressed by G. B. Shanklin, who also expressed the belief that the allowable temperature rise of 85 deg. C. is too conservative for modern low-loss cables. While he felt that cable insulation might be reduced in thickness, he pointed out that the reduction is limited by ionization. The extent of damage produced by this phenomenon is being studied. Contrary to the usual assumption, ionization in the case considered occurred next to the sheath and not next to the conductor.

Investigators formerly experimented alone, now they co-operate, Philip Torchio observed. Mr. Torchio urged that co-operation must become still more extensive if maximum results are to be expected. The operators must analyze their problems and manufacturers must study them.



EFFECT OF AIR-SPACE THICKNESS ON IONIZATION OF CABLES (SHRADER)

Another good tendency, cited by Vladimir Karapetoff, is the recent practice of considering the components of a composite problem individually instead of collectively. Professor Karapetoff also commended the tendency to explain phenomena in terms of the ionic or electronic theories, but discouraged the exterpolation of results on the basis of conditions that do not apply.

Moisture Content in Cables Determines Alternating-Current Resistance

THAT the moisture content of the dielectric is the dominant factor in determining the alternating-current resistance of electric cables was brought out in the paper of Delafield Du Bois. This conclusion was reached by subjecting a pure dielectric, containing minute particles of conducting moisture, to both constant potential and alternating potential with variations of voltage, temperature and frequency.

The investigation led to the conclusion that in a dielectric containing comparatively little moisture dielectric loss would increase in proportion to the square of the voltage, while in a comparatively moist dielectric the increase of dielectric loss with voltage would be at a greater rate. Furthermore, the dielectric constant is not independent of temperature and the conductivity of the liquid increases as temperature increases. Therefore the dielectric loss, if there are many particles of moisture present, would increase as the temperature of the dielectric increased.

Dielectric Losses Cause Cable Failures in Chicago

QUALITY, not quantity, of insulation is needed to prevent cable failures in the opinion of D. W. Roper, who presented a paper on this topic. As a result of many years of experience with cables on the Commonwealth Edison Company system, he has concluded that the chief cause for the internal breakdown of cables has been the increased dielectric losses when the cables have been loaded beyond their critical current and that the cumulative heating which followed caused the cable failure. Normal dielectric stresses have caused very few cable failures, and those failures occurred where, owing to bends, the insulation had been torn.

The permissible operating temperature of cables showing high dielectric loss is limited by the critical temperature above which cumulative heating occurs. In low-loss cables the temperature is limited by the temperature which the paper insulation will withstand without deterioration. Temperature measurements along the cable line are, in the opinion of Mr. Roper, just as important as ammeter or other readings in the power station.

Ionic Motion in Insulation Should Be Restrained

THE effects of the composite structure of impregnated paper insulations on electric properties were presented by William A. Del Mar and C. F. Hanson. The experiments indicated that when the power factor of impregnated paper insulation has been lowered as far as possible by the removal of air and moisture there remains an element which depends upon the resistivity of the oil. This may be explained as due to current which passes inductively through the capacity of the cellulose fibers and conductively through the oil. The experiments also indicated that the oil used in impregnated paper insulations normally contains free ions in considerable quantity and that the failure of impregnated paper insulation may be due to the establishment of streams of ions in the oil.

Therefore, the authors of the paper held, particular care should be taken in the manufacture and design of high-voltage cables to restrain the ionic motion in the oil by using paper of a quality and thickness which will have the maximum baffling effect so applied as to avoid sharp bends or severe mechanical strains and to use oil of a quality such as to make the dielectric loss fairly low.

The discussion of the rating of cables with respect to voltage was supplemented by a summarized history of the published knowledge bearing upon the performance of insulation under electric stress prepared by the sub-committee on wires and cables of the standards committee.

Minimum-Stress Theory of Cable Breakdown Discredited

IT HAS always been difficult to determine exactly the breakdown strength of a particular cable because of the inherent lack of uniformity of insulating material and the effect of time. Many different theories have been proposed to determine an average relation between the dimensions of cable and its breakdown strength, all of which differ materially in their assumptions and in their results. The theory of Fernie was discussed in a paper by D. M. Simons. Fernie concludes from experimentation that his results are best explained in terms of a limiting value of stress at the sheath, namely, the minimum value. In discussing this theory and the data of Fernie Mr. Simons showed that the data do not conclusively prove the minimum-stress theory, and that if it be assumed that the inner layers of insulation may be overstressed without complete breakdown of the cable due to the stable equilibrium of the remainder of the insulation, and that insulating materials have a critical breakdown gradient, a direct result of these two assumptions is that the minimum stress at breakdown is a constant, although this is not in itself a criterion.

The author concluded that Fernie's experimental data are not sufficient to justify his claim that the minimum stress is a constant. If further investigations should prove that it is a constant, the phenomenon could be explained otherwise than by assuming that the minimum stress is a limit.

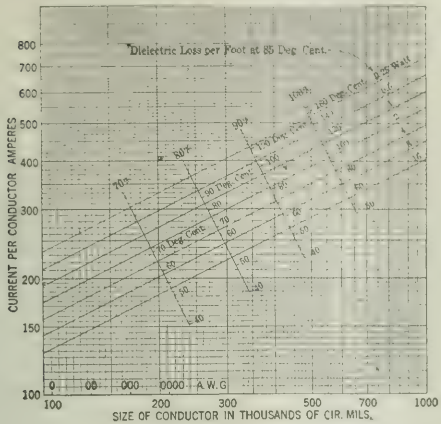
Temperature Gradient No Criterion for Grading Insulation

A SERIES of tests to determine more specifically the relations which exist between the maximum allowable gradient, the applied voltage and the geometry of cables were discussed by W. I. Middleton, C. L. Dawes and E. W. Davis. Tests made to determine the effect of conductor heating on the potential gradient of the cable were also considered. The authors have developed a modified formula which they recommended in their paper as more nearly representing the breakdown steps for small conductors with a heavy wall of insulation, and they also presented modifications of the fundamental formula as applied to special cables of various types.

It is pointed out that heat generated at the conductor of an insulated cable causes only a small change of capacity of the insulation nearest the conductor and consequently only a slight grading of the cable. Hence no dependence should be put upon the difference in temperature between the conductor and the outside of the cable to grade the insulation automatically.

Corona in Air Spaces of Dielectrics

AS A result of an investigation on the effect of corona in a dielectric, particularly applied to cables, J. E. Shrader shows that it is very difficult to exclude the air spaces in the dielectric and hence almost impossible entirely to eliminate corona formation in the insulation. The thicker the air space with a given thickness of dielectric, the more abrupt the change in power factor and the less the potential gradient. However, maximum conditions indicate that a saturation of ionization is approached which results in a decrease in power factor. The potential gradient not only depends upon the thickness of air space (that is, the thicker the air space for any given thickness of dielectric the lower the gradients that produce corona), but also depends upon the extent of the air space. This has been proved by observations made on different areas of air space of the same thickness.



CURRENT-CARRYING CAPACITY OF THREE-CONDUCTOR LEAD-COVERED CABLES

For a 250,000-circ.mil cable with four watts dielectric loss, the critical current is found to be 248 amp. By following along the four-watt line to the 100 per cent scale, we find that the maximum copper temperature would be about 83 deg. cent. To find the temperature corresponding to 90 per cent of the critical current, multiply 248 amp. by 0.90, equals 223 amp. Find this point on the 250,000-circ.mil line and then follow parallel to the diagonal lines to the 90 per cent temperature scale and get corresponding temperature of 62 deg. cent. (Roper).

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Dielectric Strength of Oil Not Uniform

AN EXPERIMENTAL investigation of the dielectric strength of oil comprising 3,000 successive disruptive tests was presented by J. L. R. Hayden and W. N. Eddy. Three groups of tests were taken of standard insulating oil with three different shapes of electrostatic fields—small sphere gaps, large sphere gaps and needle-sphere gaps. One group of tests was made with commercial oil, another with chemically pure benzol, and another with air. Each sample was tested successively 500 times at the same gap length by gradually applying voltage to the electrodes until the gap between them was broken down. The rate of applying the voltage was made exactly the same for each test, and all 3,000 breakdowns were taken in exactly the same manner. The data taken on each sample were shown graphically as the actual breakdown voltage in succession, the average breakdown voltage, and the percentage of variation from the mean against the number of breakdowns. In addition, the percentage of the total number of breakdowns was plotted against the percentage of variation from the mean.

The tests showed that the disruptive strength of oil is not constant and uniform but varies in successive tests under identically the same conditions over a wide range and in an entirely erratic manner. These variations are many times greater than the possible accuracy of breakdown tests in air and are inherent in the material. A comparison of the data taken on the tests made in oil shows that the erratic behavior of oil is not the result of the particular shape or size of the electrostatic field. The authors show that if the mean of 500 successive breakdowns is taken as the correct dielectric strength and any variations from that as the error, that the average error, using six tests on the oil, will vary from 2.7 to 4.1 per cent, with the maximum error varying from 17.5 to 14.3 per cent. If only a single test is made, the average error will vary from 7.8 to 8.4 per cent, with a maximum error varying from 44.8 to 48.5 per cent. The modification in error variation is explained by whether or not the tests are made with a long sphere gap in oil, a short sphere gap in oil or the needle sphere gap in oil.

The percentage range of breakdown voltage from the mean for oil was plus or minus 24 per cent, for commercial benzol plus or minus 14 per cent, for chemically pure benzol plus or minus 12 per cent, and for air plus or minus 4 per cent.

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Construction of High-Tension Cable Joints

VARIOUS phases of high-tension cable-joint construction were discussed in a session which was held under the auspices of the cable research committee. This committee is a sub-committee of the transmission and distribution committee of the A. I. E. E., the underground-systems committee of the N. E. L. A., and the committee on electricity distribution and use of the Association of Edison Illuminating Companies. Operating engineers and manufacturers gave their opinions and practices on the following points:

1. *Marking Conductors.*—Feasibility of having markers on the several conductors in the cable and connecting the two ends similarly marked at each joint.
2. *Copper Sleeves.*—(a) Cast versus rolled or drawn copper; (b) ratio of conductivity of sleeve to conductor; (c) soldering holes or slot; (d) tapering; (e) length.
3. *Conductor Insulation.*—(a) Method of trimming insulation in preparation for soldering; (b) minimum length of insulation between copper sleeve or bare conductor and lead sleeve or cable for various voltages; (c) method of protecting insulation during splicing operations, so as to avoid reducing the insulating value.
4. *Soldering.*—(a) Type of soldering flux to be used; (b) methods of soldering and removing surplus solder; (c) avoiding damage to conductor insulation during soldering.
5. *Joint Insulation.*—(a) Methods of handling insulating material, so as to protect from dirt or moisture, before applying to the joint; (b) use of impregnated jute or varnished-cambric tape or paper tape for filling in gaps at ends of copper sleeves; (c) paper tape versus varnished cambric for joint insulation; (d) kind of compound to be applied to wrappings of tape for the purpose of preventing voids or air spaces; (e) thickness of insulation for various voltages; (f) method of separating and binding conductors at center of joint; (g) various types of joints using formed insulation; (h) amount of taping required on conductors before applying formed insulation; (k) best material to be used for formed insulation to avoid injury by the filling compound; (l) other types of joints.
6. *Filling Compound.*—(a) Relative importance of various qualities of filling compound such as melting point, coefficient of expansion, dielectric strength, power factor, etc.; (b) should compound at maximum operating temperature be solid, plastic, or liquid? (c) tendency of solid compounds to form minute hair cracks at minimum operating temperature.
7. *Wiping the Lead Sleeve.*—(a) Wiping versus soldering versus mechanical joints; (b) effect on cable insulation of high temperature due to wiping joint.
8. *Filling the Joint.*—(a) Best method of filling joint so as to remove entrained air; (b) best methods of filling voids due to contraction of compound after initial filling; (c) is vacuum process necessary in order to properly fill joint? (d) to what extent, if any, is the dielectric strength of the cable, near a joint, affected by removal of insulating com-

pound by application of vacuum? (e) desirability of using funnels on sleeve during pouring to assist in removal of entrained air, by creating a slight head on the compound; (f) methods of sealing lead sleeve; (g) desirability of wrapping the joints with blankets or pads after filling, during cold weather, so as to prevent hair cracks in compound, due to rapid cooling.

9. *Methods of Testing Experimental Joints.*—(a) Testing at maximum and minimum operating temperatures as well as room temperature; (b) ratio of test voltage to normal operating voltage in making accelerated life tests; (c) value of dielectric strength tests as compared with accelerated life tests as a criterion for determining best type of joint.

10. *Removing Joints for Changes or Repairs Without Shortening Cable.*—(a) Best method of removing compound; (b) effect on outer layers of conductor and belt insulation.

11. *Over-All Dimensions.*—(a) Length of joint for various voltages and types of joints; (b) same for diameters.

Details of the discussion will be presented at a later date. Meanwhile the committee would like to secure the practices of other companies, in order that they may be incorporated in the report which will be presented at the next A.I.E.E. midwinter convention. D. W. Roper is chairman of the committee.

Education and Miscellaneous

Fundamentals and Character Building in Engineering Education

NO SPECIALIZATION should be allowed in engineering education, and the undergraduate years should be devoted to training in science and other fundamentals. In this way might be epitomized the views expressed in a series of papers on education by B. G. Lamme, S. E. Doane, Philip Torchio, I. C. Forshee, A. M. Dudley and Carl Hering.

A real engineer is born, not made, Mr. Lamme declared. In childhood the traits and habits of thought are indicative of the future man. A great error is made in giving improper or insufficient training in the early years. In the opinion of Mr. Lamme and others, students should be separated in accordance with their mentality, and these groups should be treated separately. Mr. Lamme considered mathematics the primary element in the success of an engineer. Persistent teaching of elementary algebra and trigonometry in the colleges would readily do away with the present adulteration of the schools with unfit engineering types.

Knowledge and mental technique are the two things of value which, in the opinion of Mr. Doane, may be obtained from classroom work. All specialization should come after graduation. In the undergraduate work social, athletic and cultural features of college life are highly important. Mr. Doane suggested that every teacher spend one year in each four in an industrial post, so that the viewpoints and problems of industry shall shape the classroom work.

A broad knowledge of all the sciences and concentrated and thorough treatment of assignments are essentials to a good scheme of education, Mr. Torchio said. Each student should exercise his initiative and use his knowledge by designing engineering machines or installations. He also advocated a knowledge of one foreign language.

Mr. Forshee made a plea for more training in the fundamentals of communication engineering and outlined the field, and Mr. Dudley observed that character training is the essential element in education. Able instructors, familiar with research and commercial practice, are also essential. A knowledge of physics combined with the ability to use mathematics as a tool is the basic thing in engineering, in the opinion of Dr. Hering.

ENGINEERING EDUCATION MEETING BRINGS FORTH MUCH DISCUSSION

F. D. Newbury, in presenting A. M. Dudley's paper, said that no man can be an engineer unless he is honest with himself and with the facts of his work, and that this is the chief direction education should take for best results.

Carl Hering, in referring to the desire of engineers to be trained as financiers and executives, declared that in many elements the moral standards of the financier do not always agree with the moral standards of the engineer, and he advised against an indiscriminate mixture.

President McClellan complained that too much of a trade-union label is given to engineering graduates as different kinds of engineers. This tends to keep them in closely defined lines, whereas they should be engineers first and not electrical or otherwise classified engineers. He also brought up the old question of how to separate and treat differently the mediocre and the exceptional groups, which both finally produce necessary kinds of engineers.

Charles S. Howe, president of the Case School of Applied Science, reported for a committee of the Society for the Promotion of Engineering Education to which had been referred the symposium papers discussed at the University of Illinois last week, and also for the society itself. He emphasized the possibility of including in curricula various suggested subjects, and said that the society recommends groups of practicing engineers to get together and make such suggestions and also to define what they mean by the broad term "fundamentals." He also brought out the way in which industry usually absorbs teachers who originally take up industrial work for a year, and said that if Mr. Doane's suggestion were to be followed industry would have to promise not to make offers to teachers to keep them in its ranks. He said, as did Professor J. B. Whitehead in another way, that most engineering colleges are now giving general rather than specialized courses.

Professor Whitehead said that the early effort was to expand the college curricula with the expansion and increase in complexity of the engineering profession, but that latterly the idea of simplification of courses has become the guiding idea.

L. A. Ferguson presented an entertaining analogy between an engineering college and a lumber mill, referring to certain characteristics of the raw material, the occasional mixture of hard wood of an exceptionally good variety with the ordinary run, the way the buyer uses the product and his opportunity to take time and trouble to notice or sort out the exceptional product.

Professor Karapetoff likened an engineering professor to a salesman on the basis of the principal qualifications necessary. The teacher is a salesman of ideas and he can no more work by a formula than can a salesman. He must not stuff facts into the student, but must draw him out so that eventually he will get the habit of transforming the latent energy in him into the kinetic energy of accomplishment.

Comfort A. Adams made an indictment of 90 per cent of the engineering graduates for intellectual dishonesty —not that they know they are intellectually dishonest, but that they are trained to be that way naturally because of their dependence on formulas and their ignorance of the accurate definition of the words they use.

L. H. Rittenhouse said that in urging engineers in practice to write the specifications for the jobs for which they want men he has asked them to write the specification so as to show the jobs they propose at one year after graduation and then the jobs that would in the ordinary course be filled by the same men in five, ten, fifteen, twenty and thirty years from graduation.

Professor Scott, who is president of the Society for the Promotion of Engineering Education, said there were two things the A. I. E. E. could do—one to tell others what to do—as it seems to be doing now—and the other to act itself. An industry which is doubling its activities every five years has the obligation of training the men who are to carry on that industry in the future. This led to the idea of the student branches of the Institute twenty years ago, and it is now the duty of the A. I. E. E. to make these branches vital in their influence. As another concrete suggestion, he said that if engineering graduates would take as much interest in sending to college good engineering material as graduates interested in athletics take in sending good athletic material the quality of the former might be improved. He mentioned the great interest in the product turned out by engineering colleges which is now being taken by the real leaders of the industry into which these graduates are going.

Others who spoke on the subject were Farley Osgood, who urged more instruction in English through all the years; W. B. Hartshorne, W. I. Slichter, L. A. Doggett, W. T. Ryan, Edward Bennett, A. H. Lovell, H. T. Plumb, C. B. Hoffman and C. F. Harding The meeting was one of the longest of the convention.

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Telephone Cable from New York to Pittsburgh Provides 417 Circuits

TO OBTAIN the best type of communication between New York and Chicago a cable is to be placed between the two cities and a very important link, that between Philadelphia and Pittsburgh, has just been completed. This link, as described by James J. Tilliod, is of the duplex aërial-cable type of construction. On 250 miles of this line 25-ft. untreated poles placed 20 ft. apart are used with steel suspension strand and metal supporting rings for the cable. The galvanized-steel suspension strand has a breaking strength of about 16,000 lb., and the actual tension under normal conditions is about 7,000 lb. The metal rings are placed 16 in. apart. The cable, which weighs about 7½ lb. per foot, has a ⅛-in. lead-antimony sheath with an over-all diameter of 2⅝ in.

The cable is of duplex construction—that is, the individual wires are first wrapped with dry-paper insulation, twisted into pairs, and the two pairs are twisted into a "quad." The quads are arranged in concentric layers. Two physical circuits and one phantom circuit are obtained from each quad, resulting in a total of 417 circuits per cable. In addition, the circuits can be composited to permit simultaneous telegraph communication. Loading coils are connected at 6,000-ft. intervals. All of the conductors in the cable are carried into stations situated about 50 miles apart where apparatus is provided for testing the condition of the cable and locating trouble.

Telephone repeaters of either the two-wire or four-wire type are connected to the circuits at approximate intervals of either 50 miles or 100 miles, depending on the type of facilities which it is economical to use in the different circuits and the kind of service for which a given circuit is intended. In some cases it was necessary to erect buildings for the sole purpose of housing these repeaters, testing apparatus and other equipment. Power plants are installed in these buildings to furnish energy for operating the apparatus, and storage batteries are provided to insure uninterrupted service.

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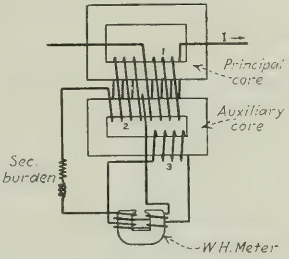
Ratio and Phase-Angle Error Eliminated in New Current Transformer

THE availability of a two-stage current transformer possessing a very high degree of precision was announced in the paper of H. B. Brooks and F. C. Holtz. This result was obtained by using an auxiliary winding and combining vectorially two currents. In principle one current transformer is used in the ordinary way and the line current and the secondary current from the first current transformer are then passed through two windings on a second current transformer in such a way as to set up an opposing magnetizing effect on the core. An auxiliary winding on the second transformer has the same number of turns as the principal secondary winding and has no current induced in it unless the secondary current in the second transformer is incorrect in magnitude or phase with respect to the line current. When such a condition exists the current in the auxiliary coil and the principal secondary current may be combined by connecting them to windings on the core of the meter to be used on the transformer system. The effect is to produce a magnetization of the meter core equivalent to that from an ideal current transformer.



AUXILIARY WINDING ON METER IN COMBINATION WITH NORMAL WINDING COMPENSATES FOR RATIO AND PHASE-ANGLE ERRORS (BROOKS AND HOLTZ)

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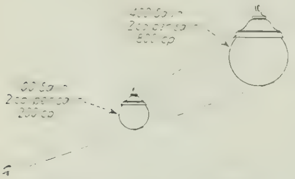
"Short-Pass" Principle Has Improved Gaseous Conduction Devices

CONTROL devices involving gaseous conduction—for example, the vacuum tube and the mercury-arc rectifier—have been handicapped by three main disadvantages, V. Bush and C. G. Smith declared. The first is the difficulty of making the discharge occur where wanted; the second, the tendency of the working gas to disappear; the third, erratic action. The type of device employing electrons and gaseous ions in which the electrons are obtained by bombardment has many good features because the current is limited only by the cooling means employed. Besides, no part has to operate at very high temperature and there is no inherent reason why disintegration of electrodes should accompany the conduction proper. Their disadvantages have recently been removed to a large extent by using the "short-pass" principle whereby discharge can be prevented except where wanted. This has led to gaseous clean-up, eliminated disintegration of electrodes and also brought about uniformity of action. Two devices utilizing this principle for rectifying purpose were described by the authors. The first obtains unilateral characteristics by the use of a magnetic field and the second by the use of a space charge.

Lighting and System Economics

Method of Getting Light Without Glare

ALMOST every invaluable development of modern applied science has brought its own particular hazards and has afforded opportunity for serious abuse. In expressing this opinion Ward Harrison contended that high-power artificial light sources form no exception to the rule. Unfortunately, the potentialities of the newer lamps as aids to progress are only half utilized or appreciated, he declared, and for this reason their flagrant misuse has for the most part been allowed to go on unchallenged. As a typical example Mr. Harrison cited a machinist who substituted for his stub of a candle an unshielded incandescent lamp of one hundred times its power and a thousand times its brilliancy and remarked that it was such a fine light it almost blinded him, but he never attempted to remove the objectionable feature.



DOUBLING THE DISTANCE PERMITS A FOURFOLD INCREASE IN CANDLEPOWER WITHOUT PRODUCING GLARE

For a fixed position of light source the degree of glare experienced is the function of the brightness of the source, the total flood of light directed toward the eye from this source and the contrast in brightness between the light source and its background. Authorities differ greatly as to the relative weight to be assigned to the three elements, but recent investigation points toward the total flux of light which reaches the eye from the light source as being the most important single factor in the production of glare. Mr. Harrison said that Dr. Nutting has found that, with a fixed area of light source at a fixed distance from the observer, a tenfold increase of the brightness of the surroundings permits only an approximation to twice the candlepower and brightness of the source if no increased sensation of glare is to be experienced. From other investigations it can be deduced also that one may approximately double the candlepower of the source having a fixed location if the area of that source is increased ten times.

If the brightness of the light source and the brightness of its background are both held constant and the distance between the eye and the source is doubled, it will be permissible to quadruple the candlepower of the source. If after doubling the distance between the eye and the light source and at the same time increasing the candlepower and area four times to preserve the glare balance it is desired to cut in two the candlepower of the source in its new position, it is then permissible to cut the area of the source to one-tenth, and by cutting the candlepower again in half the area may again be reduced to one-tenth, so that with the candlepower and the source the same as when in the first position close to the eye the area of the source need only be one-twenty-fifth of that required by the first position. It may be said, then, that doubling the distance between the eye and light source permits of dividing its area and increasing its brightness by twenty-five.

Another way in which glare is produced, continued Mr. Harrison, is by the reflection of light from polished surfaces in the field of vision. The brightness of the image on the working surface is, of course, proportional to the brightness of the light source above it, and hence one way in which to minimize this effect is to diffuse the downward light. The avoidance of highly polished surfaces in the line of vision is another good way to minimize reflected glare.

There are some examples, on the other hand, where sharp shadows and specular reflections on the materials worked upon actually assist vision. For example, in sewing on dark goods the thread is much more easily distinguished when illumination is obtained from a concentrated light source, such as a brilliant lamp filament, which casts sharp shadows but gives rise to a distinct glint from each thread.

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Pulverized Fuel Declared Cheaper Than Higher Steam Pressures

BURNING pulverized coal is a much less expensive method of obtaining the highest efficiency and the lowest operating cost than using higher steam pressures, F. A. Scheffler asserted. He declared that the benefits resulting from the difference between station water rates obtainable with present pressures and temperatures and with higher pressures and temperatures are comparatively small and do not warrant the additional first cost and yearly fixed charges for the higher pressures and superheats. These opinions were based on a hypothetical power plant of 100,000 kw. (nominal capacity) operating on the basis of 250 lb. pressure and 600 deg. Fahr. superheat, as compared with 400 lb. pressure and 700 deg. Fahr. superheat first when fired by stokers and second when fired by pulverized coal.

No reason for comparing the economy of higher steam pressures with powdered fuel was apparent to those who discussed Mr. Scheffler's paper. Both Philip Torchio and William McClellan asked where there would be inconsistency in considering both methods of increasing economy. Mr. Torchio doubted whether the cost of using higher steam pressures would be so high as Mr. Scheffler assumed, if the system came to be generally adopted, and expressed a belief that more than 5 per cent increase in economy could be effected with high pressures.

When it is remembered that improvements can be made in stokers, it is doubtful whether powdered fuel will effect a large difference in economy, Mr. McClellan declared. Furthermore, the cost of increasing economy through use of powdered fuel may not be justified if the station has a low load factor. The scattering of ashes was raised as an objection to powdered-fuel plants in large cities by Mr. Torchio, but Mr. Scheffler said that the prevention of this trouble is no more difficult than the elimination of cinders from the stack gases of stokers.

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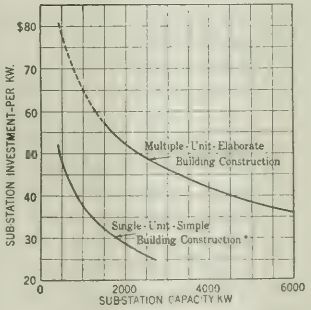
Automatic Substation Must Be Justified by Reduced Distribution Costs

THE relations that govern the size of feeders and their correct layout for any given arrangement of substations, and the principles underlying the correct location, size and type of substation, were discussed by Lawrence T. Crecelius, particularly as they refer to direct-current railway distribution and automatic substations. He declared that there are not at the present time sufficiently accurate data on cost and performance of ordinary substations to make possible a precise analysis of the situation. It is possible, however, to show limiting conditions and by example to illustrate the relation of the various determining factors to the final form. The economic justification of the automatic substation is a reduction in distribution cost, but the additional investment for automatic control is warranted in proportion to the distributing distance, so that the principal field of application includes interurban-railway or long rapid-transit lines and electrified roads. In cities, on the other hand, the economic advantages of the automatic substation are relatively small because the distribution cost is a correspondingly small part of the total cost. However, in city districts where there are wide fluctuations in load the automatic substation has an important field of application. The limitations imposed upon the reduction of substation sizes by means of automatic control are the investment cost, the substation losses and the substation maintenance costs. If any substantial saving in the total cost of power is to be had by the smaller sizes of substations, automatically controlled, it will be necessary to reduce substation losses by improving methods of control. This result may perhaps be best secured by providing the simplest form of semi-automatic control substation, comprising a transmission line directly and permanently connected to the substation-transformer primary circuit, and a synchronous converter arranged to start automatically from the transformer secondary circuit when the same is energized.



COST OF AUTOMATIC SUBSTATIONS (WITHOUT LAND) USING 60-CYCLE CONVERTERS

In many cases, Mr. Crecelius observed, a small difference in substation maintenance cost may be the deciding factor in a comparison of distribution layouts, so that the standardization of substation equipment is a matter of importance. The mechanism of the automatic substation is complex, and it is necessary to keep on hand a large variety of spare parts, investment in which is no small item. Thus both labor and maintenance may be reduced by standardizing the types and sizes of substations.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Pioneer in Phase Isolation of Station Equipment

To the Editors of the Electrical World:

In the recent descriptions of the Hell Gate station published in the *Electrical World* particular attention was called to the phase isolation in the switch house of this station. A reading of this article would leave the impression that this feature was original with the designer of the station. On the contrary, it was originated by B. G. Jamieson of the Commonwealth Edison Company and was first introduced into its new Calumet station. It would appear to be entirely proper to give the original designer due credit after giving the design such prominence in the *Electrical World*.

D. W. ROPER,
Superintendent of the Street Department.
Commonwealth Edison Company,
Chicago, Ill.

[An article on the features of construction required to isolate phases at the Calumet station of the Commonwealth Edison Company was contributed by B. G. Jamieson more than a year ago to the *Electrical World*. See page 761 of the April 2, 1921, issue.—EDS.]

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Customer Management for Superpower Projects and State-Owned Power Monopolies

To the Editors of the Electrical World:

At the present time the citizens of California are becoming wrought up over an amendment to their state constitution to be voted upon in the fall election. If the amendment carries, the state will be empowered to take over any of the properties of its power companies, the aim being to create a state-owned power monopoly. The amendment authorizes initially a bond issue of $500,000,000 for the purpose.

The main argument in favor of such a plan lies in the fact that it is necessary for a privately owned public utility to make a charge of 8 per cent or more to cover interest and other charges on the capital invested, whereas the State of California will have no trouble in selling long-time state bonds paying only 5 per cent interest or less. Neither the bonds nor the state property will pay federal taxes.

In large hydro-electric developments it sometimes happens that the overhead capital charges amount to as much as 90 per cent of the cost of power. In such developments, where the charge for capital is 8 per cent on the investment, the cost of power will be nearly 60 per cent greater than it would be were the capital charge only 5 per cent on the investment.

The main argument directed against the proposed California amendment is the possibility of inefficient management. It is planned that the administrative powers of the state-owned monopoly are to be in the hands of a board of five members, all appointed by the Governor of the state. The state-owned superpower monopoly may thus possibly become the vehicle of a superpolitical machine. No matter how efficient the board may be, the power monopoly is likely to become the football of partisan politics, with the usual wrangling and cries for investigations, etc.

There is another plan of management for a state-owned monopoly that I believe is bound to be more satisfactory. We hear a great deal about the desirability of creating certain superpower projects and the millions of tons of coal per annum that can be saved in this country through such operation. These developments are coming, and we must have sound management for them. It is my belief that the results possible from these superpower projects will never be obtained through management by salaried commissions politically appointed. The management of a superpower monopoly by a co-operative organization of the power sellers will not prove satisfactory either.

I venture the prediction that the only management that will prove satisfactory to all concerned will be management by a co-operative organization of the power users—those who pay the bills. Who will be more vitally interested in good management than those who pay the bills? Responsibility in management will be in proportion to the amount of power used—the size of the bill paid for power. The superpower projects will be managed by a board of directors through a general manager who will manage the project just as private corporations are managed. Voting power for directors will be in proportion to the amount of power used. The larger consumers, who are more vitally interested and who are likely to have superior ability in the direction of such an enterprise, will have the greater power in the selection of directors.

If the people of the State of California will work out a plan of management for their power monopoly along this line, they will have a combination of low interest and efficient management for hydro-electric development and operation that cannot be beaten, and the bad effect of the continual partisan turmoil inseparable from the plan they now propose will be entirely avoided.

Power could be sold on the basis of cost to serve, as they propose, the rates being adjusted by the State Corporation Commission. If the State Legislature considered it just, it could determine upon a profit to be paid to the state by the monopoly, probably small at first. As the bonds were retired the state's paid-up equity in the project would increase, and the state could be allowed a greater profit.

There is a great deal of interest now in the proposed superpower development on the Colorado River. It is asserted by the Department of the Interior that reclamation cannot stand any part of the cost of the dam which will give flood control and equalize the flow of the river, but that the power to be developed must eventually pay all the bills for the construction.

On account of the lack of fuel in the Southwest, power is more expensive on the whole than in any other section of the country. The Imperial Valley must have flood protection, and there is a crying need for cheap power for industry and for irrigation pumping, so the development of the Colorado for power in the near future seems likely. The well-meaning citizens and politicians of three states at least—and a few in Washington—are becoming concerned about the location of the first storage dam, whether it shall be at the head of the canyon or at the foot of the canyon, the depth of foundation to bedrock, the type of construction, the remoteness from power market, the highest feasible voltage, etc. If the power users are to pay all the bills, why not let them pass on these purely engineering and financial considerations?

The Colorado River power project is of such magnitude that 90 per cent of the cost of delivering power to the load centers will consist of charges for capital. If a combination of state or federal low-interest money with efficient management—management by those who will eventually pay all the bills—can be worked out, the cost of power in Arizona, California and neighboring states will compare favorably with the cost in any part of the world.

Why not management of superpower projects and state-owned power monopolies by those who pay the bills? Who will be more vitally interested in good management than they? Who are qualified to get better results in the management of a monopoly than they? Who that is really interested in efficient direction and cheap power will question their right to manage?

A. G. McGregor,
Consulting Engineer.
Warren, Ariz.

[In a democracy mere possession bestows no added privileges or rights. A citizen though penniless has just as great a claim on the government as a millionaire. The reason is obvious. Therefore any system of public service predicated on control by the largest user is against public policy. Small customers would never be satisfied that their rights were maintained under such management of state-owned developments, which would place the state in the position of according privileges to the large customer and leaving the small ones at his mercy—a reversion to feudal institutions quite unthinkable.—Eds.]

Wants Article Showing Reliability of Electric Engines

To the Editors of the Electrical World:

From time to time for years during my experience as an electrical engineer, not only with the War Department but while on railroad work, I have heard from some one employed in the same task but on the mechanical work, when some electric motor or other device failed to function: "Well, Mason, if it had not been some of your electric machinery, this delay would not have occurred," or something to that effect, followed up by such a remark as: "If I had a steam crane it would have been right on the job," or "If this pump had a gas engine or steam engine to operate it, it would be running right now."

While we all know that only ignorance and narrow-mindedness prompt such remarks, I should like to have on tap good articles to use or quote from in such cases, preferably not too long, but crisp and to the point, with possibly a dash of humor, not necessarily sarcasm, although at times one is tempted to be sarcastic in replying to such foolish observations.

Who can furnish me with such material, covering in a general way a good answer right to the point? The fact that I have cited cases by the dozen from practice does not alter the frame of mind of the objectors. Any publication or magazine article answering this purpose will be greatly appreciated.

W. W. Mason,
Electrical Engineer Wilson Dam.
U. S. Engineer Office, War Department,
Florence, Ala.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies. and Reports of Company Plans and Experiences

Suggestions to Improve a Utility's Service

Ways and Means of Solving Service Problems Which Have Been Used Successfully by Light and Power Companies

SOME very interesting and practical methods of bettering a central-station company's service to its customers were given in the report of the committee on commercial service and relations with customers, J. F. Farquhar, chairman, at the recent convention of the Northwest Electric Light and Power Association at Boise, Idaho. Several of the pertinent suggestions are given here.

Suggestion No. 1.—One company has discontinued the practice of disconnecting service at the pole for non-payment of bills or where houses or other establishments have been vacated, and is now sealing the service switch open—using a meter seal for the purpose. This greatly facilitates the giving of prompt service to new customers or the restoring of service to old customers after bills have been paid as it obviates the necessity of a lineman's trip to the premises. Any available employee can handle the work under this scheme. There is probably nothing more exasperating to a customer who has had his service disconnected for non-payment of a bill than to find, after he has paid the amount in arrears plus the service charge for disconnecting and restoring service, an undue delay in the restoration of that service. Under this scheme the shut-off or collect customer may hold a grudge, but it will be somewhat softened down if there is no delay in restoring the service. The new customer under this scheme will from the first be favorably impressed with company service.

Suggestion No. 2.—One company has found it very desirable to maintain a special customers' bookkeeper near the cashier's cage in order that customers without bills or customers who wish to have an investigation of the amount of their bill made may receive quick service with a minimum amount of inconvenience to themselves. This special bookkeeper puts the customer immediately at ease by offering a chair and proceeds at once to do all the running around necessary to obtain information to satisfy the customer. This plan is more desirable than that of shunting the customer from one department to another to obtain the information he desires.

Suggestion No. 3.—One company has had occasional trouble on its system with meter readers coming in contact with vicious dogs on customers' premises. Sometimes the results have been unpleasant to the meter reader, sometimes to the dog, and almost all the time unpleasant to the customer. The old adage, "Love me, love my dog," must be borne in mind by the meter reader at all times. Meter readers while protecting themselves against a dog have incurred the enmity of the owner, who, of course, is a valued customer of the company. To minimize any unpleasant relations with customers from this source, the meter readers are now required to wear puttees, which afford considerable protection against a vicious dog, and practically all trouble from this source has been eliminated since the rule has been in effect.

Suggestion No. 4.—One company has found it good policy in rendering service bills to municipalities, public institutions, etc., always to show the various rate steps in calculating the bill. It is well known that municipal bills are usually turned over to the clerk of the municipality, and this clerk, not having to pay the bills himself, takes no interest in them beyond registering and paying them. Moreover, the personnel and clerks of municipalities and public institutions change from time to time, and it is with the idea of presenting the bill in such shape as to be readily understood that the plan mentioned is pursued. This method eliminates considerable time in explaining the charges to new clerks and at the same time does away with all doubt and suspicion as to the correctness of the bill rendered or the interpretation and calculation of complex power schedules.

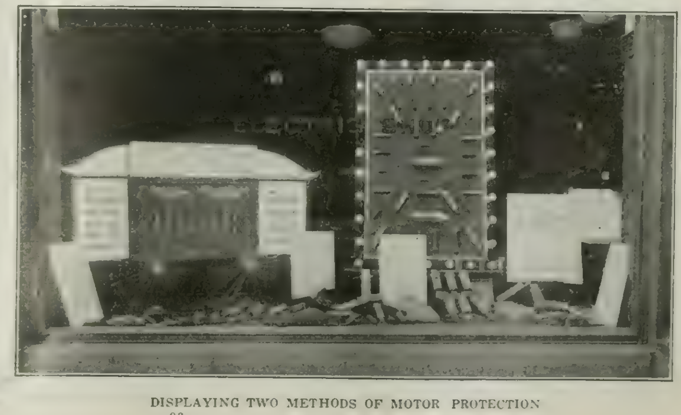
Suggestion No. 5.—One company has found it good practice whenever a new rural consumer is taken on the lines, and even among the old rural consumers, to sell to the consumer at small cost a trouble-finding set composed of two weatherproof sockets in series and two carbon lamps. The rural consumer is shown how to use this set in locating fuse trouble at the main switch and branch blocks, and consequently expensive service calls to consumers in the rural districts have been largely eliminated.

Motor Protection as a Window Display

IN ORDER to demonstrate the protection against open phases obtained by using multi-phase renewable fuses, the Commonwealth Edison Company of Chicago recently staged the window display shown in the accompanying photograph. Two polyphase motors with attached paddle-wheels were connected to fuses through a flasher control equipment.

The one motor was protected with ordinary fuses, while the other had the multiphase type. The first motor would start and run until the control equipment indicated by a flashing light in the fuse itself that the fuse had been blown. After the motor had stopped, smoke (ammonium chloride) would emerge from the commutators in a very realistic manner, to show how it had heated up from operating single-phase.

Then the other motor would operate, blow a fuse in one phase and thereby shunt the load current of that phase to the thermal coils of the other phases and so stop the



DISPLAYING TWO METHODS OF MOTOR PROTECTION motor. This was indicated by a flashing light which took the place of the regular fuses. This thermal coil is parallel to the main fuse element and is rated at one-tenth of the fuse capacity, so that when the main phase current is shunted through this coil it will burn out and thereby shunt the phase current to the next coil. Much interest was shown in this board, and many superintendents of industrial plants required their asistants and electricians to see the demonstration. V. W. Dorts was in charge of this exhibit.

Precautions to Be Used on Customers' Premises

BY C. W. EMERSON

General Foreman Meter and Test Department, The United Electric Light & Power Company, New York

AS A PUBLIC utility is judged to a large extent by the men it employs and the manner in which they go about their work, the conduct of company employees when working in a customer's residence has a great influence on that customer's opinion of the company. Meter testers are continually performing their work before the eyes of the public, and the public is deeply interested in the instrument from which the bills are computed.

Care in the arrangement of the various units of the testing equipment creates a favorable impression and greatly facilitates the work. The customer's convenience must always receive first consideration, and therefore the equipment should be placed where it will not be an obstruction.

When the resistance type of load box is used it should be set up where the heat cannot possibly blister the varnish on the floor, woodwork or furniture or singe curtains or draperies. Dirty hands and dirty test leads are a constant menace to clean walls. Testers should be provided with clean rags to protect the walls when working in close quarters. Testers are frequently tempted to stand on furniture or on their test equipment to reach high meters. This practice cannot be too strongly condemned, for reasons that are obvious.

Short circuits are entirely unnecessary and only careless employees cause them. To guard against short circuits keep the test leads in good condition and equip them with proper terminals for connection to the instruments and service. Braid the leads. It improves their appearance, increases their length of service and keeps them together as a unit. Do not leave the leads on the floor where they will be trod on or tripped over.

When connecting up the equipment, make all connection to the instruments first, see that the current and potential switches are open, then connect to the ground leg (when used) and finally to the live leg, after making certain that all connections have been made properly. By following this rule the danger of shock is minimized and there will be no live leads hanging loose to cause short circuits. When disconnecting, the same reasoning is used. Disconnect the live lead first, then the ground lead, after which all other connections can be removed in safety.

Rural Extension Guaranteed by Street Lighting

BY F. A. BELDEN

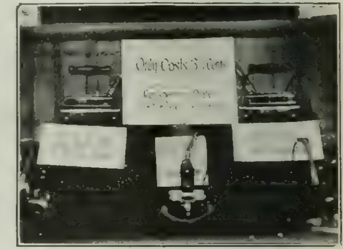
Vice-President and General Manager Rockingham County Light & Power Company, Portsmouth, N. H.

ONE solution of the rural-line problem has been found in the plan recently adopted by this company in closing a contract for street lighting with an outlying town. One hundred additional street lights voted by the people of North Hampton, N. H., in town meeting will be the means of electric service being provided along a 10-mile line extension to be made soon by the Rockingham County Light & Power Company. North Hampton is a prosperous agricultural community about 12 miles from Portsmouth. Central-station service is now available in certain sections of the town and a street-lighting circuit is in operation; but, owing to the excessive cost of construction, it seemed impossible until recently to supply service to remote sections unless prospective consumers were willing to meet part of the expense of reaching them.

At the town meeting the company proposed to the town that for a guarantee of ten street lights per mile the existing pole line would be extended and single-phase, 2,200-volt primary service installed. The lamps to be installed are 60-cp. series incandescents fed from auto-transformers, and the town will pay $22 per lamp per year for all-night and every-night service. This insures the company an income of $220 per mile per year, or $880 for four years. It appears that the services expected along the line will yield an estimated income of $320 per mile on a four-year turnover basis as a minimum, bringing the total to $1,200 per mile. The central station on one hand is assured of a definite minimum return, regardless of the number of customers, and the residents of the town, indirectly through their taxes, are providing facilities for lighting service for all sections.

What Other Companies Are Doing

Hartford, Conn. — Electric iron sales in the appliance department of the Hartford Electric Light Company are encouraged by the pithy window display cards shown in the accompanying illustration. The cards emphasize the reduced cost of operation resulting from the lately installed residence service rate, the physical burdens of old-fashioned ironing, and the time-saving effected by electrical methods.



WINDOW DISPLAY CARDS SELL FLATIRONS

New Orleans, La. — One of the most elaborate electrical homes in the South has just been opened to the public in New Orleans. It was built by the New Orleans *Times-Picayune* in co-operation with local electrical and furniture dealers and is complete to the minutest detail. A corps of experts are kept on duty at the home to explain its various electrical features. No one visiting the home is solicited to buy anything.

Dixon, Ill.—Merchandise sales of the Illinois Northern Utilities Company for the week ended May 13 amounted to $2,410 and consisted of six electric hot-plates, six irons, two curling irons, four portable lamps, one toaster, two heaters, two electric ranges, two motors, three washing machines, one electric sweeper, one heating pad and other miscellaneous items.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Gennevillier Steam Power Station.—G. MERCIER.—The electric power supply of Paris was furnished until shortly after the war by a number of private plants, the systems, frequencies and voltages of which were all different, with no possibility of interconnection. Realizing how highly inefficient this supply system was, the Union d'Electricité was formed in 1919 and laid out plans for the erection of a large central power station for an initial output of 200,000 kw., 50 cycles, three-phase, 60,000 volts. The existing private plants were acquired by this new company, a number of substations were built at suitable points within the metropolis, and as the new work progressed the old plants were abandoned. The realization of this entire program will require about 250,000,000 francs. The Gennevillier station is situated on a site of 10 hectares on the River Seine and comprises a boiler house, 51 m. x 86 m., containing ten Babcock and five Sterling boilers, arranged in two rows. Each Babcock boiler can furnish 53,000 kg. steam per hour and each Sterling bolier 80,000 kg. Superheaters elevate the steam temperature to 375 deg. to 400 deg. C. A coal-storage floor space, 200 m. x 40 m., is provided, over which travels a loading crane of 50 m. span. The generator building, which is capable of expansion, now measures 24 m. x 92 m. and will accommodate five turbo-generators rated at 40,000 kw. each. Three of these units are running at present, and the fourth will be finished late this year. The final installation will consist of eight units. All turbines are of the Zölley type, and although built by three different firms, their parts are interchangeable. Each turbine has ten bucket disks on its rotor, operating under 375 deg. to 400 deg. superheated steam of 22 atmosphere pressure at the nozzle, at a speed of 1,500 r.p.m. Two gear-driven pressure pumps, delivering 1,500 l. of oil per minute, lubricate the bearings. The large condenser casting under each turbine weighs 70 tons. The guaranteed steam consumption of these turbines is 4.37 kg. at full load. The generators are wound for three-phase and 6,000 volts and are air-cooled, the air passing through a cooling device placed directly under the generator. A 250-volt exciter is connected to the end of the shaft. The complete turbo-generator set measures over all 14.8 m. One 100-ton and one 20-ton traveling crane are provided in the engine room. The article is thirty pages long with thirty-seven illustrations and is written primarily to cover the building end of this station, with only a few mechanical and electrical data.—*Revue Industrielle,* March and April, 1922.

Generation, Control and Switching

Pulverized Fuel.—There are two distinct systems for the utilization of pulverized fuel. The first is the central system, and the second the unit system. In the first the coal is ground and dried in a central installation and supplied ready for burning to the various furnaces. In the latter, a more recent development, the coal is pulverized in small turbo pulverizers in front of each furnace and delivered to the burners together with the air for combustion. In the accompanying table are given five boiler tests with powdered fuel made in different installations in Europe. It will be noticed that the B.t.u., value of coal is quite low.—*Electrical Times,* May 11, 1922.

BOILER TESTS IN FIVE EUROPEAN POWDERED FUEL INSTALLATIONS

	Test 1	Test 2	Test 3	Test 4	Test 5
Steam pressure, lb	315	167	215	170	180
Temperature, superheat, deg. F.	188	200	nil	130	132
Feed water, temperature, deg. F.	90	212	752	70	142
Fuel used	Midland slack		Fines de Bethune	Yorkshire rough slack	Durham splints
Analysis of fuel, per cent:					
Moisture	17.84	0.4	Nil	8.65	0.93
Volatile	22.73	26.3	10	35	24.67
Fixed carbon	43.98	. .	. . . .		41.24
Ash	15.45	26.9	42	22.15	33.16
Caloric value in B.t.u.'s as fired	8,644.3	10,780	8,470	9,816	9,550
Total burned per hour, lb. (dry)	1,800	942	1,010	4,036	2,400
Water evaporated per pound from and at 212 deg. F.	8.77	7.47	6.72	6.85	7.30
Efficiency of boiler, per cent	81.1	78.5	77	81	74.1

Triple Harmonics in Transformers.—G. FACCIOLI.—A co-ordination of the factors involved in analyzing a triple harmonic in a transformer is obtained by starting with a wave of magnetization and synthetically constructing, step by step, the shape that the artifical permeability curve of the iron would have to assume to permit the production, first, of the first harmonic sine wave of magnetizing current from an applied sine wave of electromotive force and then of the other harmonics.—*Journal of the A. I. E. E.,* May, 1922.

Transmissions, Substations and Distribution

Life of Wooden Poles.—V. MALENKOVIC.—Basing his researches upon very careful statistics, the author developed a formula which accurately predetermines the useful life of well-treated wooden poles to within two years. The irregular and unreliable decay of untreated poles makes it impossible to establish a formula for their durability. The general character of the author's formula is log $y = A + B \log x$, where x denotes the years from the beginning of the decay and y the percentage of the total decay.—*Elektrotechnische Zeitschrift,* April 13, 1922.

Outdoor Substation at Tongshan, China.—GRAHAM KEARNEY.—A short account of up-to-date electrical equipment installed in a 2,000-kva. substation of a cement company.—*General Electric Review,* May, 1922.

Tests with a Quenching Coil.—A. ROTH and G. COURVOISLER.—On an existing power transmission system, operating under 50,000 volts and 70,000 volts, tests were made to investigate the performance of a Jonas quenching coil. The tests covered the ability to extinguish a ground arc, the appearance of overvoltages, resonance phenomena, the amount of the remaining current, and inductive disturbances. At 50,000 volts, with a ground current of 30 amp., a maximum dissonance of minus 33 per cent has been found still to permit the safe rupture of a ground arc. No appreciable overvoltages have been observed during the entire test period. Exact statistics kept at this power plant show that, with the same number of grounds as before, most of the grounds after the installation of the quenching coil, passed without serious results, because the arc was quickly extinguished in every case. But it has been found that it is necessary to install a properly dimensioned quenching coil in every one of these branches.—*Elektrotechnik und Maschinenbau,* May 7, 1922.

Units, Measurements and Instruments

Some Notes on the Theory of Phase Meters.—G. W. STUBBINGS.—The author considers in detail a theory of single-phase and three-phase meters which is on simpler lines than the usual analytical treatment. The resultant rotating field, pulsating fields frequency errors, accuracy and the advantages of balanced-load power-factor meters are discussed.—*Electrician,* May 19, 1922.

Relay Transformers.—R. MAYEUR.—The opening of oil switches under overload or short-circuit conditions is frequently actuated from a so-called bushing transformer, which consists of annular steel punchings upon which a secondary winding is placed. This ring surrounds one of the leads of the switch inside the oil container. The author develops formulas and curves for the determination of the exact nature of this secondary winding, according to various requirements, such as energy needed, current and resistances. —*Revue Générale de l'Electricité*, April 29, 1922.

Illumination

Ornamental Street Lighting.—L. A. S. Wood.—A large number of artistic designs of ornamental posts and equipment have been developed, and little difficulty should be experienced by municipalities in selecting designs suitable for local requirements. For the business and residence streets of the average city, single light ornamental posts, of a size suitable to the relative importance of the streets and the height of the adjacent buildings, may be used, care being taken that the height in the residence districts where there are trees shall be such as to keep the light unit below the foliage.—*Electric Journal*, May, 1922.

Scattering and Dispersion of Light.—U. Doi.—Authors differ in their opinions as to the mechanism of scattering light by a medium through which the light travels. It is shown that when the frequency of the incident wave is very near to that of the proper oscillation of the electrons in atoms a resonance phenomenon occurs. As a result of this ionization and resonance radiation of the gas may be expected.—*Philosophical Magazine*, May, 1922.

Motors and Control

Applying Electricity Scientifically to Factory Problems.—L. F. Leurey.—An example of adapting electricity to the special needs of a factory as illustrated by the modern equipment and carefully planned layout of the California and Hawaiian sugar plant at Crockett, Cal.—*Journal of Electricity and Western Industry*, May 1, 1922.

Electrical Operation of Gate Valves. —P. P. Dean.—After a lapse in its development some five years ago electrically operated gate valves have again come into favor and are now making rapid strides, threatening seriously to eliminate cylinder operation for almost every use where remote control is required. Valves of this type close quickly in an emergency and prevent flooding and consequent damage to property. A description of one system of valve control is given.—*Canadian Engineer*, May 2, 1922.

Three-phase Induction Motor. — E. Ziehl.—The author describes a method which combines low starting current with high torque on a squirrel-cage motor. Assuming a rotor with only four rods on its armature, short-circuited by one copper ring at each end, it is possible by cutting these rings open at two diametrically opposite points to change the straight parallel connection of the four rods into straight series connection, giving about four times the resistance. The motor is started in this way, and as the rotor gains speed a simple centrifugally operated mechanism forces four copper wedges into the four slots, changing thereby the armature into an ordinary squirrel-cage type. Tests made with such a motor showed that after 10,000 starts and stops the centrifugal switches failed to show any signs of wear. — *Elektrotechnische Zeitschrift*, May 25, 1922.

Winding Split-Phase Motors.—A. C. Roe.—The method outlined can be followed for rewinding stators of small single-phase motors, including the repulsion-starting type. Directions for taking data from the old motor, stripping the winding, insulating the slots, making a skein and winding it in place, etc., are among the information given. —*Electrical Review and Industrial Engineer*, May, 1922.

Heat Applications and Material Handling

Modern Electrical Handling Plant.—H. H. Broughton.—Methods and types of labor-aiding machines for ore, grain and cargo handling are described and the general problem of grain handling is outlined.—*Beama*, April, 1922.

The Melting of Cast Iron in the Rotating Electric Furnace. — H. M. Williams and T. B. Terry.—Refractories, electrodes, power consumed, rotation, charging, slagging, temperature control, pouring and metal losses are the subjects covered in this paper. A number of analyses are given which show the effect of melting on the chemical composition. Comparative physical tests are given of heats of cast iron made from borings, pig and back scrap. The effects of steel and alloy additions on the physical properties are shown in tests of several typical heats.—*Paper presented before the American Electrochemical Society at Baltimore*, April 27, 1922.

Electrophysics, Electrochemistry and Batteries

Electrolytic Generation of Hydrogen and Oxygen.—William G. Allan.—This paper deals with electrolytic dissociation of water into its elementary gases, hydrogen and oxygen. The economics of the problem are set forth in such a form that the cost of producing the gases can be ascertained by reference to a series of curves. The utilization of "off-peak" power for the purpose of generating these gases at cheap prices with a view to their use in large quantities in the chemical industry or others is advocated. Special mention, with a brief description and some illustrations, is made of a new type of electrolytic cell designed and developed by the author.—*Paper presented before the American Electrochemical Society at Baltimore*, April 27, 1922.

Kinetic Theory of Gases. — R. H. Fowler.—In the first part of the article the author points out the conditions under which a strict comparison may be made between the intermolecular fields deduced by Sutherland and those deduced by van der Waals. In the second part of the paper two proofs of the formula for the intermolecular field of force are given.—*Philosophical Magazine*, May 27, 1922.

Telegraphy, Telephony, Radio and Signals

Modification of Campbell's Arrangement for Measuring Telephone Frequency. — S. Chiba. — Campbell's arrangement for measuring telephone frequencies is not suitable to measure the lower frequencies. It is shown in this article how the original apparatus can be modified to adapt the measurement of frequency, which changes over wide range. Some special cases of this generalized bridge are found very simple and satisfactory for the determination of frequency.—*Journal of Institute of Electrical Engineers of Japan*, April, 1922.

Alignment Chart for Radio Characteristics.—L. Bouthillon.—Based upon the general formulas of Austin and Cohen, the author has developed a very elaborate alignment chart to determine quickly and with sufficient practical accuracy the reach of the electromagnetic field, the sending characteristics and the most favorable wave length. The proper use of this chart is illustrated by a great number of practical examples.—*Radioelectricité*, April, 1922.

The Piezo-Electric Resonator.—W. G. Cady.—In the course of experiments with piezo-electric crystals, certain radio-frequency phenomena were brought to light the practical application of which appeared worthy of development. The two applications that seem the most promising at present are (1) as a frequency-standard, (2) as a frequency stabilizer, or means of generating electric oscillations of constant frequency. The fundamental phenomena is explained, followed by the mathematical theory, and finally an account of the applications is given.—*Proceedings of Institute of Radio Engineers*, April, 1922.

Miscellaneous

The Rating of Electric Power Supply Undertakings.—Leonard Andrews.—It is essential that all electric power supply engineers and managers should study the questions of valuation for assessment of a supply undertaking and should obtain expert advice upon the matter. The problem of valuation and the manner in which it may be met are explained.—*Electrical Times*, May 18, 1922.

The Muscle Shoals Plant and the Nitrogen Supply.—J. K. Clement.—The fixation of atmospheric nitrogen is taken up, the chief features of the three best-known methods being touched upon. Development of the industry in the United States leads to a discussion of the government Nitrate Plant No. 2 at Muscle Shoals. The various chemical processes are explained.—*Mechanical Engineering*, June, 1922.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

Manuale per il Collaudo delle Macchine Elettriche

By G. Bianchi. Milan: Ulrico Hoepli. 463 pages, illustrated.

In this manual there are collected, besides the standards for electrical machinery compiled by the Italian Electrotechnical Commission, the most important part of the Standardization Rules of the American Institute of Electrical Engineers and the part so far published of the rules of the International Electrotechnical Commission. The author has explained and commented on these rules in an elementary manner, giving many practical examples of their application, his object being to make them clear to those concerned with electrical installations who are not highly trained in technology.

Electric Arc Welding

By E. Wanamaker and H. R. Pennington. New York: Simmons-Boardman Publishing Company. 230 pages, 167 illustrations.

This book is devoted almost entirely to autogenous electric arc welding, being based largely on the authors' experience with this form of welding as applied to railroad and structural engineering. Having been a pioneer in the application of electric welding and a consistent user thereof for many years, Mr. Wanamaker's experience should be of the utmost value to persons who are less familiar with this process.

A large amount of practical information is included that can be applied wherever this form of welding is used. This information includes descriptions of welding systems and their installation, phenomena of metallic and carbon arc welding, training of operators, sequence of metal deposition, electrode materials used, weldability of various metals, weld composition, thermal disturbances of parts welded, physical properties of welds, efficiency of welding equipments expressed in pounds of metal used or deposited per kilowatt-hour, welding cost, and so forth.

The Principles Underlying Radio Communication

Signal Corp Radio Communication Pamphlet No. 40. Washington, D. C.: Government Printing Office. 600 pages, 300 illustrations.

This revised edition has been considerably increased in size. Some obsolete material appearing in the first edition has been replaced, and considerable new material has been added. There is new material on batteries, ordinary wire telegraphy and telephony, line radio-communication transformers, antennas (including coil antennas and direction finders), transmitting apparatus (particularly arc converters, electron tubes and electron-tube apparatus), alternating-current plate supply and radio telephony. Numerous circuit diagrams are given, and the construction of antennas and ground connections is described. Besides other useful practical information, the book contains a table of dielectric constants, copper-wire tables, wave-length tables, the International Code, safety precautions for radio stations, information regarding radio laws and regulations, and a list of radio publications including those issued by the government.

Automatic Telephony

(Second edition.) By A. B. Smith and W. L. Campbell. New York: McGraw-Hill Book Company, Inc. 430 pages, illustrated.

Without doubt this is the best description of the system of the Automatic Electric Company yet published. In getting out the second edition the authors have omitted matter relating to certain systems which are no longer in commercial production. They have also included a considerable amount of new material concerning, among other things, trunking and private automatic exchanges. A description of the panel machine switching equipment of the Bell system is given. A comparison of the two editions indicates how rapid has been the development in automatic telephony during the last few years.

Economics of Electrical Distribution

By P. O. Reyneau and H. P. Seelye. New York: McGraw-Hill Book Company, Inc. 205 pages, illustrated.

This book gives a very large amount of valuable information which cannot fail to be of material assistance to any one making an engineering study of distribution circuits. The study is centered on the most economical layout, the authors having worked in a number of formulas and curves for determining the most economical layout consistent with proper service standards. A thoroughly workable method of laying out circuits for future growth is shown, with tables and curves for daily use. The effect of power factor, load factor, hours of use, etc., on operation is thoroughly gone into. A number of curves are given showing proper wire sizes, proper transformer sizes, distance between transformers, and cost of operation for different loadings. The first part of the book gives working methods and lays the foundation of the study. Some theoretical calculations and curves covering ideal cases are given, with an explanation as to their practical bearing. More directly usable information follows, with a complete explanation of its application. Transmission problems, power circuits, lighting circuits and secondary distribution all come in for a share of the thorough treatment.

One criticism may be offered, and that is that some of the symbols used in formulas and tables are not sufficiently explained. A small section of the book is apparently written from the angle of the mathematician rather than the angle of the man who desires to find a tool which may be picked up and used without too much study and cross-reference. The book as a whole, however, is excellent.

The Engineering Index

1921. New York: The American Society of Mechanical Engineers. 584 pages.

The 1921 edition of this work contains 14,000 digests of articles compiled from over 1,100 technical periodicals. Every branch of engineering is covered on a worldwide basis, and each digest is accompanied by references to the original articles. Those engineers who desire to keep up to date on published engineering articles on any subject with a minimum amount of library research find the "Engineering Index" invaluable. Through the co-operation of the Engineering Societies' Library, photostatic reproductions of any article mentioned in the "Index" can be obtained at a nominal cost, and in addition technical translations can be obtained of the articles listed from foreign publications.

Books Received

Electrical Engineering Testing. By G. D. Aspinall Parr. New York: E. P. Dutton & Company. 691 pages, illustrated.

Drahtloser Ubersee-Verkehr. By Dr. Gustav Eichhorn. Zurich: Beer et Cie. 69 pages, illustrated.

Problèmes et Exercices d'Electricité Générale. By P. Janet. Paris: Gauthier-Villars et Cie. 253 pages, illustrated.

Principles of Electrical Engineering. By William H. Timbie and Vannevar Bush. New York: John Wiley & Sons. 493 pages, illustrated.

Handbuch der Drahtlosen Telegraphie und Telephonie. By Dr. Eugen Nesper. Vols. 1 and 2. Berlin: Julius Springer. Vol. 1, 700 pages; Vol. 2, 510 pages.

Differentialgleichungen. By Dr. Martin Lindow. Leipzig and Berlin: B. G. Teubner. 106 pages, illustrated.

Essais des Machines Electriques. By C. F. Guilbert. Paris: J. B. Baillière. 552 pages, illustrated.

History of the Telephone and Telegraph in Brazil, 1851-1921. By Victor M. Berthold. New York: American Telephone & Telegraph Company. 92 pages.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

Colorado River Policy Still Undecided

After discussing the situation on the Colorado River, the Federal Power Commission has determined to continue its policy of taking no action on licenses for projects on that river pending the determination of a policy for handling the river as a whole. The question was brought up on account of the necessity of taking some action on the application of James B. Girand. The mining interests in Arizona and New Mexico are particularly insistent that Mr. Girand be granted a license covering his proposed development at Diamond Creek on the Colorado River. The commission, however, decided to extend his preliminary permit until November 30.

Utility Maturities Heavy for Second Half of 1922

Public utility bonds and notes maturing in last six months of 1922 make a large total, as reported in the *Wall Street Journal.* Owing to high interest rates in the last three years, many utility corporations floated short term notes, and others extended loans due. Total of this class of bonds falling due is $261,921,600, against $211,623,240 in corresponding period of 1921, and $60,729,000 in 1920.

Many small short term issues will be paid off without refunding. This is particularly characteristic of July maturities, which total $27,595,500. The largest item is Union Traction Company of Indiana $4,623,000 first 5 per cent bonds, due July 1.

Already considerable financing has been commenced or completed to take care of some of these maturities. American Telephone & Telegraph Company has $50,000,000 three-year 6 per cent notes due Oct. 1. This has already been financed by the sale of stock to local consumers with a total subscription list of more than 50,000. Consolidated Gas Company of New York has $20,000,000 7 per cent notes due on Dec. 1. Interborough Rapid Transit Company has $39,199,000 8 per cent extended notes due on Sept. 1. Under the plan agreed upon between the Interborough Rapid Transit and Manhattan Elevated Railroad security holders, these notes will be extended for ten years.

Remarkable improvement in earning power of all classes of public utility corporations in the last six months, as a result of lower commodity and labor prices, has again brought this class of securities into the popularity they enjoyed before the war.

In July over $27,000,000 matures, in August about the same amount, in September more than $66,000,000, in October over $88,000,000, in November only about $16,000,000, and in December more than $55,000,000.

Conference on Radio Direction Finder

Recently nine companies interested in the manufacture of radio direction finders met at the Bureau of Standards to confer with the Assistant Secretary of Commerce, the Bureau of Lighthouses and the Bureau of Standards regarding the production, cost, installation, calibration and maintenance of radio direction finders on shipboard.

It was announced that the Department of Commerce has decided to install the following radio beacon stations: Boston, Nantucket, Cape Charles, Columbia River, Puget Sound and, if funds are still available, Delaware Bay, Los Angeles and Blunts Reef. These are in addition to the two new radio beacons at Diamond Shoal (off Cape Hatteras) and San Francisco Light Vessel. Three other radio beacons have been in operation in the vicinity of New York Harbor for more than a year at Ambrose, Fire Island and Sea Girt.

Besides the requests for more radio beacons, which are now being received from foreign companies whose boats are equipped with radio direction finders, American ship-owners are also asking for better service, as they realize the growing importance of radio direction finders on their vessels.

As a result of the conference, arrangements will be made, through the Bureau of Lighthouses, between the manufacturers of radio direction finders and the operators of steamships for the trial and demonstration of radio direction finding equipment produced by the several manufacturers under operating conditions.

Coal Conference Deadlocked

National Versus District Agreements the Obstacle to Peace—Hope for Government Intervention, but No Definite Action Is Indicated

The coal conference between the bituminous operators and the mine workers adjourned on July 3, without reaching any agreement, until July 10, when sessions will be resumed with the same form of organization. While the conferences on Saturday and Sunday were behind closed doors, there is reason to believe that the arguments presented for district conferences very apparently outweighed those advanced by John L. Lewis and his associates for a national agreement. No great amount of progress was made but, as Secretary Hoover pointed out, a certain amount of discussion must be had on such occasions and he expressed the opinion that understandings are much more likely after expression has been given to pent-up feelings. It is very apparent that Secretary Hoover and Secretary Davis are going to insist that there be more than a temporary adjustment of differences. Every effort will be made to provide for the initiation of policies looking to the treatment of such fundamental ills as intermittency.

While the remarks of President Harding to the representatives of the operators and of the mine workers are capable of being interpreted as foreshadowing action which will amount to compulsory arbitration, it is known that he is relying largely on the advice of Secretary Hoover. Mr. Hoover is known to be a strong advocate of a more permanent settlement than can come from a compromise of wage differences, which is practically the only possible outcome of arbitration.

At the Saturday morning's session, Mr. Lewis took vigorous exception to the fact the so-called doubtful fields were not represented on the operators' side of the conference. He insisted that operators from Kanawha, New River, Colorado and other fields partially affected by the strike should be in attendance. A. M. Ogle, president of the National Coal Association, and designated by the President to be chairman of the conference committee, stated that only those districts which are seeking a conference with the United Mine Workers had desired to avail themselves of the opportunity to name delegates. He pointed out that representatives of the operators were, in most instances, the presidents of the local operators' associations. In certain instances, he is understood to have explained that illness and other causes had prevented the attendance of the president of the operators' association.

Representatives of most of the non-union fields were in Washington as observers.

Meetings thus far held indicate very clearly that the operators believe they are certain to win the strike if it is allowed to run its course. They are practically a unit in their advocacy of district agreements. On the other hand, there is some indication that the position of the mine workers may be altered somewhat in that connection.

The President, in requesting that the negotiations be conducted in executive sessions, was actuated, it is believed, by desire to prevent criminations and recriminations on the part of the interests concerned. An agreement is understood to have been reached whereby all publicity will be given out through government channels.

While Secretaries Hoover and Davis were participating in the conference with the bituminous operators, Secretary Fall met with the representatives of the anthracite operators and mine workers. Secretary Fall is said to have expressed the personal opinion to the anthracite operators that their business is a public utility and should be subject to the regulations usually imposed on that class of industry.

The anthracite operators are understood not to have received a satisfactory answer, when they asked Secretary Fall if the government is prepared to fix the price of coal so as to permit a fair return on the investment and to take the other steps which go with regulation.

After three months of the coal strike the bituminous surplus stocks have been reduced from 62,000,000 tons to less than 20,000,000 tons and, according to the Geological Survey, reserves are as low as they can go without endangering future regular supply. The weekly consumption now averages 8,000,000 tons and the production is a little over 5,000,000 tons.

A more critical situation exists in the anthracite deadlock since authracite is largely consumed in the homes and a shortage may result in a winter of hardship. Prices are high and production at a standstill.

Another element in the situation is that a shortage of cars may be expected when the fall demand for coal arrives.

Southern California Edison Closes Stock Sales

Since the Southern California Edison Company began selling its common stock to consumers, employees and the public of central and southern California in 1917, a total of over $34 000,000 par value has been purchased by more than 45,000 people.

The money thus obtained has made possible the hydro-electric developments at Big Creek, Kern River and on the San Joaquin River. Other money was obtained by bond sales which were largely sold in the East.

Sales of the common stock culminated in a final "John B. Miller Week" in honor of the president. The suspension of all stock sales followed in over 60 agencies as no more stock is available for sale.

Standards for Electric Service in Oklahoma

Rules governing nearly every phase of electric service and designed to improve the quality of service rendered to consumers by electric utilities are contained in an order issued by the Corporation Commission of Oklahoma on June 29, and signed by all three commissioners. The rules are designed to protect both the customer and the electric utility against the possibility of disputes or uncertainty over electric service.

An interesting feature of the order is that relating to testing of meters. This requires tests to be made by the companies of meters at stated periods ranging from every twelve months to every thirty months, owing to the type of meter installed. It requires electric utilities to keep approved and up to date equipment with which to make these tests, and in case of disputes between the utility and one of its customers over the accuracy of any meter, the consumer may request and secure a test in the presence of an authorized commission representative.

The rules contain strict provisions against tampering with meters of electric companies, and where it is shown that the consumer tampers or interferes with his meter, he may be cut off from service, pending adjustment of the matter before the corporation commission. The rules, however, make it the duty of the utilities to make needed adjustments of these meters, and to keep them in good order.

Empire State Association Considers Commercial Problems

Merchandising, Sales Methods, Advertising and Public Relations Questions Are Fully Discussed in a Two-Day Commercial Session Held at Lake George

The need of more intensive sales methods in the commercial department of central station companies, the closer study of advertising and merchandising problems and constant attention to questions of public relations were the outstanding features of the program of the commercial section meeting of the Empire State Gas & Electric Association held at Lake George, N. Y., on June 29 and 30. All of the papers presented at the meeting were marked by comparative brevity and the time thus gained was devoted to profitable discussion of the subjects.

In a paper, "Merchandising and Soliciting," LeRoy Parmelee of the Municipal Gas Company presented a compilation of the experiences and policies of various companies throughout New York. As the central station company enjoys the advantage that every one of its customers must come into the office at least once a month, W. E. Prosser, the manager of appliance sales of the Adirondack Power & Light Corporation, pointed out that the companies could not well afford to overlook this opportunity to provide additional service to the public and also reap the benefit of sales. He advocated selling merchandise at prices which would show a profit and stated that this policy was working out successfully in thirteen stores which his company was operating in the Mohawk and upper Hudson valleys. John G. Mickle of the Chatham Electric Light & Power Company believed that merchandising by central station companies has too great a tendency to follow the path of least financial resistance, and that the companies should adopt a more aggressive policy in their attitude toward merchandise sales. Mr. Parmelee pointed out that companies should by all means engage in the sale of appliances if for no other reason than to maintain the standard of the appliances which are connected to its lines. He stated that only by this method can the sale of cheap, unreliable and trouble-causing appliances be discouraged.

In discussing the standardization of applications for service, Albert Andrews, general manager Owego Light & Power Company, stated that inasmuch as the general rate schedule and rules and regulations with the Public Service Commission embody nearly all of the details, applications for service should be short, and embody only an agreement to pay for the service with a short description of the service required. E. L. Barnes of the Binghamton Railway Company on the same subject declared that an application is a form of contract and it should be more than merely an application to have service connected. From the consumers' standpoint they would know they were signing a standard form binding them to certain agreements and they would be more throughly impressed with the necessity of fulfilling their part of the agreement. In the opinion of R. B. Ingle, manager Fulton Fuel & Light Company, it is thoroughly practicable to draw up a form of application for service for residential customers which covers in a few words all the essential points. He declared that there was really no need for an application other than to identify the name and address of the customer with the account on the company's ledger.

That advertising plays an increasingly important part in the commercial activities of public utilities was brought out by W. J. Reagan of the Utica Gas & Electric Company in a paper on that subject. "One way to make advertising pay the most," he said, "is to employ a trained advertising or publicity man. Frequently it is possible to employ some one connected with a local newspaper to do the work on a part time basis. In this way copy will be written by someone who understands the people who are to be influenced."

It is highly essential, Mr. Reagan pointed out, that a budget of expenditures for advertising be prepared in order that a definite program could be planned and carried out. The use of sporadic or intermittent advertising should be discouraged because of its very uncertain value.

While the use of program advertising is looked upon by many as a form of donation or contribution, Joseph P. MacSweeney, commercial sales manager of the Rochester Gas & Electric Corporation, emphasized the fact that this type of advertising offers valuable possibilities for building good will for the utility and should not be condemned without fair consideration.

C. H. B. Chapin, secretary of the association, outlined the work and plans of the New York state committee on public utility information, whose activities were only begun within the past month. He pointed out that while it was the object of this committee to put the utility business fairly and squarely before the public it could be done only if the utilities themselves, through frankness on their part, helped to build up the confidence of the people. Faith in the public is the fundamental requirement in securing the confidence of the public and mutual confidence is the fundamental requirement of public good will.

Handling service as applied to trouble calls and complaints was discussed in papers by F. M. Houston, sales engineer of the Elmira Water, Light & Railroad Company, and W. F. Moses of the Empire Gas & Electric Company. A paper covering office methods pertaining to the new business and merchandising departments by O. C. Vieweg, also of the Elmira company, was presented.

Purchasing as applied to central station companies was analyzed by W. A. Root of the Bronx Gas & Electric Company, who emphasized the importance of a careful study of existing markets and the necessity of keeping in touch with conditions of supply and demand.

Another interesting feature of the meeting were addresses by representatives of the manufacturers, who had been invited to criticise methods now in use with the view to offering suggestions for improvements. A. M. Berger, Eureka Vacuum Cleaner Company, talked on merchandising and new business methods. L. E. Cass, Hoover Suction Sweeper Company, talked on intensive electrical merchandising, and H. B. Hindon talked on intensive sales campaigns.

Throughout the meeting it was the consensus of opinion that while many companies, during the past four years, have curtailed their commercial and merchandising departments it is now high time for them to renew these activities on even a larger scale than formerly. The most serious problem which presents itself is the scarcity of suitable men for this class of work.

New Lines for Ohio Public Service Company

The Cities Service Company today announced its approval of plans involving the expenditure of several millions of dollars on the properties of the Ohio Public Service Company, a subsidiary serving the northeastern section of Ohio.

The plans approved call for the construction of a 60-mile 130,000 volt steel tower transmission line from Lorain to Mansfield, Ohio, and a similar line 55 miles long between Warren, Alliance and Canton, where it will tie in with the system of the American Gas & Electric Company, which now operates a large power plant on the Ohio River. In addition, the plans call for the installation of a 20,000-kw. turbine at the Edgewater plant at Lorain, Ohio, and a new 30,000-kw. turbine in the Toledo Edison Company plant in Toledo.

This development work when completed on the Ohio properties at Mansfield, Massillon, Elyria, Lorain and Alliance will make available for service generating capacity now held in reserve in the individual plants.

A new 10,000-kw. turbo-generator has been authorized for the Empire District Electric Company in Joplin, Mo., together with other equipment for subsidiary utility properties of Cities Service Company which involves an expenditure of an additional $1,000,000.

Line Extension Investment Declared Reasonable

If the prospective customers of a central-station guarantee a gross income from a line extension sufficient to wipe out the estimated cost in five years, then the utility may properly construct the extension, states the Massachusetts Department of Public Utilities in the case of Stearns vs. Cape & Vineyard Electric Company, handed down a few days ago. In view of the nation-wide interest in the economics of line extensions, this decision is extremely significant.

The petitioner testified that he had sought service for several years without success, and that whenever he tried to secure an extension, which involved 876 feet of pole line and some seven poles at an estimated investment outlay to the company of about $500, he was requested to purchase stock in the utility. The company opposed on the ground of cost and claimed that the estimated total revenue would not exceed $20 per season. On this basis the company held that an expenditure of only $60 was warranted, maintaining that in a community fairly densely populated the company needs about one-third of the active cost of the line in revenue yearly to pay interest, dividends, taxes, depreciation and maintenance.

It was pointed out that in this case the average population per square mile is less than twenty-two families, with no established power requirements to help out, and also that summer customers increase the peak load of the utility. The commission ordered the company to make the extension on the guaranteeing by the petitioner alone or with others having residences which may be supplied by the extension, of a gross income from the extension of not less than $100 per year for a period of five years.

International Chamber of Commerce Meets in Rome

Several hundred representative American business men will attend the second general meeting of the International Chamber of Commerce to be held in Rome during the week of March 19, 1923, according to an announcement made today by the American Section of the Chamber. The meeting. A large transatlantic liner, business men from all over the world for a discussion of world trade problems. Sixteen countries affiliated with the International Chamber will send delegates, while several other countries which have made application for admission to membership in the Chamber will be represented.

An extensive tour is being arranged for the American delegates in connection with their attendance at the Rome meeting. A large, trans-Atlantic liner, engaged for the delegates, will sail from New York on Feb. 10, returning on May 5, a total of eighty-four days. The party will make a tour of the Mediterranean, the Near East and western Europe. Optional trips will be offered for the benefit of delegates who may not want to devote so much time to the tour.

Kellogg Amendment to Tariff Removes Duty

Senator Kellogg of Minnesota has introduced an amendment to the tariff bill removing the proposed duty of 10 per cent ad valorem on telephone, trolley, electric light and telegraph poles, paving posts and railroad ties, of cedar or other woods, and to admit them free of duty.

Winnipeg Hydro-Electric Plant Under Construction

The development of a 168,000 hp. hydro-electric plant at Great Falls on the Winnipeg River, 90 miles northeast of Winnipeg, was first contemplated in 1914. The war interfered and the project was not actively pushed until late in 1921. Further details of the plant are now reported and prospects are bright for an early completion of the project.

The development company is known as the Manitoba Power Company, Limited, with a board of well-known directors and financiers. Sir Augustus Nanton is president, A. W. McLimont, vice-president, L. Palk, secretary and W. E. Blodgett, treasurer. Most of the officers are identified with the Winnipeg Electric Street Railway. To finance the enterprise about $7,000,000 worth of 7 per cent bonds have already been sold, the bonds having been mostly purchased by United States capital. Already there are upward of 900 men at work on the construction.

There are numerous falls on the Winnipeg River which could be developed, and at Great Falls several of these have been included in one concentration by the construction of the dam and power house. The general scheme of development comprises a dam for raising the water and a power house for utilizing the entire flow of the Winnipeg River, thus forming a reservoir approximately 2,000 acres in extent, and providing a deep, wide body of water reaching upstream a distance of 5 miles and flooding out the existing rapids.

The dam will raise the present water level 46 ft. and by excavating a channel 200 ft. wide, 20 ft. deep and about 1,800 ft. long at White Mud Falls, the entire reach of the river below the power site to White Mud Falls will be lowered 10 ft. or more, making a total operating head of 56 feet, for which head the turbines are designed. In the construction of the dam the rock excavated from the cut at White Mud Falls will be utilized. The dam will have a maximum height of 70 ft. and will be over 4,000 ft. in length.

The power house will be 110 ft. wide and 380 ft. long., with a maximum height of 145 ft. The initial installation is to include a power house building complete to accommodate three units. The substructure of the power house for the accommodation of the remaining three units will be completed up to a certain point. The electrical installation includes two generators, the third to be installed in a space prepared when required; two banks of transformers and switching equipment for delivering power to outgoing lines.

The turbines will be of a single runner, vertical shaft, diagonal or propeller type, and will develop 28,000 hp. when operating under a head of 56 ft. and running at a speed of 138.5 r.p.m. The transformers will be 7,000 kva. each, single phase, water cooled, 11,000, 60,000 and 100,000 volts. The weight of each transformer will be 34,000 lb. The height from the leads is 172 in. and the floor space covered 93 in. by 55 in. The generators will be 21,000 kw. capacity, of the vertical type, and will generate three-phase, 60 cycle, alternating current at 11,000 volts.

The capital cost for the initial installation, including all permanent works for the complete development, is less than $100 per horsepower, and the cost for the complete plant will be less than $60 per horsepower. When the plant is completed, the power will be disposed of to the Winnipeg Electric Street Railway Company, and will also be used for commercial purposes.

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France May Develop Tidal Power

A bill to establish a tidewater power plant in the estuary of l'Aber-Wrac'h at Beg-an-Toul has been presented to the National Chamber of Deputies by the French Minister of Public Works Yves le Trocquer. This plant is proposed after an investigation of two years by a special commission

The plant will comprise a dam about 150 m. long and four groups of turbines driven by both the ebb and flow of tide which will be connected to asynchronous alternators located in the concrete caissons forming the dam. The dam will permit of a storage of from 1,500,000 to 4,000,000 cu.m. of water. Each turbine will produce from 75 to 1,200 hp.

Federal Power Commission Still Kept Busy

Pacific Coast and Mountain States Continue to Lead All Other Sections in the Number of Hydro-Electric Projects Seeking Approval

Preliminary permits recently asked from or granted by the Federal Power Commission for hydro-electric projects and other transactions requiring the approval of the commission are summarized below:

The Alabama Power Company's license covering its development at Duncan's Riffle on the Coosa River has been amended at the request of the company to provide for the early installation of three units instead of two and. the future installation of one additional unit.

The Nevada-California Power Company of Riverside, Cal., has applied for a preliminary permit covering a power project on Bishop Creek, a tributary of Swans River, in Inyo County, Cal. It is proposed to construct four storage reservoirs on the headwaters of the creek. The water is to be utilized at the four existing power plants on Bishop Creek.

A preliminary permit for eighteen months has been granted to Hutton, McNear & Dougherty, 61 Broadway, New York, and Insurance Exchange Building, San Francisco, covering a power project on Cascade Creek in the Juneau region of Alaska. It is proposed to develop 20,000 hp. for the purpose of the manufacture of pulp and paper.

The commission has granted the application of the Southern Sierras Power Company of Riverside, Cal., for a preliminary permit to extend for two years, covering a power project on the White Water River in San Bernardino and Riverside Counties, Cal. A similar application by Marcus Pluth of Los Angeles was denied. The project involves the construction of three power houses with auxiliary works to be connected with the system of the company, which extends from Mono Lake to Imperial Valley.

A preliminary permit for a period of two years has been granted to the St. Cloud, Minn., covering a power project on the Mississippi River in Sher-

A GROUP AT THE CANADIAN ELECTRICAL ASSOCIATION CONVENTION burne, Stearns and Wright Counties, Minn., which involves the construction of a dam and power house at some point between Clearwater and the so-called Rigby site, 2 miles above.

A preliminary permit for a period of three years has been issued to the Northern States Power Company of Minneapolis, covering the construction of a dam and a power house at a point near Otsego, Minn., on the Mississippi River, and another dam and power house at a point near Monticello, Minn. The company will make a further study of its Otsego site with a view of developing all the head between it and the Monticello site.

A preliminary permit for a period of three years has been granted to the Washington Water Power Company of Spokane, Wash., to develop power at Kettle Falls, Idaho. The Washington Water Power Company proposes to make the development in three stages. The ultimate stage is to provide a 75-ft. head, developing 153,000 hp.

The commission has approved the assignment by J. H. Cann of Juneau, Alaska, of his license covering a minor power project on Cann Creek at the head of Lisianski Inlet, Alaska, to the El Nido Mining Company.

A preliminary permit for a period of twenty-one months has been granted to the Fort Klamath Meadows Company of Fort Klamath, Ore., covering a power project on Anna Creek in Klamath County. The project involves the construction of a dam, a conduit and a power house. It is the intention to develop about 500 hp. for irrigation purposes.

To facilitate the financing of two projects on the south fork of the American River in El Dorado, Alpine and Amador Counties in California, the commission has given the Western States Gas & Electric Company permission to assign certain of its project works to the El Dorado Power Company and in turn has allowed the El Dorado Power Company to lease the same work to the Western States Gas & Electric Company for operation.

An extension of time has been granted to the Rock Creek Power Company, Missoula, Mont., so that it may begin construction work on its project as late as July 1, 1924. The date of completion has been extended to Aug. 1, 1926.

Since the Sound Power Company of 125 West Forty-second Street, New York City, proposes a complete development of a power project on Olney Creek and the Sultan River in Snohomish County, Wash., the Federal Power Commission has approved the issuance of a preliminary permit to that company and has denied the application for a similar permit to the city of Everett on the ground that the city proposes only a partial development of the stream.

The commission has ruled that it has no jurisdiction over the proposed project of the Chippewa Power Company of Boston to construct a dam across the Chippewa River in the vicinity of Jim Falls in Chippewa County, Wis.

The commission finds that the existing power dam in the Menominee River operated by the Menominee & Marinette Light & Traction Company does not come within the scope of the federal water-power act. A similar finding was reached in the matter of the proposed construction of a dam in the Menominee River 4 miles west of Swanson, Mich.

The commission also finds that a proposed project on the Saco River at Union Falls does not come within the provisions of the federal water-power act. The same finding was had in the matter of dam construction across the Peshtigo River at Johnson Falls and at Spring Rapids.

A preliminary permit covering a period of two years has been granted to the State of Illinois by the Federal Power Commission covering the Fox River project. It is proposed to erect a dam and power house near Dayton, Ill. The power is to be used for public utility purposes.

The Nevada-California Power Company, Riverside, Cal., has applied to the Federal Power Commission for a preliminary permit covering a power project which involves the construction of four storage reservoirs on the head waters of Bishop Creek in Inyo County, Cal. The water is to be utilized in four existing plants on Bishop Creek.

The Colorado Power Company of Denver has applied to the Federal Power Commission for a license covering the following transmission lines: Saguache extension from the Cocomonga distribution line to Saguache, 14.16 miles; Eagle extension, Bonanza to Eagle mine, 3.29 miles; Express extension, Bonanza to Express mine, 1.69; Queen City extension, Bonanza to Queen City mine, 1.84 miles.

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Safety Council Completes Program

The program of the eleventh annual safety congress of the National Safety Council, to be held at Detroit Aug. 28 to Sept. 1, is complete. About three thousand delegates from the United States and Canada are expected to attend. The first day's proceedings, which form a criterion for the quality of the other meetings, include a discussion on four aspects of safety—educational, industrial, public and national—to be dealt with respectively by Dr. John Wesley Hill, R. M. Little of the New York State Department of Safety, A. H. Lichty, vice-president Colorado Fuel & Iron Company, and Dr. J. J. Tigert of the United States Bureau of Education.

The Public Utilities Section is to meet on Wednesday morning, Aug. 30. "The Relation of the Chief Engineer to Accident Prevention" and "Minimizing Personal Injury Accident" will be discussed by public utility men.

Iowa Commission Adopts Rural-Line Specifications

The Board of Railroad Commissioners of the State of Iowa has adopted a set of specifications governing the construction of rural-service lines up to 6,600 volts. In general the provisions of the National Electrical Safety Code govern, the departures being where conditions differ from those considered in establishing the grades of construction for urban districts, conflicts and crossings covered in the Safety Code. The specification has been adopted because of the need of keeping rural-line construction on a basis that will produce good service and avoid the hazards that result from poorly constructed and maintained lines. Every effort has been made to make the specifications clear so that even those who are not thoroughly familiar with line-construction practice can follow them. Treated poles of minimum classes, selected from the various standard pole specifications, are required. Clearances are selected from the Safety Code and minimum sizes of hardware and conductors are specified. Recognition of the possibility of inductive conflicts is taken, and in case of differences of opinion as to the division of cost of measures to control inductive effects the commission reserves the decision to itself.

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Plans for Iowa Metermen's Short Course

As a result of experience in conducting the metermen's short course at the Iowa State College, Professor Paine of the Ames faculty outlined before the Iowa convention at Lake Okoboji some plans for future activities in this work. The state of Iowa has been divided into ten districts, in each of which is a man, representing the meter committee of the Iowa Section of the National Electric Light Association, who has a complete list of those in the district who are interested. It will be the duty of this man to get in touch with every one in his territory who is on this list and discuss meter problems in an endeavor to get the largest possible interest in the work being done by the college.

It is hoped that the representation of the companies in the course next spring will be increased from the attendance of 106 men this year, representing forty-two utilities and thirty-eight counties, to an attendance representing the entire ninety-nine counties and all the utilities in the state. The men in the next course will be classified according to the types of metering in which they are interested, from the ordinary distribution work to high-tension work, and the entire list will be segregated into small groups, each under an instructor. Part of each day will be devoted to group work under the instructors and part to general discussion of subjects assigned. The instruction work will be handled entirely by the college faculty.

International Union of Scientific Radio Telegraphy

The International Union of Scientific Radio Telegraphy was organized two years ago for the purpose of furthering, through international co-operation, the systematic study of fundamental problems of radio communication. Separate sections have been formed for a number of different countries, and the work of the American section has been in progress for more than a year. Recently systematic measurements have been made at receiving stations in the United States of the intensity of signals received from several French stations, and by a continuance of these measurements it is expected that more comprehensive knowledge will be obtained of the phenomena of radio transmission.

A meeting of the American section was held very recently at which the various committees reported, including committees on the study of radio wave intensity, atmospheric disturbances, variations of radio wave direction, measurements of radiations which cause interference and electron tubes. Particularly in the case of the measurements of the intensity of radio waves, it is important that international co-operation be promoted, since it is only by frequent simultaneous measurements made co-operatively by widely separated sending and receiving station that accurate results may be obtained.

Lighting Fixture Council Holds Summer Meeting

The National Council of Lighting Fixture Manufacturers held a two-day convention in Cleveland on June 28 and June 29 with a very large attendance for a midsummer business meeting. The trend of the sessions emphasized the responsibility of the fixture man in the present house construction program and a united purpose to develop the fixture industry to greater strength and influence.

Newton D. Baker, former Secretary of War, as president of the Cleveland Chamber of Commerce, welcomed the fixture men and discussed the position of the trade association. F. D. Lake, past-president of the American Woolenwear Association, told of the experience of that organization in the conduct of its cost campaign. Considerable attention was given to the discussion of cost accounting, in which the members of the council are taking a very active interest.

The high point of the convention was probably an address by Col. Leonard P. Ayres, vice-president of the Cleveland Trust Company, on "Prospects for Building Construction in American Cities." Mr. Ayres is an economist of wide repute and has made a very protracted study of building experience and prospects. He says that there is at present an average shortage of two and a half years of normal construction, based on an analysis of fifty cities, and predicts a very large demand for industries which provide materials for house equipment. Frank E. Watts, editor of *Electrical Record*, gave a brief description of the work of the joint committee for business development.

Much of the second day's session was given over to the discussion of a revision of the by-laws, including an increase in the amount of membership dues and a change in the date of the annual meeting and election of officers from January or February as in the past to June or July. Announcement was made also that the executive committees had approved the plan for a closer working co-operation between the National Council of Lighting Fixture Manufacturers and the Lighting Fixture Dealers' Society. This is not a combination or merger of these two organizations, but a close co-ordination of activities, each, however, retaining its separate identity.

A.S.T.M. Celebrates Twenty-fifth Anniversary

The twenty-fifth annual meeting of the American Society for Testing Materials was held at the Chalfonte-Haddon Hall, Atlantic City, N. J., June 26 to 30 in the Vernon room of the new building. The first session was on non-ferrous metals and corrosion and included several reports such as that of Committee B-2, which presented new tentative specifications for brass pipe, copper tubing and condenser tubes and also for methods of chemical analysis of brass ingots and castings, and bronze bearing metals.

A paper on the remarkable casting qualities of some copper-silicon-aluminum alloys was presented by E. H. Dix, Jr., and A. J. Lyon. The corrosion problem received attention both in committee reports and at the hands of W. D. Bancroft, who believes that measurement of electromotive force is practically valueless in this connection and that the whole problem of retarded corrosion is essentially a question of film formation.

ADVOCATE STANDARDIZATION

The second session was devoted to wrought, cast and malleable iron, beginning with a report of Committee A-2 recommending revision in existing tentative standards for wrought iron. The making of merchant bar iron by the busheled scrap process was described in a paper by W. M. Myers. The "nick-bend" test for wrought iron was discussed by H. S. Rawdon and S. Epstein, who considered that the usual "nick and bend" clause in specifications is indefinite. W. R. Webster outlined a study of the physics of cast iron and suggested that the time has come to standardize existing practice as developed during the fifteen years operations under the society's specifications. Revised specifications for foundry pig iron and for chilled cast iron were suggested by Committee A-3, of which Richard Moldenke is chairman. This also included high test gray iron castings and semi-steel castings. The malleable castings committee, A-7, recommended a modification of the test specimen and an increase in the tensile requirements of the specifications.

The third session was marked by an address of the retiring president, C. D. Young, which was abstracted in the *Electrical World* of July 1.

A session on steel included reports of Committees A-1 and A-4, the former presenting new specifications for carbon steel castings for railroads and the latter recommended practice for the heat treatment of such castings. The tensile properties of steel castings were treated of by Lawford H. Fry, having special regard for locomotive construction. A preliminary report on the effect of sulphur in rivet steel was made by G. K. Burgess, while T. Spooner and F. Kinnard described laboratory tests on testing butt welded steel plates both electrically and magnetically.

Impact testing occupied the fifth session, being a sort of symposium in which H. L. Wittemore, D. J. McAdam, Jr., T. R. C. Wilson, Earl B. Smith, C. L. Warwick, T. D. Lynch, H. F. Moore, and F. C. Langenberg and N. Richardson participated. This was followed by a session on fatigue of metals, the first paper being by H. F. Moore, J. B. Kommers and T. M. Jasper. This paper was accompanied by an exhibit of tests which attracted much attention. The measurement of the shape of Brinell ball indentations was discussed by Fred E. Foss and R. C. Brumfield. The session included reports of Committees E-1 on methods of testing, C-5 on fireproofing, D-15 on thermometers and E-8 on nomenclature. The remaining sessions dealt with such materials as coal, coke, road materials and others which have no direct bearing on machine work and are therefore omitted.

The new officers are: G. K. Burgess, president; W. H. Walker, vice-president, and the four new members of the executive committee are W. K. Hatt, J. R. Onderdonk, D. M. Buck and W. M. Corse.

Arizona and New Mexico Need Hydro-Electricity

Mining, the chief industry in the territory tributary to the power sites on the lower Colorado River, can be stimulated very greatly if this power should be developed, according to a formal statement made by F. J. Bailey, the acting director of the Bureau of Mines, and submitted to the congressional committee now considering the Swing bill, which proposes the expenditure of $7,000,000 of federal money for power development, flood control and water supply in the lower Colorado River basin. "Cheap and dependable hydro-electric power," Mr.

Bailey said, "will stimulate prospecting and development. It will cheapen metal production in a large territory. It will put the small producer on equal terms with the large producer in the matter of power costs. It will open up possibilities of the electrometallurgical treatment of low-grade ores, which at present are unavailable on account of the high cost of electric power generated by steam or in oil-burning plants."

Mr. Bailey declares that existing mining enterprises in Arizona could absorb 75,000 hp. of electrical energy. He also points out that less than 5 per cent of the potential tillable land of Arizona is under cultivation. If power is made available for pumping purposes, large tracts can be irrigated and made fertile.

British Firms Form Alliance for World-Wide Contracts

News comes from London that an alliance of several large British engineering firms has been formed, representing a capitalization of £30,000,000, to undertake comprehensive contracts in all parts of the world. These manufacturing groups employ under normal conditions more than 100,000 working people, and their ramifications cover the production of coal and iron, the building of ships, and the manufacturing of steel, railway construction materials and rolling stock, electrical machinery of all kinds, and much other engineering apparatus.

The directors of the new alliance, which has been incorporated as a limited-liability company with a capital of £250,000 and will be known as the Power & Traction Finance Company, are W. L. Hichens, chairman of Cammell, Laird & Company; Sir John Hunter, managing director of Sir William Arrol & Company; Sir George May, Prudential Assurance Company; Lord Meston, director of the English Electric Company; P. J. Pybus, managing director of the English Electric Company; Sir Hugh Reid, managing director of the North British Locomotive Company, and John Sampson, director of John Brown & Company.

Rural Line Operating Data Being Gathered

As a result of the suggestions made for collecting operating expense data on rural lines in the report of the rural lines committee of the National Electric Light Association there seems to be considerable activity in this direction. In Iowa the engineering extension department of the Iowa State College at Ames is already at work collecting data on the load characteristics of a number of typical rural lines. This work was started last year at the instance of the Iowa Section of the National Electric Light Association. In addition, the department has this year undertaken to co-operate in a study of the operating costs. In Illinois, in connection with recent hearings before the Illinois Commerce Commission, studies of the same costs will be undertaken in which the utilities will co-operate with representatives of the commission and of the farm bureau. In addition to this a number of the larger companies in various parts of the country are undertaking the work. The studies are being undertaken along the lines suggested in the report of the national committee submitted at Atlantic City, and it is expected that the results will give beter data on the subject than have hitherto been available. The task of gathering data is one that will require several years to carry to a satisfactory conclusion.

Other News Notes

Rhone Valley Electrification Planned by French.—A special cable to the New York *Times* of July 4 states that the French Cabinet decided to communicate to the Reparations Commission a plan for construction by Germany on account of reparations several big power stations in the Rhone valley for electrification of the railroads in the district. All contracts made between the French government and the German contractors will be submitted to the commission which will negotiate with the German government to secure payment to the contracting firms. A similar plan was proposed by the late Dr. Rathenau several months ago and at that time was rejected by the French government.

Steinmetz Enters Politics. — Dr. Charles P. Steinmetz was named as Socialist candidate for State Engineer in a tentative slate adopted by the New York convention. Dr. Steinmetz said he would accept provided he made no personal campaign and stated he would not let the job interfere in any way with his work for the General Electric Company.

French to Develop the Niger Valley.—French colonial authorities have selected an American engineer to report on a project of irrigation in the Niger Valley, in West Africa. He is Dr. Herbert H. Forbes, former dean of the College of Agriculture of Arizona, and lately agronomist of the Royal Agricultural Society of Cairo. The work on the Niger contemplates an irrigation dam similar to the Assouan dam of the Nile, and it will be carried out under the direction of the Governor General of French Occidental Africa.

Unemployment in France and England.—French Government returns on unemployment state that at the end of April 1, whereas 699,000 workers were scheduled as receiving unemployment allowances in Great Britain, the number similarly assisted in France was 78,000. At the end of May the French figure had fallen to 57,000. Further, it is shown that the maximum figure reached by unemployment in France was in March, when 91,200 workers were receiving allowance. The British maximum, reached in June, 1921, was 2,170,000.

Injunction Against Raise in Rates.—A temporary injunction restraining the Tennessee Power Company from putting into effect the recent raise in rates granted by the Tennessee Public Utilities Commission has been granted by Judge Sanford of the United States District Court, for the Eastern District of Tennessee. Ducktown Sulphur, Copper & Iron Company brought the suit, alleging breach of contract.

Oklahoma Gas & Electric Expanding.—Checotah and Eufaula, Oklahoma, have recently signed contracts for electric service, to be supplied by the Oklahoma Gas & Electric Company. Both towns have had local plants furnishing electric service in the past. Until the high voltage transmission line between Muskogee and Fort Smith is built, the O. G. & E. Company will operate both the Eufaula and Checotah plants to furnish light and power for these places. Actual operation of these plants by this company was begun on July 1.

Indiana & Michigan Electric Company Extends System.—The Indiana & Michigan Electric Company, South Bend, Ind., has acquired the plants and property of the Benton Harbor & St. Joseph Railway & Lighting Company, St. Joseph, Mich., with territory embracing an area of 20-mile radius. The acquisition involves a consideration of about $1,000,000. The St. Joseph company will be operated as a subsidiary of the purchasing company, and plans are being made for extensive expansion. Included in the program is a power plant at King's Landing, Mich., estimated to cost close to $1,500,000, with transmission lines.

To Electrify Missouri, Kansas & Texas Division.—The Texas Interurban Railway Company has entered into a contract with the Missouri, Kansas & Texas Railway Company for the electrification of the latter's tracks between Dallas and Denton, about 37 miles. The contract has been submitted for approval to the United States District Court at St. Louis, which has jurisdiction over the company.

Coming Meetings of Electrical and Other Technical Societies

Ohio Electric Light Association—Cedar Point, Ohio, July 11-14. (For program see issue of June 24, page 1290.)
A. I. E. E., Pacific Coast Convention—Vancouver, B. C., Aug. 8-11.
Michigan Electric Light Association—Ottawa Beach, Aug. 21-23.
International Association of Municipal Electricians — New Bedford, Mass., Aug. 22-25.
N. E. L. A. Geographic Divisions—New England, New London, Conn., Sept. 5-8; Rocky Mountain, Glenwood Springs, Col., Sept. 18; Great Lakes, French Lick Springs, Ind., Sept. 28-30.
Association of Iron and Steel Electrical Engineers—Cleveland, Sept. 11-15.
American Electrochemical Society—Montreal, Sept. 21-23.
Illuminating Engineering Society—Boston, Sept. 25-28.
National Association of Railway and Utilities Commissioners—Detroit, Sept. 26.
Telephone Pioneers of America—Cleveland, Sept. 29-30.

Commission Rulings

Proper Form of Rule Governing Cash Deposit.—The Missouri Public Service Commission has disapproved a rule made by the Mound City Electric Light & Ice Company which permitted it to "require at any time of all customers a cash deposit equal to an estimated bill covering one billing period of thirty days" and has authorized a rule permitting the company to require at its option that all *new* customers shall "make a cash deposit equal to one and a half times the estimated average monthly bill of such consumer, with a minimum of $3," the usual provisions for interest and refund being also included.

Variation in Depreciation Reserve as Between Departments.—In a rehearing of a rate case involving the Lynchburg Traction & Light Company, a combined gas, electric and street-railway utility, the Virginia State Corporation Commission decreed that an allowed depreciation rate of 4 per cent on the property as a whole had been improperly applied to the separate departments, since the proper rate was 4 per cent in the railway department, 4½ per cent in the electric department and 3 per cent in the gas department. The commission declared itself without authority to increase rates in the two last-named departments in order to make up a deficit in street-railway operations. Only an emergency to preserve public service could justify an increase in electric rates already yielding an adequate revenue.

Commission Sustains a "Demand Charge" for Energy Supplied to Railways.—By decision of the Public Utilities Commission of Utah, the "demand charge" made by the Utah Power & Light Company for interurban and street electric railways has been lowered from 70 per cent of the "five-minute average peak" in any one month to 55 per cent of the same "peak" wherever a railroad has more than two points of delivery for electric power. The railroads asked to be relieved of the demand charge entirely and to be permitted to operate on the basis of straight consumption of power. They pointed out that they must operate their trains on schedules determined by traffic demands which they could not control and said that this condition was responsible for the peak power loads. In opposition, the power company contended that freight movements at least are subject to the railroads' control, and that generally the freight business is the larger part of the interurbans' business and is growing more rapidly than passenger traffic. The commission asserted that in any event the railroads have greater control over their "peak" demands than has the power company, which must at all times stand ready to meet the "peaks" established by the railroads. "Hence," argued the commissioners, "there must be a peak component in the rate to these as to other power users."

"Going Concern" Value for Unsuccessful Business Venture.—The Maine Public Utilities Commission, while objecting to the Central Maine Power Company's retiring or otherwise disposing of worthless preferred stock of the Monmouth Electric Company, the first-named company having asked approval of its purchase of the property and rights of the second-named, did not dispute the fairness of the purchase price, $10,000, although the purchaser's valuation showed the Monmouth property to have a total value of only $9,218.42. The commission held that, even though the Monmouth company had been unsuccessful, the opportunities for increased service in the town rendered the small sum measuring the difference between valuation and purchase price a permissible allowance for "going concern" value.

Discrimination Against Small Consumers.—Return on Unused Plant Investment.—The New York Public Service Commission has handed down a decision reducing the rates charged by the Adirondack Power & Light Corporation in the city of Oneida by 20 per cent. The commission lays down the principle that it will not permit consumers of public utilities to suffer because of imprudent and inefficient management or allow small consumers to be discriminated against in favor of large users. The company asked for a 10 per cent return on its property investment, asserting that it paid 8 per cent on some of its securities. The commission did not agree with the company's contention, basing its dissent on the fact that the company's plant in Oneida was very much larger than was actually required. It was built to meet a hoped-for future demand.

Rates for Battery Charging.—The Arizona Corporation Commission in prescribing rates for battery charging for the Arizona Light & Power Company similar to the power rates of the company said it could see no essential distinction between battery charging and other small commercial activity employing power and no reason for the former to carry a higher rate. "Contrasting the power for battery charging with power used for commercial purposes," the commission said, "it is noted that the load factor of the service is exceptionally high, batteries being placed on the charging tables for periods of thirty-six hours or more. It is true that the service involves operation during the peak, but it is equally true that the adverse effect of such operation is to a considerable extent overcome by the exceptionally good load factor. The diversity between customers in the use of power on the peak is probably not so great as that between any other classes of power consumers."

Recent Court Decisions

Agreement Not to Re-enter Electric Supply Business Construed as to Seller's Right to Generate Current for Own Use.—In Barnett vs. Mays, a suit over the respective rights of the buyer and the seller of an electric light plant, the Supreme Court of Arkansas held that the seller of such a plant who agreed not to re-enter the business of furnishing electric light or interfere with the operation of the plant by the buyer may generate electricity for his own use and transmit it over his own premises or over the premises of others by permission, but cannot furnish electricity to others by transmitting it over his own premises, or interfere with the buyer's operation of the plant, even by the erection of poles over the premises of owners granting him the privilege. (239 S. W. 379.)[*]

Use of Electricity Furnished Without Express Agreement Makes User Liable for Price.—In Independent Electric Lighting Corporation vs. Brodsky & Company the defendant for three years consumed electricity purchased by the plaintiff from the New York Edison Company and retailed to tenants. The energy supplied defendant was by mistake charged to another tenant, who originally paid for it, but to whom the money was refunded when the mistake was discovered. The tenant sued maintained that he was not liable because nothing was said in his lease about electric supply. The Supreme Court of New York, overruling the trial court, found the defendant liable for the whole amount with interest, maintaining that there was no difference between appropriating electrical energy and taking money. (194 N. Y. S. 1.)

Electrocuted Workman Presumed to Have Exercised Due Care.—In Pattock vs. St. Cloud Public Service Company damages were sought because of the death of a carpenter employed by an industrial company which was served with electrical energy by the defendant. The carpenter, who had been working on a roof, was found lying on a cross-arm with both hands grasping a 2,200-volt wire which had been energized for the first time two days before. The theory was advanced that the victim of the fatality had tried to climb down from the roof by the help of this cross-arm and was therefore guilty of contributory negligence. The Supreme Court of Minnesota held that the presumption was that he was in the exercise of due care and that the evidence was not such as to make the question of contributory negligence one of law instead of one of fact for the jury.—(187 N. W. 969.)

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[*] The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Davies Elected President of Canadian Electrical Association

P. T. Davies, who has just been elected president of the Canadian Electrical Association, has been identified with the electrical industry of the Dominion of Canada for fifteen years, ten of which were spent with the Montreal Light, Heat & Power Company and five with the Southern Canada Power Company in various phases of central-station operating and sales work. Mr. Davies was born July 31, 1882, and was educated at the Newport Technical Institute and the City and Guilds Institute of London, England. After serving as the premier pupil at the Uskside Engineering Works at Newport, England, for a period of six years, he became assistant engineer in the South Wales Power Distribution Company in 1905. Two years later he took up his residence in Canada. By 1909 he was operating superintendent of the Montreal Light, Heat & Power Company. To this was added the power sales department in 1911, and in 1912 Mr. Davies was made assistant to the chief engineer. He was appointed power sales manager in 1914, and in 1917 he joined the Southern Canada Power Company as commercial manager, which position he still holds. Under the leadership of Mr. Davies the Canadian association plans for a busy year.

P. T. DAVIES

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R. J. Irvine Heads Southwestern Electric & Gas Association

Ralph J. Irvine, who has recently been elected president of the Southwestern Electric & Gas Association, has been prominent in both state and national association work for more than twenty years. Mr. Irvine entered the electric light and public utility business in Marshall, Mo., in 1900 as superintendent of the construction department of the Marshall Light, Heat & Power Company, but on account of previous engineering experience he was transferred to the position of chief engineer of the same company and in 1906 he was appointed president and general manager of the National Light, Heat & Power Company, which purchased the properties of the Marshall Light, Heat & Power Company and the Marshall Gas Company. Mr. Irvine was appointed vice-president and general manager of the Moberly (Mo.) Light & Power Company in 1911. After reconstructing the electric and gas plants of this company he resigned to become president of the Trenton (Mo.) Gas & Electric Company. In 1915 he was transferred by the holding company to San Angelo, Tex., to become vice-president and general manager of the San Angelo, Water, Light & Power Company, at which time he became also president of the Winters Light & Power Company and the Ballenger Light & Power Company, and vice-president of the Texas Electric & Power Company, in control of the operation and construction of all of the west Texas interests of the Interstate Electric Corporation. In 1920 Mr. Irvine leased the Jacksonville (Tex.) Electric & Ice Company. This entire plant was destroyed by a fire in the same year. In 1921 Mr. Irvine and his associates purchased the franchise and assets of the Jackson Electric & Ice Company and built a modern 600-kw. electric generating station and a modern electric ice plant. Mr. Irvine was elected president of the Missouri Electric, Gas & Street Railway Association in 1911 and was very active in the work of this association for several years.

TWO GREAT SCIENTISTS, MARCONI AND STEINMETZ IN CONVERSATION

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R. Paul Smith Made General Manager Potomac Company

Announcement has been made of the appointment of R. Paul Smith to be general manager of the Potomac Public Service Company and its subsidiary companies. Mr. Smith's promotion is a recognition of long and faithful service. He was born in Woodsboro, Md., and was reared on his father's farm. He attended the public schools of the county and in 1909 was graduated from Blue Ridge College. He then entered the service of the Washington, Frederick & Gettysburg Railway Company (a part of the present Potomac company) as clerk to the general manager, and in a short time he was advanced to be agent of the company. His career from this point has been one of steady progress, from agent to general agent, from general agent to general freight and passenger agent, until in April, 1912, at the age of twenty-three, he was appointed division superintendent of the company with offices at Frederick, Md. In 1917 his zeal and perseverance were rewarded when as general superintendent of the company he assumed supervision of its railway, gas and electric departments. By this time he had become conspicuous for his success in the various undertakings assigned to him, and when the position of general manager became vacant he was selected.

R. PAUL SMITH

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Dean John Frazer, professor of chemistry at the Towne Scientific School of the University of Pennsylvania, has been appointed exchange professor to France next year, succeeding Dr. Arthur E. Kennelly.

Merten Elected Vice-Chairman Pittsburg Chapter A.S.S.T.

William J. Merten, metallurgical engineer of the Westinghouse Electric & Manufacturing Company, has been elected vice-chairman of the Pittsburgh Chapter of the American Society for Steel Treating. Mr. Merten was born June 21, 1876, at Essen, Germany, and after graduation from the public schools of that city took an apprenticeship course at the Krupp gun works. He later completed a course in mechanical engineering in a German technical school. Mr. Merten came to America in 1899, working as a machinist, foreman and inspector respectively for the Westinghouse Electric & Manufacturing Company, the Westinghouse Machine Company and the Union Switch & Signal Company. He was graduated from the Carnegie Institute of Technology in 1912, specializing in metallurgical engineering, and later completed a post-graduate course in commercial engineering. He received the degree of metallurgical engineer in 1916. In January, 1916, he took charge of the metallurgical-chemical laboratories of the Firestone Steel Products Company of Akron, Ohio, as metallurgical and chemical engineer. In March, 1918, he went to Stillwater, Minn., to plan, install and superintend a shell heat-treating plant and to take charge of electric furnace steel melting for the Twin City Forge & Foundry Company. Early in 1919 he was connected with the Ohio Brass Company at Mansfield, Ohio, as assistant manufacturing superintendent in charge of the foundry and galvanizing plant and the malleable-iron casting department. He has been employed by the Westinghouse Electric & Manufacturing Company in the material-process engineering department since Nov. 1, 1919. Mr. Merten has been intimately connected with various technical associations in metallurgical and chemical engineering.

W. J. MERTEN

Mr. Merten is chairman of the papers and field committee of the Pittsburgh Chapter of the American Society for Steel Treating and is also serving as a member of the research committee of the same society.

John F. Killeen Takes Charge of Mitchell Vance Sales

On July 1 John F. Killeen, who for fifteen years had been associated with the General Electric Company, resigned and has affiliated himself with the Mitchell Vance Company. His long service led through a steady course of promotion until in January, 1916, he was appointed general manager of the Electrical Heating Device Department at the Pittsfield works. Soon after Mr. Killeen entered the department it was combined with the Hot Point and Hughes companies to form the Edison Electrical Appliance Company, and in January, 1919, Mr. Killeen joined the staff of that company at its general headquarters in Chicago. At the end of the year he was transferred to the general offices of the General Electric Company in New York City as assistant to A. K. Baylor. For the past three years Mr. Killeen in this capacity devoted himself particularly to the business of the Edison Electric Appliance Company of Chicago, the Hurley Machine Company of Chicago and the Electric Vacuum Company of Cleveland. During the period of his wide activities in the domestic appliance field he has served on various committees of the National Electric Light Association.

D. E. Bent President of the New Mexico Association

The New Mexico Electrical Association recently elected to the presidency D. E. Bent, manager of the Tucumcari Light & Power Company. Mr. Bent was born in Lamar, Col., Nov. 23, 1890, and was graduated from the Massachusetts Institute of Technology in 1912. Soon after graduation he entered the General Electric Company course at Schenectady and later was transferred to the sales department of the storage-battery company. Later Mr. Bent became interested in public utility properties which his father held at that time and devoted himself to work at small central stations. Subsequently he attended the central-station institute of the Commonwealth Edison Company of Chicago. Having been highly successful in managing the plants at Eldorado Springs and La Plata, Mo., he disposed of them at a profit, and in October, 1917, undertook the management of the Tucumcari Light & Power Company. In addition to his duties in this capacity, Mr. Bent has assumed the responsibilities of directing other A. E. Bent interests as general manager. His activity has even carried him into the political field, and he served as representative from his district in the 1921 session of the State Legislature.

D. E. BENT

Obituary

William Reiser, treasurer of the Electric Bond & Share Company, died Sunday near Port Jervis, N. Y., while on an automobile trip with his family. He had apparently been in good health, although a few years ago he had suffered from heart trouble. His body was removed to his home at Ridgewood, N. J. He was born in New York City, March 9, 1881. He joined the Electric Bond & Share Company organization in 1909 and was elected treasurer in 1918. In addition, he was treasurer or assistant treasurer of the companies associated with the Electric Bond & Share Company. He was a Mason and also a member of the Elks.

Dr. Jefferson E. Kershner, professor of physics and mathematics in Franklin and Marshall College, Lancaster, Pa., died suddenly on June 29 while attending a convention of the American Society of Electrical Engineers, held at Niagara Falls. He was born in 1854 in Berks County, Pa., and after preparation in his native county, entered Franklin and Marshall College, from which he was graduated in 1877. Dr. Kershner was tutor in Franklin and Marshall College from 1877 to 1879 and later became professor of mathematics. From 1898 to the time of his death he was professor of mathematics and physics. Dr. Kershner was a thorough student of electricity and acted in the capacity of counsel for many electrical companies. He is well known in the educational world and has written valuable scientific articles.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic
Problems of the Producer and Distributor, with Market Reports, Trade
Activities, Foreign and Construction News

Should the Jobber Handle Equipment?

Being Accustomed to Selling Staples, Is He Organized to Give Service on More Complicated Devices?

By a Manufacturer

It needs little demonstration that the simpler the design of the commodity, the easier it is for the electrical supply jobber to handle it. Rubber-covered and weatherproof wire, porcelain tubes, flexible armored conductor, cross-arms and many other supplies can be handled in bulk with little chance of injury to these materials. Their sale is in large measure a transaction in staple products.

Different Selling Needed

We enter a different field of service when we pass into the marketing of equipment as distinguished from supplies. Here the point is how the jobber should handle such products, not necessarily of delicate design, but composed of many parts, adjusted pieces of mechanism, fitted to particular uses and to be sold, not like sugar or flour, but with intelligent appreciation of the customer's requirements and the manufacturer's interests.

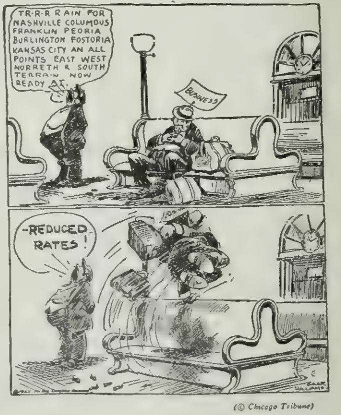
Speaking as a manufacturer with former experience in the electrical supply jobbing field, I believe that many jobbers are of the opinion that their handling of equipment today meets all reasonable requirements. Careful sales engineering, they say, goes hand-in-hand in their organizations with business development. In too many cases this opinion is not correct, and the jobber fails to distinguish between the problem of selling bulk supplies and the marketing of a fabricated mechanical and electrical mechanism like a safety switch or a power-plant recording device.

It is seldom difficult to provide the jobber with a stock of equipment and to meet his requirements on deliveries under normal and often abnormal conditions. I have no disposition to criticise the jobber's desire to make a liberal profit out of every line which he handles, and in general the well-established electrical supply jobber and the manufacturer ought to be able to do business together on the basis of mutually satisfactory credit relations. But before the jobber, speaking generally, can distribute equipment satisfactorily to the manufacturer, one thing must be assured—proper handling of goods from the time delivery is made by the manufacturer to the time the equipment is installed ready for service.

Improper Handling

Experience shows that in far too many cases equipment is improperly handled by the jobber or his representative in its path from the factory to the consumer. Many jobbers cannot believe this to be true, owing to their confidence in their organizations and methods. But too many examples have come to hand to warrant the conclusion that all's well. Sporadic cases, of course, prove nothing; but recurring experience is another matter, and the jobber with open mind will do well to look into this question.

Will This Wake Him Up?


TR-R-R RAIN FOR NASHVILLE COLUMOUS FRANKLIN PEORIA BURLINGTON FOSTORIA KANSAS CITY AN ALL POINTS EAST WEST NORRETH & SOUTH TERRAIN NOW READY AT.
BUSNESS
-REDUCED RATES!

(© Chicago Tribune)

BUSINESS has been waiting for a chance to start and go somewhere. The recent sweeping reductions in freight rates should bring far-reaching stimulus—but we must all help get our customers aboard the train.

Manufacturers intend that their equipment shall leave their factories ready for installation and immediate service. Shipments received by the jobber for stock or for early transmission to the consumer should be in proper condition for service. The practice of dismantling apparatus for demonstration purposes or its rough handling en route or in the warehouse of the jobber leads to trouble. Reassembly of parts by members of the jobber's staff often results in maladjustment. Then the equipment goes into place, perhaps with a screw lost in the working mechanism or with some important part missing or adjustment out of line with proper practice. Result—dissatisfaction to the user, a "black eye" for the manufacturer, return of parts or complete equipment to the factory, or a demand for extra field service to be met by the manufacturer.

Manufacturers Will Help

No great amount of engineering should be necessary on the part of the jobber's salesman to sell a standard product like a safety switch, for instance, with ample descriptive literature. If interest in a device warrants maintaining a sample "taken down" at the jobber's wareroom, that situation can be met easily enough; but let us do away with the "catch-as-catch-can" method of exhibiting mechanism to be marketed for specific service. If engineering problems arise in connection with the application of such devices, the manufacturer will always be found ready to co-operate in getting at the right solution, if the jobber will seek his assistance.

By taking an active interest in pushing a line of equipment and by treating it with reasonable respect as compared with cable reels, knobs and tubes, the jobber will take a long step toward qualifying as a proper distributor of apparatus as well as of bulk supplies.

A Simple Code of Business Ethics*

The Fundamental Principles of Honest Business Can Only Be Expressed in Terms of Service

BY EDWARD A. FILENE

THERE seems to be need of a simple general written code of business ethics. I propose the following:

1. A business, in order to have the right to succeed, must be of real service to the community.

2. Real service in business consists in making or selling merchandise of reliable quality for the lowest practically possible price, provided that merchandise is made and sold under just conditions.

This is short and simple. At first glance it may appear insufficient. Yet a closer study will show that it covers the whole field of business ethics.

In the first place, I say that one has not gained the right to success until he has made his business of real service to the community. Just because one has organized a company, built a factory or opened a store is no reason why the community owes him a living. He went into business voluntarily. He must justify success by doing something which merits compensation.

This would seem self-evident, and yet it is true that a great deal of business is done with no real comprehension of this axiomatic truth. If I take money from you without return service, by force or threat, I am legally a thief and a robber and can be arrested and put in prison. Likewise, if I take from you by fraud or false pretense, I can be dealt with legally. But under the common practice of today I can safely take from you, in return for merchandise, all that I can induce you to pay.

"REAL SERVICE TO THE COMMUNITY"

What constitutes "real service to the community?" Clearly it is not offering merchandise for sale at the greatest price which we believe can be obtained from the public. The work of the manufacturer consists in making goods which to his expert knowledge are best adapted for the particular uses for which people want them. The work of the merchant consists in obtaining merchandise in wholesale quantities and selling it in retail quantities at a just price.

The merchant who buys a pair of shoes and sells them for more than a fair advance over cost performs no adequate service to the community. We would refuse to pay the bill of the physician, the carpenter or the man who shovels snow off the sidewalk if he did not perform a service somewhere nearly equal to his charge. Should not the same demand for adequate service be made on the manufacturer, the merchant and the banker as on other servants of the community?

If one makes merchandising too expensive, if he exacts a profit greater than a just compensation for his work, then he ceases to serve the community. The manufacturer or merchant who does not reduce business costs and profits to the lowest practicable figure, and so enable the community to obtain goods for as low a price as possible, is not serving the community to the best of his ability and consequently is not entitled to large rewards.

"LOWEST PRACTICABLE PRICE"

But this is still not enough. Our code should furnish us something with which to measure this lowest practicable price. A price that is the "lowest practicable" in one place may not be so in another, and the lowest practicable price one year will probably not be the lowest practicable another year. Civilization started when a savage horde discovered that some one of the group could make sharper arrow heads than the others and gave him the task of making arrow heads for all the rest, promising, in return, to provide him with the necessities of life. From then until now we have gone on progressively. Each improvement and refinement of this process makes each effort of each individual worth more, or, relatively, makes the things he needs or desires cheaper. It should be axiomatic that the merchandise must be of reliable quality, for a lowering of prices through the substitution of inferior merchandise is not real progress.

"JUST CONDITIONS"

Finally, the proposed code calls for merchandise made and sold under "just conditions." If one "serves" the community at the expense of any portion of it, he has not added to the sum total of the community's welfare, but has been merely the means of depriving some of its members of benefits for the sake of distributing them to others. If a merchant handles merchandise that has been made by underpaid or overworked people, he is sinning ethically as well as economically, for either he is benefiting himself or he is letting the rest of the community benefit at the expense of those workers.

CARE OF EMPLOYEES

Equally, a manager's treatment of his employees must be just. Too much thought and planning cannot be given to creating good relations between employer and employee, but in the endeavor to improve these relations the fact should not be lost sight of that such work is not an end in itself, but merely a very important factor among the means for attaining the true aim of business—service to the community.

The world is pretty well agreed now that, after all, its greatest progress will come from the greatest freedom to all men. No man is really free if he does not have more than enough with which to purchase the necessities of life for his wife, his children and himself.

Under a code of ethics that requires business to sell cheaper and cheaper, the necessaries of life will be more easily obtained, and gradually the so-called luxuries of life will become more and more available for less and less hours or days of work; and thus men will become freer and freer.

The results of selling goods cheaper and cheaper show in the reduction of the number of hours of a day's work. Within a generation the working hours have gone down from sixteen to eight. There are enough indications and possibilities of further reductions in sight to make it not impossible that in time five hours' work a day will be sufficient to provide a living for a man with a family. This does not mean that a man will work only five hours, but rather that he need work only five hours for a mere living. Many men under such circumstances will work eight or ten hours at their vocation, spurred on by the desire to put their children through college or to satisfy other desires.

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*A paper presented before the American Academy of Political and Social Science.

CONCLUSION

Along this line, I believe, lies the solution of many of the pressing economic questions of today which seem so hopelessly insoluble to many thoughtful citizens. It lies in making the products of business available at ever cheaper prices, and so permitting the great mass of the people to enjoy the full fruits of modern specialization and standardization. The producer or the merchant who grasps the truth of this thought will in the end win a reward which is fairly his and which goes far beyond the dreams of the man who is in business for the profit alone.

Freight Loadings Totaled 860,722 Cars

Loading of revenue freight totaled 860,722 cars during the week which ended on June 17, compared with 846,002 cars during the preceding week, or an increase of 14,770 cars, according to the report just received from the railroads of the United States by the American Railway Association. This was the largest number of cars loaded during any one week since Oct. 22, 1921, and exceeded the corresponding week last year by 85,444 cars. It was, however, 55,964 cars under the corresponding week in 1920.

Coal loadings totaled 99,136 cars, a reduction of 2,688 cars compared with the previous week.

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Electrical Exports for May Show Large Increase

Exports of electrical goods took an upward turn in May, figures just compiled by the Bureau of Foreign and Domestic Commerce show. May exports were valued at $4,529,394. This is an increase of nearly $700,000 over those of April. Some of the items contributing to the increase are: Power transformers, carbons and electrodes, storage batteries, motor accessories and parts, metal filament lamps, radio and wireless apparatus. The detailed figures are as shown in the accompanying table.

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Fixture Manufacturers Report Better Business

Artistic lighting fixture manufacturers in New York City report considerable improvement in their business over the corresponding period of last year. Department stores have been the largest buyers of this class of merchandise, it is reported. One important manufacturer of wrought iron bridge lamps says he sold 1,000 of these to a local department store, which in turn cleared them within two days at the attractive price of $4.50, giving the choice of either 12-in. silk or parchment shade. The increasing sale of the bridge lamp has, for the time being, slowed down the turnover of the cheaper grade floor lamps of the regulation style. Much export business in high grade lamps is reported.

ELECTRICAL EXPORTS FOR MAY, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

	May, 1921		May, 1922	
	Quantity	Value	Quantity	Value
Electrical glassware, except for lighting, lb	...	...	189,585	$10,246
Electrical porcelain, lb	..	.	768,580	117,588
Carbons for electric lighting, electrodes and batteries, lb		27,464	1,063,292	132,582
Insulated wire and cable (iron and steel) lb			106,731	21,104
Other manufactures of aluminum, lb		81,888	375,389	88,386
Copper wire (bare), lb	2,706,213	461,967	884,774	140,067
Insulated copper wire and cable, lb.	.	860,491	762,085	146,671
Generators:				
Direct current—				
Under 500 kw., number	.	. .	288	49,858
500 kw. and over, number		.	30	53,823
Alternating current—				
Under 2,000 kw., number		.	9	8,169
2,000 kw. and over, number			2	14,029
Accessories and parts of generators, lb			147,280	49,828
Self-Contained lighting outfits, number			167	54,579
Batteries, number		430,525		
Primary—dry, number			416,088	106,118
Primary—wet, number			1,040	1,179
Storage, number		.	8,701	140,220
Transforming or converting apparatus—				
Power transformers, number			652	516,366
Other transformers, number			2,148	46,302
Rectifiers, number			211	4,864
Condensers, double current and motor generators, dynamomotors, synchronous and other converters, number	.. .	. . . .	1,284	69,968
Transmission and distribution apparatus—				
Switchboards and panel boards, except telephone, number	.	..	194	253,490
Switches and circuit breakers number		.	161,074	194,229
Fuses and fuse plugs, number	.		171,889	15,442
Watt-hour and other measuring meters, number	. ..	. .	4,146	40,132
Volt, watt and ampere meters, and other recording, indicating and testing apparatus, number	. ..	. . . . .	6,212	76,308
Lightning arresters, choke coils, reactors, and other protective devices, number	. . . .	. . .	5,794	66,765
Motors, starters and controllers:—				
Motors, under 1 hp., number	. . . .	. . . .	5,876	76,472
Stationary motors—				
1 to 200 hp., number		.	1,489	198,514
Over 200 hp., number			47	45,731
Railway motors, number	......	. .	26	2,245
Electric locomotives, number	8	274,511	......	....
Railway	......	....	....	....
Mining and industrial, number	......	......	2	10,900
Other motors, number	......	1,641,827	480	29,760
Rheostats, controllers and other starting and controlling equipment, lbs	......	101,663	136,661	67,239
Accessories and parts for motors, lbs	......	....	188,368	100,370
Electric appliances—				
Electric fans, number	3,712	77,480	6,587	70,794
Electric lamps—				
Arc, number	38	878	1,405	2,461
Incandescent—				
Carbon filament, number	47,795	15,194	22,522	5,751
Metal filament, number	1,185,347	353,339	416,285	96,654
Other electic lamps, number	.	. .	25,154	22,572
Flashlights, number	. . .	......	26,236	23,797
Searchlights and projectors, number	. .	......	370	3,509
Motor-driven household devices, number	. . .	. . .	2,007	53,722
Domestic heating and cooking devices, number	. .	101,745	8,343	47,554
Industrial electric furnaces and ovens, number	. . .	... ...	61	6,132
Therapeutic apparatus, x-ray machines, galvanic and faradic batteries, etc.	.....	....	446	59,058
Signal and communication devices:				
Radio and wireless apparatus, pound	.	..	92,328	186,525
Telegraph apparatus (including wireless), number	.	190,343	.. . .	....
Telephone, including switchboards, pounds	.	...	319,220	434,287
Police, fire and burglar alarm, pounds		... .	3,002	1,097
Railway signals, switches and attachments, pounds	......	....	39,390	8,239
Bells, buzzers and annunciators, number	.. ..	....	5,334	5,176
Other electric apparatus:				
Spark plugs, magnetos and other ignition apparatus, pounds	......	92,595	84,689	103,705
Insulating material, pounds	. . . .	... .	316,162	83,854
Metal conduit, outlet and switch boxes, pounds	......	......	170,529	15,147
Sockets, outlets and receptacles, number	......	....	104,060	20,963
Other wiring supplies and fixtures, pounds	.	114,564	198,168	102,968
Other electrical apparatus not elsewhere specified, pounds		2,132,800	2,507,102	875,694
Electrical machinery and apparatus (total)	....	$8,056,791	......	$4,529,394

Restrictions Handicap English Industry

Riley Stoker Company President States that Closed Shop There Is Deadening Influence—Impressed with Our Strong Economic Position

EXCESSIVE restrictions upon output and the deadening influence of the closed shop are handicapping industry in England, declared R. Sanford Riley, president Sanford Riley Stoker Company, Worcester, Mass., to a representative of the *Electrical World* a few days ago, following his return from a short trip to Great Britain and the Continent. Mr. Riley also visited France and Germany and was much impressed by the strong position the United States is in economically in comparison with these overseas countries. The domination of labor unions upon English industry, he says, has become a heavy burden upon the prosperity of the nation, chiefly through the short-sighted and arbitrary curtailment of output advocated in organization circles. Inflation in Germany appears to be carrying that nation toward the brink of an economic precipice, but there is little opposition to piece work in industry as compared with England. Attempts are now being made by the German authorities to limit exportations, the low prices received being unsatisfactory. The exchange situation as regards Germany continues very bad, but this is improving gradually in England.

While France is chiefly interested in the securing of reparations from Germany for war damages, a good deal of industrial development is under way in the former country. Mr. Riley noted with interest the thoroughness of testing which is practised in French manufacturing and stated that American machinery producers might well take a leaf from the French book in this particular. Thus, in stoker manufacture, tests are made of the gear-box efficiencies and temperature readings are taken and studied in connection with the try-outs of such apparatus in the shop and elsewhere. Much interest exists in France today in the development of super-power plants for economical supply of energy, some remarkable installations being under way in Paris. Although the advantages of centralized energy supply have been investigated extensively for London, comparatively little real progress has been made toward the simplification of electrical systems in the British capital.

Mr. Riley brought home a vigorous conviction that upon the adherence of American industry to the open-shop principle and to the encouragement of individual initiative among employees of all ranks will depend in no small degree the future of manufacturing prosperity here. At present the opportunities for overseas trade are severely restricted by the economic conditions abroad, and the cultivation of the domestic market appears the most promising line of development for American engineering materials.

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Lamp Sales Running Ahead of Last Year

Incandescent lamp production and sales the country over are nearly 30 per cent better than a year ago, comparing months of 1922 with the same portion of 1921, according to E. J. Poor, sales manager of the Hygrade Lamp Company, Salem, Mass. In the Hygrade *Triangle* for June 16 Mr. Poor points out that business is on the upward swing, but that a long, hard pull will be necessary to equal the record for the years before the war.

In New England, May, 1922, bank clearances were about 20 per cent larger than a year ago. Industrial building is up 250 per cent, residential building is up about 200 per cent and freight movements are 30 to 40 per cent larger. Many New England industries are now operating at better than 70 per cent of normal production. Mr. Poor feels that labor troubles in the textile and coal fields and the threatened railroad strike must be settled in a broad-gage way, leading to better business in the end. Superlatively good business cannot be had until foreign trade is restored, he said.

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Hollow-Ware Sales in June Finished Strong

Improved business in New England is reflected in the June sales of hollow-ware in both wholesale and retail circles. At this writing it looks as though at least 35 to 40 per cent larger sales would be recorded in electric irons and certainly a 25 per cent better movement in toasters and percolators than in June, 1921. Individual distributors naturally vary in experiences, but on the whole the public has responded well to the price reductions effected from the war-time peak in electric table-ware, and doubtless reductions in central-station rates have further aided these sales. Though small in volume, the trade in chafing dishes for bridal presents has been good, and grills have increased materially in popularity. Practically all these socket appliances for table use are getting into the staple class, and continuous sales efforts are yielding good results.

The June demand in Chicago for hollow-ware for graduation or wedding presents was not very pronounced. Sales on chafing dishes and percolators have been fair, but not in amounts great enough to state that there were increases over the 1921 sales. The only exceptions are where sales campaigns have been conducted. Most of these have been successful. Dealers' stocks are good and most of them attribute this lack of movement to the public's remembrance of conditions during the past winter, which induces them to save their money. The only appliance which received much attention was irons. This was the sales leader, according to many jobbers.

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Metal Market Situation

This week's copper market was steady and the price of 13⅞ cents prevailed. The largest sale of the week, 8,000,000 lb. at 13¾ cents, is noted. Demand is improving and the trade expects another large buying movement when the holidays are over. Inquiries in the market have been slow and many are inclined to delay purchases until next month. Mills continue to accept metal orders as fast as producers are ready to ship, as all are reporting operations at good rate.

NEW YORK METAL MARKET PRICES

Copper	June 28, 1922	July 5, 1922
London, standard spot	£ s d. 63 2 6	£ s d 63 2 6
	Cents per Pound	Cents per Pound
Prime Lake	14 00	13 87½
Electrolytic	13 62½	13 75
Casting	13 25	13 25
Lead, Am. S. & R. price	5 55	5 75
Antimony	5 00	5 05
Nickel, ingot	36 00	36 00
Zinc, spot	5 62½	5 45
Tin, straits	31 12½	31 50
Aluminum, 98 to 99 per cent	19 10	19 10
OLD METALS		
Heavy copper and wire	11 00–11 50	10.50–11 00
Brass, heavy	5.50– 5.75	5.50– 5 75
Brass, light	4.87½–5.00	4.87½–5 00
Lead, heavy	4.62½–4.70	4.62½–4 65
Zinc, old scrap	3.00– 3.12½	2.87½–3 00

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

DEMAND for electrical supplies is more active this week than for the week before, reports from all over the country indicate. Wire is moving well, although price competition is fairly keen and some small recessions are noted. The lamp trade continues brisk notwithstanding the short nights and daylight saving handicap. Considerable flood-lighting is in use in connection with business building construction and the trade in automobile headlights continues active. Business in the smaller size motor market is fair, large orders being recorded in the Western districts. Central-station business improves, money for extensions and improvements is easier to secure. Most large companies are carrying out comprehensive construction programs. Radio stocks are moving in larger volume, and there is optimism expressed for record sales in the fall months.

New York

Business Holding Up Well—Some Price Competition—Easier Quotations on B-X Cable

Demand in the electrical trade is holding up well and jobbers are reporting a satisfactory volume of sales for this time of the year. Wiring supplies are moving steadily, although price competition is fairly keen and some small recessions were noted. Quotations on flexible armored conductor are a little easier and lamp cord is slightly lower than the last prices quoted. Sales to industrial users have continued and this class of business appears to be gaining headway as the summer advances. Fan sales are also showing renewed activity owing to the sustained warm weather.

Rigid Conduit.—No change was reported in prices or conditions affecting this material. Demand is only moderate and stocks are ample. Quotations were as follows: For ½-in. black pipe in 2,500-ft. lots, $44.50 to $46.58; ¾-in. $58.10 to $59.57, and 1-in., $82.79 to $84.66 per 1,000 ft. Quotations on galvanized pipe in the same sizes and quantities were $50 to $51.68, $64.50 to $66.47 and $92.20 to $94.86 per 1,000 ft.

Flexible Armored Conductors.—Prices on B-X cable are slightly lower. No. 14 two-wire, single-strip, is quoted at $42 per 1,000 ft. and double-strip at $44 per 1,000 ft. both in that quantity. This is a decrease of $1 per 1,000 ft. under previous quotations.

Rubber-Covered Wire.—Demand is fair and prices are firm. No. 14, sinble-braid, rubber-covered sells for $6.20 to $6.50 per 1,000 ft. in 5,000 ft. lots.

Lamp Cord.—Lower prices are in effect on silk and cotton cord. In 1,000-ft. lots No. 18, cotton twisted sells for $10.50 per 1,000 ft., and the parallel for $12.40 per 1,000 ft. Silk cord in the same size is quoted at $25.70 and $27.60 for twisted and parallel respectively.

Fans.—Sales are reported to be very active with the continual warm weather and jobbers are well satisfied with the business received thus far this season.

Chicago

Seasonal Variations Cause a Slump in Market—Wiring Material Calls Please Jobbers

Seasonal variations have created a slight slump in the electrical trade here, but jobbers are pleased with the way calls for wiring materials have kept up during the past two months. Prices on conduit are considerably firmer because of lowered stocks. The call for rubber-covered wire and armored conductor has fallen off slightly. Another active week was reported by manufacturers of high tension equipment. The motor market is improving, since practically all manufacturers report a steady volume of business on motors under 10 hp. An active demand for safety switches, both small and large sizes, was noticed.

Flexible Armored Conductor.—The call for this material is progressing at a steady rate, although few large orders have been reported. Most all dealers state that there is a goodly volume of fair sized orders. The No. 14, two-wire, single-strip is available at $42.50 per 1,000 ft. in 5,000-ft. lots. Stocks are in fair condition.

Conduit.—The market for conduit is still active and prices are firm, ranging from $43 to $44 per 1,000 ft. in 5,000-ft. lots for the ½-in. black pipe. Stocks of most dealers on the smaller sizes are low, since shipments from manufacturers have been slow and because of the very active demand in the building activities. Several jobbers reported some good sized orders on the three and four-inch pipe for industrial installations.

Wire.—Rubber-covered No. 14 sells around $6.25 per 1,000 ft. in 5,000-ft. lots. Orders have kept up to about their former level, but jobbers report a slight slump due to hot weather and vacation schedules. Very little change occurred in the bare and weatherproof wire market; prices are still firm.

High-Tension Equipment.—Business for the high-tension manufacturers is continuing briskly. One company received orders for three 1,500-kva., 33,000-2,300-volt, steel-tower outdoor substations and one 450-kva., 33,000-2,300-volt outdoor substation, both for the Middle West. Indoor busbar supports are also moving well. Another company reports that the volume of fuses per order has increased and inquiries are steadily pouring in. Another firm states that trade in outdoor substation equipment has been keen.

Motors.—While most all dealers report a steady demand for motors under 10 hp., a few state that the larger sizes are also beginning to move. The downward readjustment in the prices of d.c. motors about the middle of June, ranging from 3 to 15 per cent, has produced very little effect on the buying public. However, the June market on the smaller sizes has been, according to one manufacturer, the best month for several years. Another company reports that its orders have not fallen below the level set up during May. With most of these motors going into new installations for industrial purposes, manufacturers feel that the motor market is becoming strong again.

Boston

Magnet Wire Demand Is Active—Brisk Trade in Lamps Continues—Sockets Are Steady

Business continued last week without much change in volume, wiring devices and lamps being in especially good demand. In the appliance field electric irons are selling exceptionally well.

A slight improvement in the demand for heavy cable is reported and magnet wire for radio apparatus is moving swiftly. Electrical manufacturers are much more encouraged as to the outlook and little is heard of curtailment in this field. Most of the New England factories producing electrical material will probably run on a fairly good basis of orders throughout the summer. Central-station commercial activities are stimulating the demand for electric service, and an enormous business in new telephone installations is being carried on in this territory. Retail trade continues good in comparison with a year ago. Central-station outputs are gaining and small-power business is a little better. Building and engineering contracts in New England for the week ended June 27 totaled $7,970,800, compared with $4,196,000 for the same period last year.

Magnet Wire.—An active demand is apparent for radio work in anticipation of late summer and early fall business. Quantity deliveries are a bit slow. A representative jobber sold 6,000 pounds of No. 40 enameled magnet wire on recent order. Prices for this size of silk-covered wire range from $3 per pound in less than 100-lb. lots to $2.25 in larger quantities.

Lead-Covered Cable. — Sales are better than last winter. Deliveries are easy and prices fairly steady.

Lamps—A brisk trade in lamps continues notwithstanding the short nights and daylight saving handicap. Restriction of consignment stocks within closer limits of sales results is tending to equalize stocks in general. Yearly increased use of electricity in summer resorts and camps is helping to swell the total volume of sales. Considerable flood-lighting is in use in connection with business building construction and the trade in automobile headlights continues active.

Flexible Armored Conductor. — Single-strip No. 14 was quoted at $42 net cash per 1,000 ft. in 5,000-ft. lots at the week-end. Stocks are plentiful and the demand active on account of building work. Competition is very sharp.

Wire.—Rubber-covered No. 14 is moving well at $6.25 per 1,000 ft. in 5,000-ft. lots. Business is excellent in inside wiring of old and new structures. Weatherproof is moving rather unevenly on a 16½-cent base, central-station construction being still extremely conservative. Industrial plant wire buying is very moderate.

Sockets.—Prices held steady in the Boston market among the regular distributors up to the holiday, but long-experienced dissatisfaction with the jobber's profit on case lot shipments is expected to result in firmer quotations shortly. Boston prices on pulls in case lots are about 31½ cents, keys 18½ cents and keyless 17 cents.

Rigid Conduit.—Local stocks are not very badly reduced this week, expectations of a possible shortage being occasional rather than general as the month opens. Unquestionably there are irregularities among distributors' stocks, but so far current demands are being met well. Boston downtown building operations are beginning to be felt in requests for bids, many new structures being under way on the sites of old establishments.

Nail-It Knobs.—Sales are confined largely to sections absorbing loom. Stocks are easy and the prices continue steady at $15.50 per 1,000 in barrel lots.

Tumbler Switches.—Prices are easier, list on a prominent make of surface type tumblers having dropped from 72 to 64 cents net.

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Atlanta

Flat-iron Sales Strong—Conduit Stocks Are Plentiful—Outlet Boxes Moving Satisfactorily

Indications of returning prosperity and normalcy are in daily evidence. Not only is this condition reflected in the spirit of the various members of the electrical trade, but the spirit of optimism seems to have spread generally throughout all business lines in this section. Excellent weather conditions have served to boost the spirit of the rural population and have given them an opportunity to get in much needed work on the farms, with the result that the prospects for good crops are much brighter than two weeks ago.

Quite a bit of activity is to be noted in the industrial field, which to date has assumed only the phase of inquiry and investigation.

Financial conditions in the small towns are better and a number of the small state banks which have been closed for some time are opening, tending to stabilize financial conditions. Unemployment has shown a large decrease, most of the jobless now being among the unskilled labor, though it remains to be seen what the rail strike called this week will do toward throwing additional skilled labor out of work. No industrials as yet report the pinch of the coal strike and sufficient time has not elapsed to permit of any reflection from the rail strike.

Flatirons.—Sales in this specialty are reported quite good, with the 3-lb. and 6-lb. irons leading in popularity. Jobbers have put in good stocks and shipments are satisfactory.

Lamp Cord.—A fair but steady demand for this item is apparent, with stocks plentiful. Prices are reported as steady.

Poles.—The movement is somewhat slow, such orders as materialize being placed by the larger utility companies. The heavier types of 35 ft. and 40 ft. should begin to move readily within the next thirty to sixty days as long transmission lines now proposed get under way. Shipments are quite satisfactory in all sizes.

Pole-Line Hardware.—This line is running at cross purposes to poles and shows a very satisfactory movement, especially in the telephone and 2,200-volt types. Jobbers' stocks are in first-class shape with shipments satisfactory.

Flexible Non-metallic Conduit.—This item continues its steady gait with No. 14 and No. 12 two-wire leading the field, though there is some three-wire in steady demand. Stocks are in good shape with no recent price changes reported.

Outlet Boxes.—The popular sizes of outlet boxes continue to move very satisfactorily, with plentiful stocks on hand. Prices remain steady.

Lightning Arresters—Sales in this line have not come up to expectations, despite the fact that the summer season is well under way. Jobbers have accumulated heavy stocks in anticipation of a more active market.

Soldering Materials.—A fair demand for this line is reported, with good stocks on hand. Recent quotations on solder, in lots of 5 to 25 lb., are 35 cents, while solder paste in ½-lb. tins, lots of twelve to fifty, is reported at $18.30 per 100 cans.

Refrigerating Equipment.—The household type is increasing in popularity, though the movement is somewhat limited because of high prices. The manufacturers are undertaking sales efforts which will probably be productive of results within the next sixty days.

St. Louis

Snap Switch Demand Is Improving—Business in Smaller Size Motors Is Active

Steady improvement in general business conditions, explained principally by the favorable crop prospects, is found in this territory, according to a report just issued by the Federal Reserve Bank of St. Louis.

The fuel situation is beginning to cause some concern. Heavy inroads have been made on the stocks in the hands of the industrials, but with fairly consistent shipments of Kentucky and Alabama coal there has been no shortage. The steel mills are coming into the market for electrical equipment of large capacity, and sales of electrical goods to all the industries are generally better. In fact, the entire electrical field in this territory gives promise of a continued improvement of stable character.

Motors.—Business in the smaller sizes is active and demand is now developing in the larger units. A new refrigerating company here this week purchased two 450-hp. units and one 300-hp. unit, all of the synchronous type, and it will soon place orders for about 350 hp. in miscellaneous auxiliary motors. Stock delivery of most of the smaller motors can be given. Slightly longer delivery in the larger and special motors is reported.

Snap Switches. — These have been steadily improving in demand, following the greater volume of residential construction, and virtually normal business is reported by some of the jobbers. A single-pole, non-indicating switch can be obtained for $15.40 per 100 in standard package lots of 250, and similarly a single-pole, indicating switch can be purchased for $17.60 per 100. A three-point switch is priced at $39.36 per 100 in standard package lots.

Locknuts and Bushings.—In lots of 100, prices per 100 are found to be: ½-in. locknuts, 60 cents; ¾-in. locknuts, 85 cents; ½-in. bushings, $1.50; ¾-in. bushings, $2. The demand is considerably improved over that of a few months ago, running as high as 50 per cent in the case of one jobber.

Conduit.—Notwithstanding the materially increased business stocks are being maintained in good condition, for one of the requisites in obtaining most of the orders is immediate delivery. With increased confidence in prices, contractors are placing larger individual orders. Representative prices are as follows: ½-in. black, $4.56 per 100 ft.; ½-in. galvanized, $5.20 per 100 ft.; ¾-in. black, $5.77 per 100 ft.; ¾-in. galvanized, $6.61 per 100 ft. All prices are for 100 ft. or more.

Pipe Straps.—Net prices per 100, for lots of 100 or more, in the one-hole strap are found to be about as follows: ½-in., $3.60; ¾-in., $4.32; 1-in., $5.70; 1¼-in., $10.08; 1½-in., $14.40. Two-hole galvanized straps, ½-in. to 3-in. inclusive, are priced at 10 cents per pound.

San Francisco

Much Competition Prevails—Large Radio Sales Are Expected to Start Soon —Motor Sales Excellent

A decided increase in general retail activity is noted running about 15 per cent higher in sales for May, 1922, than for May, 1921. The lumber and oil industries, which have slumped during the past two years, have recovered completely. In fact, the immense amount of building which has set new California records has resulted in orders exceeding the output. Crops are progressing nicely. Despite a few sectional disappointments, the average yield will be normal. Crop prices are higher, too.

Journeyman electricians of the Oakland district suddenly walked out on a demand of $9.25 instead of $8 a day. This country of electric power and fuel oil does not appreciably feel the coal strike, but a complete rail tie up would be disastrous. Shipments have been prompt and, despite the sudden increase in building, especially after pessimistic predictions for the year, there have been no exasperating shortages. An increasing amount of direct Eastern competition is noted. Highly competitive conditions have resulted. Retail business has been rather disappointing, there having been several failures and many curtailings of effort.

Radio sales in the late spring were enormous, though they were shut off abruptly in May because of exhaustion of stocks. Such stocks are now arriving nicely and a tremendous volume of sales is expected for the balance of the year. Considerable retail money is tied up in stocks ordered or enroute and similarly customers' radio purchases have disturbed other electrical retail lines. Appliance sales dropped sharply in June, possibly because of the summer season. Motor sales are excellent. There have even been shortages of smaller pumping plant motors. However, the year's peak of such sales has now passed. No power curtailments are expected. In fact, some of the interior power companies whose activities have been hitherto hampered by such shortages are now preparing vigorous range campaigns at a time when it has been usually necessary to make such curtailments.

Salt Lake City–Denver

Business Conditions Reported in Fine Shape—Commercial Fan Market is Satisfactory

Railroad employees affected by the strike order went out without demonstration of any kind, many of them expressing regret at having to obey the union's mandate. Trains are running on schedule and without interruption.

A new $15,000,000 company has been organized for the purpose of developing Utah's vast coal and iron mines. The project is to be launched at once. The movement is said to be backed by important capitalistic interests of the Pacific Coast. That it will be an epochal undertaking for the intermountain country is conceded by business men generally.

Utah's coal mines are producing heavily during the period of the coal strike and big tonnage is moving into Eastern markets to meet temporary shortage. There are practically no unemployed men in this territory.

The early fruit crop is a bounteous one and the market at the canneries is unusually good.

Fans—The sale of fans to date is satisfactory. Selling campaigns, utilizing liberal advertising space, are stimulating trade.

Portland–Seattle

Central Station Business Reported Increasing—Demand for Jobbers' Supplies Steadily Growing

The successive increases shown during the first six months of this year in general business, industry, bank clearings, postal receipts, imports and exports, and the marked gains made in building construction, all indicate a slow but sure return to prosperity. The electrical industry has shared in this returning prosperity. All branches of the industry find conditions much improved over those prevailing during the first six months of 1921. Central stations find it much easier to get money to carry on the needed extensions and improvements, and all of the large companies have comprehensive construction programs for the year.

The Portland Railway, Light & Power Company is pushing work rapidly on its $3,000,000 Oak Grove hydro-electric project, the Pacific Power & Light Company has just begun work on a 7,500-kw. hydro-electric plant to cost $1,250,000, the Puget Sound Power & Light Company is building a 120-mile transmission line from Seattle to Wenatchee, the California Oregon Power Company has construction work well along on a 120-mile 110,000-volt transmission line from one of its plants in southern Oregon to Eugene, Ore., the cost of which will be close to $1,000,000, and many other construction jobs of lesser importance are under way in various sections of the Northwest.

All of the companies are kept busy making line extensions and service connections to new residences and commercial and industrial establishments. One large central station will spend in the neighborhood of $1,000,000 this year on this class of construction alone. Jobbers are busy and the demand for supplies had a steady growth and is good in practically all major lines.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Changes Made in Westinghouse Power Sales

L. C. Bullington Appointed Assistant Manager—Charles F. Lloyd Becomes Manager of Electric Division and R. E. Carothers Takes Charge of Steam Division

IMPORTANT changes have been made in the power sales department of the Westinghouse Electric Company, East Pittsburgh, Pa. The changes include the promotions of three managers and the creation of two new managerships in the power department and are effective immediately.

L. C. Bullington, who has been assistant to the manager of the power department for the past several years, has been made assistant manager and will have charge of the general work of the power department. Charles F. Lloyd, formerly manager of the substation section, has been made manager of the electric division and R. E. Carothers, formerly manager of the turbine section, has been appointed manager of the steam division.

The vacancies caused by the promotions of Mr. Lloyd and Mr. Carothers have been filled by the elevation of Bruce H. Lytle and D. O. Tylee, the former becoming manager of the substation section and the latter manager of the turbine section.

Mr. Bullington was born in New York City and received his education in the schools of New York and New Jersey. Shortly after he left school in 1889 he entered the employ of the Westinghouse - Church - Kerr Company, remaining with that company until the sales department of the Westinghouse Machine Company was formed in 1904. At that time, he was appointed manager of the Atlanta district office of the Westinghouse Machine Company and later, when the Machine Company was merged with the Westinghouse Electric & Manufacturing Company, was appointed power division manager of the Atlanta office of the Westinghouse Electric Company. In 1916, he was appointed to a similar position in the Buffalo office, which position he occupied until 1918, when he was made assistant to the manager of the power department.

Mr. Bullington is a member of the American Institute of Electrical Engineers and the Engineering Society of Western Pennsylvania.

Mr. Lloyd was born in Trappe, Md., and received his early education there. He graduated from St. John's College at Annapolis, Md., in 1906, receiving the degree of Bachelor of Science. Immediately upon his graduation, he entered the employ of the Westinghouse Electric & Manufacturing Company, taking the company's apprenticeship course and receiving the degree of Electrical Engineer. In 1908, he was employed in the power correspondence department of the company looking after United States government work. He later was engaged in high voltage transmission work and, in 1909, upon the reorganization of the sales department at East Pittsburgh, was transferred to the substation section of the railway and lighting department. Three years later, he was appointed manager of this section and continued in that position through the period of the change in name of the department to power department until the present time.

Mr. Lloyd is an associate of the American Institute of Electrical Engineers and the Electric Power Club.

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The Electric Auto-Lite Company, Poughkeepsie, N. Y., manufacturer of electric equipment for automotive service, is arranging for a bond issue of $3,000,000, a portion of the proceeds to be used for expansion. The company also operates plants at Toledo and Fostoria, Ohio, and has recently been reorganized with Clement O. Miniger as president.

C. M. Ripley of the publicity department of the General Electric Company, Fort Wayne, Ind., gave an interesting address recently at a meeting of the Optimists' Club on the progress of electricity since Benjamin Franklin first sent up his kite. The talk was nontechnical and was illustrated with slides of artists' drawings, photographs, maps, charts and cartoons.

Remy Electric Company, Anderson, Ind., has secured the contract to make lighting, starting and ignition equipment for the Maxwell automobile for two years. The contract will mean about 20 per cent increase in production and an addition of 500 workers.

Palmer-Watson Electric Company has opened an office and store, as well as workroom, in Charlottetown, N. B. Electrical wiring and repairs, auto electric equipment, farm-lighting plants, installations of rural telephone lines will be the scope of operations outlined by the new company.

Electrically operated machinery recently installed in the new postoffice building at Washington, D. C., includes the following: Pick-up table, distributing machine, two adding machines, forty electric fans, lathe, changing boards for electric trucks and for storage batteries and an electric stove.

The Wilson Welder & Metals Company, Inc., 132 King Street, New York City, recently appointed King-Knight Company, Underwood Building, San Francisco, Cal., exclusive representative in central and northern California for Wilson Plastic-Arc Welding Machines and Wilson "Color-Tipt" Metals.

The Electric Furnace Construction Company, 908 Chestnut Street, Philadelphia, manufacturers of Electric Furnaces, "Electro" Steam Boilers, etc., reports an increase in capital and the appointment of the following new officers: P. H. Falter, vice-president and treasurer, and Arthur G. Dickson, of Dickson, Beitler & McCouch, Philadelphia, vice-president and counsel. The following are new directors: John Gilbert, of Madeira, Hill & Co.; William A. Webb, president, Empire Coal Mining Company, and T. H. Weisenburg. Frank Hodson retains the presidency of the company.

The Edison Electric Illuminating Company of Boston has opened a store for the sale of electrical apparatus, collections and other company business.

The Century Electric Company, St. Louis, announces that it has opened an office at Seattle, Wash., in the Alaska Bldg., in order to facilitate movements of orders to the Pacific Coast territory.

The National Motor Accessories Corporation, 47 Vesey Street, New York, wireless instruments, motor accessories, etc., has plans under way for general expansion. It is proposed to acquire an exisiting plant, located either in Pennsylvania or Virginia, or to build a new factory in a suitable location. A stock issue of $1,000,000 is being sold to carry out the details of the project. Henry F. Vortkamp is president.

Advisory Committee General Electric Company

Reading from left to right—Back row, F. S. Terry, B. G. Tremaine, managers National Lamp Works of General Electric Company; C. E. Patterson, vice-president in charge of accounting; A. G. Davis, vice-president in charge of patents; J. R. Lovejoy, vice-president in charge of sales; F. C. Pratt, vice-president in charge of engineering; M. F. Westover, secretary; G. F. Morrison, vice-president in charge of incandescent lamp business. Left to right—Front row, G. E. Emmons, vice-president in charge of manufacturing; A. W. Burchard, vice-chairman board of directors and president and chairman of the International General Electric Company; Gerard Swope, president; Owen D. Young, chairman board of directors; E. W. Rice, Jr., honorary chairman board of directors; Henry W. Darling, treasurer.

The Torrington Electric Light Company, Torrington, Conn., will start work shortly on the erection of a large boiler house at the corner of Harwinton Avenue and Franklin Street.

Charles T. Main, engineer, announces that his offices are now located in the Massachusetts Trust Building, 200 Devonshire Street, Boston, Mass.

The Economy Fuse & Manufacturing Company of Chicago, Ill., announces the appointment of Charles H. Bluske as district sales manager of the Los Angeles office at 1304 Maltman Avenue. Mr. Bluske was formerly connected with the Pacific States Electric Company of Los Angeles and succeeds George L. Davis. The Pittsburgh sales office of the company has been moved from 2223 Farmers' Bank Building to 1006 Peoples' Bank Building, at Fourth Avenue and Wood Street.

The Domestic Electrical Appliance Company, Gloversville, N. Y., has moved to larger quarters at 11 Church Street owing to increased business, officials of that company announce.

The Freeman Electric Company, 803 East State Street, Trenton, N. J., will remodel and improve a building at Mead and Prince Streets, recently acquired, for a new assembling plant. Equipment will be installed at an early date.

The F. W. Wakefield Brass Company, manufacturer of Red Spot lighting specialties, announces that plans are now under way for enlarging its factory at Vermilion, Ohio. The company reports that a substantial increase in demand for both commerical lighting fixtures and automobile spotlamps makes necessary the additional manufacturing facilities.

Foreign Trade Notes

ELECTRIC LIGHTING SYSTEMS FOR SOUTH AFRICA. — According to reports received by the Department of Commerce from Trade Commissioner P. J. Stevenson at Johannesburg, South Africa, electric lighting systems are soon to be installed at Fort Beaufort and Robertson Municipality, Cape Province, which will cost £8,000 and £23,000 respectively. Important alterations and extensions to the electric lighting system at Krugersdorp are under consideration.

CONCESSION FOR UNDERGROUND ELECTRIC RAILWAY IN SPAIN.—The Sociedad Anonima Ferrocarril Metropolitanode Barcelona, according to the *Electrical Review*, has been granted a concession to construct and operate an underground electric railway to connect the Barcelona-Tarragona and the Barcelona-France railways in Barcelona. The cost of the project is estimated at 710,784 pesetas.

PROPOSED ELECTRIC POWER PLANTS IN MOROCCO.—Concessions have recently been granted, accordng to the *Electrician*, for electric light and power systems in the towns of Marrakesh, Mazagan and Saffi, Morocco. Plans for the station at Marrakesh provide for an initial capacity of 1,200 hp., at Mazagan for 750 hp. and at Saffi for 1,200 hp., each system to be three-phase, 50 cycles, with a voltage of 115 for lighting and 200 for heating purposes. The town of Rabat has also granted a concession for supplying electricity for lighting and power in the town and surrounding districts. The proposed station will have a capacity of 1,000 kw. and will receive energy at 50 cycles, 55,000 volts, which will be stepped down to 110 volts for lighting and 190 volts for power purposes.

PROPOSED ELECTRIC POWER STATION FOR UTRECHT.—Plans are being prepared by the N. V. Provincial Utrechtsche Electriciteits Mij (Provincial Electric Supply Company of Utrecht), 32 Catharijnesingel, Utrecht, the *Electrician* states, in co-operation with the municipal electric works and tramways (Nicolaas Beetstraat 3, Utrecht), for the construction of a large provincial power station near Utrecht.

Foreign Trade Opportunities

TELEGRAPH AND TELEPHONE EQUIPMENT FOR AUSTRALIA.—Tenders will be received by the Commonwealth of Australia, according to the *Electrical Review*, for furnishing telegraph and telephone instruments as follows: Until July 25, Schedule 42, paper-insulated cable and lead-covered submarine telegraph and telephone cable; Aug. 15, Schedule 31, tinned copper wire; Aug. 9, Schedule 563, protective apparatus; Aug. 22, Schedule 35, silk and cotton-covered switchboard cable; Oct. 17, Schedules 39 and 40, automatic C. B. telephone equipment with all associated equipment, including apparatus for use at subscribers' premises. Tender forms, specifications, etc., may be obtained on application to supply officer, Room 101, Australia House, Strand, London.

TELEPHONE SUPPLIES FOR EGYPTIAN RAILWAYS.—Tenders will be received by the Egyptian State Railways, Cairo, Egypt according to the *Electrical Review*, until Aug. 22 for a supply of desk and wall telephones. Copies of specifications may be obtained on application to the manager, Egyptian Railways, Cairo, and at the office of the Administration's Inspecting engineer in London.

New Incorporations

THE STOCKHOLM (ME.) LIGHT & POWER COMPANY has been organized with a capital stock of $40,000 to generate and distribute electricity in Stockholm. The directors are: Herbert J. Merrill, president; John Anderson, treasurer; Ralph A. Merrill, clerk; Irving Z. Howe, Carl Sanstrom, Eric Larsson and Fritz Anderson, all of Stockholm.

THE WEST SHORE ELECTRIC COMPANY, 1235 South Dearborn Street, Chicago, has been incorporated with a capital stock of $10,000 to generate and distribute electricity. The incorporators are: A. E. Black, Edward J. Stevens and James McKeag. William A. Jackson, Public Service Building, Milwaukee, is correspondent.

THE PAGE POWER COMPANY, Newport, Va., has been incorporated with a capital stock of $300,000 to install a hydro-electric plant on the Shenandoah River, near Luray. The officers are: M. E. Roundabush, Stanley, president and treasurer; K. E. Roundabush, vice-president, and A. A. Roundabush, Shenandoah, secretary.

THE WEST FLORIDA POWER COMPANY, Tallahassee, Fla., has been organized by B. H. Hardaway, Sr., B. H. Hardaway, Jr., and C. A. Mees. The company is capitalized at $1,000,000 and propcses to build a hydro-electric plant on Ocklocknee River.

New Apparatus and Publications

LEVER SWITCHES.—Bulletin No. 47,326 issued by the General Electric Company, Schenectady, N. Y., describes its type "QC-3" quick-break lever switches for use on direct-current or alternating-current circuits up to 600 volts and 1,000 amp.

RADIO APPARATUS. — The Dubilier Condenser & Radio Corporation, New York City, has issued bulletin R-101, describing the "Dublier" Micadons, type 601. The company is also distributing a circular covering its "Ducon" device, which allows a radio receiving set to be connected to any electric lamp socket.

POLE PROTECTOR. — The American Pole Protective Company, Freeport, Ill., is distributing a twelve-page pamphlet describing the "APPCO" pole protector.

GAS FILTER.—The Uehling Instrument Company, Paterson, N. J., is distributing bulletin 113, describing its new double-disk type "Pyro-porus" gas filter.

RENEWABLE FUSE PLUG.—A new plug known as the "Federal Three-Thirty" renewable fuse plug has recently been brought out by the Federal Electric Company, 8,700 South State Street, Chicago.

ELECTRIC VEHICLE. — The Walker Electric Vehicle Company, 531 West Thirty-ninth Street, Chicago, announces the addition of a new "light delivery" model to its line of "Walker" electric trucks.

ELECTRIC METERS. — The Sangamo Electric Company, Springfield, Ill., has made arrangements with the Rothacker Film Company, Chicago, to produce a three-reel film showing the most interesting and important processes in the manufacture of the Sangamo meters and some of their interesting applications in service.

RAILWAY AND LIGHTING POLES.—The Electric Railway Equipment Company, 2900 Cormany Avenue, Cincinnati, is distributing catalog "F," covering its "Elreco" combination railway and lighting poles.

BELL RINGERS.—A new skeleton type "Vim" (exposed-core type) bell ringer has recently been developed by the Betts & Betts Corporation, 645 West Forty-third Street, New York City.

ELECTRIC TOASTER.—A new double reversible toaster "Excelsior" has recently been developed by the Perfection Electric Products Company, New Washington, Ohio. George Borgfeldt & Company, 111-119 East Sixteenth Street, New York City, are national distributors for the Perfection Company.

COAL AND ASH-HANDLING EQUIPMENT. — The Conveyors' Corporation of America, 326 West Madison Street, New York City, has issued an illustrated booklet entitled "Cut Ash-Handling Costs," which explains the steam-jet conveyor method of ash handling and contains a description of the conveyor.

TRANSFORMER. — An oil-immersed, water-cooled transformer for large capacity and high voltage use is being manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

SOCKETS.—The Betts Electric & Manufacturing Corporation, 342 Madison Avenue, New York City, is distributing a booklet describing and illustrating its No. 90 "Bi-Lite" multi-sockets, recently placed on the market by the company.

BOILER-FEED WATER.—The Northern Equipment Company, Erie, Pa., has published a small booklet entitled "Regulating Boiler-Feed Water," in which it describes the "Copes" system of boiler-feed control.

LAMP CONTROL RHEOSTAT. — The Ward Leonard Electric Company, Mount Vernon, N. Y., is distributing a leaflet covering the "Ward Leonard" projection lamp control rheostat.

FARM-LIGHTING EQUIPMENT. — The Delco-Light Company, Dayton, Ohio, is distributing bulletin No. 289, describing the "Delco-Light" deep-well pump.

Construction News

Projects, Plans, Bids and Contracts,
Contemplated or Under Way

New England States

GARDINER, ME.—The installation of a new street-lighting system in the business district is under consideration.

LEWISTON, ME.—Plans are under consideration to increase the output of the Municipal electric light plant.

PRESQUE ISLE, ME.—The Maine & New Brunswick Power Company will commence work at once on extensions and improvements to its local system.

BRATTLEBORO, VT.—The directors of the Twin States Gas & Electric Company has authorized an increase in capital stock from $4,000,000 to $6,000,000.

BROCKTON, MASS.—The construction of a new building, to cost about $40,000, for the fire-alarm system is under consideration by the City Council.

FOXBORO, MASS.—The Union Light & Power Company has applied to the State Department of Public Utilities for permission to issue $310,000 in capital stock to pay for extensions, etc.

TORRINGTON, CONN.—Steps have been taken by the Torrington Business Men's Association to secure an ornamental lighting system in the business section of the borough.

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Middle Atlantic States

ALBANY, N. Y.—Bids will be received by Charles L. Cadle, superintendent of public works, Capitol, Albany, until July 25 for (Terminal contract No. 89) the constructing portion of railroad and crane tracks, electrical work, etc., at Syracuse.

BATAVIA, N. Y.—The Genessee Light & Power Company contemplates extending its service to Newstead, installing a street-lighting system in Pembroke and to make improvements to its substation at Attica. The cost is estimated at about $58,000.

ELMIRA, N. Y.—The Council is considering the installation of a new ornamental lighting system on Lake, Water and Main Streets. It is proposed to replace the three-cluster lamps with single lamps of larger candle power.

FRANKLIN SPRINGS, N. Y.—The Public Service Commission has granted the Utica Gas & Electric Company permission to acquire the property of the College Hill Electric Light Company, Inc., and to exercise certain franchises under which the two companies serve electricity to the communities at and near Clinton.

GENESEO, N. Y. — The Geneseo Gas Light Company has submitted a proposal to the Village Trustees for an improved street-lighting system. The plans call for an increase in lamps from 63 to 116, and 25 ornamental standards to be installed on Main Street.

GRAND ISLAND, N. Y. — The Grand Island Light & Power Company has applied to the Public Service Commission for permission to construct and operate a local electric system. Energy will be secured from the Niagara Falls Power Company.

ISLIP, N. Y.—Steps have been taken by the Town Board to secure a better street lighting system.

MIDDLETOWN, N. Y. — The Orange County Hydro-Electric Corporation has issued $600,000 in bonds, part of the proceeds to be used in connection with the construction of a 5,000-hp. hydro-electric plant at Mongaup Falls.

NEW YORK, N. Y.—The Long Island Railroad Company contemplates extensions to its power plants, and construction of new generating stations in connection with the electrification of different sections of its road. The cost is estimated at about $1,000,000.

NEW YORK, N. Y.—The New York Edison Company, it is reported, contemplates the construction of an electric generating plant, to cost about $1,400,000. The company will erect a transformer station at 19 East Thirty-second Street, to cost about $100,000.

NIAGARA FALLS, N. Y.—The Niagara George Power Company has applied to the

State Water Commission for permission to construct a hydro-electric plant on the Lower Niagara River.

PENN YAN, N. Y.—The Associated Gas & Electric Company has issued $270,000 in bonds, part of the proceeds to be used for expansion and improvements.

DOVER, N. J.—The New Jersey Power & Light Company is planning to erect transmission lines to connect with the lines of the Eastern Pennsylvania Power Company, for which surveys are being made.

EAST ORANGE, N. J.—Bids will be received by the Board of Water Commissioners of the city of East Orange until July 20 for developing a water supply of not less than 2,000,000 gallons per 24 hours from driven wells, including construction of pumping station, three well houses, etc. The equipment will include boilers, engines, electric generators, electric transformers, transmission line, etc., and four electric motor-driven centrifugal or reciprocating deep well pumps. Nichols S. Hill, Jr., and S. F. Ferguson, 112 East Nineteenth Street, New York City, are consulting engineers. Roswell M. Roper is secretary.

NEWARK, N. J.—M. Augenlick & Brother, 15 Commerce Street, will install a power plant in connection with a cold storage and refrigerating plant at 142-50 North Canal Street, to cost about $75,000.

CARLISLE, PA.—Bids will be received by the Chamber of Commerce until July 20 for the installation of a street-lighting system. O. H. Starner, chairman, is in charge.

CHESTER, PA.—The Delaware County Electric Company has issued $5,000,000 in bonds, part of the proceeds to be used for extensions, etc.

JOHNSTOWN, PA.—The Clarion River Power Company has issued $2,700,000 in bonds, the proceeds to be used for the construction of a 22,000-hp. hydro-electric plant at Piney Creek, on the Clarion River, to cost about $3,000,000. The entire output has been contracted for by the Penn Public Service Company. Later two other hydro-electric plants will be built on the same river.

LANCASTER, PA.—The Lancaster Light, Heat & Power Company has issued $100,000 in bonds, part of the proceeds to be used for extensions.

MILLERSBURG, PA.—The Blue Mountain Electric Company has acquired the Millersburg flour mill and will erect a hydro-electric plant on the site.

MOUNT HOLLY SPRINGS, PA.—The Cumberland Valley Light & Power Company has issued $40,000 in bonds, the proceeds to be used for expansion purposes.

PHILADELPHIA, PA.—The City Council has requested the Philadelphia Electric Company to prepare estimates of cost of replacing all arc-lamps in use with incandescent lamps.

POTTSVILLE, PA.—The Eastern Pennsylvania Light, Heat & Power Company has awarded contract for its proposed electric generating plant at Pine Grove to the J. G. White Engineering Corporation, 43 Exchange Place, New York, to cost about $2,500,000. The initial installation will have a capacity of 25,000 hp.

PUNXSUTAWNEY, PA.—The Jefferson Electric Company will soon begin work on the erection of a transmission line to Cloe, 1½ miles distant, and also on a line from Reynoldsville to Brookville to furnish electrical service in those towns.

READING, PA.—The Metropolitan Edison Company contemplates extending its transmission line to Wellsville to furnish electricity to farms and residences between Dover and Wellsville.

SCRANTON, PA.—The Scranton Electric Company has issued $693,000 in bonds, part of the proceeds to be used for extensions, etc.

WILMINGTON, DEL.—The Board of Harbor Commissioners will install electric traveling cranes, electric dock winches, and other electrically-operated machinery at the Marine Terminal, now under construction.

OAKLAND, MD.—The Youghiogheny Power Company has applied to the Public Service Commission for permission to construct a hydro-electric plant on the Youghiogheny River, near Oakland. The company will supply electricity to the Youghiogheny Water & Electric Company.

NEWPORT NEWS, VA.—The Newport News & Hampton Railway, Gas & Electric Company has issued $1,200,000 in capital stock, part of the proceeds to be used for extensions, etc.

WASHINGTON, D. C.—Bids will be received at the office of the chief of engineers, room 2802, Munitions Building, Washington, D. C., until Aug. 2 for the construction of four Diesel electric seagoing hopper dredges.

North Central States

BERRIEN SPRINGS, MICH.—The Chapin Company, South Bend, Ind., which recently acquired the Interurban Traction Company, operating from Dowagiac to Benton Harbor, contemplates building a hydro-electric plant near here.

DETROIT, MICH.—The Detroit Edison Company has filed plans for an addition to its service building on Willis Street, to cost about $65,000.

LANSING, MICH.—The Council has authorized the Municipal Light and Power Department to erect transmission lines to Hope and Haslatt, to furnish commercial service in those towns. Bonds to the amount of $40,000 have been voted for the installation of a new street-lighting system at East Lansing.

PLYMOUTH, MICH.—Bids will be received by J. D. Stutzman, superintendent, Detroit House of Correction, 1441 Alfred Street, Detroit, until July 10 for construction of Penal Institution, consisting of administration building, 76 ft. by 420 ft., three stories; cell block, 32 ft. by 328 ft., three stories; one and two story, 408 ft. by 840 ft. industrial building, and prison power house, 105 ft. by 130 ft., to cost about $2,500,000. A. Kahn, Marquette Building, Detroit, is architect.

ST. JOSEPH, MICH.—The Mayor has recommended to the City Council that a committee be appointed to confer with the street railway company for the purchase of electricity by the city for lighting the city parks and boulevards.

CLEVELAND, OHIO.—The City Board of Control has authorized the purchase of a new superheater and boiler for the municipal electric light plant.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until July 14 for paper-insulated, lead-covered cable.

HAZARD, KY.—The Holdcraft Electric Company, Hazard, recently incorporated, with a capital stock of $20,000, is planning to erect an electric plant in a town in southeastern Kentucky. A. D. Holdcraft is president.

LOUISVILLE, KY.—Arrangements have been made by the Louisville Gas & Electric Company to enlarge the Waterside power station. Contracts have been placed for equipment.

PRINCETON, KY.—The Princeton Tobacco Company will build a power house in connection with additions to its plant, to cost about $75,000. S. B. Lee is manager.

INDIANAPOLIS, IND.—The Merchants' Heat & Light Company has been granted permission by the Public Service Commission to issue $7,205,000 in bonds, part of the proceeds to be used for extensions, etc.

NOBLESVILLE, IND.—Arrangements have been completed by the Noblesville Heat, Light & Power Company for the construction of a dam across White River, 4 miles above Noblesville, to provide additional power for the local plant. The cost is placed at $100,000.

SOUTH BEND, IND.—Work will soon begin on the addition to the power house at the automobile works of the Studebaker Corporation, to cost $60,000.

CHICAGO, ILL.—The Commonwealth Edison Company will take bids at once for the construction of a one-story substation, 78 x 100 ft., at 707-15 South LaSalle Street.

CHICAGO, ILL.—The 1922 budget of the Middle West Utilities Company, 72 West Adams Street, calls for an expenditure of $12,000,000, of which $7,000,000 will be used for additions and the balance for new plants.

CHICAGO, ILL.—A resolution has been introduced to the Board of Commissioners of Cook County recommending electric lamps to be erected on all the main highways of Cook County. The initial cost is estimated at about $2,000,000.

DANVILLE, ILL.—The Danville, Champaign & Decatur Railway & Light Company has issued $1,000,000 in bonds, part of the proceeds to be used for extensions.

DAYTON, ILL.—Plans are reported to be under consideration by the Division of Illinois Waterways, 304 South Wabash Avenue, for the construction of a 700-hp. hydro-electric plant on the Fox River at Dayton. Frederick Bright is in charge.

MILWAUKEE, WIS.—A heat treating building, including power plant and boiler room, will be erected at the proposed new works of the Clayborn Process Corporation, to cost about $150,000. Herman J. Esser, 82 Wisconsin Street, is architect.

OSHKOSH, WIS.—The Eastern Wisconsin Electric Company contemplates extensions and improvements, including construction of car barns, railway spurs, switches, etc., to cost about $150,000.

NORTH ST. PAUL, MINN.—Extensions to waterworks and electrification of pumping plant, to cost about $60,000, is under consideration by the Council. Toltz, King & Day, Pioneer Building, St. Paul, are engineers.

CLINTON, MO.—The City Council is considering a proposition to purchase electricity to operate the municipal electric lighting system.

HERMAN, NEB.—Bonds to the amount of $20,000 have been voted for the installation of an electric lighting system. Electricity will be purchased from the Continental Gas & Electric Company, Omaha.

PICKRELL, NEB.—The erection of a transmission line from Pickrell to Beatrice to connect with the lines of Nebraska Gas & Electric Company is under consideration. The cost is estimated at $10,000.

ANDALE, KAN.—The contract, for the erection of a 20-mile transmission line from Wichita to Andale, to cost $33,000, has been awarded to Dwight Chapin, Jr., 1806 East Twenty-ninth Street, Kansas City, Mo. The Ruckel Engineering Company, Interurban Building, Hutchinson, is engineer.

PARSONS, KAN.—The Kansas Gas & Electric Company, Wichita, plans the construction of a power plant near Parsons, to cost about $1,000,000. The equipment will include two 10,000 kw. turbo-generators.

Southern States

BELHAVEN, N. C.—Bids will be received by the town of Belhaven until July 19 for a 150-kw. Diesel or semi-Diesel crude oil engine-driven generating unit, with accessories. W. C. Olsen, Kinston, is consulting engineer.

LENOIR, N. C.—The property of the Citizens Light & Power Company, including ice plant, has been purchased by A. M. Kistler, Morgantown. Extensive improvements are contemplated to the local system. Surveys have been made for the erection of a 40,000-volt transmission line from Lenoir to Hickory to connect with the transmission system of the Southern Power Company.

MEBANE, N. C.—The White Company will install an electric plant to replace steam power at its furniture factory. W. E. White is president.

SPINDALE, N. C.—The Spinners' Processing Company will build a power house in connection with its proposed textile mill. S. E. Elmore is president.

WILMINGTON, N. C.—The Council contemplates extensions to the ornamental street-lighting system to include a number of thoroughfares in the downtown district.

WARE SHOALS, S. C.—The Ware Shoals Manufacturing Company will build an auxiliary power house at its local textile mill. The proposed plant will develop 27,000-hp.

TOCCOA, GA.—The City Council has granted the Georgia Railway & Power Company, Atlanta, a franchise to supply electricity for power purposes in Toccoa.

GREEN COVE SPRINGS, FLA.—Bids have been asked by the City Council for equipment for the municipal electric plant, to cost about $25,000.

HOMESTEAD, FLA.—Bids will be received by the Town Council until July 28 for construction of a municipal electric light plant, including building, two 300-kw. steam turbo-generator sets, switchboard, two boilers, 150 to 200 hp., one 10-ton crane installation, etc. B. M. Duncan, Homestead, is engineer.

LIVE OAK, FLA.—The Council has approved plans for the installation of an ornamental street-lighting system in the business district.

ORTEGA, FLA.—The City Commission has appropriated $11,332 to rebuild the electric trunk transmission line to the substation at Ortega.

KOSCIUSKO, MISS.—The Council has authorized plans for the rebuilding the municipal power plant, recently destroyed by fire.

COTTER, ARK.—The Dixie Power Company has been granted permission by the Federal Power Commission to construct a hydro-electric plant on White River, near Cotter. The plans include a transmission system.

SHREVEPORT, LA.—A new automobile service works and machine shop, 45 ft. x 40 ft., will be erected by the Southwestern Gas & Electric Company for its trucks and cars.

JAY, OKLA.—The Grand River Hydro-electric Company, Tulsa, contemplates the construction of a hydro-electric plant at Jay. R. Salisbury Company, 233 Broadway, New York, is engineer. J. L. Brown is president.

OKEENE, OKLA.—The date for taking bids for extensions to the municipal power plant has been postponed, owing to pending legal proceedings.

PAWNEE, OKLA.—Bids will be received by the City Clerk until July 12 for the construction of a municipal electric-lighting plant, in conjunction with water works extensions. The Benham Engineering Company, 512 Gumbel Building, Kansas City, Mo., is engineer.

RUSH SPRINGS, OKLA.—A municipal electric lighting system will be installed, for which $5,000 in bonds have been voted.

AMARILLO, TEX.—The Council will install an electrically-operated fire alarm system, to cost $25,000.

CLEBURNE, TEX.—James G. Taylor is organizing a company to construct and operate a local electric power plant to be used primarily for cotton gin mill operation.

DALLAS, TEX.—The Texas Interurban Railway Company has entered into a contract with the Missouri, Kansas & Texas Railroad to equip the tracks of the latter between Dallas and Denton, 37 miles, for electrical operation. Plans, it is stated, are ready for connecting up with the power transmission systems of the Texas Light & Power Company.

ROCKDALE, TEX.—The Empire Fuel Company will build a power house in connection with its proposed briquette manufacturing plant, to cost about $1,000,000.

Pacific and Mountain States

ABERDEEN, WASH.—The Grays Harbor Railway & Light Company will commence work at once on construction of a power plant, to cost about $250,000. A transmission line will be erected to Montesano, Elma and vicinity.

SEATTLE, WASH.—Bids will be received by the Board of Public Works, City-County Building, until Aug. 14 for the erection of superstructure, machinery and electrical equipment of a steel bascule bridge and two side spans over West Waterway at West Spokane Street. C. B. Bagley is secretary.

SPOKANE, WASH.—Surveys are being made by the Washington Water Power Company for the erection of 9 miles of 13,000-volt transmission lines to connect with the substation of the Chicago, Milwaukee & St. Paul Railroad Company at South Cle Elum to supply electricity to the coal mines of the Rosyln (Wash.) Fuel Company, and to the Independent Coal & Coke Compan at Cle Elum.

WOODLAND, WASH.—The Department of Conservation & Development has granted the Lewis River Hydro-Electric Company permission to construct a hydro-electric plant on the North Fork of the Lewis River.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has been granted permission by the State Railroad Commission to construct a hydro-electric plant on Middle Fork of Stanislaus River. It will be known as the Spring Gap plant and will have a capacity of 7,500 kva., and will cost about $750,000.

CASA GRANDE, ARIZ.—A committee has been appointed to investigate the practicability of establishing a power irrigation system in the Salt River Valley and to negotiate with the Salt River Valley Water Users' Association regarding the extension of the Roosevelt power line into the proposed district. The towns of Casa Grande and Florence are interested in the project.

FLORENCE, ARIZ.—The Council has authorized an issue of $57,000 in bonds, of which $20,000 will be used to extend the Roosevelt transmission line to Florence if the electric district in the valley materializes, if not, it will be used for extensions to the municipal electric plant.

Canada

TIMMONS, ONT.—The Hollinger Consolidated Mines Company is reported to have applied to the Dominion Government for permission to develop the water power at Three Carrying Places Rapids, just below Long Sault Rapids, where, it is estimated that 40,000 hp. is available. A. F. Brigham is general manager of the Hollinger Mines.

MONTREAL, QUE.—The Electrical Commission is receiving bids for the installation of conduits in streets west of Bleury Street to line of Beaver Hall Hill and east of St. Lawrence Street to Berri Street. The cost is estimated at $250,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 13, 1922)

1,419,571. Motor Terminal Connection; I. E. Kinser, Dallas, Tex. App. filed Jan. 22, 1921. Wire clamping device on frame.

1,419,584. Cable Holder; Harvey Olsen, New York, N. Y. App. filed April 2, 1919. Supports for cables in vertical conduit.

1,419,596. Microphone Mounting; E. C. Wood, Somerville, Mass. App. filed April 25, 1918. Pressure on telephone transmitter used under water equalized.

1,419,598. Table Lamp; S. J. Zelazo, Adams, Mass. App. filed April 22, 1920. Ornamental lamp with spherical globe.

1,419,606. Telephone Muffler; T. Benedict, New York, N. Y. App. filed Jan. 27, 1922. Voice of user inaudible to persons in room.

1,419,607. Electrical Equipment of Motor Vehicles and Aircraft; F. H. Bowman, Manchester, England. App. filed Aug. 28, 1920. Motor-generator built into flywheel.

1,419,613. Electric Heating Fabric; P. E. Charles, Victorville, Cal. App. filed May 3, 1920. Heating pad.

1,419,644. Insulating Coupling Unit for Pull Socket Chains; A. C. Recker, Oakville, Conn. App. filed Aug. 18, 1920.

1,419,673. Electrical Measuring Apparatus; H. W. Hitchcock, New York, N. Y. App. filed Oct. 18, 1920. To determine resistance and reactance components of impedance.

1,419,674. Electrical Measuring Apparatus; H. W. Hitchcock, New York, N. Y. App. filed Oct. 18, 1920. To determine impedance of circuits.

1,419,677. Transmitter for Selective or Printing Telegrams; C. L. and H. L. Crum, Chicago, Ill. App. filed Jan. 21, 1921. Tape fed direct from punching machine to transmitter.

1,419,708. Signaling Apparatus; Frank W. Wood, Montclair, N. J. App. filed Jan. 4, 1919. Signal with return signal.

1,419,723. Controller for Electrically Driven Sewing Machines; D. M. Durkee, Rockford, Ill. App. filed June 21, 1920. Operated by knee.

1,419,725. Absorption Wedge; E. H. Fisher, Pittsburgh, Pa. App. filed April 12, 1920. Optical pyrometer for comparing light intensities.

1,419,744. Welding Tool; Royal Mattice, Philadelphia, Pa. App. filed March 24, 1922. Device for gripping and holding electrode.

1,419,749. Alternating-Current Motor; T. J. Murphy, Rochester, N. Y. App. filed June 21, 1917. Phonograph table stator of induction motor.

1,419,778. Automatic Regulating System; L. W. Thompson, Schenectady, N. Y. App. filed Aug. 3, 1920. By changing position of motor brushes.

1,419,797. Amplifying System; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Feb. 13, 1919. Cascade arrangement of electrode tubes.

1,419,803. Commutator and the Like; S. R. Bergman, Nahant, Mass. App. filed Sept. 3, 1920. High-voltage commutator.

1,419,816. Multiple-Filament Incandescent Lamp; Leon Cammen, New York, N. Y. App. filed April 15, 1918. Three-wire filament for automobile lights.

1,419,825. Starting and Lighting System for Motor Vehicles; J. K. Delano, New York, N. Y. App. filed March 11, 1918. Motor-generator adapted to Ford cars.

1,419,833. Attachment for Pug Mills; Charles M. Fee, Fulton, Mo. App. filed July 1, 1919. Signal to indicate density of material from mill.

1,419,839. Process of Manufacture of Zinc Cups Intended for Dry Cells; E. L. Gaston, Lyons, France. App. filed June 28, 1920. Cups made by electroplating.

1,419,872. Control of Electromagnetic Switches; R. H. McLain, Schenectady, N. Y. App. filed Oct. 29, 1917. Breaking circuits carrying heavy currents.

1,419,874. Electric Ship Propulsion; Campbell MacMillan, Schenectady, N. Y. App. filed Feb. 11, 1920. Synchronous motor used as induction motors during maneuvering.

(Issued June 20, 1922)

15,389 (reissue). Automatic Telephone-Exchange System; C. L. Goodrum, New York, N. Y. App. filed Feb. 28, 1916. Adapted for party-line service.

1,419,935. Electrical Heater; F. Kuhn and J. A. Hand, Detroit, Mich. App. filed June 15, 1918. Concave reflector type.

1,419,955. Trolley; George Bryar, Boston, Mass. App. filed Oct. 22, 1921. Two wheels combined to prevent dislodgment.

1,420,030. Signal System; H. C. Ford, New York, N. Y. App. filed Oct. 10, 1917. Automatic telephone system.

1,420,037. Electrolytic Cell; John Harris, Lakewood, Ohio. App. filed Aug. 4, 1919. Generates hydrogen and oxygen.

1,420,076. Turbo-Generator; W. F. Bouché, Lancaster, N. Y. App. filed Oct. 30, 1918. For locomotive headlights.

1,420,103. Transformer; Samuel Horelick, Pittsburgh, Pa. App. filed May 10, 1921. Furnace transformer with reactance coils that can be either in series or parallel.

1,420,127-1,420,130. Process of Extracting Metals from Their Ores; A. J. Moxham, Great Neck, N. Y. App. filed Nov. 2, 1918. Four patents on extracting iron from ore by solvents and separating from resulting solution by electrolysis.

1,420,131. Socket or Base for Trolley Poles for Electrically Propelled Vehicles; M. E. Munro, London, England. App. filed Feb. 16, 1922. For trackless trolley.

1,420,160. Electric Heater; U. D. Straw, Goshen, Ind. App. filed Sept. 13, 1920. Removes cover of storage battery by melting sealing wax.

1,420,167. Electric Pocket Lamp; A. Vogt, Berlin, Germany. App. filed Oct. 27, 1919. Arrangement of cells and lamp in casing.

1,420,181. Automatic Electric Heating Device for Glass Furnaces; W. G. Clark, New York, N. Y. App. filed March 29, 1920. Applied to continuous process.

1,420,189. Variable Grid Rrsistance; A. R. Goodwin, Melrose, Mass. App. filed Sept. 8, 1921. For filament of electron tube.

1,420,211. Apparatus for Effecting Chemical Reactions; H. W. Paulus, Richmond Hill, N. Y. App. filed July 26, 1920. Reactions made by amalgams.

1,420,212. Method of and Apparatus for Electrolytic Reduction and Oxidation; H. W. Paulus, Richmond Hill N. Y. App. filed July 26, 1920. For converting sodium glyoxylate into sodium tartrate.

1,420,254. Electric Wave Transmission; J. H. Hammond, Jr., Gloucester, Mass. App. filed May 20, 1912. Uses liquid or gaseous antenna.

1,420,255. Antenna for Radio-Transmission System; J. H. Hammond, Jr., Gloucester, Mass. App. filed Feb. 27, 1913. Antenna on ships' runs from towers to float following vessel.

1,420,256. System of Teledynamic Control; J. H. Hammond, Jr., Gloucester, Mass. App. filed Feb. 25, 1913. Control of bodies at a distance by wireless.

1,420,257. System and Apparatus for Automatic Wave Selection; J. H. Hammond, Jr., Gloucester, Mass. App. filed Jan. 21, 1910. To avoid wireless interference.

1,420,258. System for the Radio Control of Moving Bodies; J. H. Hammond, Jr., Gloucester, Mass. App. filed Sept. 3, 1913. Complete control of distance ships by wireless.

1,420,311. Cash Register System; G. M. Gorden, Portland, Ore. App. filed June 15, 1920. Simultaneous operation of two or more registers.

1,420,317. Sound-Recording Apparatus; N. H. Holland, West Orange, N. J. App. filed Nov. 30, 1914. Phonograph for recording telephonic conversation.

1,420,350. Trolley Reel; A. A. Thiele, Omaha, Neb. App. filed March 2, 1920. Reel for mine locomotive with following cable.

1,420,385. System of Electrical Distribution; C. W. Place, La Grange, Ill. App. filed March 19, 1920. Means for regulating overload on circuits.

1,420,395. Vertical Fluoroscopic Unit; H. F. Waite, New York, N. Y. App. filed Nov. 20, 1920. Protective screen for X-ray machine.

1,420,398. Rotary Transforming Apparatus; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Aug. 23, 1919. Converter with separate alternating-current and direct-current windings.

1,420,407. Suspension for Trolley Wires and the Like; G. W. Bower, Schenectady, N. Y. App. filed Oct. 19, 1920. Clamps for grooved wire.

1,240,408. Trolley-Wire Clamping Ear; G. W. Bower, Schenectady, N. Y. App. filed May 27, 1921. Clamp for groove wire.

1,420,435. Storage Battery; Paul M. Marko, Brooklyn, N. Y. App. filed May 2, 1919. Connector for cells.

1,420,485. Variable Electrostatic Condenser; G. F. Johnson, Springfield, Ill. App. filed May 18, 1920. Means to prevent accidental movement after adjustment.

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A Purpose for Us All

TO EVERY electrical man Charles A. Coffin's vision of the future of the electrical industry is a matter of interest. Forty years ago this man turned from shoe manufacturing in Lynn to the electrical business. As head of the General Electric Company he has inspired and guided the most spectacular achievement in commercial history. For he has been the great upstanding leader in our industry through all these years of its development.

Upon his recent retirement as chairman of the board Mr. Coffin gave an interview to the New York *World*. In it he pictured his vision of the part that electricity will play in future years.

"THE next big social change, as I see it," he said, "will be decentralization. Electricity made the big city. It may now be expected to unmake it."

He then went on to explain how the massing of men in cities where power and labor were at hand made our great industrial development possible. But the expanding progress of electricity is now bringing power to all men, in the villages and on the farms. This "broadcasting of power" will gradually make it possible to manufacture our raw materials close to the source and obviate the necessity of transporting them first to the distant city factory and then in the manufactured state back to the markets.

For food can be eaten more economically out in the country where it is produced. Fabrics should be woven where the cotton, flax and wool are grown. Coal should be burned and ores converted into articles of commerce close to the mines. All this will be possible when labor is distributed out through the open country. And Mr. Coffin believes this will come through the extension of great superpower systems and the establishment of small electrically driven factories in all communities adequate for the utilization of all the natural resources of the section.

AT PRESENT 51.4 per cent of America's population live in the city, and this is the source of most of our social and economic troubles. Strikes, non-employment, intermittent occupation, crime waves, high prices are all products of urban congestion. The city has almost destroyed the home, but it has brought other advantages which modern man will not do without.

Electricity is now going to make it possible to carry these comforts, amusements, occupations and opportunities out from the city into the clear air and healthful spaces of the country, and life there will be no longer difficult or solitary. We electrical men of today must make this a purpose. Here is our great opportunity for service and for achievement, our common broad road to prosperity.

Alfred Edward Newton

Chief executive of an electrical manufacturing enterprise of international fame and an author and essayist of distinction.

MOST of the active chief executives of the more important manufacturing companies in the electrical industry are recognized and spoken of as electrical men. They are known widely to their contemporaries in the industry and have had a considerable contact with their customers. Occasionally, however, we find a man at the head of some eminently successful company who has been interested not in the industry but by an idea embodied in a business, and has so focused his attention and his energies upon the purpose of that business that he has brought his company and his product to a point where they enjoy an international reputation, while he himself remains almost unknown in his own business world.

Such a man is A. Edward Newton, for twenty-seven years directing head of The Cutter Company of Philadelphia. He is an author and essayist of note wherever men read current English literature. As a collector and an authority on old books his name is as familiar in London as in New York or Philadelphia. But few men realize that his chief concern during the larger part of the life of the electrical industry has been the development and perfection of electrical control apparatus—notably the circuit breaker.

When Mr. Newton displaced the sheriff as the financial manager of The Cutter Company in 1895, that pioneer producer of automatic electric cut-outs was reduced to financial extremities through the vicissitudes of the development period, as was unhappily too often the case. Mr. Newton was not an electrical man and, in fact, does not consider himself one today. But he was attracted by the apparent commercial possibilities in this new idea of automatic protection for electric circuits and equipment by a self-acting cut-out switch. He staked all the money he had and more on the success of the idea and as treasurer gradually lifted the company out of the slough and established its financial credit—and succeeded to the presidency.

The mechanical and electrical perfection of the Cutter product is due in no small measure to Mr. Newton's ability to surround himself with keen and capable technical assistants and then not interfere. Meanwhile, with keen business perception and capability, he has guided the commercial promotion of the idea of automatic protection which has been his chief interest from the first.

As an avocation he chose that of a man of letters and there has found delight and recreation. His welcome to the roll of *Atlantic Monthly* contributors attests the quality of his work. He is the author of two volumes, "The Amenities of Book Collecting" and "The Magnificent Farce," and a large number of other essays, including an introduction to the Gutenberg Bible. Bound up with this introduction, single leaves of one of these priceless treasures—from a mutilated volume of the original edition—are now being made available to libraries and book lovers. Mr. Newton has gathered together a collection of old books which contains many of the most notable landmarks of English literature in first editions and is especially rich in early printing.

Mr. Newton is now in his sixtieth year. Like so many other men who have achieved distinction, he is largely self-educated. He began his business career when only fifteen years of age. He lives a somewhat retired life on his large country place at Daylesford, Pa.

Editorial Comment

Electrical World, July 15, 1922

Volume 80

Number 3

Keep the Market Stable and Encourage Resales

THE investment pendulum has swung in the direction of utility securities, particularly those of electric light and power companies. Before and during the war the investing public regarded them with indifference, but during the last year a very active market has been available. Public service commissions have established a regulatory basis that encourages capital investment in such securities, and the after-war financial slump was confined largely to manufacturing, so that utility credit is good.

Investors realize now that light, heat and power are stable necessities supplied by companies that are regulated by law to such an extent that they rank with banks as safe enterprises. Another element entering into the matter is that radio, domestic appliances and many new inventions and developments have popularized electricity and at the same time have increased utility revenues.

The point in connection with present conditions is that this stable market must be maintained by the utilities. Dividends or interest payments should not be suspended or jeopardized. Resale of securities should be encouraged so as to take advantage of favorable discounts and interest rates.

The public and regulatory bodies should be still further educated to a proper realization of utility finance. Financing from stock sales is the same as cash advanced by the utility and should be so regarded in rate schedules. Stock sales are legitimate sources of money and should be encouraged.

A Safe Way to Meet an Emergency

ONE of the great trunk line railroads of the country at least has been obliged to withdraw twenty-three daily trains because of coal shortage. Other railroads have dropped many more trains from their daily schedules, but whether the withdrawals are due to the strike of the shopmen or to lack of coal is not stated. Railroads have been known to seize coal in transit on their lines for their own use in emergencies, but if no coal is moving empty bins cannot be replenished in that way.

In sharp contrast to this abridgment of railroad service is the 100 per cent service being rendered by the electric light and power companies of the country. Anticipating a coal strike, which is not a difficult matter seeing that miners' wage agreements expire at a definite time, the electric light and power companies many months ago began to accumulate and store coal. This is always an economic and wise policy to pursue in threatened strikes because coal can always be used, and the loss through deterioration is nothing compared to the loss of prestige and revenue due to a curtailment of service for want of it.

Typical of the central-station attitude is the spirit shown by the Westchester Lighting Company. It foresaw last October what is happening today. It took the initiative. It displayed resourcefulness and decided to act immediately. By mortgaging itself heavily it obtained enough coal to keep running until next January. Not all electric light and power companies were in a position to secure or purchase that much coal, but all laid by a generous supply. Sagacity has always been required in electric public utility work. Stations and lines must be built in advance of the demand and in providing fuel to tide them over a strike period the electric light and power companies of the country are running true to form. Foresight, not hindsight, is the watchword.

Advertising Space Should Be Purchased on a Value Basis

OCCASIONALLY some one gets up in a utility convention for a talk on advertising which can be reduced to the statement that newspaper space should be used to keep the editor's mouth shut. A case of this kind occurred in a recent central station convention when an operator told of his method of using advertising space and distributing job printing. It was to use advertising space in the papers of each community served and distribute the job printing in the community in which it was to be used to the papers of that community, and, last but not least, never to question any price that was charged for the advertising or job printing service.

It is regrettable that there are men in the utility business who cling to the belief that any newspaper whose support is of value can be bought in such a way as this. A community newspaper is of value for advertising purposes only as it wields influence based on its standing. To achieve a standing worth while the editor must face and discharge responsibilities that are as great as those of any other citizen. Such an achievement must have a foundation of honesty of purpose that will not permit him to be influenced by such petty suggestions as that made by the utility man referred to above. Being influenced by this sort of thing is the editor's surest road to oblivion.

Advertising space in the local newspaper is a commodity that should be purchased strictly for its value in reaching the people to whom the utility operator wants to talk. Job printing is another commodity that has a real value on which it should be purchased. The average small city or town paper owner is operating, like all the business men of such communities, on a cost basis that may not permit him to compete dollar for dollar with the great city printing establishments, and is entitled to consideration of that fact in negotiations with him for any commodity that he has to sell. The utility operator should purchase his wares on the same basis he buys any other service he needs in his business, and that without regard to whether editorial opinions are agreeable or not. In fact, editorial opinions that disagree with the utility man's viewpoint may indicate a class of readers that it is important to reach. The medium may be all the more valuable from an advertising standpoint because that class of readers can be reached in no other way than by a well-worked-out advertising policy based on the use of such papers. It will be easy to weed out the very small number of papers whose editorial policy is basically dishonest and keep clear of them in the same manner that good policy dictates keeping clear of any business man who is found to be dishonest.

Tertiary Winding on Main Transformers for Line-Control Apparatus

THE favorite solution for the regulation problem on long-distance transmission lines is to use a synchronous condenser at the load end. While this affords a cheap means of accomplishing the desired result, a practical difficulty arises out of the fact that it is difficult to design rotating machines for the logical and most economical step-down voltage of high-tension transmission lines.

To obviate this difficulty it has been suggested that the step-down transformers be equipped with a tertiary winding having a voltage which is applicable to the synchronous condenser. This arrangement should permit of a saving in transformer costs. Furthermore, by connecting the tertiary winding in delta and the main windings in star, the tertiary winding can supply a third harmonic exciting current to the transformer bank and a grounded neutral can be used, if desired, on the secondary of the main winding.

Operating data on this type of installation are eagerly awaited by a number of companies which do not feel that any entirely satisfactory solution to the problem of line regulation has yet been presented.

Reactor Arrangements—A Problem Economic as Well as Technical

IN THE early days the insertion of reactance in circuits to limit or localize the results of a short circuit was avoided because of its effect on voltage regulation. But with the improvement of load power factors and the development of automatic voltage control this objection has lost much of its importance. In fact, generators and transformers are now intentionally designed with high inherent reactance so as to contribute a part of the total protection necessary. The problem was relatively simple while station capacities were still small, the usual arrangement being a reactor in series with each outgoing feeder. However, with the modern central station of large units and of total capacity continually in advance of the ratings of standard equipment, it has been found increasingly important to sectionalize the buses, with reactances between sections, so that local feeder or station trouble may not endanger the entire system.

As a consequence the design of reactance coils for specific duties is now receiving unusual attention. Rugged constructions have been developed, increased current ratings have been made possible, and insulation for relatively high voltage has been provided, so that we should now have apparatus which will give the desired protection and reliability.

However, one problem is yet unanswered, at least in readily understandable form, and that is what the relative values of different arrangements of reactors are from the viewpoints of unit cost, protection afforded, space occupied and so forth. Information on the subjects will be welcomed by all companies designing new plants or remodeling old ones.

Offhand Comparisons Must Not Be Drawn Between Expenses of Different Stations

OUR readers should be interested in the mass of data which we have been able to collect for the first time on the fuel economy and general expense of production of a considerable group of stations, part of them coal-burning and another group burning oil or other fuels. These stations range in capacity from 170,000 kw. to less than 1,000 kw., and in annual load factor from 55 per cent to 6½ per cent, representing therefore a wide variation in load conditions.

A brief analysis of the general character of the results shows that there is a notable correlation between the load factor, the characteristics of the fuel and economy. This is as might be expected, but it is most notable when one segregates the stations into groups according to output and compares the groups. When it comes to an investigation of the lists, station by station, group correlations seem very much less striking, and one is impressed with the enormous difference between individual stations in production expense. For example, station No. 18 shows a total production expense of 0.526 cent. It is of 20,000 kw. capacity and its annual load factor is a little less than 40 per cent. Station No. 17, of the same rating and with an annual load factor of 59 per cent, shows more than double the total production expense. A little examination shows that it is burning a lower grade of coal and burning it inefficiently, so that the B.t.u. required per kilowatt-hour is almost 50 per cent in excess of what is required by the other station.

From an example like this it becomes evident that the annual load factor is not the really significant figure, since this may be none too high, and yet the station, save for unused capacity, may be operated in an extremely efficient and economical manner. A load factor week in and week out for the units in use or held under steam is a more important criterion for efficiency. The largest station of all here considered has slightly lower coal consumption but much lower B.t.u. per kilowatt-hour than No. 18 and a materially higher load factor. Still, it shows a somewhat greater total expense. In this instance it was chiefly due to an evidently higher cost for coal and for wages. Local factors like coal and wages have an all-important bearing on the final cost of production, so that no safe conclusion as to cost can be drawn by comparing one plant with another without very careful analysis of these data. An example in point here is plant No. 13, with the lowest coal consumption per kilowatt-hour of the entire steam-driven group, but with a relatively high expense for wages and superintendence. The result is a cost of 1.015 cents for the total production expense.

Still another example of how not to draw parallels between miscellaneous plants about which one has imperfect knowledge is to be found in the case of plant No. 29 of 3,750-kw. rating, 18.9 per cent annual load factor and a heat debit of 44,000 B.t.u. per kilowatt-hour. On their face these figures are scandalous, but the fuel cost is exceptionally small and the final total production expense with a handicap against it of only 1.09 cents per kilowatt-hour, a figure lower than the average of the group with from 20,000-kw. to 30,000-kw. rating and very much higher average annual load factor.

The data from the oil-burning plants are of a much less detailed and satisfactory character. Some of them are conspicuously high, others notably low, but the full data are in most instances missing. The same is true of some of the plants burning gas and hogged fuel. It would be very interesting to investigate the relation in these stations between the annual load factor as stated and the average daily load factor with respect to plant in use. It is the latter rather than the former which bears directly upon the working efficiency of the installation, while the former has a significant correlation with the investment charge per kilowatt generated.

We believe that it is well worth while to continue studies along this general line to increase the available knowledge as to generating costs of electricity. If some of the enthusiastic advocates of municipal ownership who are always harping about what some station in a remote part of the country has accomplished would settle down to a serious study of data like those which we here present, we think they would quickly see the futility of offhand estimates as to costs of electrical service.

Why Some Appliances Are Not Being Used

RESIDENCE surveys in many cities are serving to focus attention on a matter which has already been sidestepped for too long a time. We have known that a goodly number of folk have laid away their chafing dishes, percolators, grills and even their flatirons on the closet shelf and have given up the use of them. And we have said that this is natural, because so many people purchase things like this on impulse and then, because old habits and traditions die hard, carelessly neglect to organize unaccustomed elements of service into their daily living.

But the surveys have discovered also that too many housewives are not using their vacuum cleaners and their clothes washers and their fans and mixing motors in the way they should. They are not depending on them enough. They are not using them as often and as much as we have taken for granted that they would.

There is nothing to be alarmed at. Most people who possess these electrical appliances do use them because of their great labor-saving and comfort value. But the fact that any of these appliances are abandoned or half-used is something that concerns us all.

The reason seems to be a lack of thoroughness in selling. Salesmen are taking advantage of the ready appeal of these household devices to sell them easily, without establishing adequate enduring confidence in the need for their constant use. For clearly no woman would apply a vacuum cleaner once a month and broom-sweep in between who really understood the superior cleanliness of the electric sweeper. It is not enough for the dealer or the central-station or the manufacturer to sell such an appliance. He must so sell it that it will be used habitually with complete reliance. And apparently it would be well for electrical appliance salesmen to give more thought to this.

Does Relay Protection Pay for Itself?

MANY engineers have been faced with the questions of "Isn't the investment in the relay and allied equipment of a power system too large a proportion of the total investment?" and "Does relay protection pay for itself?" Based on both confidential and public information which we have received, these questions can be answered in favor of relay protection, when properly selected, installed, inspected and maintained.

In one case referred to, which involves one of the most congested distribution systems in the country and which has the reputation of being the most effectively protected, the investment in relays, accessory transformers and the like is only one-tenth of 1 per cent of the total system investment. This seems to be a very modest proportion considering the purpose of relays.

On another system, during the last five years, it has been possible to reduce the total number of interruptions in thirteen typical substations (about 15 per cent of the total) from 270 to 21, despite the fact that the number of cases of trouble have been reduced only about half or from 288 to 130. Furthermore, the capital expenditure for this protection only amounted to $25,000, which at 15 per cent makes the fixed charges $3,750. Adding to this the costs of engineering, maintenance and testing, the total annual charges are only $8,050, which are offset by the saving in revenue of $8,350 through reduction in interruptions.

Hence this relay system is paying for itself, not including any intangible value that can be placed on maintaining the public confidence in reliability of central-station service.

Experience in Severe Climates Will Determine Extent of Outdoor Metering

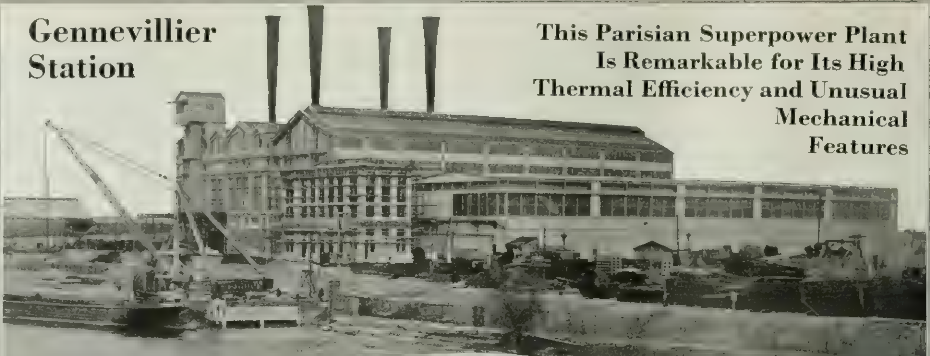
OUTDOOR metering has been carried on successfully over a period of years despite the obstacles imposed by dense sea fogs, according to the report in this issue by H. R. Thomas. He points out that the Southern California Edison Company has developed standard outdoor metering equipment that has been used extensively in 10,000 and 15,000-volt installations. Many engineers may contend that the weather conditions in the section served are such as to make outdoor metering a relatively simple proposition. However, the success of such an undertaking in one section of the country should indicate the possibility of similar results in another if additional precautions are taken to meet local weather conditions.

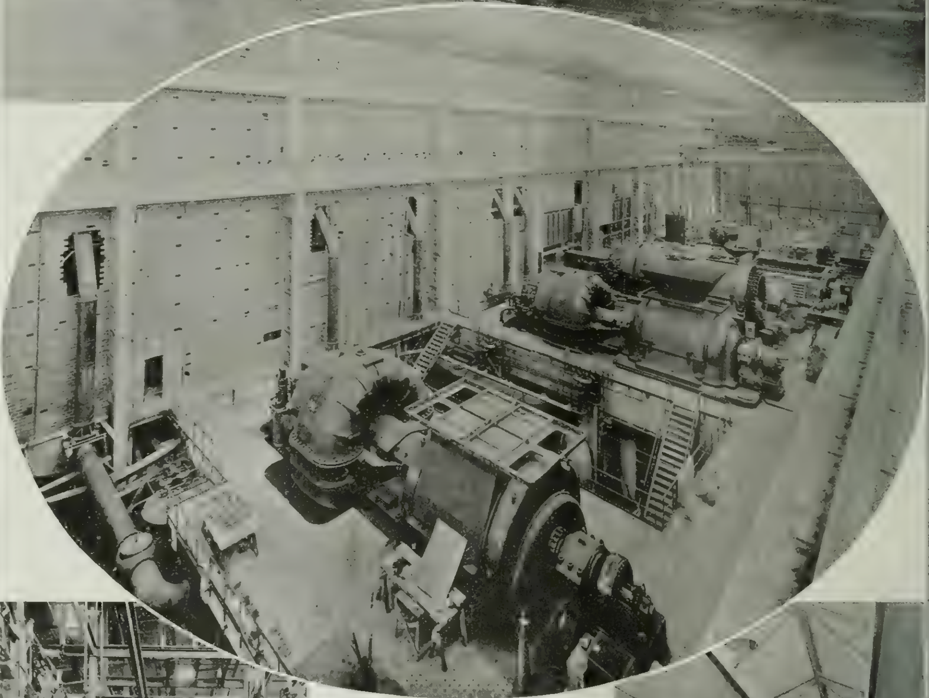
From an economic viewpoint outdoor metering is a very attractive proposition in many cases. In most places where customers are furnished primary energy or distribution voltages up to 15,000 volts it has been necessary up to the present time to install expensive vaults to hold the metering equipment. Outdoor switches have come to be generally accepted, but outdoor metering equipment has not received the same extensive acceptance. Experience in California points out the possibility of metering primary customers outdoors, and further reports from more severe climates will determine the extent to which it will be carried.

The prospect of a considerable reduction in investment clearly emphasizes the necessity of investigating the possibilities of such outdoor installations in all sections of the country.

Gennevillier Station

This Parisian Superpower Plant Is Remarkable for Its High Thermal Efficiency and Unusual Mechanical Features





THIS new 320,000-kw. (ultimate) plant of the Union de l'Electricité, Paris, which has been in the limelight ever since it was started, now has three 40,000-kw. turbo-generators in operation and the fourth will be running the latter part of this year. Eventually eight units will be installed. All of them are of the Zölley type and are designed to operate under 280 deg. superheat and 320 lb. pressure at the nozzles. The guaranteed steam consumption at full load is 9.62 lb. per kw.-hr. and at three-quarters load is 9.46 lb. Among other features of the plant are the use of two types of boilers, one with chain-grate and the other with underfeed stokers; ejector-produced draft; both air preheaters and economizers; recovery of generator losses; purification and degasification of feedwater and the bleeding of the turbines for main heating of feedwater. These features will be discussed in an early issue.

Fuel Economy and Production Expenses

Data Are Given for Electric Plants Burning Coal, Oil, Gas and Hogged Fuel—Careful Analysis of Data Permits Interesting Comparisons Between the Results Obtained

By ALLEN M. PERRY
Engineering Editor Electrical World

TO AFFORD a basis for comparison of plant performances and production expenses, but chiefly to show how these figures are affected by load factor, characteristics of coal, plant size, etc., the *Electrical World* has collected the accompanying data from fifty-five central-station companies. The data show in a striking manner that plants of similar rating develop a kilowatt-hour with widely different B.t.u. inputs and operating expenses. Hence the occasional contention that one station should be able to generate energy at the same expense as another of the same rating derives little support from these data. The data do, however, serve to indicate what results are possible of attainment under identical conditions.

It would be interesting to try to detect any relation between plant condition (such as modernity, upkeep, etc.) and fuel economy or operating expenses, but it is impossible to indicate adequately the condition of so many plants in a table of reasonable size. Management and the human factor involved in station labor are other important considerations which could not be converted into tangible figures, all of which should indicate that definite conclusions cannot be drawn from statistics alone, although they may be of considerable value. Despite the many factors which influence operating economy and production expense, it is interesting to observe how closely the results obtained follow the load factor and coal characteristics. For illustrative purposes the data will be considered in groups.

LOWEST OPERATING EXPENSES OF ALL REPORTED

Of the first group indicated, the 170,000-kw. station with 51 per cent load factor has the highest fuel economy of all stations reported, namely, 20,250 B.t.u. per kw.-hr. It also has the lowest production expenses for the group. Very good economy was also obtained in the other 170,000-kw. station and 150,000-kw. station operating at 48.1 per cent load factor. The relatively high production expenses of station 1a, 1b and 2, compared with the next smaller group, were unexplained by the contributors of the data, but they may be due to the age of the stations, the high unit wage expense and the excessive steam equipment maintenance.

In the 50,000-60,000-kw. class the best fuel economy, namely, 22,950 B.t.u. per kilowatt-hour, was obtained in a 60,000-kw. plant operating at 44.2 per cent load factor and burning 13,124 B.t.u. coal containing 9.6 per cent ash. This performance was obtained despite the fact that its load factor was lower than that of some other stations in the group, but this may be attributed to the fact that it is the most modern station in the group and to the relatively high-grade coal burned. This station also incurred the lowest total production expense of all steam stations reported, namely, 4.87 mills.

The general manager of the station mentioned made the following comment in submitting the data:

"We wish to call your attention to the fact that during 1921 our operating conditions at ——— were in no wise normal, owing to the necessity of operating the main generating units for several months during this period at a low load factor. Our present operation is at a load factor of approximately 75 per cent, changing our generating cost very materially.

"While the average fuel cost for the year 1921 was 3.63 mills per kilowatt-hour, we are now operating at a fuel cost of less than 3 mills per kilowatt-hour, with a corresponding reduction in total net generating costs, which may be considered the normal performance of this station."

In the same group with this station is a 50,000-kw. station having a load factor of 45.5 per cent which developed the poorest fuel economy. However, this is largely attributable to the relatively poor coal, which contained 10,147 B.t.u. per pound and 21.4 per cent ash, and to the fact that this plant had only 30,000 kw. installed for eight months of the year reported. This fact really entitles the plant to comparison with stations in the 30,000-50,000-kw. class.

The highest operating expenses obtained in the 50,000-60,000-kw. group were incurred by a 53,000-kw. station with high load factor (51.3 per cent) burning 10,350 B.t.u. coal. The operating expenses were 7.78 mills.

Only two stations are represented in the 30,000-50,000-kw. class. The largest, rated at 44,500 kw., developed the best fuel economy (31,500 B.t.u. per kilowatt-hour) and had the lowest operating and maintenance expenses, namely, 9.56 mills and 0.95 mill respectively. A combination of bituminous and No. 3 buckwheat coal was burned in the proportions of about five to one.

A fuel economy of only 33,600 B.t.u. per kilowatt-hour was developed by the other station of the same group. Its operating and maintenance expenses were also higher, namely, 11.86 and 1.27 mills respectively. This performance, however, is due largely to the fact that the station has quite unusual load demands, providing insurance for the hydro-electric system with which it is interconnected. In this service it has a load factor of only 28.7 per cent, the demands being of a relatively sporadic character. For this reason they cannot be planned for as in a system even of the same load factor where the load fluctuations are periodic. Another handicap is the fact that this is a relatively old station, although it has been kept very nearly up to the latest standards.

REMARKABLE ECONOMY WITH HIGH-ASH COAL

In the 20,000-30,000-kw. class the best fuel economy (22,700 B.t.u. per kilowatt-hour) was developed by a 20,000-kw. station operating at a load factor of 39.7 per cent with coal containing 13,938 B.t.u. and 18

Operating Economy and Production Expenses of Fifty-five Generating Stations

	Rating Coal-Burning Stations, Kw.	Annual Load Factor, Per Cent	Output, Kw.-hr. Twelve Months	Peak Load, Kw.	Total Coal Used Twelve Months	B.t.u. per Lb. Of Fuel	Per Cent Ash	Lb. Coal per Kw.-hr.	B.t.u. per Kw.-hr.	Operating Expense, Cents per Kw.-hr. Delivered from Switchboard				Maintenance Expense, Cents Per Kw.-hr. Delivered from Switchboard				Total Production Expense	Remarks
										Fuel	Wages	Superintendence, and Misc.	Total	Station Building	Steam Equipment	Electrical Equipment	Total		
1	170,000	51.0	527,121,000	118,000	427,000	......	.	1.62	20,250	0.532	0.069	0.026	0.627	0.011	0.045	0.002	0.058	0.685	
†1a	170,000	38.4	461,809,700	137,450	390,602	13,879	7.3	1.690	23,460	0.737	0.105	0.040	0.882	0.023	0.095	0.008	0.126	1.008	
†1b	150,000	43.2	493,848,800	131,000	503,705	13,218	10.0	2.020	27,000	0.896	0.114	0.0390	1.049	0.024	0.138	0.018	0.180	1.229	
†1c	150,000	48.1	473,782,743	112,500	410,441	13,396	9.98	1.735	23,720	0.746	0.0670	0.024	0.837	0.007	0.052	0.019	0.078	0.915	
2	95,000	11.2	57,026,700	58,000	70,460	12,713	12.5	2.46	31,400	0.782	0.167	0.088	1.037	0.035	0.131	0.005	0.171	1.208	
3	60,000	44.2	239,936,000	62,000	209,596	13,124	9.6	1.75	22,950	0.363	‖‖0.062	¶¶0.028	0.453	0.004	0.027	0.003	0.034	0.487	
4	56,000	42.3	108,829,278	29,358	139,429	10,983	12.9	2.56	28,200	0.530	0.089	0.031	0.650	0.018	0.061	0.016	0.095	0.745	
5	53,000	51.3	127,758,800	28,400	152,799	10,350	....	2.39	24,800	0.700	0.055	0.023	0.778	0.007	0.077	0.006	0.090	0.868	
6	52,000	38.2	164,464,720	49,200	157,290	12,216	....	1.91	23,350	0.632	0.078	0.010	0.720	0.004	§§	§§	0.058	0.778	
7	*50,000	45.5	201,550,584	50,650	330,519	10,147	21.4	3.28	33,300	0.361	0.072	0.059	0.492	0.014	0.116	0.097	0.227	0.719	
†8	44,500	27.6	§§34,017,300	28,115	32,490 6,408	14,300 11,000	8.3 20.0	2.29	31,500	0.780	0.098	0.078	0.956	0.015	0.073	0.007	0.095	1.051	Bituminous and No. 3 buckwheat coal burned
9	36,000	28.7	78,579,120	31,200	94,800 ‡14,000	13,960 18,500	8.8	......	33,600	0.949	0.162	0.075	1.186	0.013	0.107	0.007	0.127	1.313	Standby for hydro-electric system Burns coal and oil
10	29,500	38.2	59,775,632	17,970	133,410	10,043	17.5	4.47	44,900	0.648	0.116	0.029	0.793	0.005	0.061	0.022	0.088	0.881	
11	26,150	42.1	44,405,000	12,050	96,556	9,000	12.0	4.34	39,100	0.918	0.141	0.004	1.063	0.001	0.082	0.060	0.143	1.206	
12	22,600	47.9	45,783,090	10,900	57,966	10,330	14.0	2.53	26,200	0.920	0.120	0.080	1.120	Neg.	0.260	0.070	0.330	1.450	
†13	22,500	43.0	§§30,134,000	16,000	24,293	14,600	7.0	1.61	23,600	0.695	0.109	0.081	0.885	0.022	0.103	0.055	0.130	1.015	
†14	20,750	34.0	17,479,655	11,700	16,921	14,353	7.0	1.94	27,800	0.800	0.192	0.044	1.036	0.012	0.057	0.011	0.080	1.116	Coal at $8.25 a ton
†15	20,500	35.7	16,903,667	10,800	19,143	14,800	9.0	2.26	33,550	1.101	0.244	0.061	1.315	0.054	0.076	0.007	0.137	1.452	Coal at $8.97 a ton
16	20,000	4.8	5,857,000	13,700	20,700	14,300	....	7.07	101,100	......	......	......	......	.....	.....	.....	.....	4.930	Standby for hydro-electric system
17	20,000	59.0	47,358,299	9,200	68,359	11,350	14.0	2.89	32,800	0.707	0.155	0.089	0.951	0.012	0.079	0.038	0.129	1.080	
18	20,000	39.7	69,623,000	20,000	56,565	13,938	18.0	1.63	22,700	0.429	0.046	0.017	0.492	0.001	0.028	0.005	0.034	0.526	
†19	18,500	41.3	20,126,100	11,100	19,532	14,500	7.0	1.94	28,200	0.855	0.130	0.023	1.008	0.006	0.034	0.007	0.047	1.055	Coal at $8.82 a ton
20	18,000	39.0	60,269,400	17,600	62,563	13,775	8.2	2.08	28,600	0.530	0.088	0.020	0.638	0.001	0.062	0.004	0.067	0.705	
21	16,500	36.5	36,111,820	11,300	48,272	13,500	10.0	2.67	36,100	0.876	0.162	0.022	1.060	0.022	0.119	0.023	0.164	1.224	Operated in conjunction with water power
†22	16,100	40.7	10,701,600	6,000	10,860	14,450	6.5	2.03	29,300	1.370	0.313	0.128	1.711	0.032	0.212	0.060	0.304	2.015	Coal at $10.19 a ton
†23	13,100	35.8	5,720,680	3,650	7,090	......	....	2.48	......	1.100	0.340	0.105	1.545	0.021	0.090	Neg.	0.111	1.656	Coal at $8.963 a ton
24	10,000	38.2	18,092,320	5,400	27,057	......	....	2.99	......	0.792	0.075	0.079	0.946	.....	.....	....	0.019	0.965	
25	10,000	42.8	27,419,574	7,300	33,792	11,500	10.5	2.46	28,300	0.740	0.076	0.001	0.817	Neg.	0.003	Neg.	0.003	0.821	
26	8,500	45.5	29,914,900	7,500	38,026	......	12.0	2.54	......	0.536	0.098	0.001	0.635	.....	.....	.....	0.094	0.729	
27	8,500	42.5	26,029,860	7,000	37,049	12,500	14.5	2.84	35,600	0.611	0.110	0.050	0.770	0.010	0.090	0.010	0.110	0.880	
†28	7,500	36.1	§§5,395,500	3,400	9,360 ‡‡291	14,450	9.0	....	......	1.280	0.341	0.163	1.784	0.025	0.092	Neg.	0.117	1.901	Burns coal and coke breeze
29	3,750	18.9	5,965,870	3,600	11,909	11,000	18.2	4.00	44,000	0.550	0.250	0.090	0.890	0.020	0.150	0.030	0.200	1.090	
30	2,000	35.3	2,950,590	954	8,657	9,000	....	5.86	52,800	1.238	0.330	.....	......	.....	.....	.....	0.100	....	
31	750	26.6	1,376,900	590	4,087	11,000	....	5.94	65,300	1.530	0.613	.....	......	.....	.....	.....	0.040	....	

	Rating Oil-Burning Stations, Kw.	Annual Load Factor, per Cent	Output, Kw.-hr. Twelve Months	Peak Load, Kw.	Total Oil Used Bbls. Twelve Months	B.t.u. per Lb. Of Fuel	Deg. Baumé	Bbls. Oil per Kw.-hr.	B.t.u. per Kw.-hr.	Operating Expense, Cents Per Kw.-hr. Delivered from Switchboard				Maintenance Expense, Cents Per Kw.-hr. Delivered from Switchboard				Total Production Expense	Remarks
										Fuel	Wages	Superintendence, and Misc.	Total	Station Building	Steam Equipment	Electrical Equipment	Total		
32	64,000	25.6	126,510,000	......	635,229	......	18.0	0.00502	......	......	......	......	0.984	.....	.....	.....	0.123	1.107	
33	47,000	40.0	164,860,000	......	675,887	......	16.0	0.00410	......	......	......	......	......	.....	.....	.....	.....	0.900	
34	39,000	11.5	40,030,000	......	220,766	......	16.0	0.00552	......	......	......	......	......	.....	.....	.....	.....	2.060	
35	33,500	19.5	59,980,000	......	301,846	......	18.0	0.00503	......	......	......	......	1.080	.....	.....	.....	0.254	1.334	
36	30,000	8.9	15,230,000	......	96,922	......	17.0	0.00636	......	......	......	......	1.842	.....	.....	.....	0.115	1.957	
37	28,000	55.0	98,777,500	20,500	......	......	....	......	......	0.695	0.032	0.032	0.759	0.013	0.095	0.009	0.117	0.876	Burns oil and gas
38	27,000	22.0	52,060,000	......	303,368	......	18.0	0.00582	......	......	......	......	1.289	.....	.....	....	0.169	1.458	
†39	14,250	22.6	§§20,601,900	20,800	102,823	18,200	....	......	30,200	¶0.680	¶0.099	¶0.072	¶0.851	¶0.014	¶0.012	Neg.	¶0.111	¶1.656	Oil at $1.366 per bbl.
40	10,000	55.3	56,140,000	......	273,235	......	17.4	0.00487	......	......	......	......	1.089	.....	.....	.....	0.058	1.147	

41	10,000	41.5	30,563,230	8,400	......	......	......	......	......	0.790	0.100	0.076	0.966	0.026	0.160	0.015	0.201	1.167	....
42	9,250	39.4	19,994,280	5,800	111,000 ‖189,023	19,000	......	......	35,190	1.000	0.088	......	......	0.003	0.042	0.026	0.071	.....	Burns oil and gas
43	8,575	40 4	††18,095,847	5,100	241,000 §2,208	......	......	......	......	0.257	0.082	0.012	0.351	0.001	0.034	0.014	0.049	0.400	Fuel oil, water-gas oil and coal used
44	7,200	23.6	7,790,000	......	62,002	......	17.4	0.00795	......	......	......	......	1.856	.....	.....	.....	0.189	2.045	....
45	6,600	14.0	6,340,000	......	21,540	......	16.5	0.00340	......	......	......	......	......	......	......	......	......	0.940	
†46	6,500	30.0	4,663,930	3,550	30,800 §313	18,250 14,200	......	......	42,000	1.150	0.226	0.056	1.432	Neg.	0.157	Neg.	0.157	0.589	Oil at $0.0391 a gal. and coal at $10 205 a ton
47	5,000	6.5	4,000,000	......	24,383	......	18.0	0.00608	......	......	......	......	1.749	......	......	......	1.240	2.989	....
48	5,000	36.5	11,335,272	3,550	722,000 §3,487	18,000 11,330	......	....	45,000	1.307	0.187	0.134	1.628	0.010	0.189	0.003	0.202	1.830	....
49	4,000	30.3	10,108,916	3,800	......	......	......	....	......	1.240	0.190	0.150	1.580	0 100	0.130	0.056	0.280	1.860	Burns oil and gas

	Rating Hogged Fuel Stations, Kw	Annual Load Factor, Per Cent	Output, Kw.-hr. Twelve Months	Peak Load, Kw.	Total Hogged Fuel Used Units Twelve Months		Deg. Baumé			Operating Expense, Cents per Kw.-hr. Delivered from Switchboard				Maintenance Expense, Cents per Kw.-hr. Delivered from Switchboard				Total Production Expense	Remarks
										Fuel	Wages	Superintendence, and Misc.	Total	Station Building	Steam Equipment	Electrical Equipment	Total		
50	18,500	21 0	33,340 000		96,900 **408	. .	.. .	.	. . .	0 246		.	0.413	. .		.	0 166	0 579	Burns hogged fuel and oil
51	13 000	10 0	9,340,000		35,633 **1,832		..	....	..	0.395	.	. . .	0 714	. .	. .	.	0 296	1 010	Burns hogged fuel and oil
52	7,500	17 2	14,150,000	.	28,959 **3,062	.	16 5	. . .	....	. . .	.....	. .	.....	. .	.	. . .	.	0 920	Burns hogged fuel and oil

* For eight months the plant was rated at 30,000 kw.
† For the six months ended Dec. 31, 1921.
‡ Fuel oil, gallons.
‖ Cubic feet of gas, 950 B.t.u. per cubic foot.
¶ Costs based on kilowatt-hours generated.
§ Coal used in addition to fuel oil.
** Barrels of fuel oil.
†† Total power generated and purchased.
‡‡ Coke breeze.
‖‖ Including superintendence.
¶¶ Not including superintendence.
§§ Power also purchased, but is not included.
x Approximate rating.

per cent ash. Furthermore, at this station the lowest operating and maintenance expenses were incurred, namely, 4.92 and 0.34 mills respectively. This is a rather remarkable performance considering the high ash content.

The poorest economy and the highest production expenses characterized another 20,000-kw. station, which operated at the abnormally low load factor of 4.8 per cent. This plant is merely a standby for a hydro-electric system. Being very old, it is doubtful whether economical results could be obtained even if operating conditions were more favorable.

Another station in this group which was not so handicapped by poor load factor had the next poorest fuel economy, but this may have been due to the poor coal, its content being 10,043 B.t.u. and 17.5 per cent ash.

High operating expenses were incurred by the 20,500-kw. station in this group, due evidently to high unit fuel and labor prices. It is possible that the high maintenance expense of the 22,600-kw. station was due to the high-ash coal since the steam-plant maintenance is the largest item of this expense.

LOW RELAY-PLANT ECONOMY THE PRICE OF SERVICE RELIABILITY

In the 10,000-20,000-kw. group the best fuel economy (28,200 B.t.u. per kilowatt-hour) was developed by an 18,500-kw. station having a semi-annual load factor of 41.3 per cent and burning coal containing 14,500 B.t.u. and 7 per cent ash. The poorest economy (36,100 B.t.u. per kilowatt-hour) was developed by a 16,500-kw. station having 36.5 per cent load factor and burning 13,500-B.t.u. coal containing 10 per cent ash; but this is due to the fact that the station operates in conjunction with a water-power plant. For about eight or nine months of the year it serves merely as a relay for the hydro-electric system. During the remainder of the year it operates at about 80 per cent load factor. The management expressed the belief that if this station could be operated with an average monthly load factor equal to its present annual load factor much better results could be obtained.

The highest operating and maintenance expenses were piled up by a 16,100-kw. station operating at 40.7 per cent semi-annual load factor and using 14,450-B.t.u. coal containing 6.5 per cent ash. The high operating expense was due evidently to the fact that coal cost $10.19 a ton. As may be observed, the steam equipment maintenance expense was relatively high.

For low operating expense the 18,000-kw. station operating with a 39 per cent annual load factor takes first place in this group, while the 10,000-kw. station with a load factor of 42.8 per cent excels in lowest maintenance expense.

In the 5,000-10,000-kw. group the lowest combined operating and maintenance expenses (7.29 mills per kilowatt-hour) were incurred by an 8,500-kw. station operating at 45.5 per cent local factor but with 12 per cent ash. The highest production expense was reported by a 7,500-kw. station operating at 36.1 per cent load factor on a mixture of Pocahontas coal and coke breeze in the proportion of fifty to one. The bituminous coal contained 14,450 B.t.u. and 9 per cent ash. Wages, fuel and superintendence were particularly high.

In the group representing stations under 5,000 kw. the best economy was submitted by a 3,750-kw. station operating at 18.9 per cent load factor with 11,000 B.t.u.

coal containing 18.2 per cent ash. The economy was 44,000 B.t.u. per kilowatt-hour, and the operating and maintenance expenses 8.9 and 2 mills respectively. Poorest economy and highest operating expense were reported by a 750-kw. station operating at 26.6 per cent load factor and using 11,000-B.t.u. coal. The size of the plant, the load factor and the high unit fuel and wage expense account for this.

Prior to the war there was a decided downward tendency in operating costs as outputs and plants increased in size, but few medium-sized stations succeeded in producing a kilowatt-hour for less than 7.5 mills at the station bus (net manufacturing cost). In general, a station ranging from 10,000 kw. to 50,000 kw. rating and burning good-quality bituminous coal on automatic stokers with a per ton coal cost of around $4 to $5 at the outside considered itself doing well if it generated energy at a station expense, excluding fixed charges, of 8 to 10 mills per kilowatt-hour.

Then came the war, and fuel prices doubled and trebled. Outputs increased rapidly, and plants were extended at an unprecedented rate to meet service requirements. Up went the unit costs of operation, but the chief factor in this advance was the price of fuel. Larger generating units were installed and a sharp watch on boiler-plant operation was maintained. Interconnection began to be felt as a factor in regional power production, and the saving in fuel resulting was marked. Production costs exclusive of overhead went in many plants of good type to 1.25 to 1.5 cents per kilowatt-hour, and had it not been for the engineering supervision given to these plants, there is little question that some of those which prided themselves on their moderate costs would have reached or exceeded 2 cents. Some reduction in the price of coal is now evident. Today some of these plants are getting back to the region of a net station cost of about 9 or 10 mills per kilowatt-hour.

The writer is indebted to H. S. Knowlton, New England editor; J. C. Martin, Western editor, and G. E. Armstrong, Pacific Coast editor, for their assistance in procuring the foregoing data.

The Superpower System in France

THE superpower idea has progressed very rapidly in France, owing particularly to the availability of many water-power sites both in France and in neighboring countries, especially Switzerland, Italy and Spain, and the very high cost of coal. It is therefore not surprising to find that a great deal of engineering thought has been given to the interconnections of the many existing and proposed water-power plants and steam plants of France. The matter of the electrification of railroads is also being considered seriously.

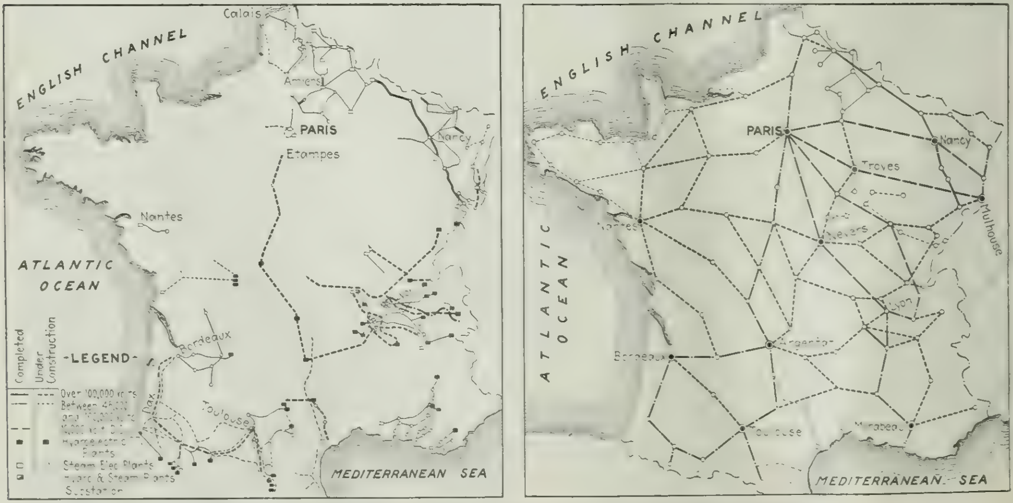
Two maps are shown which indicate the present status of such systems and the proposed plans. The first map shows the development to date of lines of 45,000 volts and over, indicating the existence of twenty-six large power companies. The second map shows the system into which the existing lines will fit when the plan is completed. Five important systems at 150,000 volts are proposed, with facilities for interconnections, each one making use of the available water power in its territory and whatever steam plants are necessary. These systems are meant to supply energy for the electrification of the railroads. The matter of financing and controlling them has been considered and the following methods are proposed:

1. The lines are to be built by the state with or without the assistance of private capital. After construction the control is to be turned over to a board of directors whose personnel is to be made up two-fifths of government officials and three-fifths of officials of the companies that are formed to operate these systems.

2. Concessions will be given by the government for construction and operation of these systems to companies.

3. Concessions will be given for construction and operation, in which the railroads will be expected to invest up to a certain stated amount and in which they will have voice in operating matters.

4. Concessions will be given for construction and operation to companies with or without financial assistance from the state. This plan has the advantage of giving the most incentive to private enterprise.



EXISTING TRANSMISSION SYSTEMS IN FRANCE AND PROPOSED DEVELOPMENT

Cost of Outdoor Metering Installations

Data Given for 2,200-Volt, 10,000-Volt and 15,000-Volt Installations of the Southern California Edison Company — Features of Construction Presented

By HALBERT R. THOMAS
Testing and Meter Department, Southern California Edison Company

THERE are a number of manifest advantages in the practice of placing electric meters out of doors, at least for certain classes of installations. Chief among these advantages is the accessibility of the meter for reading, inspection and testing, which nearly always involves some inconvenience to the consumer when the meter is in the building. Second calls forced by locked premises are eliminated with the outdoor installation. Industrial plants frequently have no desirable place for meters on account of dust, fumes, vibration, liability to physical damage or lack of room for the uncrowded type of instrument favored by the modern meterman. In some cases outdoor metering becomes virtually a necessity; for instance, service supplied to a group of oil wells at transmission voltage may make it obligatory either that the meter be placed outdoors or that a building be erected especially to house it.

An outside meter is usually placed either on a pole or on the side of a building. In both cases it should have adequate protection from the weather. This seems so obvious as scarcely to be worth mentioning, but the operating company which installs meters out of doors soon finds that it must adopt rigid rules for their protection and employ much firmness and perseverance in the enforcement of these rules.

About ten years ago the Southern California Edison Company found itself facing a serious situation with regard to its meters in a number of cities along the seacoast. It was necessary to place many meters outside owing to the number of locked houses at certain seasons of the year. These meters were in many cases unprotected from the salt fogs blowing in from the ocean, or were inclosed in home-made boxes of various types which usually made the meter almost inaccessible for adjustment or repair. The life of the unprotected meters under these conditions was very short. In from two to five years after installation the case would be badly corroded, the cover nuts rusted on and the holes for the cover posts so enlarged that corrosion of the interior would be found to have commenced.

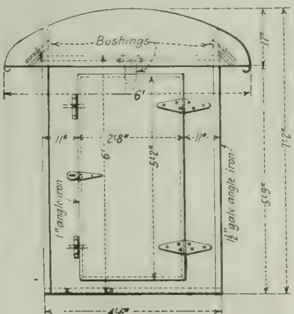


FIG. 1—GALVANIZED-IRON BOX FOR HIGH-VOLTAGE PRIMARY METERING

The adoption of a standard box was thought desirable. Such a box should combine a number of features: It should be durable, should protect the meter from rain or fog, should allow quick and accurate reading without the necessity of opening a door (which is apt to be left open), and should provide convenient access from all sides for repairs and adjustments. These requirements were met very satisfactorily by the type of box shown in Fig. 3 C and D, which is now used for outdoor installations in both coast and inland towns. This box, which was designed by the meter department, consists of a flat back on which the meter and entrance switch are mounted and a cover attached to this back by a hook and eye on either side. A large glass in the front is provided for reading purposes, making the removal of the cover by the meter reader unnecessary. The tester, however, may easily remove the cover and gain access to the meter from all sides, as shown in Fig. 3 D. The boxes are made up in large lots in the company's shops and sold to consumers and contractors at cost, amounting to about $1.25.

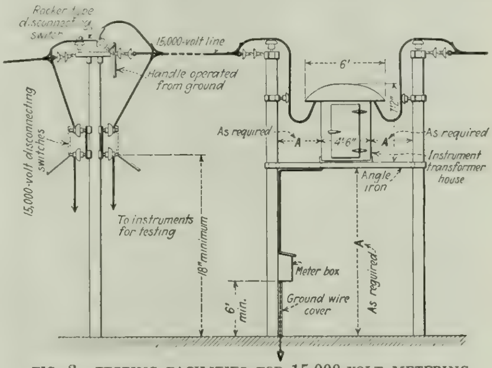

Rocker type disconnecting switch
15,000-volt line
Handle operated from ground
15,000-volt disconnecting switches
To instruments for testing
18" minimum
6' min.
Meter box
Ground wire cover
As required
A
4'6"
A
As required
6'
1'2"
Instrument transformer house
Angle iron
A
As required

FIG. 2—TESTING FACILITIES FOR 15,000-VOLT METERING INSTALLATION THAT HAVE PROVED SATISFACTORY

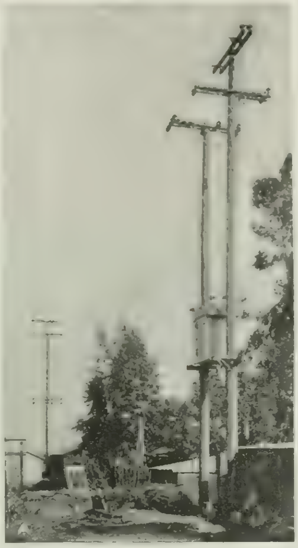
Locked premises are not a factor that compels the location of power meters out of doors, and if they are thus installed, it is usually for one of the other reasons referred to above. The majority of the power meters placed outside are of the primary type, installed with current and potential transformers.

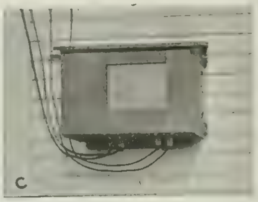
The outdoor metering of a 2,200-volt installation presents a considerably simpler problem than with some

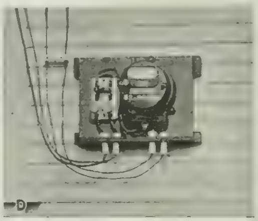
TABLE I—COST OF 2,200-VOLT OUTDOOR METERING INSTALLATION

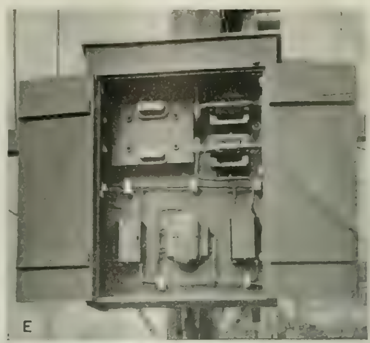
One 2,200-volt weatherproof box	$8.76
Two 50-watt, 2,200 110-volt potential transformers	39.50
Two 50 5-amp., 2,500-volt current transformers	34.90
One test panel	19 32
Instrument wire, cleats, tubes and miscellaneous	4 13
Cross-arms and insulators	5 00
150 ft No. 4 2,500-volt cotton-covered wire	35 03
Labor wiring interior of box	7 50
Labor of installation	15.00
Supply expense and overhead	5.00
Cartage, etc.	5.00
Total	$179 14

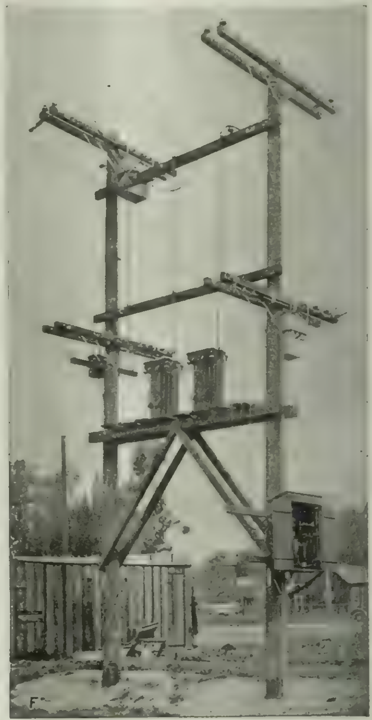
Despite Dense Sea Fogs Outdoor Metering Is Being Successfully Used by the Southern California Edison Company











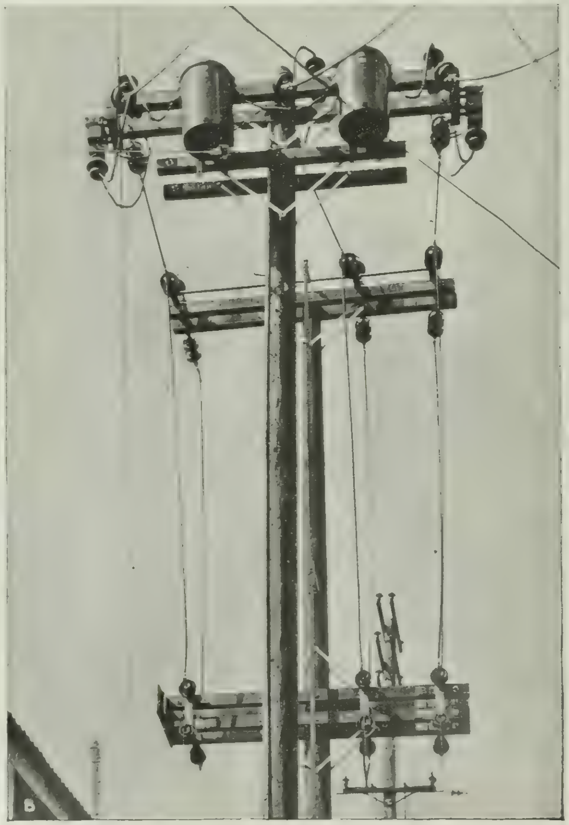


Fig. 3—A—Indoor-type instrument transformers for a 15,000-volt metering installation placed in a metal box the details of which are shown in Fig. 1. The meter is placed in a box at the foot of the pole. On the pole in the background may be seen the arrangements for testing. B—15,000-volt installation using outdoor-type instrument with wooden box containing meter at the foot of the pole. C and D—Residence metering equipment placed outside of house. F—2,200-volt meter installation with the meter and transformers in wooden box, a detail of which is shown in E. Note the primary testing panel in upper left-hand corner.

TABLE II—RELATIVE COSTS OF OUTDOOR METERING EQUIPMENT FOR 10,000-VOLT AND 15,000-VOLT POWER INSTALLATIONS

INDOOR-TYPE INSTRUMENT TRANSFORMERS

10,000-Volt Installation

One galvanized-iron box for transformers	$201.00
One weatherproof box for meter	6.64
Two 11,000/110-volt potential transformers, indoor type	172.00
Two 75/5-amp., 11,000-volt current transformers, indoor type	92.50
Six R.E.C. disconnecting switches	62.91
Instrument wire, conduit, condulets, etc.	15.00
Cross-arms, insulators and hardware	35.00
One 50-ft. pole	33.45
One ground	5.40
300 ft. No. 6 cotton-covered wire, 10,000-volt	63.60
Labor and overhead	100.00
Cartage	10.00
Total	$797.50

15,000-Volt Installation

One galvanized-iron box for transformers	$201.00
One weatherproof box for meter	6.64
Two 16,500/110-volt potential transformers, indoor type	259.70
Two 50/5-amp., 15,000-volt current transformers, indoor type	92.50
Six R.E.C. disconnecting switches	62.91
Instrument wire, conduit, condulets, etc.	15.00
Cross-arms, insulators and hardware	35.00
One 50-ft. pole	33.45
One ground	5.40
300 ft. No. 6 cotton-covered wire, 15,000-volt	72.84
Labor and overhead	100.00
Cartage	10.00
Total	$894.44

OUTDOOR-TYPE INSTRUMENT TRANSFORMERS

10,000-Volt Installation

One weatherproof box for meter	$6.64
Two 11,000/110-volt potential transformers, outdoor type	238.50
Two 75/5-amp., 15,000-volt current transformers, outdoor type	136.04
Six R.E.C. disconnecting switches	62.91
Instrument wire, conduit, condulets, etc.	15.00
Cross-arms, insulators and hardware	10.00
One ground	5.40
150 ft. No. 6 cotton-covered wire, 10,000-volt	27.80
Labor and overhead	50.00
Cartage	5.00
Total	$557.29

15,000-Volt Installation

One weatherproof box for meter	$6.64
Two 16,500/110-volt, 200-watt potential transformers, outdoor type	362.32
Two 50/5-amp., 15,000-volt current transformers, outdoor type	136.04
Six R.E.C. disconnecting switches	62.91
Instrument wire, conduit, condulet, etc.	15.00
Cross-arms, insulators and hardware	10.00
One ground	5.40
150 ft. No. 6 cotton-covered wire, 15,000-volt	36.42
Labor and overhead	50.00
Cartage	5.00
Total	$689.73

of the higher voltages, as it is quite feasible to place 2,200-volt equipment in a wooden box. The use of such a box for 11,000-volt or 15,000-volt current and potential transformers is inadvisable, the danger of fire being greatly increased.

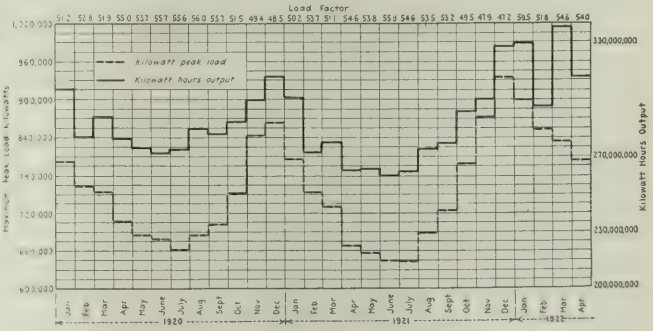
A box containing all equipment for a 2,200-volt installation, including meter, current and potential transformers and a testing panel for "over-all" tests, is illustrated in Fig. 3 E and F. This box is wired up in the meter department complete with meter and shipped to the place of installation. The cost of the complete installation, with the exception of the meter, including labor of placing on pole and connecting up, is shown in Table I.

The 10,000-volt and 15,000-volt equipment must necessarily be high enough to minimize the possibility of outsiders coming into accidental contact with it. Where indoor-type transformers are used, the galvanized-iron box illustrated in Figs. 1 and 3 A has proved very satisfactory. The meter is not in the iron box, but in a wooden box about 6 ft. from the ground, the secondaries being run down the pole in conduit. The iron box is made to order by local cornice works and delivered to the company's shops, where it is fitted with its angle-iron supports, insulators for connecting wires and frame for holding current transformers in the upper part of box. The potential transformers rest on the bottom. In testing primary metering apparatus for these voltages the scheme shown in Fig. 2 meets all requirements very well. Table II compares the total cost of constructing such an installation for 10,000 and for 15,000 volts.

Outdoor transformers are, of course, preferable when available, as the box may be dispensed with as well as the extra pole necessary for its support. Fig. 3 B illustrates such an installation. On account of the small amount of room available for high-voltage equipment at this particular plant, the outdoor metering proved particularly advantageous. The approximate cost of this type of metering installation is given in Table II. The tables give the approximate cost of the meter installation exclusive of the meter itself. Only such equipment is included as is fairly chargeable to the installation or testing of the meter. A capacity of 150 kw. is assumed for the 2,200-volt installation and 1,000 kw. for the higher voltages.

Load Grows in Middle West

THE accompanying curves show the combined output of a number of central stations in the Middle West, giving the peak load and also the kilowatt-hour output for a period from Jan. 1, 1920, through April, 1922. These curves are plotted from compilations made by the Chicago office of the Westinghouse Electric & Manufacturing Company. This curve shows a considerable increase both in peak load and output over the same period a year ago. It is interesting to note that the central stations are rapidly regaining the load lost some time ago, if in fact they have not already recovered it all. A very large increase is also shown in the output for the year 1922 over both 1920 and 1921. The average load factor of these companies is also given, the highest load factor being that of January of this year, when it was reported as 59.5 per cent.



COMBINED OUTPUT AND LOAD OF FOURTEEN CENTRAL STATIONS IN THE MIDDLE WEST

The Storeroom Solution on a Scattered System

Oklahoma Gas & Electric Company Organizes a Supply Handling System for Its Oklahoma Properties—Accuracy and Service Aimed at—Special Attention Given Storage and Arrangement of Materials

By **PAUL HOHEISEL**

Accountant Stores Department, Oklahoma Gas & Electric Company

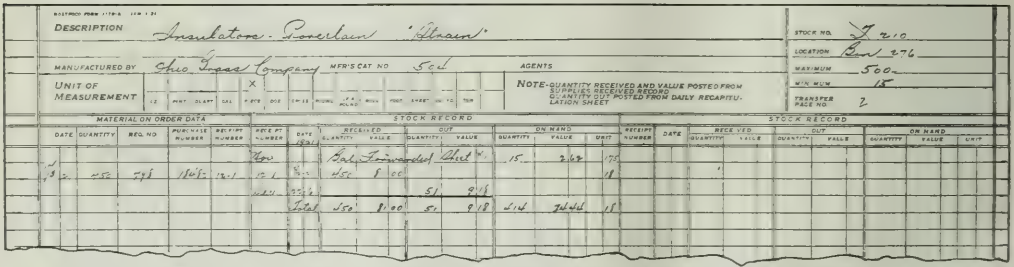
THE stores organization of the Oklahoma Gas & Electric Company, which operates properties well distributed over the entire state of Oklahoma, has been within the past year reconstructed, with results that have been exceptionally satisfactory. The seven storerooms of the system are now operating economically and in perfect harmony with all departments. Much effort has been concentrated on perfection of these four important features: The reducing of all stocks to the minimum practical supply, the standardization of materials, the installation of an accounting system and the establishment of a central storeroom at Oklahoma City.

In the minimizing of stocks, the need was to secure both reduction and the retention of the reduction. To obtain the reduction, the several foremen were instructed to use all of the inactive materials that would be practical in maintenance work. The storekeepers were instructed to ascertain whether or not there were articles in the stores bins that would substitute for items which they were about to restock, and if so to postpone the restocking until the substitute was used. Inventories were taken of all inactive and overstocked materials and lists of these sent to the other storerooms. In this manner much of the surplus of one store was transferred to relieve the deficit of another.

Such material as could not be transferred was sent from the closer stores to the central storeroom. The more remote storerooms furnished the general purchasing agent with lists of their surplus and placed it at his disposal. The turnover of each item of stock was carefully studied and a maximum and minimum quantity list made. At the central storeroom this was made on the basis of a three months' supply and at the branch storerooms on the basis of two months. The storekeepers were instructed to place requisitions as nearly within the scope of the listed quantities as possible, deviating only for special conditions which demanded an excess.

Retention of reduction, of course, is aided greatly by standardization of materials. The same types of crossarms, insulators and pole line hardware are used throughout the system. This applies also to pipe and fittings used in gas line repairs and extensions. Standardization was effected through the co-operation of the general superintendents of departments and is maintained by them, to the extent that each must personally approve all requisitions for supplies affecting his department before purchase is made. Thus they are in a position to know the style and quantity of the materials desired by their storeroom.

Standardization has very greatly reduced the variety of stores, made more bin space available in the storeroom and eliminated much uncertainty in accounting. The main feature is that the storeroom is able to keep a substantial stock of one type of material that will fill the same requirements of half a dozen miscellaneous items, possibly ordered for trial.



DESCRIPTION Insulators - Porcelain 'Strain'
MANUFACTURED BY Ohio Brass Company MFR'S CAT NO 50[illegible]
AGENTS
UNIT OF MEASUREMENT × PIECE
NOTE—QUANTITY RECEIVED AND VALUE POSTED FROM SUPPLIES RECEIVED RECORD QUANTITY OUT POSTED FROM DAILY RECAPITULATION SHEET
STOCK NO. I 210
LOCATION Bin 276
MAXIMUM 500
MINIMUM 15
TRANSFER PAGE NO. 2

MATERIAL ON ORDER DATA					STOCK RECORD								
DATE	QUANTITY	REQ. NO.	PURCHASE NUMBER	RECEIPT NUMBER	RECEIPT NUMBER	DATE 1921	RECEIVED QUANTITY	RECEIVED VALUE	OUT QUANTITY	OUT VALUE	ON HAND QUANTITY	ON HAND VALUE	UNIT
					Nov		Bal. Forwarded Sheet 1				15	2.62	.175
[illegible]	450	748	1848	12-1	12-1	[illegible]	450	8.00					.018
					[illegible]	[illegible]			51	9.18			
						Total	450	8.00	51	9.18	414	7.44	.018

RECEIPT NUMBER	DATE	RECEIVED QUANTITY	RECEIVED VALUE	OUT QUANTITY	OUT VALUE	ON HAND QUANTITY	ON HAND VALUE	UNIT

FIG. 1—A VERY COMPLETE RECORD OF THE STOCK CARRIED IN STORES ACCOUNTS IS KEPT ON THE SYSTEM OF THE OKLAHOMA GAS & ELECTRIC COMPANY

This form is used. The entries show the method of handling the accounts and the way in which the classification of material is carried out. The exact location in the storeroom is shown and the maximum and minimum stock quantities are carried for the guidance of the storekeeper in requisitioning additional supplies and keeping stocks at their proper levels.

THE ACCOUNTING SYSTEM

The accounting system is complete and thorough. The transactions for each item are carefully followed from the time of receipt until disbursement. If the theory of the system is strictly carried out, no clerical error could avoid detection.

The materials are divided into three general accounts, namely: Material and supplies, transient stores and unclassified construction supplies.

The material and supplies account embraces all of the standard materials used in operation and construction, with the exception of meters and transformers. For the purpose of analysis, this account is divided into twelve classifications, each symbolized by an alphabetical letter, and titled according to the materials they embrace:

Classification
- A—Fuel oil.
- B—Lubricating oil.
- C—Lime and soda ash.
- D—Poles.
- E—Wire.
- F—Pole line hardware.
- G—Other electrical supplies.

Classification
- H—Plant parts and supplies.
- I—Automobile repairs and accessories.
- J—Pipe
- K—Fittings
- L—Other gas supplies.

The classifications are set up separately in the stock ledgers in such a manner that a distinct report can be made of each. By comparison of these accounts, it is determined which classifications are not in proportion to the operations of their governing departments.

The unclassified construction supplies account contains all electric meters and transformers, gas meters and regulators. The transactions of this account are handled in the same manner as those of the material and supplies account.

The central storeroom provides from an outside source sustenance for the entire organization. It is so organized as to be at any time prepared to increase or decrease stock according to the activities of the other departments. While under the control of the auditing and operating departments, it is in constant touch with the purchasing department to insure proper consideration of price and supply in replenishing.

The management, realizing the need of safeguarding stores, has spent much money in making the central storeroom an efficient model for the branch stores. It is given distinct, constant and keen supervision by a department head or storekeeper. He is rated with other department heads and subject to the same administrative control.

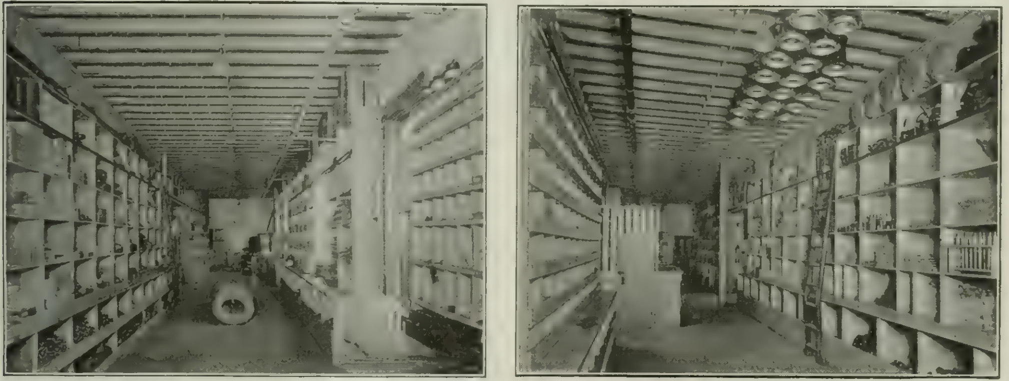


FIG. 2—AN ESSENTIAL OF AN EFFICIENT STOREROOM IS ORDER IN THE STORAGE OF STOCK

These illustrations show how the problem is handled in the main storeroom of the Oklahoma Gas & Electric Company. Material is not allowed to accumulate in the aisles even when new shipments are received. A space is provided for the handling of shipments away from the stock storage. Each bin is marked, similar items are grouped together and the articles in each bin are neatly arranged for quick handling and checking of stock. Service is one of the aims of the organization, so that unnecessary loitering on the part of employees securing material from stock is eliminated and much time saved.

All transactions of the material and supplies account are handled in stock ledgers. Every article of material is set up as a distinct account and the account numbered (Fig. 1). This account number, with the alphabetical prefix of the classification in which it appears, forms the symbol by which the article is identified in future receipts and disbursements.

The stock ledgers contain the controlling figures of each account, which, when totaled, agree with the general office ledger balance. Each account presents a detailed description of the material it represents, designating the trade name, manufacturer, catalog number, unit of measure, maximum and minimum quantity and location of material in the storeroom. Spaces are provided for material order data, material received, material checked out and balance on hand.

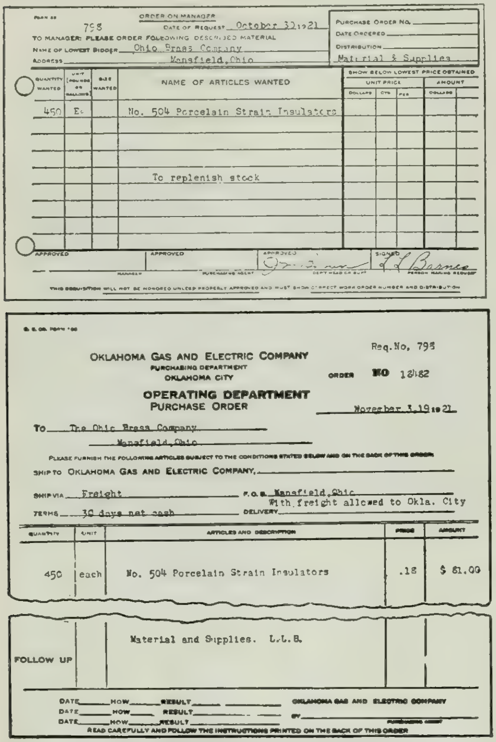
A transient stores account was established to account for incidental items purchased for immediate use. To open new accounts on the stock ledgers for the many and various articles not standard to operations would cause much extra effort without satisfactory results. Transient stores materials are recorded in a receiving ledger. From this ledger the accounts are charged against the proper operations and the ledger cleared.

It is operated on the principle of co-operation with the other departments. Every effort is extended to furnish each with a complete stock necessary for operation.

The stores clerks are taught the meaning of service. Requisitions for supplies are cared for promptly and correctly. Materials are thought of as money by the entire department and every article of stock is cared for with almost the same degree of precision. Orderliness is an essential upon which great stress is laid. Material awaiting disposal in bins or on shelves is not left to accumulate in aisles or at the receiving point (Fig. 2). Everything has its place and is in its place. A complete card index is kept showing the name, description, bin number and symbol number of every article of stock. Thus a new clerk can be directed to any desired article of which he has had no previous knowledge. Adequate receiving space is prepared in a portion of the storeroom, apart from the delivery section, where special and undivided care can be given all incoming materials. The storeroom is provided with proper equipment such as bins, shelves, racks, lifting and conveying apparatus and scales.

The stock arrangement is such that articles having similar characteristics are stored in adjacent bins. Every bin is numbered and is equipped with a metal holder containing a card showing a complete description of the material therein. All materials of a nature to permit uniform arrangement are placed in their respective bins so that almost at a glance one can determine the stock on hand.

Orderliness in arrangement enables the storeroom to handle quickly and in a businesslike manner all requisitions presented by messengers of the several departments. Every effort is made to avoid delays which encourage loitering at the delivery window. In disbursing materials nothing is allowed to be taken from the storeroom without a written order or requisition signed by a department head or his authorized agent. Each article in stock is designated by a standard symbol. This symbol is shown on the proper bin tag and on the stock records. Without this symbol there would be much uncertainty as to the identity of an item shown on a requisition due to the several different terms used by the different requisitioning authorities.



ORDER ON MANAGER

798 DATE OF REQUEST October 31 1921

TO MANAGER: PLEASE ORDER FOLLOWING DESCRIBED MATERIAL

NAME OF LOWEST BIDDER Ohio Brass Company

ADDRESS Mansfield, Ohio

PURCHASE ORDER NO.

DATE ORDERED

DISTRIBUTION

Material & Supplies

QUANTITY WANTED	UNIT (POUNDS OR GALLONS)	SIZE WANTED	NAME OF ARTICLES WANTED	SHOW BELOW LOWEST PRICE OBTAINED UNIT PRICE DOLLARS	CTS	PER	AMOUNT DOLLARS	
450	Ea		No. 504 Porcelain Strain Insulators					
			To replenish stock					

APPROVED MANAGER

APPROVED PURCHASING AGENT

APPROVED DEPT HEAD OR SUPT

SIGNED L L Barnes PERSON MAKING REQUEST

THIS REQUISITION WILL NOT BE HONORED UNLESS PROPERLY APPROVED AND MUST SHOW CORRECT WORK ORDER NUMBER AND DISTRIBUTION

Req. No. 798

OKLAHOMA GAS AND ELECTRIC COMPANY
PURCHASING DEPARTMENT
OKLAHOMA CITY

ORDER NO 12482

OPERATING DEPARTMENT
PURCHASE ORDER

November 3, 1921

To The Ohio Brass Company
Mansfield, Ohio

PLEASE FURNISH THE FOLLOWING ARTICLES SUBJECT TO THE CONDITIONS STATED BELOW AND ON THE BACK OF THIS ORDER

SHIP TO OKLAHOMA GAS AND ELECTRIC COMPANY,

SHIP VIA Freight F.O.B. Mansfield, Ohio
With freight allowed to Okla. City

TERMS 30 days net cash DELIVERY

QUANTITY	UNIT	ARTICLES AND DESCRIPTION	PRICE	AMOUNT
450	each	No. 504 Porcelain Strain Insulators	.18	$ 81.00
FOLLOW UP		Material and Supplies. L.L.B.		

DATE HOW RESULT
DATE HOW RESULT
DATE HOW RESULT

OKLAHOMA GAS AND ELECTRIC COMPANY
BY
PURCHASING AGENT

READ CAREFULLY AND FOLLOW THE INSTRUCTIONS PRINTED ON THE BACK OF THIS ORDER

FIG. 3—FORM OF REQUEST FOR ORDER AND THE PURCHASE ORDER USED BY THE OKLAHOMA GAS & ELECTRIC COMPANY

STOCK UPKEEP

It is the endeavor of the storeroom to keep an adequate supply for the current operations. When the supply becomes inadequate the dependent operators are weakened. As the stocks become overabundant the department is functioning inefficiently. Thus great care is given to intelligent replenishment. The standardization of materials has been of great assistance in stock maintenance, in that the variety of articles has been reduced. Established limits for maximum and minimum quantities for every standard item are the basis of the entire stores structure. These limits were established after a thorough analysis of each item by counsel with the purchasing and operating departments.

The term "minimum" is used to denote the lowest quantity that a stock item should be allowed to reach. Thus it is necessary to restock before the quantities reach that point, but not restock to over-reach the maximum limit, or the normal condition of the stores. The quantities between the limits at the present time represent about a three months' supply, with the exception of wire, poles and such materials as are purchased in carload lots.

The stock clerks are trained to be ever on the alert for materials reaching the ordering point. A report is made of these in a form of a want book, wherein is recorded the date, description of the material and the quantity on hand. The head stockman frequently consults this report and makes requisitions on the purchasing department for the needed items.

Before the requisition leaves the storeroom, the quantity shown as being on hand is compared with the stock record figure. If there is any difference, it leads to an investigation, which in turn leads to the righting of some wrong. It provides a special form of perpetual inventory, of which there cannot be too much use in any storeroom. Very often it is found that a new clerk is not aware of the storage in the warehouse of some item which is running low in the storeroom bins. By check to the stock records a large difference will be shown which will lead to the discovery of this reserve and eliminate the necessity of restocking.

REQUISITIONING

The requisition on the storeroom is made in duplicate. After stock record comparison, both copies are delivered to the storekeeper, who signs them, retains the duplicate and sends the original to the superintendent of the department which will use the material upon receipt. The storekeeper's duplicate copy is filed and is a reference for materials on order with the purchasing department. The original copies are sent to the department heads so that they may note the quantities and styles of materials being requisitioned. Upon being approved at this point, the requisition is returned to the storeroom and thence to the purchasing department.

At the time the purchase papers are made, two copies of the order (Fig. 3) are sent to the storeroom. One is for the receiving department and the other for file as reference to materials on order. As the purchase order copies are received, the storeroom requisition file is cleared and attached to the purchase copies. Data on these are entered under the proper accounts in the stock ledgers to show the date of order, quantity requisition and purchase numbers.

On the receiving copy of the purchase order, after each item, the ledger account number or stock symbol is entered, which symbol is to be used by the receiving clerk in the labeling of all materials at the time of receipt. Thus proper identification is made from the beginning. In the event of material which is ordered for immediate use and is not to be carried on the stock ledgers, the purchase order entry is made in a looseleaf ring book, according to the alphabetical arrangement of the material name. The receiving copy in this case is stamped "Transient Stores" and is to be handled accordingly by the receiving clerk.

What I Found Out on a Residence Survey

Some Personal Experiences in Investigating Residence Service Conditions with a Few Suggestions that Come Out of It—Getting the "Feel" of the Public

By CLARA H. ZILLESSEN
Advertising Department, Philadelphia Electric Company

IT IS an interesting thing sometimes to put your finger out and for a minute personally get the "feel" of the public that we talk so much about. The residence survey offers such an opportunity, although it does not always provide it in full measure. The survey man is apt to be intent on getting the job done and eager to fill his card and be gone quickly. But it takes a bit of time, with patience, comprehensive purpose and an understanding mind, to really make the friendly contact that is necessary if the full part that electricity is playing in the habits of each home is to be found out. Miss Zillessen has an unusual background and an eager interest, and her experience on the Philadelphia survey gives reflections of conditions as they are that are worth pondering.

DOFFING the shell-rimmed spectacles which are the outward manifestations of the fact that I am an advertising writer, and donning the identification badge and portfolio of the regular members of our survey squad, I recently sallied forth on a doorbell-pulling adventure in search of sales and advertising data on that mysterious and elusive element which we know as "the public." Our company is making a partial survey in certain districts of Philadelphia of commercial and residential properties—mostly the latter. It has primarily the purpose of definitely locating potential business, but also of obtaining accurate and first-hand information regarding our customers' knowledge of certain company policies and their feeling toward the company in general.

So with my fingers crossed and a new pair of rubber heels on my most comfortable shoes I started out. The first move was to disarm possible suspicion with as heartfelt a smile as could be mustered; then to identify myself and declare my errand—to wit, to ascertain if service, lights and so on were satisfactory; next, to gather data regarding sizes of lamps used, appliances and number of hours' use per week and similar miscellaneous information, all of which was duly recorded. I took my time and tried to ingratiate myself into the confidence of the housewife or house owner, so that they would talk to me fully and freely and without the self-consciousness people are apt to feel when being assailed with rapid-fire questions by the professional investigator.

The districts I "worked" might conveniently be classified into three types of properties. The first comprises houses which were built about twenty-five years ago and most of which have been wired within the last five years—the majority of them within the last year or two. Those living in them are probably people with incomes of $3,000 to $5,000 a year—conservative, quiet-living individuals, with parlors instead of living rooms, closely drawn shades and a sort of mausoleum air about the lower floor. You know the type!

Another class was of the small houses occupied apparently by people of very moderate means—clerks, machinists, printers and small storekeepers. These people live on a very close margin, but nearly all of them have one or more appliances. They have bought their homes already wired and obviously take their electric service as much for granted as they do their bathrooms.

The third type I interviewed were apparently a little higher up in the social scale, for these houses boasted of an occasional maid. These homes, too, were wired when built, and nearly all the occupants have cleaners and flatirons, at least. The mere fact that the occupants have more money, however, does not put them in the higher ranks of intelligence, as my story will show later on.

This survey work is rich in human contacts. You meet all kinds—busy mothers, society ladies, dear old grandmothers, indifferent maids, curious old granddads, noisy children, talkative folk, abrupt and sharp-spoken ones, kind people and some not so kind—all the types that go to make up this world of ours. Meeting customers face to face in their own homes certainly does provide a lot of curious high lights on the broad scope of electric service and how it has woven itself into the fabric of home life. But sometimes I used to get almost heartsick to see how many women there are who, with the means right at hand to live comfortably and happily, take years out of their lives, and waste precious energy, because they run their homes with no better tools than those to which their grandmothers were restricted.

FLATIRON REACTIONS

My first few days on the survey were a constant surprise to me. I used to ring the doorbell of a house and think: "Well, I wonder what new thing is going to hit me now." I got a few serious shocks those first weeks. I was thoroughly "sold" on the idea of electric service in the home. We have all sorts of electric labor savers in my own home which are used to the limit. The idea of persons having these things and not using them therefore didn't fit into the picture at all.

I have never understood where all the electric flatirons that are sold go to. Thousands are sold every year and everybody seems to have one. Lots of people have two or three, and they usually treasure them as if they were worth their weight in gold. But every once in a while (and more often than you'd think) I came across some woman who hasn't bridged the gap between this generation and the last, who has an electric iron and deliberately either uses the old-fashioned iron herself or lets her maid do so. I tried hard to get at the mental attitude that would intentionally do an already hard job the hardest possible way, but it couldn't be done. People like that have shifters' minds—you drive home an argument one way and they dodge away. They shift to some other point, equally weak, from which they will slide as soon as your ammunition is trained there. I came to the conclusion that such women were practically walking in their sleep and that nothing short of explosive advertising would wake them.

VACUUM CLEANERS AND WASHERS ARE USED IN THESE HOMES

I sold electric sweepers once from house to house when they first came on the market—when they were ugly big brutes to haul over a carpet, anything but the light, compact machines we have today. That early training instilled into my very marrow the absolute need for an electric cleaner in every home. I had cleaned too many so-called clean carpets for the first time with an electric cleaner, with the usual result of over a quart of dirt, to believe that a broom or carpet sweeper, no matter how vigorously wielded, can keep floor coverings really clean.

You can imagine my "reaction" when day-after-day questioning revealed that the majority of women are really not using their electric cleaners often enough. Certainly once a month will not keep carpets and rugs free from dirt, even though supplemented by unnecessarily hard broom cleaning. I used to tell these women that all the household experts say that the easiest way of taking care of a house is to "keep a clean house clean," that an electric cleaner should be used at least once a week, that hundreds of good housekeepers go over their rugs every second or third day, that estimates from all over the country indicate that the average family can make liberal use of an electric cleaner for a whole year for about $2.50 worth of electricity.

I remember one attractive frail little lady who lived in a good-sized house. We were talking about this question of cleaners, and I asked her how she used hers. "Well," she said, "once a month I go over the house thoroughly with the broom and then with my electric cleaner." Can you imagine it? There is nothing much harder for a woman than to sweep a whole house with a broom. But she had been habitually doing this, with a good cleaner, an expensive machine ready there in the home to do the work for her. There is only one explanation, and that is that the salesman had not sold her full confidence in the machine when she bought it.

THE ANTIPATHETIC-SERVANT POSE

The thing that used to make me nearly explode with impatience was when somebody would tell me she didn't need an electric iron or an electric washer because she "had somebody to do the washing." Or she didn't need an electric cleaner because she had a good maid who didn't mind using the broom and carpet swepeer, was really "sot" against any electrically driven appliance. I have come to the conclusion, however, that a lot of this so-called objection among servants against electric labor savers is purely mythical and merely a wall behind which the employer intrenches herself because she would rather spend the money for something else.

It's usually the older generation that has this weird idea of not saving servant labor. I remember interviewing a mother and two daughters on the subject. It was one of those hot days of early spring and we were seated in the cool, pleasant living room. The mother said that they had an electric iron for light pressing upstairs, but that her maid used the old-fashioned ones and that she was at that very moment ironing the family wash. The daughters were obviously ashamed of this condition, realizing, as they did, the incongruity of their sitting idly in a cool, attractive room with the maid bending over the hot stove using an old-fashioned iron. The old lady militantly countered that she wasn't one to spoil her help by "puttin' a lot of new ideas in their heads." She had employed help for thirty years and she knew!

WASHERS AND WIRING

And then the arguments about the electric clothes washer! All sorts of wild ideas—from fear of shock all the way down the line to the fact that they had *heard* a washer was hard on the clothes, and that it was cheaper to send them to the laundry. Over and over I told the same old story—the washer was easier on clothes than the hand method of rubbing; it was perfectly safe to use; it was demonstrably cheaper to use a washer than to send the things to the laundry.

You never could tell from the looks of a house, either, whether it might not have a complete electric laundry. A lot of cheaper houses had washers, because these people of limited means are used to buying on credit and many of them had bought their washers by the same method by which they had acquired their player-pianos and victrolas. These are the practical people, who are struggling to rear families and save money on limited incomes, and the housewives of this type will deny themselves to get a really efficient labor saver.

Looking over my records, I find relatively few houses called upon that were not wired for electric service. The very large majority of people owning their homes undoubtedly *want* electric service. There seems to be only one bugbear—the real or fancied expense and the general lack of knowledge as to just how much it will cost to wire the particular property in which they are interested. Judging from my survey of unwired houses, I should say that there are a lot of these "prospects" just sitting on the fence, waiting to be pushed off by means of a campaign on housewiring which will tell them definitely how much it will cost and how they can pay for it.

One condition I encountered that was rather surprising. The survey people are trying to educate our consumers to use the proper size lamps, and they carry literature along this line which will be helpful. In raising this point as I went on with the work, I was astounded to find that nearly every woman knew just exactly what size lamps were being used in different parts of the house, naming them by wattage. Not once did I hear the word "candlepower." Together with a great many other persons, I had always believed that the women of the house were a bit vague about lamps and their sizes, and it was refreshing to find the very great majority of them using and knowing all about the proper tungsten lamps to use.

LEFT—SMALL HOUSES CLOSELY GROUPED FURNISH A GOOD BUSINESS. RIGHT—COST IS LESS FOR WIRING A GROUP OF SIMILAR HOUSES WHEN BUILT

When a few days had passed after finishing this self-imposed task of surveying, my more or less chaotic impressions had simmered down to something like this:

THINGS TO REMEMBER IN ADVERTISING AND SELLING HOUSEWIRING

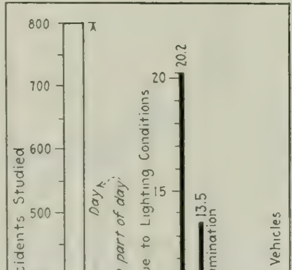
1. Find out definitely what kind of potential business there is along each line—where and what type of house and people you will have to deal with.
2. Get the cream of the business first. Talk a definite plan, prices and terms. This is important, for many house owners are "sold" on the idea of electric service, but have a vague and generally mistaken idea of price.
3. Get a set of wiring plans—nearly any of the model "electric home" plans will do—and give them broad distribution. Remember that nearly everybody—whether he or she has a home or not—is susceptible to the insidious attraction of playing with house plans.
4. Keep after neighbors and friends of people who have recently wired—they are splendid prospective customers.

THINGS TO REMEMBER WHEN ADVERTISING AND MERCHANDISING APPLIANCES

1. Keep everlastingly at it. Repeat the fundamental facts of what the appliances will do and what they will save—their prices and selling terms—and keep on repeating and repeating until you think the public must be sick of the story. And then keep on repeating, for just about then slight glimmers of understanding will be evident.
2. Make your sales and advertising talk in plain, simple and everyday English. Use no "hifalutin'" language or "subtle stuff" which shows your nimble and agile mind, but bread-and-butter facts which every one can understand.
3. Be sure the appliance is properly sold. High-pressure salesmanship often sells appliances without the purchaser's being really confident. This is often the purchaser's fault, but the manufacturer's and distributor's salesmen should reckon with this fact and see that every purchaser thoroughly understands all the uses and the necessity for frequent use (when this is so). Both central stations and contractor-dealers will find this advice pertinent.
4. Make a mental classification of your merchandise. With the type on which the public is already thoroughly educated it is a matter of selling *your make*. The other class of appliances calls for educational work. To sell the first, talk terms, price, the points of your particular make. To sell the second, talk free trial, labor and time-saving qualities, then terms, and lastly price.

Inadequate Highway Lighting an Accident Factor

GLARE from automobile headlights or other exposed light sources has for some time been looked upon as a conspicuous cause of night accidents on highways, but recent data obtained by Alfred W. Devine, head-lighting inspector at Boston for the Massachusetts Department of Public Works, indicate that a still more important factor in such occurrences may be the illumination of the roadways themselves. From the reports of departmental inspectors 800 motor-vehicle fatal and non-fatal accidents were analyzed, 400 during 1920 and 400 during 1921. Of these 522 occurred in daylight, 20 at dusk and 258 at night. Of the 258 night accidents 20.2 per cent were due to lighting conditions, nearly two-thirds being due to insufficient illumination. Slightly less than 5.8 per cent were due to glare, and 0.9 per cent to there being no lights on other vehicles. A new headlight law for motorists went into effect in August, 1921, in which special provision was made to reduce glare. During the four months from Dec. 1, 1920, there were 119 fatal motor-vehicle accidents in Massachusetts compared with ninety-four in the corresponding period a year later. This reduction of twenty-five, when it is further analyzed, shows that there were twenty-two fewer fatal accidents at night in the four months ended March 31, 1922, and indicates that the new lighting law is already proving beneficial, largely through eliminating glare from headlights.



MORE THAN 20 PER CENT OF AUTOMOBILE NIGHT ACCIDENTS ARE DUE TO LIGHTING CONDITIONS

Letters from Our Readers

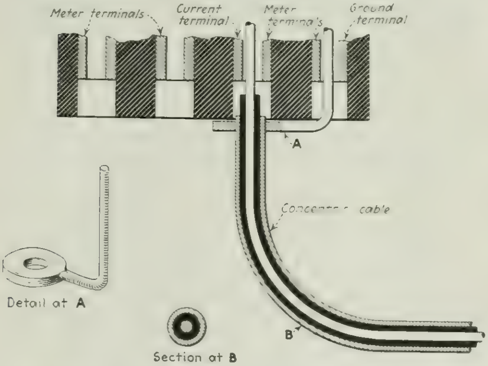
A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Preventing Theft of Electricity

To the Editors of the Electrical World:

Will you permit me to describe a method which has been developed for preventing the theft of electrical energy in a community where it is all too common? This method is applicable to single-phase instruments used on grounded systems (such as the widely used three-phase, four-wire system) and is the outcome of an experience lasting over several years in a city having 35,000 metered installations and where no less than fifteen different ways of "beating the meter" have been discovered. Although partial protection can be given by a complete rigid conduit installation, this is not only costly, both in material and labor, but is not so effective as the much cheaper method to be described.

Proper protection of the instruments can be attained by making three things impossible, namely: (1) Access to what will in future be called the "current" wire, to distinguish it from the "ground" wire; (2) access to the "current" terminal of the instrument; (3) reversal of the incoming leads. (This last is important, as when it is possible to reverse the leads the removal of one fuse and the making of an "artificial ground" in the interior installation will permit of the use of current without meter registration.)



CONCENTRIC CABLE USED IN METER SERVICE TO PREVENT THEFT OF ELECTRICITY

In describing the method an ordinary watt-hour meter is used as an example, though it will be readily seen that other instruments such as time clocks, current-limiting devices, etc., can be protected in the same general manner. The method consists of a combination of concentric cable, connecting the supply company's wires or cable with the meter, and a simple terminal piece at the terminal board of the meter. A cross-section through the meter terminals, the cable and the terminal piece is shown. The concentric cable consists of a double wrapping, or sheath, of tinned copper tape surrounding an inner rubber-insulated conductor. In practice the outer sheath is braided and compounded in order to protect the metal.

The recommended manner of making the connections is the following: For a line connection the outer sheath of the cable should be bound to the "ground" wire of the system and there soldered; the sheath should then be stripped down to this point and clipped off, leaving a sufficient length of the insulated current wire projecting to connect with the phase wire. Thus made, it will be seen that, mechanically, reversal of the leads is practically impossible without easy detection.

The connection to the meter is made as follows: The required amount of braiding is removed, and the terminal piece is slipped over the sheathing and soldered to it. The copper sheath is then stripped down to this point and clipped off as before. Sufficient of the insulation of the inner wire is then removed in order to allow it to enter the "current" terminal. The projection on the terminal piece is now bent up so as properly to enter the "ground" terminal, and the two conductors are firmly clamped in their respective holders by the screws provided for the purpose. The job is now completed, except that if the ground terminal of the meter is not grounded, the cable sheath will have to be grounded at some convenient point.

This new method, then, makes access to the interior or "current" wire impossible; second, no pin or wire can be pushed into the current terminal of the meter, as the plate covers it and cannot be moved, and, third, reversal of the leads is mechanically difficult, and when the sheath is grounded, electrically impossible without causing a dead ground.

The cost of the cable (for installations up to 2,000 watts) is approximately 6 cents per foot, and that of the terminal piece 50 cents. Both articles are sold by the W. T. Henleys Telegraph Works, Ltd., London. Although the cost of the material is low compared with that required for a conduit installation, the greatest economy is found in the labor item as the connection is of the simplest character. J. A. E. Reynolds,

Mexico, Mex. Electrical Engineer.

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Tribute to Clifford D. Babcock

To the Editors of the Electrical World:

I was grieved to read in a recent issue of your paper of the death of Clifford Dudley Babcock. He came to me almost at the beginning of my work in wireless and was for years a most efficient and helpful assistant. He was unquestionably the hardest worker I ever knew, regarding neither rest, food nor sleep when work was to be done. He was ingenious and resourceful to an unusual degree. His mind was truly encyclopedic, his memory marvelous. An omnivorous reader of scientific papers, he could, with uncanny precision, recall dates, data and circumstances of experiments done by himself or read years previously. His advice and encouragement during the early work which led up to the audion were invaluable. It was Babcock who gave this device its name.

His example in industry and cheerfulness was a ceaseless inspiration, not only to me but to many others associated with us in those early days of American wireless. "Bab," as he was affectionately known in older radio circles, always fought an uphill battle against heavy odds, yet was ever cheerful, never discouraged. His memory will long be cherished among large numbers of wireless pioneers, with whose names that of C. D. Babcock must always be inscribed.

Berlin. Lee de Forest.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Carrier-Current Communication Through Cable

EXPERIMENTS on the Commonwealth Edison Company's underground cable systems for carrying high-frequency currents indicate that, while satisfactory for short distances, this method of communication is still in the experimental stage for longer distances. Further experiments must be conducted, investigating the effect of increasing the amount of power input and increasing the wave length. Since very little work had been done previously on transmitting high-frequency currents through underground cable systems, this company conducted the following tests in order to determine how electrostatic and radiation losses affected carrier-current transmission. However, tests conducted on both direct-current and alternating-current underground systems indicate that another step has been taken toward using utility lines as further means of service.

BEST RESULTS OBTAINED WITH LONG WAVES

A transmitting set was first connected to the direct-current lines of the West Division Street substation through a 0.0003-mf. condenser to the positive side and to the ground bus of the station. This set, designed by E. H. Gager, an engineer of the company, consisted of a 10-watt phone transmitting set with four 5-watt tubes, two serving as oscillators and two as modulators, using a Heising modulation system with a Hartley oscillation circuit. The filaments were supplied with 7.5-volt, 60-cycle current and the plates with 500-volt direct current from a small motor generator. The receiving equipment was a Westinghouse regenerative-circuit detector and two-stage amplifier. With the receiving set several thousand feet from the transmitter, communication was satisfactory, conversation also could be received from an aërial and ground, though not so strongly. This indicates that considerable energy was being radiated, but the greater part of the energy undoubtedly went into the underground cable. The high-frequency output was 0.6 amp. at a wave length of 218 m. By moving the receiving set to a distance of 10,000 ft. and connecting it to a lamp socket in the Lydia Street substation, strong signals were received, with both good buzzer and good telephone modulation. Much better results, however, were obtained with a wave length of 625 m. Absorption losses appeared to be such as to limit communication to short distances when using wave lengths as low as 600 m. and with small amount of transmitting power.

Tests were next conducted on the 60-cycle, 12,000-volt cables by connecting the set to the secondary of the 12,000-volt transformer through a 0.0005-mf. condenser. With a radiation of 1.4 amp. at 600 m., voice and buzzer signals were heard satisfactorily at the Lake View substation. The set was connected through a lamp socket to the secondary of the distribution system over a distance of 35,000 ft. With the receiving set connected to an antenna parallel to the high-tension bus, signals were heard, but not so loud. The conducting medium for this test was first from the low-tension side of the 12,000-volt transformer, then to 35,000 ft. of three-conductor cable through a generating station to which are connected three other generating stations and all of the high-tension transmission cable system, then through a 12,000/4,000-volt transformer to the distributing circuit, and then down to 115-volt secondary circuits.

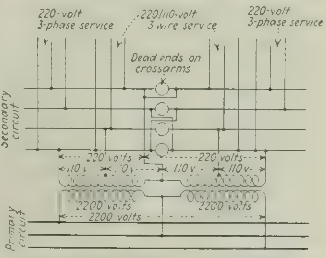
MORE INVESTIGATION ESSENTIAL

It must be remembered that these tests were conducted on a distribution system having a power capacity of 300,000 kw. and with cable whose characteristics on high frequency were unknown. While attempts to communicate over long distances are not yet successful, probably owing to short wave lengths and the small amount of power, it is believed that the increase of these factors, together with the results of research, will greatly increase the radius of satisfactory transmission. The results so far indicate sufficient possibilities to justify the continuation of investigation.

GEORGE M. ARMBRUST,
Electrical Engineer's Office.
Commonwealth Edison Company,
Chicago, Ill.

Four-Wire System Used for Both Light and Power

THREE-PHASE, 220-volt power or single-phase, 220/110-volt light and power can be satisfactorily supplied from one bank of transformers connected in open delta with a secondary distributing system using but four wires. The arrangement employed by the St. Petersburg (Fla.) Lighting Company for accomplishing this is shown in the accompanying diagram.



FOUR-WIRE SYSTEM FOR THREE-PHASE POWER OR 220/110-VOLT LIGHTING CIRCUIT

The wires are dead-ended on the transformer pole and the secondaries of the transformers connected as shown. Each transformer serves the single-phase, 220/110-volt lighting and power services in one direction only. This necessitates locating the transformer pole as near the center of this type of load as possible in order that the transformer may be properly balanced. The three-phase power load is supplied by the cross-connections shown.

While the efficiency as regards output to input is not as high as with the closed-delta system for three-phase, the transformers are in use nearly twenty-four hours of the day, with a good load practically all the time. The power load with some lighting occurs during the day followed by the lighting load during the night. This combined loading cannot be obtained in purely power systems of day loads only or light systems of night loads only. With only four wires in the secondary mains, instead of the usual three for three-phase and three for 220/110 volts for single-phase, considerable copper is saved in the initial outlay of new mains, as well as space on a crowded pole.

The system is used to considerable extent in small cities and has proved very satisfactory where the motor load remains practically constant. For elevator motor and other motor loads which are continually started and stopped, causing voltage fluctuations, the system is not practical because of the effect produced on the light, the voltage of which should be kept unvarying.

M. A. Wagner,
Assistant Superintendent Distribution,
St. Petersburg Lighting Company,
St. Petersburg, Fla.

◆

Water Rheostat that Absorbs 450 Kw.

To facilitate a rating test on a generating unit a convenient home-made water rheostat was constructed by setting up a wooden tank about 12 ft. long by 6 ft. high and 3 ft. wide inside dimensions or giving a volume of 216 cu.ft. In the bottom were placed three iron plates about 16 in. square and ½ in. thick, bonded together with heavy copper cable. Three movable elements for connection to the three-phase taps from the generator bus were made of similar plates bolted through one corner to a wooden cross-arm, the latter being supported by block and tackle. The tank was filled with fresh water and sufficient salt added to give the required load with the plates submerged. During a preliminary test of one hour at an average load of 450 kw. the water boiled away so rapidly that it was not possible to hold the load steady for the last ten minutes. It was therefore arranged to overcome this difficulty by mounting a second tank near and above the main tank, installing piping so that fresh water could be supplied to compensate for the evaporation. Owing to the location, it was necessary to fence in the main tank. The material was picked up around the plant and the cost of construction was therefore light.

I. W. Phillips,
Electrical Engineer.
Perry & Whipple, Mill Engineers,
Providence, R. I.

Advocate Relay Simplicity and Systematic Maintenance

Relative Merits of Differential Protection Discussed—Figures Given on the Economic Benefits of Protection in New Jersey System

The paper on "Trend in Relay Protection" by Messrs. Hester, Conwell, Crichton and Traver (extracted on page 66 of the last issue) was commended most highly by various speakers at the Niagara Falls convention of the A.I.E.E. and referred to as a piece of work which has been greatly needed and the accomplishment of which will be widely appreciated. In the discussion almost every speaker emphasized the importance of simplicity of relay circuits and of systematic and thorough inspection and maintenance. Their proper application demands the close co-operation of manufacturer and operator. The discussion centered about the relative merits of differential protection. Some very interesting figures were also presented on the actual economic benefits which have been derived from increasing relay protection on the system in New Jersey.

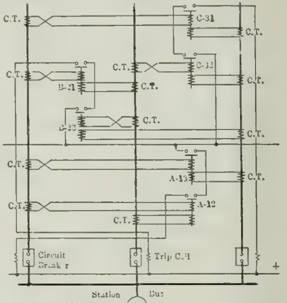


FIG. 1

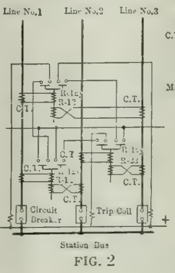
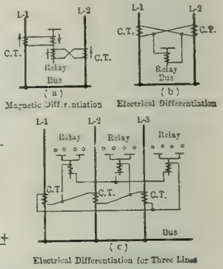


FIG. 2



(a) Magnetic Differentiation

(b) Electrical Differentiation

(c) Electrical Differentiation for Three Lines

FIG. 3

NO BLOCKING RELAYS ARE REQUIRED FOR THESE METHODS OF PROTECTION

Fig. 1—Differential current relay system as used on three parallel lines. Fig. 2—Differential current relay system for three lines using one relay per line. Fig. 3—Methods of obtaining differentiation.

A request for assistance from the membership at large was made by C. H. Sanderson in preparing the new relay handbook which is to be published this fall. He asked for suggestions as to subject matter to be included as well as the form of presentation.

According to some data which R. N. Conwell presented referring to thirteen substations on the New Jersey system, the total number of interruptions during a period of five years has been reduced from 270 to 21 by an earnest endeavor properly to apply and operate relays. During this period the total number of cases of trouble occurring has decreased from 288 to 130, indicating that the number of interruptions per case of trouble has been reduced from 0.94 to 0.16. In 1917 the revenue lost because of interruptions in these thirteen stations was $8,500, whereas in 1921 it was only $150. The capital expenditure for improving protection in these stations was $25,000. The fixed charges are $3,750, the cost of engineering, maintenance and testing $4,300, making the annual charges $8,050 per year. Inasmuch as $8,350 lost revenue was recovered through improved protection, this work netted the company $300 annual profit in 1921 aside from the beneficial influence on the public's attitude toward central-station service.

E. R. Stauffacher referred to the use of current-balance relays and a device for killing the field to localize the faults on a line where some mysterious flashovers occurred without apparent cause. He contended that the most effective and reliable relay applications can be made only through closer co-operation of manufacturers and operators.

While differential protection may have the disadvantage that it breaks the circuit before the current can drop off, R. Bailey said, it has the advantage of preventing the dropping out of synchronous apparatus. Current balance or differential protection is best where several feeders are in parallel and is most difficult to use with double buses.

Paul Ackerman presented an extensive discussion on the merits of differential protection, which he opened by saying that he was glad that operating companies had the courage to depart from the old practice and that differential protection is becoming more popular. Back in 1912 the same objections were raised to differential protection that are raised in the paper that was extracted in the last issue. The best proof that these objections are not very serious is afforded by the fact that those who raised the most objections originally are today the most ardent supporters of differential protection.

FAVORS DIFFERENTIAL RELAYS

Differential-current schemes are complicated, the speaker agreed, but the connections are made only once and, if properly installed, are permanent and safe. On the other hand, the relays are much more rugged than time-limit overload or directional relays. Although objections have been raised to having several relay contacts in series, not a single failure can be attributed to this cause, according to experience with several hundred relay installations in existence. Where blocking protection is embodied on double line protection, trouble may result if the current settings of the relays are very low. Attention was also called to the fact that open-circuited phases may trip the wrong line when differential-current schemes are used unless the relays are set higher than the total load fed by the two lines. However, this system has given practically 100 per cent effectiveness on single lines having copper wire, whereas only 80 per cent protection effectiveness has been obtained with aluminum lines.

Referring to the relay schemes shown in Figs. 1, 2 and 3 Mr. Atkinson pointed out that no blocking relays are required, and, despite the rather complicated wiring, the scheme can be made fairly simple if plan 3-C is used. He declared that it is particularly adaptable to underground distribution where substations are fed over three or more cables. The speaker declared that he had no sympathy for split-conductor and pilot-wire protection, except for lines less than one mile in length and for general and transformer protection. The ground selector performs on the underground system the same duty for which the neutral ground has been introduced.

Each system of protection and each individual problem must be considered separately, Mr. Ackerman concluded. To copy other companies' practices without careful analysis of their fitness to conditions under consideration may lead to disastrous results, he contended.

E. P. Peck pointed out that he has found it almost impossible to apply relays so they will function properly year in and year out on combined water-power and steam systems where the proportion of load carried by each station varies greatly. To keep the relays in proper operating condition they are tested every Saturday at midnight.

Refuting Mr. Ackerman's objection to split-conductor protection, W. H. Cole declared that this system has been operated to the extent of 600 mile-years in Boston with satisfaction. The only objection is extra cost, former objections having been eliminated.

Caution was urged by O. C. Traver in the use of high resistance neutral grounds because of their effect on relay operation.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Keeping Meter Statistics to Better Performance

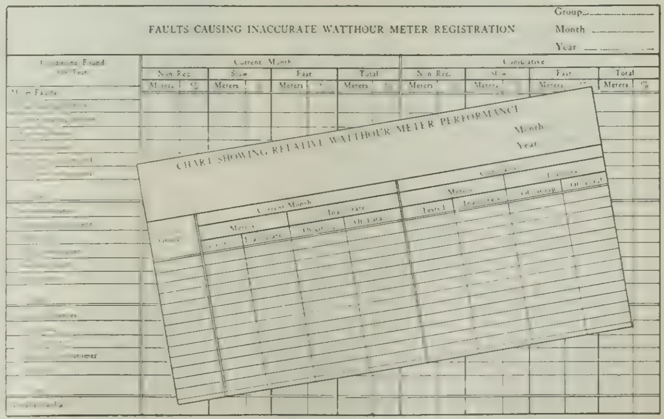
THAT an exceptionally large percentage of the watt-hour meters in this country are accurate is a fact known to the meter profession but frequently questioned by the public. Every utility manager and meter superintendent constantly strives to reduce the number of inaccurate meters, already small, to an insignificant figure.

There are many conditions that influence meter accuracy, and certain faults are quite common in some parts of the country that are unknown in others. Friction is the most common enemy of sustained accuracy, and all meters, regardless of their locality, are subject to error from this cause. Some faults are characteristic of only certain makes, types or sizes of meters, while other faults result from conditions at the point of installation.

Careful study is required in order to obtain a high degree of meter accuracy, and elaborate systems of records are kept by many companies for the purpose of analyzing faults.

A very useful system of records is one that shows the relative performance of the various types, sizes and makes of meters owned by the utility. Such a system will show at a glance the group that causes the downward tendency in the performance curve, facilitating the further analysis necessary to isolate and correct the fault. In conjunction with this system a record of all the faults causing errors in excess of the minimum set by the company should be kept. These records are particularly valuable for determining the frequency of test best suited for each group of meters and for formulating rules and regulations.

Meter faults can be tabulated under three major headings, poor maintenance, meter faults and external influences. For convenience in analyzing the data, records should be sectionalized according to whether



FAULTS CAUSING INACCURATE WATTHOUR METER REGISTRATION

Group________

Month ________

Year ________

Current Month | Cumulative

Non Rec. | Slow | Fast | Total

Meters | %

CHART SHOWING RELATIVE WATTHOUR METER PERFORMANCE

Month

Year

Current Month

Meters

Tested

CHARTS THAT FACILITATE THE ANALYSIS OF METER INACCURACIES the meters are fast, slow or stopped. The system outlined can be used to the best advantage after all the recurrent faults are known and have been listed. Forms can then be printed, and the only clerical work required will be the entering of totals in the respective columns and the conversion of the figures to a percentage basis.

A simple application of this system is shown in the two charts reproduced in the accompanying illustration. The smaller chart shows the performance of meters grouped in accordance with their make, type and rating, the letters A, B, C, D, etc., being used to designate the various groups. All the faults of the inaccurate meters in any one particular group are then segregated and filled in on the form shown in the other chart.

Referring to the first chart it can readily be seen which groups have a large percentage of inaccurate meters, both for the current month and for the year. Then by referring to the individual charts for each group the distribution of the inaccurate meters over the particular faults, such as top-bearing friction, register friction, poor maintenance, etc., can be seen.

Curves are often very useful for the study of meter performance and can be plotted readily from data compiled in the foregoing manner.

CHARLES W. EMERSON, JR.
General Foreman Meter and Test Department.
The United Electric Light & Power Co.,
New York, N. Y.

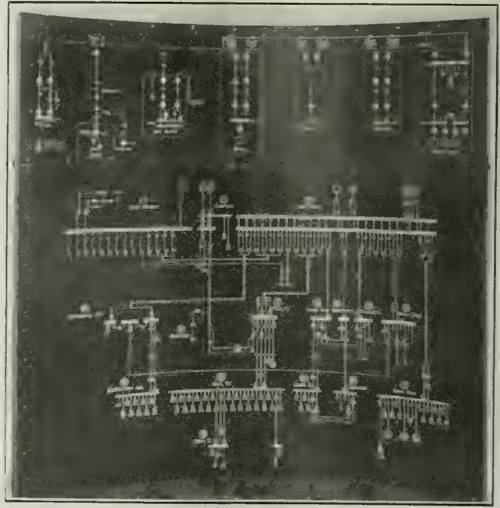
Ratios for Determining Amortization Claims

RATIOS for determining replacement costs based on prices of June 30, 1916, have been computed by the Internal Revenue Service to facilitate the making of amortization claims. Some of the more important ratios are these: Lumber, hard, 240 per cent; lumber, soft, 175 per cent; structural steel, 60 per cent; building materials, other than lumber and structural steel, 225 per cent; steel other than structural steel, and steel products, 90 per cent; building equipment, 150 per cent; labor, all classes, 160 per cent; electrical machinery and equipment, 130 per cent; engines, turbines, compressors and similar facilities, 175 per cent; boilers, 160 per cent; all other machinery, including cranes, the cost of which did not exceed 10 cents per pound as of June 30, 1916, 120 per cent; machinery the cost of which did exceed 10 cents per pound as of June 30, 1916, 130 per cent.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Dispatcher's Board Using Plug and Tag Signals

CONTROL of the systems of the Connecticut Power Company and of the Hartford (Conn.) Electric Light Company by a single load dispatcher at the new South Meadow station of the latter is facilitated by the indicating board illustrated herewith. The board, made of sheet-iron ⅛ in. thick, is 3 ft. 9 in. long, with an upper section 15 in. high and a lower section 3 ft. 5 in. high. It is curved to a 36-in. radius and is mounted on a box frame. The upper section shows the lines and switches of the power company, which is interconnected with the Hartford system, and the lower section is assigned to the Hartford company.



TWO POWER SYSTEMS ARE CONTROLLED FROM THIS DISPATCHING BOARD

The board serves as a manually operated memorandum for the load dispatcher. It is laid out upon the single-line painted diagram basis, the 66,000-volt lines being shown at the top on the Connecticut system, and the 11,000-volt and 2,400-volt lines of the local company at the bottom.

Switches are indicated by ¼-in. holes. When the switch is closed a rubber plug is inserted in the hole. There are a few disconnecting switches used for insurance on the city lines. These are indicated by ⅛-in. holes, and a celluloid plug is used to show when the switch is closed. The power company is operated partly by oil switches and partly by disconnecting switches. All holes in the upper section board are ¼ in., and the oil switches are indicated by a ⅛-in. white rim about the hole. In case a circuit is out of commission for inspection or repairs, or if the disconnecting switches are open, a brass tag is hung in the corresponding hole. The switch on which it is hung cannot be closed without reference to a log sheet and the removal of the corresponding tag from the operating board. In each case when a switch is out of commission a tag stating the reason is inserted, and those interested are noted on the log and on a tag attached to the operating switch. The switch cannot be closed until every one affected has reported clear and the fact has been noted on the tag and the load dispatcher's log.

T. H. SOREN,
Vice-President.
Hartford (Conn.) Electric Light Company.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Intensive Selling by Central Stations*

How Electric Light and Power Companies Can Build Up Their New Business Departments and Increase Their Merchandise Sales

BY H. B. HINDON

SELLING merchandise today calls for a great deal of study and requires constant training to meet the many changes that are taking place in the marketing of goods. Today is the day of specializing and intensive selling methods, and must be coupled with well-placed high-grade advertising copy, one being directly dependent upon the other and essential to successful results.

Central station companies are facing the keenest competition in the merchandising of appliances they have ever had, and their commercial departments will be tested to the limit if they want to hold the lead. During the war period, gas and electric companies curtailed or discontinued their commercial departments and, in general, disrupted their entire selling organizations. Today they are paying for it in the loss of trade after having spent thousands of dollars in educating the public to use their service.

All over the country hundreds of appliance specialty stores are springing up that are adopting intensive selling methods, using well-planned big copy newspaper advertising, house to house canvassing, splendid window displays, together with long and very attractive terms both for cash and credit. They are hiring high-grade specialty salesmen and are paying them more attractive salaries and commissions than the gas and electric companies. The utility companies in general are not paying either the managers or salesmen in their new-business departments the proper salaries to meet this competition and are losing a lot of good men in consequence.

To overcome this growing competition, central stations will have to adopt intensive selling. Intensive selling means direct concentration on different appliances as the different seasons come into line, to be followed with enough advertising and selling effort to get the benefit of special sales during the balance of the year, as there is always a large number of created prospects from these sales that are allowed to die for lack of follow-up.

In order to reach any degree of success in this intensive or campaign method of selling and advertising, it is necessary to make out a strong, well-planned program and carry it through to the last minute of the time devoted to the sale, as the final closing will show the result of this planned and executed effort.

EMPLOYEES' INTEREST

In planning these sales it is necessary to sell the idea to your own organization first—that means everybody from the janitor to the president of your company. It is necessary to arouse every one's interest in the success of this effort and to impress them with the benefits of these sales. Holding meetings with shopmen, meter readers, collectors, salesmen, and every one who directly benefits by these sales, tends to arouse interest, as everybody likes to be identified with a busy, prosperous and going organization.

In the sale of the larger appliances too many companies are dilatory in their system of staging a campaign and lean too heavily on the manufacturer for results, when they should be the leader in the movement and have everything ready to go when the factory salesman appears on the job. Advance work should be done on everything, including advertising, window trimming, personal calls by company salesmen, arrangement of prospect lists and as much preparatory work as is possible, so that all the time may be devoted to closing, rather than creating live prospects.

Floor displays should be arranged so that the appliance to be specialized will appear strongly in evidence over everything else during time of sale. The volume display of goods always impresses the public with quantity buying power and assurance of quick delivery. Displaying goods in volume arouses interest and inquiries.

A sufficient stock should be carried so that immediate deliveries of appliances sold can be made. Possession of goods keeps down the percentage of cancellations, as delivered goods are not often returned.

Specialty men in an organization are a great asset and lead to greater volume of sales, for when a salesman talks, thinks and studies one or a few appliances, he becomes more expert in his selling arguments.

Working demonstrations are of great assistance, particularly outside or sidewalk displays, for then you can talk to ten while talking to one, for you usually have an audience.

Setting a sales quota and pledging your salesmen to produce a given number of sales, offering prizes to meter readers, collectors and shopmen for prospects turned in and from which sales are closed, all helps to put across big volume business.

Many appliance salesmen fall into the habit of following the line of least resistance and, unless they are checked up occasionally, they become mere order takers. Setting a quota for each salesman every month for the sale of larger and more revenue producing appliances on your lines is good practice and, just at this time, all companies should put more effort into a closer following up of building operations.

From a profit standpoint, the turnover on special sales is big, and if followed up properly, results in many more sales during the balance of the year. Summing it up, intensive selling will produce volume business if properly planned and followed up, but you must be organized in the right way to reach success.

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*A paper presented at the meeting of the commercial section, Empire State Gas & Electric Association, at Lake George, N. Y.

Introducing Electrical Appliances Through the Country Stores

By Eugene Carpenter

Treasurer Cape & Vineyard Electric Company, Vineyard Haven, Mass.

ELEVEN towns in the Cape Cod district of Massachusetts are now being served by the Cape & Vineyard Electric Company, the territory being for the most part scattered and sparsely settled. With the exception of one town the company has built up its business from a standing start to a point where it now serves 6,000 customers, who paid a gross revenue in 1921 of $290,000. To develop this new business in such a territory at a cost which would not be prohibitive in the light of returns has required considerable careful planning on the part of the management.

In appliance distribution the company's policy has from the first emphasized the fullest co-operation with local dealers and contractors, who naturally receive the most protection and best prices from us. We decided as a first essential that the company should limit itself to the selling of electric service. This policy requires considerable attention to the marketing of appliances through local merchants.

We have endeavored to place a supply of electric lamps in every village store which formerly sold oil lamps, wicks, burners and kerosene. This gives these merchants a sort of substitute for the class of trade they were losing as a result of the development of house-wiring installations and the resultant purchasing of electrical conveniences. As for washing machines, we have tried to have every storekeeper (and there are many of these small merchants on Cape Cod) who had formerly handled washtubs, washboards, wringers, clothespins and clotheslines handle electric washers. We also have persuaded merchants who heretofore sold carpet sweepers, brooms, dust pans and brushes to put in a line of vacuum cleaners, and our own merchandising department acts simply as a wholesaler, doing business and soliciting but making no sales or deliveries direct to the user.

The results of this policy, while unsatisfactory at times in certain cases, have on the whole shown a tendency to improve with time, and today we can say that the plan is a success. We purchase electric pumping outfits in quantities and "peddle them out" to the plumbers in our territory. Load building through local merchants is aided by the advice of our staff, and we feel that these country stores and village business establishments are becoming more and more co-operative agencies in the development of electric service in our extended territory.

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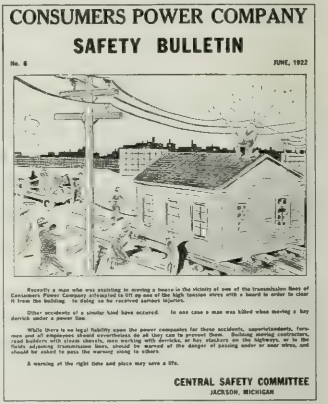
Educating the Public in Accident Prevention

ACCIDENTS caused by people operating derricks, moving houses, using steam shovels or other similar equipment which may come in contact with light and power wires and cause serious or fatal injuries are a source of serious concern to power companies. Ordinarily such accidents are caused by the ignorance or carelessness of people in attempting to move the wires out of their way without calling on the company to send out experienced men to handle the conductors.



CONSUMERS POWER COMPANY

SAFETY BULLETIN

No. 6

JUNE, 1922

Recently a man who was assisting in moving a house in the vicinity of one of the transmission lines of Consumers Power Company attempted to lift up one of the high tension wires with a board in order to clear it from the building. In doing so he received serious injuries.

Other accidents of a similar kind have occured. In one case a man was killed when moving a hay derrick under a power line.

While there is no legal liability upon the power companies for these accidents, superintendents, foremen and all employees should nevertheless do all they can to prevent them. Building moving contractors, road builders with steam shovels, men working with derricks, or hay stackers on the highways, or in the fields adjoining transmission lines, should be warned of the danger of passing under or near wires, and should be asked to pass the warning along to others.

A warning at the right time and place may save a life.

CENTRAL SAFETY COMMITTEE
JACKSON, MICHIGAN

CONSUMERS POWER COMPANY'S PUBLIC SAFETY POSTER

The Consumers Power Company is using the poster shown in the illustration in an educational campaign in the Michigan communities; it serves to prevent such accidents. In many cases such accidents have been found to be due to the fact that the man was actually ignorant that there was any danger in handling the wires. Educational campaigns pointing out the dangers involved in carelessness when working near such conductors seem to be worth while.

What Other Companies Are Doing

Brattleboro, Vt.—The Twin State Gas & Electric Company in one week sold nine electric ranges, three washing machines, ten irons and other small appliances. The company has just closed a thirty-day campaign for sale of electric irons, during which period 225 irons were sold.

Indianapolis, Ind. — Appliances sold by the Interstate Public Service Company in one week were eleven vacuum cleaners, twenty-five irons, nine washing machines, one ironer, two curling irons, one sewing machine motor, three fans, two lighting fixtures, two electric cookers and four motors. Total sales for the week amounted to $5,538.62.

Okmulgee, Okla.—With a series of three luncheons during the past three weeks the Oklahoma power division of the American Public Service Company has entertained the local Rotary, Kiwanis and Lions' clubs in this city. The management took this opportunity to show these civic clubs the improvements recently completed at its plant.

Illinois.—Ninety-five per cent of the employees of the Central Illinois Public Service Company own stock in that company. In twelve offices or departments of the company the employee ownership is 100 per cent. Employees of the company are also active in selling the company's securities to customers.

Boston, Mass.—House wiring and appliance business reported by electric utilities managed by Charles H. Tenney & Company reflect marked improvement in economic conditions within recent months. In April and May 275 tenements were wired on the lines of the Fitchburg (Mass.) Gas & Electric Light Company, a gain of nearly 50 per cent over any other two consecutive months. A single contractor at Haverhill, Mass., wired twenty-eight houses in two months in the co-operative campaign being run by the Haverhill Electric Company. This company added ninety-six meters during May alone. The Malden (Mass.) Electric Company sold twenty washing machines in six days recently, and total appliance sales in the group of ten Tenney companies in the week ended June 3 were $14,935. Nine of these electric companies increased their total output during that week from 2,345,959 kw.-hr. in 1921 to 2,818,819 kw.-hr., or a gain of 20.1 per cent.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Developments in Power-Station Design.—Two surface condensers recently installed in the Bankside station of the City of London Electric Light Company, each designed to deal with 170,000 lb. of steam per hour, are described. Single-effect evaporators are used to supply the boiler make-up water.—*Engineer,* May 12, 1922.

The Next Big Western Power Scheme.—Active construction work is now under way on the Great Falls development, situated on the Winnipeg River, by the Manitoba (Canada) Power Company. When completed this hydro-electric installation will have a capacity of 56,000 hp. in two units. The complete capital cost will be less than $80 per horsepower.—*Electrical News,* April 15, 1922.

Hydro-Electric Station at Mouthier.—J. Reyval.—A very detailed description of a new French hydro-electric plant with a present capacity of 12,000 hp. in three units of 4,000 hp. each, operating under a head of 122 m. Francis type turbines running at the unusually high speed of 750 r.p.m. are connected over a flywheel to 50-cycle, 3,500-kva., 5,500-volt three-phase generators. An indoor transforming station raises the machine voltage to 60,000 volts, which feeds a 300-km. transmission line to Besançon and Pontarlier. A number of 10,000-volt trunk lines radiate from the station to tie in with four neighboring plants.—*Revue Générale de l'Electricité,* May 13, 1922.

Generation, Control and Switching

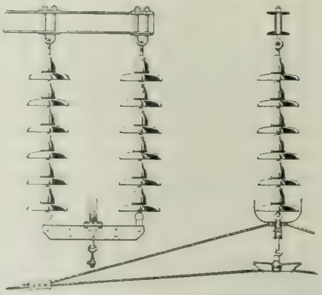
Overvoltage Protective Apparatus.—W. Hoffmann.—This paper deals with the different methods of modern overvoltage protection for power lines up to 40,000 volts. The author describes the proper use of single and multiple horn-gap arresters, describes the design of resistors and mentions grounding choke coils. The latter are built like transformers with primary and secondary windings and are used as three-phase, star-wound types for three-phase lines or as single-phase coils for the "Y" point of a system.—*Siemens Zeitschrift,* April, 1922.

High-Voltage Switchgear Design.—W. A. Coates.—The problem of building electrical equipment for the high voltages which are now becoming common is mainly one of insulation. Two main types of insulation are required, that which merely supports the conductor, and that which insulates the conductor where it passes through a grounded body. The author discusses at length the details of modern outdoor switchgear compared with indoor equipment and points out its economic and engineering advantages. — *The Electrician,* May 5 and 12, 1922.

Generators for Queenston-Chippawa Hydro-Electric Development. — A description of generators Nos. 4 and 5 of this plant is given. They are three-phase, sixteen-pole machines, each rated at 45,000 kva., 187½ r.p.m., 12,000 volts, at a power factor of 80 per cent. They are of the vertical-shaft, revolving-field type, with spring thrust bearing, upper and lower guide bearings and direct connected exciter.—*Electrical News,* May 1, 1922.

Transmission, Substations and Distribution

A 100,000-Volt Line Through the Streets of Berlin.—E. Rühle.—To add 20,000 kw. to the power supply of the northern parts of Berlin, without the installation of a new step-down transformer station, it was decided to extend a branch of the Golpa and Trattendorf 100,000-volt transmission line directly into the Moabit powerhouse, located near the very center of the city. Special safety precautions had to be taken for such an unprecedented right of way, because the streets traversed by the line are densely populated and carry many overhead telegraph and telephone wires. Steel towers of a simple but pleasing design have been erected every 160 m., which carry the double three-phase lines at a minimum height of 18 m. above the pavement. Twin-chains of 6 cap-and-pin insulators each were used throughout, with a double arcing horn between them. One of these units is shown in the accompanying illustration. Tests were made to investigate the danger to boys flying kites when the string touches the 100,000-volt line. It was found that a string, even when wet from rain water, does not carry sufficient current to be of any danger. If the wet string falls across two wires, it burns off instantly. — *Elektrotechnische Zeitschrift (Festschrift),* May 28, 1922.



Twin Chain Insulators Used on 100,000-Volt Line

The Application of Electric Power in the Iron and Steel Industry. — W. S. Hall.—The subject is treated under the following headings: Sources of waste fuel for power generation; problems of plant transmission; frequencies to be used; distribution systems; demand for electric power and a few general considerations.—*Journal of the Western Society of Engineers,* May, 1922.

Units, Measurements and Instruments

Mechanical Testing Machines for a Porcelain Factory.—W. Demuth.—The author gives an elaborate description of the machines for testing insulators in the new mechanical laboratory of the Hermsdorf (Germany) porcelain works. Of these the following are of special interest: A 500-ton compression press, a 30-ton tension press, a machine for testing pin-type insulators under a side pull, an optical apparatus to measure the expansion coefficient of porcelain, and a temperature-change arrangement whereby an insulator is dipped into cold and hot water in quick succession.—*Elektrotechnische Zeitschrift,* May 4, 1922.

Vibrograph for Turbo-Generators.—J. Geiger.—For detecting irregularities of operation in high speed machines, a specially built vibrograph is described, which gave good results in locating troubles in steam turbo-generators. The apparatus measures 200 mm. each way and is small enough to be used in inaccessible places, like middle bearings, etc. A large number of oscillation curves, obtained with this apparatus are reproduced, which illustrate its sensitiveness. The author suggests that a more general use of such vibrographs would enable the operator to detect and to locate running troubles of turbines, gas engines, etc., in a very simple and positive way.—*Zeitschrift des Vereines Deutscher Ingenieure,* May 6, 1922.

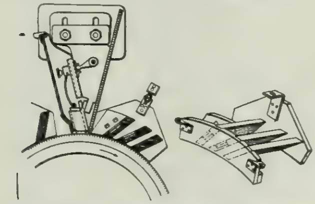
Illumination

Illumination Fundamentals for the User of Light.—J. R. Colville.—The importance of good lighting is not generally recognized and its industrial importance is only beginning to be understood. The author describes in some detail the fundamentals which must be considered in producing good lighting. These are (1) amount of light, (2) diffusion, (3) color quality, (4) shadow, (5) uniformity, and (6) maintenance. The article is concluded with an analysis of good and bad lighting. In analyzing bad lighting he gives the cause, the effect and the remedy—*General Electric Review,* June, 1922.

Ideal Requirements and Practical Solutions of Industrial Lighting.—L. Gaster.—There are four main conditions to be satisfied for ideal lighting, namely: (a) Sufficient illumination; (b) constancy and uniformity of illumination over the working area; (c) the placing and shading of lights so that no inconvenience is experienced from glare; (d) the placing of lights so as to avoid any inconvenient extraneous shadows on the work. There was a general recognition expressed in the discussion of this paper that these requirements could readily be complied with by using modern illuminants and illuminating apparatus and that their application would remove the worst cases of unsatisfactory lighting and raise the general standard of illumination in factories considerably.—*The Illuminating Engineer*, Vol. 15, No. 3.

Motors and Control

Voltage Limitations and Flashing of Synchronous Converters.—J. L. Burnham.—The author discusses the technical details of the causes and shows the remedy for serious flashovers on synchronous converters. He describes and illustrates the flashover barriers which have been put into service and which have proved most successful.—*General Electric Review*, June, 1922.



Flash Barrier with Brush Rigging for Preventing Flashovers

Cutting Operating Costs in Silk Mills by Correct Motor Applications. — All the motors used in the silk industry are in general of comparatively small size. The squirrel-cage induction motor appears to be a favorite since its inherent characteristics fit in with the work to be done, and also enable it to perform its functions with a minimum of attention and usually with practically no maintenance expense. About thirty applications of motors in particular cases are shown in the illustrations.—*Electrical Record*, May, 1922.

Heat Applications and Material Handling

Electric Heating of Residences. — E. A. Loew.—A bulletin reviewing the experiments and reports on electric house-heating installations, the most extensive, other than those in Tacoma, Wash., being found in the community established on the Minidoka Project of the United States Reclamation Service in Idaho. The author gives an extensive description of domestic heating in Tacoma, where for a number of years a power rate has been in effect for encouraging consumers to use electrical energy for this purpose. In view of the excellent showing, it seems apparent that Tacoma's experiment in electric house heating has been quite successful. — *Bulletin No. 15 of the University of Washington.*

Electric Furnace Iron and Steel Intermittent and Alternating Operations. —W. E. Cahill.—It is shown that in Treadwell, Alaska, cast iron is made more cheaply in the electric furnace than in the cupola. Analyses figures show that from charges of all-scrap cupola-melted iron the electric furnace produces metal of greatly reduced sulphur content. Factors affecting the economy of melting and the advantages of the electric furnace in foundry practice are discussed. The effects of intermittent operation on the furnace and the precautions necessary in alternating heats of iron and steel are discussed.—*Paper presented before the American Electrochemical Society, Baltimore, Md.*, April 27, 1922.

Electrophysics, Electrochemistry and Batteries

Prevention of Electrolysis Troubles in Underground Water Pipe.—E. B. Stewart.—After discussing the effects of electric currents on cast iron pipes and giving descriptions of pipe drainage systems, the author enumerates several methods for preventing electrolysis. Among those commonly used are: (1) Surface insulation of pipes; (2) insulating joints and (3) pipe drainage systems.—*The Canadian Engineer*, May 16, 1922.

Traction

Electric Freight Locomotives for Chile. — A description is given of the freight and switching locomotives that are to be used on the electrified section of the Chilean Railways. The operating potential is 3,000 volts. The freight locomotive is rated at 1,680 hp. and the switching locomotive at 560 hp. The dimension and weights of each type are given in the accompanying table.—*Railway Electrical Engineer*, May, 1922.

CHILEAN STATE RAILWAYS LOCOMOTIVES FOR ELECTRIFIED SECTION

	Road Freight Locomotive	Switching Locomotive
Track gage	5 ft., 6 in.	5 ft., 6 in.
Length over buffers	49 ft., 10 in.	40 ft., 0 in.
Length over cab	38 ft., 0 in.	17 ft., 0 in
Total wheelbase	37 ft., 0 in.	27 ft., 4 in.
Rigid wheelbase	13 ft., 9 in.	8 ft., 6 in.
Height, top of rail to cab roof	12 ft., 7 in.	12 ft., 3 in.
Width over cab sheets	10 ft., 0 in.	10 ft., 0 in.
Height of coupler	41 in.	36 1/16 in.
Wheel diameter	42 in.	42 in.
Weight of complete locomotive	226,000 lb.	136,000 lb.
Weight of mechanical parts	140,000 lb.	86,000 lb.
Weight of electrical equipment	86,000 lb.	50,000 lb.
Weight per driving axle	37,670 lb.	34,000 lb.

France Making Real Progress in Electrification.—P. Carpentier and E. M. Bill.—The Paris-Orleans Railway, a pioneer in electrification, plans to electrify at once a complete steam-engine division with direct current at 1,500 volts. Other French railroads are planning to follow suit. The total mileage that is involved in the twenty-year program outlined is 5,000.—*Electric Railway Journal*, June 10, 1922.

Telegraphy, Telephony, Radio and Signals

The Recording and Printing of High-Speed Radio Signals.—G. W. O. Howe. —The several types of recorders that are now in use are reviewed with the statement that the future economic success of long-distance radio-telegraphy depends to a large extent upon the development of reliable high-speed transmitting and receiving apparatus. —*The Electrician*, May 12, 1922.

Methods of Radio Direction Finding as an Aid to Navigation.—F. W. Dunmore.—Since the great value of the radio direction finder as an aid to navigation is being recognized, considerable importance attaches to the question whether its proper location is on shipboard in the hands of the navigator or on shore. The author summarizes the relative advantages and disadvantages of its location on shore and on shipboard and comes to the conclusion that the place for the direction finder, like the magnetic compass and other navigating instruments, is on shipboard in the hands of the navigating officer.—*Letter Circular No. 56 of the Bureau of Standards.*

Mobile Radio Telephone for the Parisian Police.—For a better policing of the city of Paris, regular radio telephone communication is now maintained between one police airplane, two police automobile ambulances and headquarters, all four being equipped for sending as well as receiving. Standard French military sets are used, supplied with current from a propeller driven generator on the airplane, and from storage battery driven motor generators in the ambulances. Two 4-m. long steel tubes, attached at the end to a bakelite stick, form a mast to support a 40 m., single wire antenna, the other end of which is fastened to a short bamboo pole, driven in the ground. If no gas or water outlets are available for a ground connection, a copper wire mesh 10 m. by 0.8 m. is stretched out on the ground. Only ten minutes are required from the instant of arrival to make the necessary set-up. Perfect telephonic conversation can be maintained among these stations within a radius of about 30 km.—*Radioelectricité*, May, 1922.

Miscellaneous

Equipment and Inspection Records. —A system for keeping account of equipment and maintenance work is outlined that will avoid delays and expense when changes or repairs are made. Besides enabling the department head to be prepared for changes and repairs, it also helps the maintenance force to carry on its work at the lowest possible cost.—*Electrical Review and Industrial Engineer*, May, 1922.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editor, of wide enough interest to the news service, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Alternators, High Speed, Windage and Load Losses In.

It is possible to measure the load losses in totally inclosed generators more accurately than with any other type. From numerous determinations of rise of air temperature extending back several years, it is apparent that in the largest steam-turbine-driven generators that have been built, the windage losses are approximately 40 per cent of the total losses, and the load losses approximately 25 per cent.—*W. J. Foster, Schenectady, N. Y.*

Current Transformer, Radio Frequency.

We have recently produced a radio-frequency current transformer having a current ratio of 200/1, and suitable for actuating a 1-amp. thermocouple type ammeter, thus functioning as a 200-amp. radio-frequency ammeter. This combination should be useful in research work on high frequencies in general, and in metering in connection with high-frequency electric furnace developments. The transformer is of the ring type, and is furnished without any primary winding. One turn of the primary produces a ratio of 200, two turns of the primary a ratio of 100, etc., giving a number of ranges with the same apparatus. Any 1-amp. thermocouple or hot-wire ammeter can be used with this transformer, and the errors in transformation are within tolerable limits for wide variations in frequency.—*Paul MacGahan, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Flow Meter.

A novel scheme has been developed of recording electrically the rate of water passing over a weir and also integrating the total amount. The method depends upon the depth of immersion of electrodes placed in the water above the weir. The higher the water level the deeper the immersion, and the less the electrical resistance. A second similar set of electrodes with constant depth of immersion, excited by the same direct-current voltage, forms part of the "control" circuit. The recording instrument is an ohm-meter connected to the two electrode systems. The apparatus can be placed at a very considerable distance from the weir, as the currents are very small.—*H. Tinsley & Company, London, England.*

Furnace, Electric, High Pressure, High Temperature.

A high-pressure melting furnace of small capacity has been constructed and iron successfully melted under an external gas atmosphere of 3,000 lb. per square inch. The furnace casing is a chrome-nickel steel forging 7 in. diameter x 15 in.; the heating element is a graphite helix hung from the steel cover by heavy copper tubes, which serve as electrodes and for the circulation of cooling water. The entire furnace is cooled by immersion in a flowing stream of water. The heating space is 1½ in. diameter x 4 in.; a magnesia crucible holds 100 grams of metal. The rate of power consumption increases with the pressure of the gas atmosphere, and at 3,000 lb. per square inch the charge of iron can be brought to fusion with an expenditure of 12 kw. at 50 volts in thirty minutes.—*N. B. Pilling, East Pittsburgh, Pa.*

Wattmeter, Polyphase, Thermoelectric.

A wattmeter (Fawssett indicator) has been developed for automatically indicating the power in a three-phase circuit at a distance of several miles. The actual operating element is a thermoelectric one making use of a unipivot direct-current galvanometer which may be scaled in thousands of kilowatts. Pilot wires laid with the transmission cables may be made use of to carry current.—*Cambridge Scientific Instrument Company, England.*

Welded Joints, Electric and Magnetic Tests Of.

The electric or magnetic potential drop across the weld was measured with a definite emf or magnetic potential applied on opposite sides of the weld. This drop was compared with the drop over an equal length of unwelded plate. After completing the electrical and magnetic tests the plates were cut into strips 1 in. wide at right angles to the welds and these strips tested for tensile strength. The electrical, magnetic, and tension tests showed a very fair general agreement among themselves and with the known quality of the welds are reported by the welder. A paper on the subject was presented before the American Society for Testing Materials, June, 1922.—*T. Spooner and I. F. Kinnard, Pittsburgh.*

X-Ray, Rectification Devices For.

A synchronously revolving spark gap has been perfected for the rectification of high-tension alternating currents. The stationary part consists of metal spheres, the revolving part of two toroidal segments with rounded ends. The advantages of such a gap over the usual point gaps are: (a) Its properties are more nearly those of a stationary sphere gap; (b) the form of the rectified wave is more nearly constant and accurately adjustable; (c) it is substantially without corona and operates with a minimum of annoying ozone and nitrous acid.—*Montford Morrison, Chicago.*

Research in Progress

Corona Loss.

We are working on the determination of corona losses in large conductors. This matter is of great practical importance, and preliminary tests have shown surprisingly large losses for certain large cables.—*J. C. Clark, Department of Electrical Engineering, Stanford University, Cal.*

Cable, Hochstadter Type, Tests On.

Considerable interest has been manifested in the last few years in the developments of the Hochstadter type cable, which consists in a wrapping of thin metal strips around the conductor insulation and omitting the outer belt insulation. An extended investigation was made by the Electrical Testing Laboratories of New York. Apparently the increased current carrying capacity of this type of cable is about offset by the increased cost and the advantage, if any, will be due to the elimination of the tangential stresses in the central portion of the cable and the elimination of cable faults due to this cause. Tests to determine this point are now being conducted by a number of the member companies.—*Underground Systems Committee of the N. E. L. A.*

Induction Motors, M.M.F. Harmonics in Space.

An investigation is being made of single-phase and two-phase characteristics and of the variations caused by changes in the ratio of the turns in the various stator coils. The investigation has for its object a more thorough knowledge of the ways in which harmonics produced in space by the winding distribution affect the motor torque.—*Massachusetts Institute of Technology, Cambridge, Mass.*

No-Voltage Release with Time Delay.

Pacific Coast members brought out the desirability of a time delay for no-voltage releases which would prevent the current being cut off of a motor during an interruption, or period of low pressure of a few cycles duration. Two devices of this kind have been developed and are now undergoing tests.—*Electrical Apparatus Committee of the N. E. L. A.*

Oils, Insulating, Durability Tests For.

Suitable methods of durability tests of transformer oils are being studied by a committee representing transformer manufacturers, consumers, and oil producers. Sludging tests and accelerated oxidation tests in use in this country and abroad are receiving careful attention.—*T. G. Delbridge, Atlantic Refining Company, Philadelphia.*

Suggestions for Research

Alloys, Melting Points and Impurities.

The relation of melting points of alloys to composition, and the influence of natural impurities, are known fairly well for certain combinations, but there are many exceptions which cannot be accounted for by the use of any known law.—*C. E. Skinner, East Pittsburgh, Pa.*

Corona Loss.

There is need for a determination and tabulation of Peek's "irregularity factor," Mo, for a wide variety of large cables. This is needed in order that his corona loss formulas may find a wider field of usefulness.—*J. C. Clark, Stanford University, Cal.*

Conductivity, Relation of Electrical to Thermal.

It is not certain at the present time that there is a definite relation between these two characteristics of materials, either conducting or insulating. If a general law could be established, it would be of considerable value in connection with design work.—*C. E. Skinner, East Pittsburgh, Pa.*

[This suggestion has come up more than once, because of its importance in design work. According to the electron theory, there must be a definite relationship between the two conductivities.—ED.]

Cables, Dielectric Stresses In.

Until the proper method of calculating the limiting stresses of high-voltage cables and the limiting values for these stresses is determined, it will not be possible to design cables with the thickness of insulation properly proportioned to the working voltage.—*D. W. Roper, in the A. I. E. E. Journal, June,* 1922.

Furnace, Electric, for Making Insulators.

On account of its better temperature distribution and control, an electric furnace would be preferable to the present fuel furnace, for firing insulators. Such a furnace would have to stand the required high temperature, up to 2,500 deg. C. The electrical industry urges electric heating on other industries; here is an opportunity of using it at home.

Oil, Centrifugal Separator For.

Some operating companies are using centrifugal separators in place of the filter press for cleaning and drying their insulating oil. A systematic study of advantages and disadvantages of both methods is desired.—*Electrical Apparatus Committee of the N. E. L. A.*

Meter, Volt-Ampere-Hour.

One method for measuring the total volt-ampere-hours is to measure the true watt-hours (*IEH* cosϕ) with an ordinary watt-hour meter, and the *IEH* sinϕ with a similar meter in which the potential phase has been shifted by 90 electrical degrees. An automatic addition of these two quantities from instant to instant may be possible by using a hard rough sphere to the surface of which two disks are applied, each actuated by one of the two above-mentioned meters. The disks must be applied in a diametral plane at 90 deg. from each other. The motions of rotation which these disks seek to communicate to the sphere are proportional to cosϕ and sinϕ respectively, so that the actual velocity of rotation of the sphere is proportional to *IEH*. The arrangement is similar to that used in harmonic analyzer (see, for example, *Journal of Franklin Institute*, September, 1916.)—*F. R. Innes, Detroit, Mich.*

Insulation, Effect of Transient Voltages on.

The solution of this problem is of increasing importance with high-voltage transmission.—*C. E. Skinner, East Pittsburgh, Pa.*

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

To Celebrate Founding of Edison System

The fortieth anniversary of the starting of Edison service will be celebrated in New York City on Sept. 11. As a matter of history the old Pearl Street station in New York began operations at 3 o'clock on the afternoon of Sept. 4. but inasmuch as that date is a holiday (Labor Day), when most people are apt to be out of the city, it was decided to celebrate the fortieth anniversary of the starting of the Pearl Street station a week later. The New York Edison will be the host and suitable addresses by Edison pioneers will be made. It is expected also that Edison himself will be in attendance. A feature of the celebration will be an historical exhibit of Edison apparatus, models, lamps, photograph, etc., which are now being collected and arranged.

Coal Production Decreasing

The effect of the railroad strike and of the holiday period has been to decrease the weekly production of coal about a million tons. No general demand for coal exists as yet, showing there are still stocks in the hands of consumers.

The anthracite situation seems to be clearing up with the acceptance of the offer of President Harding with a reservation, but the bituminous deadlock still continues.

German Die Patents Data Returned

Francis P. Garvan, president of the Chemical Foundation and former Alien Property Custodian, turned over to the special Federal Grand Jury in Washington books and records relating to the German patents acquired by the foundation. In regard to the report that the patent investigation resulted from German influence, Attorney-General Daugherty made a flat denial.

On Monday the government served formal demand on the Chemical Foundation for return of the former German patents and other property sold to it by former Alien Property Custodian F. P. Garvan. Announcement was made by Alien Property Custodian Miller that the papers had been served on Mr. Garvan as president of the foundation in New York by Frederick H. Wilson, acting for the property custodian. Service was also made in Wilmington, Del., on the Corporation Trust Company, representative of the foundation. The foundation was subpœnaed to appear in Washington on July 11 with books and records before the grand jury. It is reported the government is preparing a criminal suit against the foundation for trial in the District of Columbia.

International Engineering Congress in Brazil

Through and by the courtesy of Brazil, on the occasion of her Centenary of Independence, it will be possible for engineers of all countries to meet in conference. The meeting will occur Sept. 7-30 at Rio de Janeiro in connection with the opening of the Brazilian International Exposition.

The Club de Engenharia of Rio de Janeiro is officially charged with organizing the congress. It is understood that representatives of all American countries will attend. The subjects for discussion will be power development from coal and water, irrigation methods, elimination of waste, railroads, port developments, steel industry and engineering co-operation.

Government to Offer Radio Telephone Service

Plans are being considered by the Post Office Department for changing at least a few of the fifteen radio stations operated in connection with the Air Mail Service to provide both radio telegraph and radio telephone service. The stations are at Washington, D. C.; Habelhurst, L. I.; Bellefonte, Pa.; Cleveland, Ohio; Bryan, Ohio; Chicago; Iowa City, Ia.; Omaha, Neb.; North Clerk, Neb.; Cheyenne, Wyo.; Rock Springs, Wyo.; Salt Lake City, Utah; Reno, Nev.; San Francisco, Cal.

The Washington station has had both radio telegraph and radio telephone service for nine months. Besides maintaining an hour to hour record of the progress of air mail the Post Office Department radio stations now send out other information. Complete weather reports now go out daily. Also reports of grain, dairy, and livestock prices travel the ether waves to the farms and farming communities.

It is still uncertain just when the stations will be changed to radio telephone apparatus. Because of the first call on the radio by the air mail, the equipping will probably be gradual. Further announcements concerning the new service are expected soon.

Another Bill on Muscle Shoals

Acceptance of the offer of Henry Ford to lease the Muscle Shoals, Ala. nitrate project is proposed in a bill introduced by Senator Ladd of North Dakota, a member of the Senate agricultural committee, which has been considering the lease offers. The bill is similar to the measure presented in the House by Representative Wright of Georgia. In presenting the bill Senator Ladd read letters approving the Ford proposal from a number of farm organizations. The Senator says a number of the members of the Senate agricultural committee favor the Ford proposal.

New 150,000 Kva. Plant for Connecticut

A large steam station is to be constructed for the Connecticut Light & Power Company at Devon, Conn., near the mouth of the Housatonic River. This site is at tidewater and the new plant will tie in with the company's existing steam and hydro plants.

It is now planned that this plant will have an ultimate capacity of 150,000 kva. It will be so designed, however, to permit expansion beyond this size. The site selected for the plant consists of about 50 acres of land fronting on the Housatonic River and lying between the river and the Naugatuck division of the New York, New Haven & Hartford Railroad immediately north of the main line bridge over the Housatonic River. This site will enable the company to obtain both rail and tidewater delivered coal. The initial installation will probably be two 25,000-kva. units, although it is possible that larger units may be installed.

Transmission lines operating at 66,000 volts will run from this plant to connect with existing lines at the company's new Stevenson hydro-electric plant and another line will run from the new plant to supply the company's distribution system in the vicinity of Norwalk.

"This plant in all respects will be one of the so-called superpower stations so that it will fit in with the superpower plan for New England," stated Irvin W. Day, vice-president of the company.

The construction work will be done by the U. G. I. Contracting Company of Philadelphia and it is expected that the plant will be ready for operation in the fall of 1923.

Japan Buys Thirty-four Electric Locomotives in England

The Imperial Government Railways of Japan has just placed with the English Electric Company an order for thirty-four complete electric locomotives of a total value of more than $2,000,000.

Eight of the locomotives are for heavy express passenger service. They are of the 2-C-C-2 type, weigh about 96 tons and are designed to haul a 415-ton train at 60 m.p.h. Each locomotive has six motors rated at 306 hp., 500 volts. The motors are connected in two groups of three in series on a 1,500-volt trolley.

Of the remaining locomotives, nine are for local passenger service and seventeen for heavy freight service. These twenty-six are of the B-B type and weigh about 56 tons each. They each have four motors similar to those on the express passenger locomotives. The local passenger locomotives are designed to haul a 315-ton train at 55 m.p.h. The freight locomotives haul a 600-ton train at 40 m.p.h.

◆

A 600-Kv. Experimental Transmission Line

An experimental transmission line for operation at 600 kv., the highest voltage line in the world, has recently been completed at Purdue University, Lafayette, Ind. This line is approximately one-third of a mile in length and consists of three 600-ft. strands of steel core aluminum cable supported on steel towers 65 ft. high. Fifteen-unit suspension insulators are hung from carriages upon 40-ft. channel-iron crossarms in such a manner as to be readily moved in a transverse direction while under strain of the cable. Tests may therefore be readily made with different spacings between cables. Two cables, sizes varying from No. 1 B. & S. to 500,000 circ.mil, are used for a single-phase circuit upon which may be impressed voltages up to 600 kv. at 60 cycles.

Two 300-kv., 135-kva. Westinghouse transformers, each with one terminal connected through a condenser bushing, and one terminal grounded, may have their secondary coils connected in series in order to provide 600 kv. between line cables. Voltage is measured upon tertiary coils provided in the transformers which are calibrated with the A.I.E.E. standard sphere-gap. A crest voltmeter is also available for maximum voltage readings. The actual power being supplied to the line may therefore be measured in the high voltage circuit without introducing transformer losses. A short feeder, consisting of two 500,000 circ.mil cables widely spaced, reduces the tare losses to a minimum. These may be accurately measured and subtracted from the gross readings. The voltage is controlled by means of an auxiliary transformer and double-drum motor-driven controller which provide 480 equal steps, or voltage increments without distortion of wave form.

The steel towers are an adapted standard semi-flexible construction of the Bates Expanded Steel Truss Company with spcial channel-iron crossarm and crossarm truss. Intermediate towers are self-supporting, but end towers are provided with bridle guys of $\frac{5}{8}$-in. steel extending to four points upon the crossarm. Four standard types of suspension insulators were provided by the Locke, Ohio Brass, Thomas and Jeffery-Dewitt Companies, while the cables were supplied by the Aluminum Company of America.

As little is known about the phenomena of corona losses above 220 kv., and as it is probable that voltages far in excess of that value will be used for power transmission in the future, as the results of the further development of coal mines and hydro-electric power plants at great distances from available markets, it is believed that this line at Purdue University may prove of great value in these pioneer investigations.

◆

Public Relations and Transmission Discussed at Ohio Convention

With the People Dependent on Service They Are Interested in the Welfare of Utilities—Highway Lighting Suggested as a New Field of Development

AN ADDRESS which emphasized the need for public utility companies gaining and keeping the good will of their patrons, who comprise practically every family in the state, was prepared by W. A. Wolls, president of the Ohio Electric Light Association, to open the twenty-eighth annual convention of that organization at Cedar Point on July 11. Owing to the unavoidable absence of Mr. Wolls, the address was read by E. L. Franklin, vice-president.

With practically all the people of the country dependent more or less on the service of utilities Mr. Wolls stated that this factor alone would create an interest in welfare in these utilities. Considering the problems of the new-business departments, he thought that the highway lighting field might be one worthy of investigation.

In presenting his report as chairman of the transmission and distribution committee, A. M. Wilson, Cincinnati, Ohio. voiced the need of extensive studies on the subject of grounding secondaries. With very little information on the ground resistances in various sections of Ohio for different seasons Prof. Wilson considered this a real problem worthy of experimentation. He also reported progress on the preparation of the Ohio map showing the power lines of 10 kv. or over.

While discussing lightning arrester developments G. N. Lemmon of Marietta, Ga., asserted that the discharge rate should be studied since it is one of the most vital factors in the problem of transmission because of the shock and sudden readjustment of the electrostatic and magnetic energy. The ideal arrester would be one limiting this shock to a small value. He also declared that weather conditions affected the disk gaps since rain caused a discharge at a lower voltage

Operation of the Ohio State Public Utilities Commission's rules governing the construction of overhead wires in the state was discussed Wednesday by Ward H. Snook, inspector of power wires for the commission, addressing the convention.

"These Ohio rules, drafted by engineers for Ohio utility companies, with the co-operation of the commission's engineers, are perhaps the best thing of their kind in existence," said Mr. Snook. "They are but the milestone on the highway of progress which marks the official adoption by the utlity companies of Ohio of the soundest of all economic principles, namely, 'Do unto others as you would that they do unto you'; in other words—co-operation.

"The use of a highway by a public utility is a public use. Its right on the highway is a public right and not a private right. The public utility using the highway must, therefore, so use it that it will not unnecessarily interfere with the public's use of its own, either for travel or for further use of the highways as an artery of commerce, communication or supply.

"Should some future Bell, Edison, or Marconi still further complicate matters by inventing something of similar utility, there will have to be found a place for it on the highways. The complexity of this problem has led Ohio to adopt rules, regulations and specifications based on the natural and economic laws involved."

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New $3,000,000 Coal Pier at Norfolk

The Virginian Railway is preparing to spend $3,000,000 for the erection of an electrically operated coal pier at Sewalls Point. Bids are expected to be asked for within a short time. This pier is in line with plans greatly to augment the facilities for handling coal. New lines are to be built into the coal fields which are served by the Virginian. Hampton Roads as a coal port is rapidly coming to be of great importance. To the two piers of the Virginian, there are added the three piers of the Norfolk & Western and two of the Chesapeake & Ohio.

Municipal Radio Stations Attracting Attention

Considerable talk is being indulged in by municipalities in various parts of the country looking toward the establishment of radio transmitting stations. A number of cities are already using the radiophone for police purposes in a limited way and some use is also being made for broadcasting purposes. Chicago has had a well-equipped station in operation since last fall experimenting with the police and fire department uses and is believed to be the first city to maintain a regular broadcasting schedule. Such a schedule has been maintained for several months and consists of talks on matters of public interest from authorities on the subjects selected as well as musical and other entertainment features. New York has announced that it will erect its own station. Dallas has been using radio in its police department, and in a number of cases broadcasting stations owned by private parties are co-operating with police authorities in the broadcasting of police and other news.

John Fritz Medal Awarded to Marconi

The John Fritz Medal, the highest award in the bestowal of American engineers on July 7, was presented to Senator Guglielmo Marconi before a distinguished audience in the Engineering Societies' Building, 29 West Thirty-ninth street, New York.

Bestowed annually for "scientific and industrial achievement," Marconi was awarded the gold medal of 1923 for the invention of wireless telegraphy. Dr. Elihu Thomson, medalist of 1916 for his achievement in electrical engineering and scientific research, made the presentation, hailing Marconi as the great pioneer in wireless, the individual directly responsible for safety on the high seas and the other "beneficent results" that followed his invention.

In acknowledging the honor conferred upon him, Marconi described himself as being nervous about continuing "to make good" in face of the high hopes and expectations of his friends in this country.

"I have long realized that in America, more than anywhere else, the most cordial and generous encouragement is given to any honest endeavor to apply science to useful and practical purposes," he said. "I consider myself fortunate that much of my early work in radio has been carried out in this country, for I cannot help feeling that you realize that wireless communication has become useful and often necessary, on sea and on land, besides tending to increase and simplify the facilities for closer communication between distant peoples on this earth, thus contributing, I hope, to make good will take the place of the unrest and mutual suspicion which unfortunately seems at present to be a dominating feeling among many nations."

Professor Comfort A. Adams of Harvard University, chairman of the John Fritz Medal Board of Award, described Marconi as the nineteenth Fritz medalist, his predecessors having all been engineers of surpassing achievement on both sides of the Atlantic. The award was established in 1902 about the time of John Fritz's eightieth birthday. The medal fund was contributed by friends of Mr. Fritz, and its administration was assigned to the four national engineering societies: The American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

Senator Marconi sailed for Italy on his yacht *Electra* on July 8.

Hydraulic Survey of Green River

For the purpose of determining power and reservoir site possibilities, a complete topographic survey of the Green River from Green River, Wyo., to Green River, Utah, is being undertaken. The work will take between three and four months. It is the first attempt to complete an actual survey.

The 300-mile river trip and a 70-mile side trip down the Yampa River will be made in three specially constructed boats. Nine feasible dam sites, capable of an approximate production of 1,500,000 hp., will be investigated.

The personnel of the party includes Ralf R. Woolley, hydraulic engineer of the United States Geological Survey; K. W. Trimble, chief topographer; two experienced boatmen who will act as rodmen, an expert boatman, a geologist, a cook, and H. L. Stoner, representing the Utah Power & Light Company.

Commonwealth Edison Makes Record

The Commonwealth Edison Company became the greatest producer of electricity in the world in 1921 with an output of 1,928,271,940 kw.-hr. It had 536,982 customers and it is estimater that the company produces 70 per cent of the electricity and 45 per cent of all steam and electric power used in Chicago.

The books of the company show an investment of $3.18 in producing property for each dollar of revenue from operation. The total investment of $118,275,716, as of December, 1921, is divided as follows: $43,700,000 in generating stations, $10,000,000 in overhead lines, transformers and services, $10,000,000 in tunnels and conduits, $20,000,000 in underground cables, over $60,000,000 in meters and the remainder in real estate, etc.

The company has the record of never having increased its rates for electricity and has scaled them down whenever possible.

Decision on Non-Par Value Stock Tax

The Appellate Division of the New York State Supreme Court, Third Department, handed down a decision Monday on the state taxation of so-called "non-par value" stock. Action was brought by the Terminal & Town Taxi Company, which was assessed for license and franchise taxes as though each share of "non-par value" stock were worth $100. The taxi company set forth that this assumption, based on the provisions of the law in 1920, mitted to the commission for further the actual value of each share was $8.55. In view of the fact that many public utility companies have large issues of non-par value stock the findings of the court are not without interest.

The decision of the Appellate Division, which was written by Justice Kellog, said:

"There is no authority for the assumption that non-par value stock has a value of $100 a share for the purpose of assessing the tax under Section 181. We think that the tax to which the relator is liable under that section must have as its base the actual capital of relator employed within this State."

"The determination of the State Tax Commission should be annulled," the decision concludes, "and the case remitted to the Commission for further action in accordance with this opinion."

Status of Appeal on Depreciation Regulation

In a letter to the Secretary of War, L. W. Wallace, the executive secretary of the Federated American Engineering Societies, asks what has happened to the appeal of the electrical industries against the depreciation regulation drafted for use in connection with the waterpower act. Mr. Wallace's letter reads as follows:

"For many months there has been pending before your commission an appeal from the electrical industries against the depreciation regulation which it was proposed to enforce in the administration of the waterpower act.

"Many of the engineers who compose this organization are particularly anxious to see our waterpower resources utilized as extensively and as promptly as is possible, and some of them have requested that I secure an authoritative statement as to the status of the matter. There is a feeling that the uncertainty in regard to depreciation is tending to retard this development.

"May I inquire what are the prospects for action on the depreciation regulation? It should be very helpful to our members if we could have the advantage of any personal views on the subject which you may care to express."

Plumbs Ocean Depths

An invention of great importance has been contributed to the science of the sea through the discovery and development by the navy of a radio sounding device for registering ocean depths. The new device was tried out on a cruise of the destroyer *Stewart* from Newport and Gibraltar and proved a complete success, registering automatically and instantaneously depths ranging from 2,400 to 28,000 ft.

Dr. Harvey C. Hayes, physicist of the Naval Engineering Station at Annapolis, is the designer of the apparatus and went on the *Stewart* to test it. He has cabled to the department that the experiment was a complete success and is now on his way home to give a detailed report.

The apparatus is simple in operation and measures the time it takes for a sound from a ship to reach the bed of the ocean and return. Sound from an oscillator, installed in the aft part of the ship, is projected against the ocean bed and rebounds, being received by sensitive ears in the forward part of the ship. The elapsed time is automatically measured.

The sound transmitter develops a high frequency vibration in a diaphragm, which is in contact with the water. The high note carries many miles, while the receiver also can detect signals from great distances.

National Electrical Safety Code Approved by A. E. S. C.

The American Engineering Standards Committee, by letter ballot, has approved the National Electrical Safety Code of the Bureau of Standards, which covers the generation, distribution and utilization of electricity for power, light and communication.

In making public this decision, the Standards Committee announces that here is now in process of formation a thoroughly representative sectional committee to consider any revisions of Part 2 of this code, "Rules for the Installation and Maintenance of Overhead and Underground Electrical Supply and Signal Lines," which may be deemed necessary by any of the interested parties. There are also being organized three sub-committees to take up the unification of crossing specifications under the three following heads: Signal lines crossing railways, power lines crossing railways and power lines crossing signal lines.

These committees are being organized in conformity with the action of the recent conference, held on March 2, on the standardization of crossing specifications, at which there were present the representatives of fourteen national, engineering, utility and industrial associations, four departments of the federal government, various state commissions of Connecticut, Iowa, Minnesota, New York, and of the telephone, telegraph and cable companies.

It is believed that this action, together with the organization of the representative committees to take care of the revision of the code and to prepare the crossing specifications, constitutes one of the most important steps yet taken in securing national uniformity in these matters.

Commercial Problems to Feature Illuminating Convention

Application problems and commercial questions will largely occupy the program of the Sept. 25-28 convention of the Illuminating Engineering Society at Boston, Mass., according to an announcement following a meeting last week at Boston of the general convention committee. Forty delegates were present, including two past-presidents from outside New England. Committees are now at work planning a business and entertainment schedule which will appeal to many different minds in the electrical industry. At the Boston meeting the following committee chairmen were appointed: Entertainment, C. A. B. Halvorson, Jr., Lynn, Mass.; publicity, M. R. Griffeth, Boston; attendance and local arrangements, A. W. Marcou, Boston; finance, R. S. Hale, Boston. President C. L. Edgar of the Edison Electric Illuminating Company of Boston is chairman of the general committee, H. F. Wallace of the General Electric Company, Boston, vice-chairman, and J. Daniels, Boston, secretary.

A. M. Powell, Harrison, N. J., vice-chairman of the meetings and paper committee, is in charge of the convention program.

Illuminating Engineering Nomenclature Approved

The American Engineering Standards Committee announces that the illuminating engineering nomenclature and photometric standards of the Illuminating Engineering Society, 1918 edition, have been approved by the A. E. S. C. as "American standard," with the substitution of six internationally agreed upon definitions for certain ones of the 1918 rules. The definitions which have been reworded are: Luminous flux, luminous intensity, illumination, candle, lumen, and lux.

The special committee of the A. E. S. C. which examined the proposal submitted by the I. E. S. and which recommended approval of the nomenclature and photometric standards included representatives of the U. S. Bureau of Standards, the American Gas Association, the American Physical Society, the International Acetylene Association, the Optical Society of America, the American Institute of Electrical Engineers, the Illuminating Engineering Society and the National Electric Light Association.

Short Circuit Causes Subway Accident

Intense Heat and Fire Extinguisher Fumes Overcome 150 Passengers in Interborough Tube

An arc starting in a controller box on a subway train in New York on July 6 resulted in smoke and fumes from chemicals used as fire extinguishers which overcame 150 passengers.

The intense heat of the d.c. arc apparently broke down the carbon tetrachloride, which is one of the chief ingredients, into phosgene gas, carbon dioxide and carbon monoxide. Whatever the cause of the gas, the passengers in the train were overcome by fumes and smoke and had to be carried to the surface.

In reporting the accident the New York *Times* stated that Dr. W. F. Hellebrand, chief chemist of the Bureau of Standards, said that experiments had been made which showed that when pyrene is cast on a hot fire corrosive and irritating fumes are produced. Dr. Clarence L. West, a noted chemist, is reported as having said: "Pyrene when used in an inclosed space develops phosgene gas. The Bureau of Mines has been making experiments in its Pittsburgh laboratory and my understanding is that these experiments have disclosed this fact. I, of my own knowledge and experience, also know that phosgene gas is caused when pyrene is used in extinguishing fires."

The intense heat of an arc resulting from a d.c. short circuit on the subway system apparently involves so much energy that the constitutents of the extinguisher are broken down. However, for small fires, the action is entirely different and satisfactory results are obtained.

The one great advantage of the carbon tetrachloride extinguishers is that they are non-conducting and thus increase the safety of the operator.

In the 1922 report of the Accident Prevention Committee of the N. E. L. A. the statement is made that "Care must be exercised when carbon tetrachloride is discharged in a confined space with little or no ventilation, as the chloride gas given off may cause unconsciousness."

To Hold Conference of Co-operative League

In order to create an opportunity for the exchange of ideas and experiences which may assist more effectively in carrying forward local activities, a conference is to be held in September or October. A canvas is now being made by the Society for Electrical Development to ascertain the date most favored.

The call for the conference is made to local co-operative leagues throughout the country and the belief exists that such a meeting will produce valuable results, for the objects of all such organizations are the same.

New Film for N. E. L. A.

"Back of the Button," the popular film on electricity put out last year by the N. E. L. A., has been surpassed in popularity by the new film entitled "Yours to Command," described in the *Electrical World* of May 20.

The picture depicts the use of electricity in every-day activities and plays up special processes using electricity. The picture ends by showing that revenues are vital to secure the growth of the utilities. Reports indicate that the new film is very popular.

India Interested in Water Power

Considerable interest is being shown in the Bombay district of India in the development of waterpower, the mountainous nature of this part of India, the need for irrigation and the heavy rainfall during the monsoon period all adding to the probability of early development of hydro-electric resources.

A ready market for electric power exists in the city of Bombay and vicinity, the growth of which market is being provided for by the new installation at Nila Nula, bids for which will probably be asked for in the summer of 1923. The increasing need for power in Bombay is due to the growth of mills there, the proposed plan to electrify the steam railroads within the city and projected new interurban trolley lines. The electrification of the steam railroads will be decided upon in the immediate future.

The next project in importance is that of the Pench River to supply power to the mills and lighting plants at Nagpur, a city of 101,000 population. Immediate action on this project is probable.

Preliminary surveys have been made at the direction of the Governor of Bombay for thirteen other projects in this presidency. The total power possibilities of these thirteen sites is estimated at 230,350 kw.

Coal Mining Costs Vary

Any attempt by the government to fix coal prices or establish maximum limits for selling charges will require "adequate and current information" as to costs and investments in the industry and differences in the figures between districts, the Federal Trade Commission reported to Congress in a discussion of its investigation into bituminous production.

Although its inquiries have been suspended by reason of injunction proceedings brought against its activities in the industry by the bituminous coal operators, the commission explained that work carried out prior to suspension indicated a wide range of investment totals.

Coal is being mined in important districts, with a permanent capital investment as great as $9 per ton of annual output and as low as $1 per ton of annual output, the commission found. The average investment cost is $3.12 per ton.

Investment was placed at $4.26 per ton in southwest Pennsylvania, at $3.04 per ton in central Pennsylvania, at $1.94 in the Illinois No. 3 district, at $1.44 per ton in the Indiana No. 1 district and $8.32 per ton in Utah. All figures referred to bituminous production. This variation, the commission indicated, was very important in the matter of fixing fair prices or setting price standards for coal, since each ton of coal produced would be obliged to bear a corresponding ratio of overhead cost of production. The investment information would be useless in determining final production costs, the commission indicated, unless there was added to it and considered with it the current costs of operation, selling costs and other factors.

Mexican Railroads Turning to Electric Power

Within the next twelve months the mountain division of the National Railways of Mexico between Monterey and Carneros will have been transformed from steam to electric power, according to G. L. Trevino, electrical engineer of the system, who is in charge of the construction work now in progress. This track forms part of the trunk line that runs between Laredo, Tex., and Mexico City.

The division which is being electrified is 96 miles long and the maximum grade is 2 per cent. It is asserted by Mr. Trevino that the electric power for operating the locomotives will be obtained from two stations, one in Monterey and the other in Saltillo. The engines will be of 300 tons and their hauling capacity will be 1,500 tons each. The fact that a very heavy freight traffic passes over the division between Monterey and Carneros, much of it coming from the mines in the region adjacent to Saltillo, makes the adoption of electric power of much importance. Mr. Trevino estimates that the saving in the use of electric power over steam power will amount to more than $500,000 in United States money a year.

As soon as the electrification of this 96-mile stretch of track is finished the still more important project of converting to electric power the Tampico-San Luis Potosi division of the system will be undertaken, according to Mr. Trevino. In connection with this latter improvement it is planned to install a large hydro-electric plant at Micos Falls, situated within sight of the road. This division is 276 miles long and the maximum grade is 3 per cent. The electrifying of other divisions of the system is in contemplation.

Reports persist that the electrification of the Mexican Railway, the English-owned line which connects Mexico City with Vera Cruz, is before long to be undertaken. It is said in Washington that definite arrangements for equipment were entered into some time ago by the railroad, but that the inauguration of the work is to be contingent upon its ability to put through certain additional financing. This in turn is dependent upon the political stiuation in Mexico. The plan, it is understood, is to electrify only that part of the road in the vicinity of Orizaba, where there is an abrupt ascent from the coastal plane to the central tableland. Waterpower is available in that region.

Joint Committee and S.E.D. Agree on Working Plan

The Joint Committee for Business Development, sponsored by the N. E. L. A. and the Society for Electrical Development, has emulated a working plan for closer co-operation between the two organizations in carrying on the work of business development under the slogan "Electrify." According to the arrangement the S. E. D. will produce the literature, gather the statistics and do such other work as the joint committee may call on it for. In addition the S. E. D. will have general charge of the field work in connection with the formation of local electrical leagues. All work in connection with the business development movement will be under the general direction of the joint committee or of the executive committee of the Joint Committee for Business Development.

Southern California Edison to Alter Stock Issues

John B. Miller, president of the Southern California Edison Company, issued a formal notice to 47,000 stockholders of the company announcing a plan of rearrangement of capitalization of the corporation.

"The company's general policy," said President Miller, "is to provide the major part of its new construction needs through the sale of bonds and the remainder by capital stock. Heretofore common stock paying 8 per cent dividends has been sold. It is now proposed to substitute a stock limited to 7 per cent dividends for future sales, thus resulting in the company securing funds at 1 per cent less than formerly, with the resultant benefit to present stockholders.

"The present capitalization of the company consists of first preferred stock, of which $4,000,000 was authorized and an equal amount outstanding. Of the second preferred, $12,500,000 was authorized with $12,029,900 outstanding. Of the common there was authorized $83,500,000, with $50,407,400 outstanding, making a total authorized capitalization of $100,000,000, of which $66,437,300 is outstanding."

It is now proposed to rearrange the capitalization so as to provide for the original preferred stock, of which $4,000,000 will be authorized, with the same amount outstanding; preferred stock $36,000,000, with $9,500,000 outstanding. Of the common, $60,000,000 will be authorized, with $50,407,400 outstanding, making the total capitalization $100,000,000, with $63,907,400 outstanding.

The original preferred stock will occupy the same position as the present preferred stock, says President Miller. All of the second preferred stock will be retired. This rearrangement will make available a new stock limited to 7 per cent dividends, which will be used to provide a part of the funds needed for the company's construction program, which during the next ten years includes the development of approximately 1,000,000 hp. on the company's Big Creek project, with appurtenant transmission lines and distribution systems.

This plan will also eliminate the present outstanding $12,029,900 face value of second preferred stock by the issuance in place thereof of $9,500,000 of new 7 per cent preferred stock, thus resulting in an improvement of the position of the common stock by the reduction of $2,500,000 of outstanding capitalization.

Customer-Ownership Campaign

Announcement is made that the customer-ownership campaign of the New York State Gas & Electric Corporation, which was inaugurated on July 19, is progressing satisfactorily. This company operates in the south central section of New York State, supplying gas and electric service to about 20,000 consumers in the cities of Ithaca, Cortland, Norwich and Oneonta, as well as in twelve villages and eighteen towns. The company is offering 3,000 shares of its cumulative preferred capital stock of no par value, and paying dividends of $7 per annum, at $100 per share, this issue of preferred stock having been authorized by the New York State Public Service Commission for the payment of a 3,000-kw. turbine and a 500-hp. boiler in the power plant at Ithaca; a new water gas set and accessories at Cortland, and the construction of a transmission line between Oneonta, Sidney and Norwich.

Italian Engineer to Study American Practice

M. G. Soldini, an electrical engineer of Milan, Italy, arrived in this country this week and will devote one year to a study of American central station practice. Mr. Soldini will visit all the principal steam and hydro-electric stations in the United States and some in Canada. He will also make a study of trunk line and suburban railroad electrification. Italy, he points out, possesses no coal, importing all her fuel from England and Germany. On the other hand the northern section of Italy has large water powers, from 3,000,000 kw. to 4,000,000 kw. being available for immediate development. In winter it will be necessary to use steam to supplement this water power. While Italy is now slowly recovering from the war, Mr. Soldini says the possibilities for industrial and railroad electrification are very great.

Brief News Notes

Changing Theater Control Board Without Performance Interruptions.—Changing the control board of the State-Lake Theater, Chicago, without any loss or interruptions of performances, in seven hours' time, is a record set up by the Monroe Electric Company, 35 West Lake Street, Chicago. Although the preliminary work of installing this lighting system required eight weeks between the hours of 8 a.m. and 4.30 p.m., the final insertion of the new 330-kw. Major remote control and pre-selective board was accomplished between the hours of midnight and 7 a.m. One hundred and fifty-six 500-watt border lights were installed between the drop of the curtain at midnight Tuesday and its rise at 11 a.m. Wednesday. This installation required seventy-two new dimmers and 10 miles of wire.

Utilities Change Ownership in West Virginia and Pennsylvania.—The American Water Works & Electric Company has recently acquired the Monongahela Power & Railway Company, which operates in and near Fairmont, W. Va., and the Potomac Public Service Company of Martinsburg, W. Va. Stock purchases were made through the West Penn Company. The acquisition of these two properties adds about $8,250,000 to the gross earnings of the American company.

Utilities Had Fifty-three-Day Coal Supply on June 15.—A canvass of the coal stocks of the electrical and artificial gas public utilities as of June 15 shows an average of fifty-three days supply on hand, according to a recent announcement of F. R. Wadleigh, Chief of the Coal Division of the Department of Commerce. Also many utilities are receiving current supply from non-union production and, in the opinion of Mr. Wadleigh, utility stocks will last from twelve to fifteen weeks.

Promoting Industrial Research.—To arouse national interest in industrial research, Alfred D. Flinn, secretary of the Engineering Foundation and chairman of the division of engineering of the National Research Council, is on a tour of several weeks to the Pacific Coast. Mr. Flinn goes as the emissary of organized research to enlist the aid of engineers of the Far West in a nation-wide plan of industrial research in which the Engineering Foundation, the National Research Council, government departments and the industries will link their efforts. In addition to explaining the purposes of the Engineering Foundation and the National Research Council to the engineers of the West, he will deal with "The Engineer and World Problems," dwelling on the appeal of Dr. B. Stepanek, Minister at Washington of the Czechoslovak Republic, for the establishment in central Europe of "a great American university and library as a center from which could be given out the best products of American culture and which would be a source of correct information about America and American ideas."

Receivership to Be Vacated Soon.—Readjustment of the affairs of the subsidiaries of the former American Cities Company, now controlled by the National Power & Light Company, has progressed so satisfactorily that vacation of the receiverships for the Memphis Gas & Electric, Memphis Street Railway and the Birmingham Railway Light & Power Companies is expected before the end of 1922, and possibly within three months in the case of two former companies. The remaining concerns which were in the original combination and later taken over by the National Power & Light, Little Rock Railway & Electric Knoxville Railway & Light and the Houston Lighting and Power companies are reported to be in excellent financial conditions, while their physical properties are said to be in a high state of efficiency.

Mountain States to Buy Power from California - Oregon. — The Mountain States Power Company has completed arrangements with the California-Oregon Power Company for the purchase of a large block of hydro-electric power—12,000 kw.—for distribution among its customers in the Willamette Valley, Oregon. Under the terms of the contract the California-Oregon Power Company is constructing a 115-mile transmission line to connect its hydro-electric plant at Prospect, Ore., on the Rogue River with the Mountain States Power Company's substation at Springfield, Ore. The line, which will be operated at 110,000 volts, will cross the foothills of the Siskiyou Mountains.

German Hydro-Electric Development Again Attracts Notice.—Owing to the internal industrial stiuation, it is interesting to see how Germany's power requirements are being increasingly met by the use of water and lignite. In 1913, says the London *Electrician*, about 75 per cent of the whole of the electricity supply was produced by ordinary coal, water power and brown coal (lignite) accounting for about 15 per cent of the remainder. It is now stated that only about 15 per cent of black coal is used, the proportion of lignite having increased to nearly 35 per cent. The annual production of lignite in Germany was 11,635,000 tons in 1920, that of black coal being 131,428,000 tons. In eight or ten years it is calculated that, by an extension of existing hydro-electric stations, together with new water-power projects, it will be possible to generate 50 per cent of the whole of the power required for industrial and private uses and for traction by means of water power alone. In Bavaria and the South German States hydro-electric developments will enable the use of ordinary coal for industrial work to be almost entirely dispensed with and make possible the electrification of the whole of the railways of South Germany.

Sunbury, Pa., Celebrates an Electrical Anniversary.—A bronze tablet was dedicated to Thomas A. Edison at Sunbury, Pa., on July 3 in connection with a sesqui-centennial celebration. It was placed on the City Hotel, and the inscription is as follows: "This tablet commemorates the installation at Sunbury, Pa., of the first three-wire central incandescent electric lighting plant in the world, on the night of July 4, 1883. Thomas A. Edison, the creator of the incandescent lamp and inventor of numerous mechanical and electrical devices necessary for a complete system of electric light, heat and power, acting in a triple capacity of chief electrical engineer, mechanical expert and superintendent of construction, turned over to the Edison Electric Illuminating Company of Sunbury, Pa., a completed operating central-station electric plant. The City Hotel, then on this site, was the first building commercially wired for electricity."

Electricity on an Antipodean Farm.—An interesting example from Australia of the use of electricity in farming is condensed in the London *Electrician* from the *Industrial Australian.* A farmer in New South Wales has constructed a dam on a small creek near his farm and has erected a Pelton waterwheel giving 17 hp. with the water applied as at present through a 3-in. nozzle. This drives a direct-current dynamo of about 5 kw., which supplies energy for lighting and for fans and radiators in five houses on the farm and in the dairies and other outbuildings, while it also supplies power to a 5-hp. motor which operates a milking machine, sepatator, lathe grindstone, chaff-cutting, corn-shelling and bushnut-shelling machines. A sawmill for heavy work is driven directly by the Pelton wheel, the electrical plant being temporarily disconnected. A novel feature of the electrical installation is that no battery is used, the speed of the generator being regulated by means of wires extending from the farm to the Pelton wheel, a quarter of a mile away, and attached to the valves controlling the water supply to the wheel.

Signal Corps Gets Nearly Two Million.—An appropriation of $1,825,000 for telegraph and telephone systems of the army Signal Corps is now available under the War Department appropriation bill passed by Congress and approved by the President for the year which began July 1. For installation and replacement of electric light and power plants at seacoast fortifications in the United States $270,000 is made available; for maintenance and repair of searchlights and electric light and power equipment for seacoast fortifications, tools, electrical and other supplies $110,000; for like equipment at insular possessions $60,000, and for like equipment at the Panama Canal $40,000; for installation and replacement of electric light and power plants at Hawaiian defenses $120,000.

Louisville Utility Adds 20,000-Kva. Unit.—Construction work on the Waterside station of the Louisville Gas & Electric Company will be started immediately to make room for another 20,000-kva. unit. The demand for increased generating capacity is seen from the fact that the total connected load in 1914 was only 24,314 hp., whereas at the present time it is 64,046 hp., a gain of over 160 per cent. During the same period the number of customers increased 103 per cent. The kilowatt-hour output for the year to date is running 17 per cent greater than that of last year. This has been caused by a net gain for the first five months of 1922 of 4.266 hp. of motor load and 1,651 kw. of lighting load.

Tidewater Extends Lines.—Transmission lines of the Tidewater Power Company will be extended to Warsaw, N. C., a distance of 53 miles, according to announcement by Fred A. Matthes, executive vice-president of the company. Conferences with municipal authorities of the various towns to be covered by the extension have been called for this week. It is also announced that the line will probably be extended from Warsaw to Clinton, in the event the present venture is given the proper support. This is the first move in a development campaign around Wilmington, promised when the company was taken over last spring by the Fitkin interests of New York.

Associations and Societies

Michigan Electric Light Association to Hear John F. Gilchrist—Plans for the ninth annual convention of the Michigan Electric Light Association have developed sufficiently to give promise of one of the most important meetings in the history of the electrical industry in this state. The meeting will be held Aug. 21-23 at Ottawa Beach and inquiries already received by Secretary Herbert Silvester of Ann Arbor indicate a record attendance. John F. Gilchrist, vice-president of the Commonwealth Edison Company, Chicago, a national authority on public relation matters, will be one of the principal speakers at the banquet to be held on the evening of Aug. 22. Gov. A. J. Groesbeck has promised to attend the meeting, provided no important state matters intervene, and give the electric utility men his idea of how they can best serve Michigan.

Executive Committee of Waterpower Conference in Washington.—Gathering for the first time since the permanent organization was brought about in Asheville recently, the executive committee of the Southern Appalachian Waterpower Conference will meet in Washington, D. C., this week, Col. Joseph Hyde Pratt, president of the conference, announces. The purpose of the meeting in Washington at this time is to endeavor to secure the passage by Congress of an appropriation totaling $249,000 for a thorough investigation of the Tennessee River, including its headwaters in North Carolina. Necessary steps have been taken to publish in book form the entire proceedings of the Asheville conference.

Rocky Mountain Electrical Show.—Plans are being laid by the Rocky Mountain Electrical Co-operative League for a Rocky Mountain Electrical Exposition to be held at Bonneville Park, Salt Lake City, Utah, from Oct. 2 to 14. This league is composed of central stations, manufacturers, jobbers and contractor-dealers and will have the support of the electrical interests from six states. A "Regional" arch typifying the occasion will be designed by W. D'Arcy Ryan of the General Electric Company.

Engineers' Society of Milwaukee.—The following have been elected officers of this society for the ensuing year: President, Arthur Simon, Cutler-Hammer Manufacturing Company; vice-president, Fred H. Dorner; treasurer, A. Q. Dufour; secretary, Fred T. Goes.

Dallas Electrical Club.—Under the leadership of its president, Joe H. Gill, assistant general manager of the Dallas (Tex.) Power & Light Company, the Dallas Electrical Club has undertaken a general education campaign with the object of better acquainting all members of the club, which include nearly all the men in Dallas engaged in the electrical business, with the affairs of the chief electrical companies of the city. The Dallas Electrical Club has a membership of more than 300 and an average attendance at its Monday luncheons of nearly 200.

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Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

A. I. E. E., Pacific Coast Convention—Vancouver, B. C., Aug. 8-11.
Michigan Electric Light Association—Ottawa Beach, Aug. 21-23.
International Association of Municipal Electricians—New Bedford, Mass., Aug. 22-25.
N. E. L. A. Geographic Divisions — New England, New London, Conn., Sept. 5-8; Rocky Mountain, Glenwood Springs, Col., Sept. 18; Great Lakes, French Lick Springs, Ind., Sept. 28-30.
Association of Iron and Steel Electrical Engineers—Cleveland, Sept 11-15.
American Electrochemical Society — Montreal, Sept 21-23.
Illuminating Engineering Society — Boston, Sept. 25-28.
National Association of Railway and Utilities Commissioners—Detroit, Sept. 26.
Telephone Pioneers of America—Cleveland Sept. 29-30.
Rocky Mountain Electrical Co-operative League—Salt Lake City, Oct. 2-14.

Recent Court Decisions

Mercantile Establishment Demonstrating Machinery Must Guard Clerks from Injury.—In a suit brought by a clerk who was injured by having her hand caught in an electric washing machine she was demonstrating (Stoll vs. Frank Adam Electric Company) the trial court instructed the jury to find for the defendant, on the ground that mercantile establishments were not included in the law relating to the liability of employers for personal injuries sustained by those working for them in the course of their employment. This finding has been overruled and a new trial ordered by the St. Louis Court of Appeals, which finds "mercantile establishments" to be not only impliedly but specifically included. Contributory negligence was a question of fact for the jury. (240 S. W. 245.)*

Municipality Cannot Discontinue Commission Proceedings Which It Has Initiated to Acquire Plant.—The town of Milton, Wis., on Jan. 20, 1920, voted to purchase the water plant of the McGowan Water, Light & Power Company and petitioned the Wisconsin Railroad Commission to value it. Subsequently the commission was notified by the town officials to discontinue hearings, the voters having declared against the scheme. The company insisted on the proceedings being continued, and, on being enjoined, appealed to the Wisconsin Supreme Court, which has decided (Town of Milton vs. McGowan Water, Light & Power Company) that a municipality cannot discontinue proceedings instituted by it before the commission for the acquisition of a waterworks system where such proceedings were instituted by it after the act of 1917. (187 N. W. 661.)

Conditions Which Customer Seeking to Change Rate Must Fulfill.—The case of Duquesne Light Company vs. Public Service Commission involved a petition of the late H. C. Frick to the commission to order the Duquesne Light Company and the Allegheny County Steam Heating Company to discontinue discrimination in charges alleged to have been made against him. An order of the commission sustaining the complaint was reversed by the Superior Court and the complaint dismissed. This decree has now been affirmed by the Supreme Court of the state, which declares: (1) A consumer should not have been permitted to file a single complaint attacking separate tariffs of different corporations. (2) Where the consumer expressly stated he did not intend to introduce evidence of the value of the property of public utilities or the reasonableness of the rates, and the utilities thereafter offered evidence tending to show that the rates asked by the consumer would be confiscatory, to which evidence the consumer objected, it was a grave mistake for the commission not to rule on the admissibility of the evidence, since such evidence, unless rebutted, required a dismissal of the complaint. (3) the provision of the public service company law prohibiting rates which are unjust or unreasonable nevertheless permits the utilities to divide their customers into groups according to the purpose for which the service is needed and to subdivide the groups into classes according to quantity taken. (4) When a public utility files its tariff with the commission and the effective date of the tariff passes without objection being made, a presumption arises that the divisions and subdivisions of the customers therein are equitable. (5) Where a customer complains that a public utility is charging him a rate different from that specified in its tariffs on file with the commission, the commission can order the utility to charge only the prescribed rate without notice to any other customer and without considering whether the effect will be to reduce the utility's total revenue below that to which it is entitled. (6) Where the effect of sustaining a complaint would be to alter the tariff of rates on file with the commission, the complaining customer must show that the rates on file are unjust as to him, and also, if he elects to proceed with notice to the utility only, at least that the result of changing the schedule will not deprive the company of the revenue to which it is entitled. (7) When the change in a schedule demanded by a consumer would so reduce the utility's revenue as to be confiscatory, the commission should at once dismiss the complaint or should proceed to examine all the schedules of the utility after such notice to its other customers as is deemed requisite. (8) Special contracts between a public utillity and a consumer cannot, without defeating the purpose of the public service company law, have given to them the effect of continuing in force the rates therein prescribed or as giving the consumer a preference by putting him in a separate class so far as rate making is concerned. (117 At. 63.)

Failure of Power Company to Render Situation Safe as Soon as It Knew of Broken Wire Negligence per Se.—Affirming a verdict for the plaintiff in Kidd vs. Kansas City Light & Power Company, where damages were sought for injuries to an eleven-year-old boy who picked up the end of a broken transmission wire lying on the ground, the Kansas City Court of Appeals held that the company was guilty of negligence *per se* because after the breaking of the wire was registered on the instrument kept for that purpose it did not immediately shut off the current on that circuit but instead sent a man to make repairs, the live wire being permitted to remain on the ground for an hour. (239 S. W. 584.)

Commission Rulings

Duty of Municipal Plant to Serve Customers Outside City Limits.—The Wisconsin Railroad Commission held an investigation with respect to the discontinuance of electric service by the city of Manitowoc to three consumers outside the city limits. The evidence showed that service had originally been made to the parties through an intermediate line of another consumer, but this service had been discontinued and the line removed, the owner having contracted for service with the Lincoln Highway Light Company. The commission held that the city owed the three disconnected consumers service and recommended that it arrange with the Lincoln Highway Light Company to connect these patrons with its existing secondary circuit upon payment to the city of a specified line rental by the consumers, such rental to be billed with the regular consumption charge and turned over by the city to the Lincoln Highway Light Company. That company would secure additional revenue thereby without any appreciable additional expenditure, the city would adhere to its policy of avoiding the acquisition or maintenance of property outside of the city limits, and the complainants would secure service upon a more favorable basis than if they were obliged to construct and maintain a separate line.

Danger of Valuation at Cost of Reproduction New.—In its valuation of the property of the Virginia Railway & Power Company the State Corporation Commission of Virginia observed: "It may be that in the very near future regulatory bodies will be confronted with proposals from consumers to reduce rates by establishing reproduction values on a unit price level very much lower than that upon which large sums were invested during the high-price period for extensions and enlargements of utility property. It might happen that a valuation then reached on the strict reproduction theory would represent sums materially less than the amounts honestly and prudently invested in the public service. Perhaps, then, the theory of reproduction cost at the time service is given to the public will rise like Banquo's ghost to plague the dreams of utilities, commissions and courts." The commission adopted a plan whereby it began with 1920 property with 1914 prices (less 1914 land), deducting the additions between 1914 and 1920 at 1914 prices, thereby arriving at approximately the 1914 appraisal on 1914 inventory. This 1914 property, including overheads, was appreciated for seven years at 3 per cent compounded. There were then included the additions from 1914 through 1921 at actual cost.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Southwestern N.E.L.A. Elects E. H. Kifer President

The Southwestern Division of the N.E.L.A. has recently elected as president E. H. Kifer, vice-president and general manager of the San Antonio Public Service Company. Mr. Kifer has been prominent in association work for several years past. He was born in Lincoln, Neb., June 8, 1884, and was graduated from the University of Wisconsin in 1908 as an electrical engineer. Prior to graduation he had been employed by the Madison (Wis.) Gas & Electric Company, and upon graduation he continued with the same company, being appointed superintendent of the electrical department in 1910. In 1912 he was promoted to be general superintendent and held this position until 1916. In 1918 he was elected vice-president and general manager of the San Antonio (Tex.) Public Service Company, which position he still holds. Mr. Kifer was chairman of the Madison Section of the A.I.E.E. in 1915 and a member of the national membership committee of the N.E.L.A. in 1914.

E. H. KIFER

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G. E. Armstrong Enters Manufacturing Field

G. E. Armstrong, who has been the Pacific Coast editor of the *Electrical World* for the last two years, has resigned to become the representative in Los Angeles of the Garland Affolter Engineering Company, manufacturers' agent. Mr. Armstrong was a member of the 1914 class of the University of California, and upon leaving college he entered the employ of the Southern California Edison Company as assistant to the superintendent of generation. Later he was assistant superintendent of transmission and then protection engineer and assistant to the chief electrical engineer. Mr. Armstrong is widely known through his technical writings and his activities in the technical and other electrical societies. He has served on numerous committees of the A.I.E.E. and the Pacific Coast Electrical Association. For many years he has been a member and secretary of the technical committee of the latter association. Upon leaving the Southern California Edison Company he was associate editor of the *Journal of Electricity and Western Industry* until he joined the staff of the *Electrical World.*

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H. Carl Wolf Chief Engineer of Maryland Commission

The recent promotion of H. Carl Wolf to be chief engineer of the Public Service Commission of Maryland is a recognition of his service as assistant chief engineer. He received his training in electrical engineering at the University of Illinois, from which he was graduated in 1913, later receiving his master's degree and the professional degree of E. E. from the same institution. After serving as assistant engineer in the engineering department of the Illinois Public Utilities Commission, he took over the management of a public utility property in Illinois.

During the war Mr. Wolf played an active part, mostly abroad, as an officer in the Engineer Corps, first in designing electrical installations for the American Army and later as electrical engineer for the base section around Marseilles. When the American Peace Commission was engaged in the valuation of damage done by the Germans to the public utilities of France, Mr. Wolf was associated with the engineering department. Upon return to civil life he went into industrial engineering work with Griffenhagen & Associates, Ltd.

H. C. WOLF

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R. F. Pack New Fourth Vice-President N.E.L.A.

It seems only proper that after thirty-one years' experience in the electric light and power industry, during which time he has been intimately interested in the work of the national technical associations, Robert F. Pack should have been elected fourth vice-president of the National Electric Light Association at its recent convention held in Atlantic City. His becoming one of the official leaders of the association will bring into play an experience in association work which only a few men in the industry possess. Mr. Pack served as president of the Canadian Electrical Association in 1912, and while holding this office he was instrumental in bringing about the affiliation of the Canadian Electrical Association with the National Electric Light Association. He has, besides, been influential in his service to the industry in that he is an active member of the American Institute of Electrical Engineers. During the war he was appointed by the Governor of Minnesota to represent employers on the State Board of Arbitration, which consisted of three members.

R. F. PACK

Mr. Pack was born on the Isle of Wight, England, Oct. 1, 1874, and was intended for the British Navy. Before his education was completed, however, his parents moved to Canada, taking their son with them. He entered the service of the Toronto Electric Light Company in 1891 as office boy and had the unusual experience of filling nearly every position in the company, including that of general manager. His success as an executive attracted the attention of H. M. Byllesby & Company, who in 1912 made him general manager of the Minneapolis General Electric Company. In 1916 he was appointed vice-president and general manager of the Northern States Power Company, also a Byllesby subsidiary.

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Lunn Elected a Manager of the A. I. E. E.

Ernest Lunn, chief electrician of the Pullman Company, has been elected a manager of the American Institute of Electrical Engineers. Mr. Lunn was born in Greenville, Mich., June 23, 1874, and was graduated from the University of Michigan in 1899 as electrical engineer. Upon graduation he became connected with the Detroit Edison Company. In 1902 he went with the Commonwealth Edison Company as storage-battery engineer, serving in this position for twelve years except for seven months in 1910 when he was employed by the Firestone Tire & Rubber Company of Akron, Ohio. Mr. Lunn has been connected with the Pullman Company since 1914 as chief electrician. From 1903 to 1914 he was successively secretary-treasurer, vice-president and general manager and president of the Walker Vehicle Company of Chicago. He is a member of a number of national technical societies.

ERNEST LUNN

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Harry H. Martin, vice-president of the Bankers' Trust Company, has been elected to the directorate of the International Radio Corporation.

F. D. Mahoney, for several years commercial manager of the Alabama Power Company, has resigned to accept the vice-presidency of the Western Pennsylvania Electric Company, with headquarters at Pittsburgh. He leaves at once to begin his new duties.

F. A. Nobbe has been presented with a silver service by the Louisville Gas & Electric Company in recognition of his record of fifty years' continuous service with that company. His first position was with the Louisville Gas Company, a predecessor of the present company, and is at present assistant secretary and assistant treasurer.

A. M. Perry, engineering editor of the *Electrical World*, has been elected a manager of the New York Section of the Illuminating Engineering Society for the fiscal year beginning Oct. 1, 1922.

Thomas A. Edison was recently honored by Rutgers College, New Brunswick, N. J., at its one hundred and fifty-sixth annual commencement. Mr. Edison was given the degree of doctor of science, not bachelor of science, as was announced in the July 1 issue of the *Electrical World*.

Frederick J. Dunn has been elected president of the Gardner Electric Light Company, Gardner, Mass. Mr. Dunn was at one time judge of the First District Court of Massachusetts, resigning to go to Worcester, where he became identified with the Connecticut River Power & Transmission Company. He succeeds his father, Thatcher B. Dunn, who at the time of his death was president of the Gardner Electric Light Company.

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Arkwright Member Executive Committee N. E. L. A.

P. S. Arkwright was elected a member-at-large on the executive committee of the National Electric Light Association at its recent convention in Atlantic City. Mr. Arkwright brings a wide executive experience to the association by reason of his twenty years' presidency of the Georgia Railway & Power Company. He was born in Savannah, Ga., in 1871, and was graduated from the University of Georgia in 1890 with the degree of B.Ph., and also from the University of Georgia Law School in 1891 with the degree of LL.B. Mr. Arkwright practiced law in Atlanta from July, 1891, to January, 1902. At the latter date he was elected president of the Georgia Railway & Electric Company on its organization. He continued in this capacity until about March, 1912, when the property of this company was leased to the Georgia Railway & Power Company.

P. S. ARKWRIGHT

Barrows Made a Vice-Chairman Public Relations Section, N.E.L.A.

Edwin A. Barrows was elected a vice-chairman of the Public Relations section of the National Electric Light Association at its recent convention in Atlantic City. Mr. Barrows is unusually well qualified for this executive position with the association by reason of his thirty-two years' experience in relations with the financial and general public. He was born and educated in Providence, R. I., and was graduated from Brown University in 1891. His business training was acquired with the Rhode Island Hospital Trust Company, with which he became identified shortly after graduation. In 1902 he severed his connections with the trust company to become national bank examiner for the districts of Rhode Island and Connecticut. From this appointment he resigned in 1904 to become secretary-treasurer of the Narragansett Electric Lighting Company. In 1915 he was elected vice-president and in January, 1916, president.

E. A. BARROWS

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R. E. Fisher, vice-president in charge of the sales of the Pacific Gas & Electric Company, has been nominated to the board of directors of the California Development Association.

A. Emory Wishon, general manager of the San Joaquin Light & Power Corporation, Fresno, Cal., has been nominated to the board of directors of the California Development Association.

Sumner R. Keyes, for the last eleven years head of the standardizing division, department of standardizing and testing, Edison Electric Illuminating Company of Boston, has been appointed assistant superintendent of the purchasing department of that company.

Brig.-Gen. John J. Carty, vice-president of the American Telephone & Telegraph Company, received the honorary degree of doctor of engineering from New York University at its graduation exercises held June 6. This is a very unusual degree and is conferred for only unusually meritorious services.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

The Jobber's Territory—What Should It Be?

Suggesting a Basis for Calculating How Far the Salesman Should Be Sent—A Matter of Financial Capacity

By O. Fred Rost
General Manager Newark Electric Supply Company, Newark, N. J.

THE most common mistake we make today in the jobbing business is probably trying to serve too great a territory. We send our men out through the neighboring states to get business. We route their trips to towns where we believe they can get orders. That is the point of view from which we do our planning. We forget entirely that what they should be doing is adequately covering the population that we can efficiently and profitably serve. For there must be some limit to the area that an organization should travel. Beyond a certain point the expense is too great to make it pay. What is this limit for each one of us?

Per Capita Ratio

When I became manager of this supply house seven years ago, our men were traveling into New York State, Connecticut, one-half the State of Pennsylvania and all New Jersey. The fact that Philadelphia and New York City jobbers can naturally serve parts of this area far more economically than a house in Newark had been disregarded.

It seemed to me that the first thing was to decide how great a population we could afford to serve, and as the result of experiments covering a period of years, I finally arrived at this conclusion—that a jobber, to ascertain the territory in which he can perform his function economically, should map out an area which has a population about the equal of his gross annual sales in dollars.

This simply means that if he desires to restrict his territory without material loss in the volume of business and he does now a $250,000 business, he should make his territory embrace approximately a 250,000 population. If his sales total $500,000, he should not try to cover much more than a 500,000 population.

Coming back to our own experience: We proceeded to reduce our territory to northern New Jersey, the area that we could serve at least as quickly, easily and economically as anybody else. Our salesmen all cover their districts in Ford coupes and sleep at home. Only one man has to be gone several days at a time. This extreme concentration, of course, is made possible by exceptional conditions, and it is impossible to many jobbers because of less density of population in the respective territories. But the principle of using per capita ratio as a guide to determine the territory upon which to concentrate applies to every one.

O. F. ROST

Too Much Waste Time

The average jobber's salesman travels too far. He spends too much of his time on trains and street cars. He goes to too many towns because he "wants to take care of" perhaps one good customer, whereas he might better stay right where he was and work to make good customers out of the other prospects who are not buying. He can only get orders by calling on people. While he rides, he sells nothing. His capacity to call is limited by the hours of the day. Therefore he should sell the greatest possible number who are located conveniently near his shipping point.

Take a jobbing house that travels six states and does a million dollars worth of business annually. Let them cut down to the most easily served surrounding territory of about a million population. Let them spend the same money and effort, the same number of salesmen calling oftener on more customers, the same advertising appropriation concentrated on the smaller list. By the end of the year they would have made more money and more easily.

How to Go About It

The jobber in the smaller city, with his towns more scattered, does not serve so large a population but his need to concentrate on the population that he can economically serve is even greater. It will pay him to study his map and find out what area will provide the population that he can afford to serve on the one dollar per capita per year ratio to his present volume of business. Then let him reshape his salesmen's districts so that instead of their spending half their time traveling *to* their customers they can spend more time *with* them. The results will be surprising.

The salesmen will not so constantly be hurrying off to catch trains and will be able to serve their customers in more of the little ways that in the past they have had to neglect—little ways that make closer friends and develop more dependence on the jobber. The manager can keep in closer touch with what his men are doing and is in closer contact with his customers. Deliveries will be quicker, collections will be easier, traveling expenses will be less and salesmen will like it better because they can sell more goods with less hardship.

In normal times a successful jobber will double his business every four years. The expansion of the industry, the growth of population, the increasing use of electricity, and, of course, particularly his own effort, will bring a 25 per cent gain each year unless he is slipping somewhere. But he cannot do this if he tries to cover a greater territory than he can economically serve. Also, every jobber owes the industry a degree of service. If he cannot serve some territory as well or better than anybody else, he has no right to exist. But that area in which he can function efficiently and economically is his *natural* territory and he should work here extensively.

The one dollar per capita basis of determining at the outset a jobber's natural territory will prove quite satisfactory. But, of course, this does not mean that a territory will produce only one dollar per capita per year for each jobber. For instance, in our territory are located three real jobbers and twenty others who claim to be jobbers. Yet, we are making better than our one dollar per capita ratio. I figure the dollar per capita merely as the limit beyond which a jobber should not extend his territory at the time when he decides to confine operations to his *natural* territory and makes restriction of territory effective.

FINANCIAL CAPACITY

The important point is, that a jobber should know how much territory his financial and other capacities enable him to cover economically and effectively, and then restrict himself to that. Then he can employ his financial capacity to the utmost advantage, and gain the greatest possible reward from operations within the natural boundaries of his activities.

Poaching upon the other fellow's rightful field generally involves extraordinary expenditures in time and effort. A careful study will prove to any jobber that most business taken outside of his natural territory adds nothing to his assets but materially increases his liabilities. It does not pay any business to try to live beyond its income.

Importation and Progress in Scientific Instrument Development

BY JAMES BIDDLE
Biddle & Company, Philadelphia, Pa.

THE tariff bill—designated H. R. 7456—now before our Senate in Washington may well be of concern to users of scientific instruments because of the high rates of duty proposed. Under the present Democratic tariff, which became effective in 1913, the ad valorem rate for scientific instruments in general is 20 per cent, and also there is provision for duty-free importations by universities, colleges and schools.

The Payne-Aldrich act, which prevailed prior to 1913, imposed a duty of 45 per cent on scientific instruments but also allowed for duty-free importations for educational purposes.

By comparison it is rather significant that the ad valorem rate in H. R. 7456 has been put at 55 per cent, and also the time-honored practice of permitting educational institutions to import on a duty-free basis has been omitted. Consequently, as compared with both present and past tariffs, the proposed rate for scientific instruments is much increased, while those who have occasion to use them for educational purposes will have to pay more than "half as much again."

It is claimed that the scientific instrument business is a "key industry" and that the United States was seriously handicapped during the late war because of not manufacturing devices that were absolutely essential and which we had been in the practice of obtaining from abroad. To avoid such an embarrassment in the future we are told that a high rate of duty must be imposed, to encourage the development and manufacture of such apparatus in the United States.

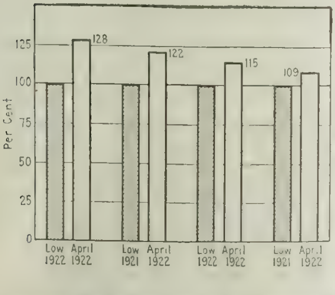
NON-COMPETITIVE METERS

As opposed to this idea, I would submit the unmistakable fact that there is a great variety of scientific instruments now made abroad, in comparatively small quantities, noncompetitive with goods of American manufacture, and for which the demand is so limited as not to invite production here. In such cases, whatever tariff is levied becomes the equivalent of a tax and affords no real "protection."

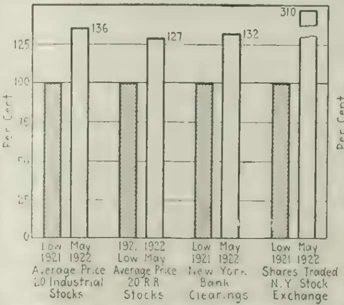
Whenever, as a business proposition, it is worth while to do so, and especially when there is need for quantity production, we have ample evidence that American instrument makers can compete with the civilized world, irrespective of the tariff rates.

A notable instance is the line of superior electrical measuring instruments devised by Dr. Weston more than thirty years ago, and in con-

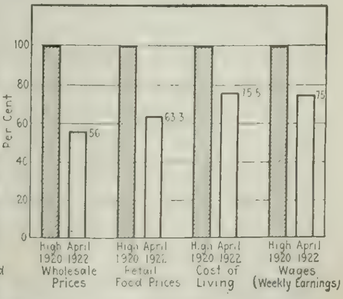
Charts Show General Business Conditions Throughout the Country



INCREASE IN VOLUME OF TRADE COMPARED TO LOW POINTS OF 1921 AND 1922. LOW, 1921 OR 1922, EQUALS 100



REVIVAL IN THE SECURITY MARKETS, 1921 LOW EQUALS 100



DECLINE IN PRICES AND WAGES 1920 TO 1922. 1920 HIGH EQUALS 100

(Figures in the above charts were compiled by the *Chemical Bulletin*) nection with the sale of which I believe the makers have never been disturbed by competition from abroad, even in the face of possible duty-free importations by universities and colleges.

As another illustration I would mention X-ray tubes, which, in so far as concerns manufacturing skill. are rather peculiarly a German product. To-day "Coolidge" tubes are produced in Schenectady and sold everywhere at prices which entirely ignore competition. Probably they would find just as ready a market in the United States if X-ray tubes of foreign makes were admitted without duty, because the "Coolidge" article is in a class by itself as to results in service.

Pyrometric instruments are another example of what I have in mind. They have been developed so highly in the United States as to fear nothing from foreign competition, whatever rate of duty might be determined for them.

It is my opinion, therefore, we can afford to have the business of manufacturing scientific instruments placed in such a position that success will depend upon design, quality of workmanship and performance, rather than upon price. It has been demonstrated abundantly that our engineering scientists can accomplish almost any task which warrants their attention, and I am confident that no benefit commensurate with the possible burden will follow the placing of a high tariff on instruments made abroad, or by prohibiting duty-free importations on behalf of educational institutions.

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Summary of Reports from 71 Telephone Companies Issued

Summary of reports of seventy-one large telephone companies for the month of April of this year has been compiled by the Interstate Commerce Commission. This summary includes companies having annual operating revenues in excess of $250,000. The table of the commission shows that at the end of April, 1922, 10,004,799 company stations were in operation in comparison to 9,536,427 at the end of the same month in 1921. This shows an increase of 468,372 company stations.

Revenues for April were: Subscribers' station revenues, $31,190,047; public pay station revenues, $2,184,795; miscellaneous exchange service revenues, $404,448; message tolls, $11,930,045: miscellaneous toll line revenues, $1,339,209; sundry miscellaneous revenues, $791,258; licensee revenue, Cr., $1,709,854 and licensee revenue, Dr., $1,707,013. Total of these telephone operating revenues amounts to $47,842,643.

Expenses were: Depreciation of plants and equipment, $7,028,041; all other maintenances, $6,658,375; traffic expenses $13,149,772; commercial expenses, $4,412,505; general and miscellaneous expenses, $2,334,466, and telephone operating expenses, $33,583,159.

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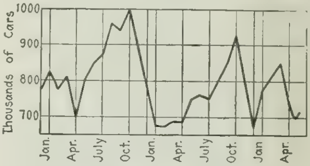
Freight Cars Loaded Last Week Totaled 877,856

Cars loaded with revenue freight in the week ended June 24 totaled 877,856, according to reports received by the American Railway Association. This represented a gain of 17,084 cars over the preceding week, and the total of the latter period was the largest reported since October 22, 1921.

As compared with the preceding week, loadings of all classes of freight increased with the exception of grain and grain products, which dropped only 922 cars. Ore shipments totaling 64,284 cars represented an increase of 10,462 cars over the previous week, while gains of 4,824 and 1,584 cars, respectively, were recorded in coal and merchandise freight.



Freight Cars Loaded During 1921 and 1922

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Collections in Atlanta Section Improve

Electrical Jobbers in the Atlanta, Ga., section report collections as considerably improved, though credit is extended with even greater caution, due to the number of small electrical dealers springing up over night, particularly since the radio has come into such popularity. Commercial failures in the Sixth Federal Reserve District in May were substantially smaller, both in number and in total of liabilities, than during April, and liabilities less, though the number was larger, than during May last year.

Says Radio Slump Is Boon to Entire Industry

"The present slump in the radio business during the summer months is a boon to the entire industry," declares Joseph D. R. Freed, president of the Freed-Eisemann Radio Corporation. "Both the radio dealers and the more stable and serious radio manufacturers are learning a well-needed lesson from this slump."

"For example," continued Mr. Freed, "dealers are beginning only now to realize the truth of the fact that they cannot afford to carry a large and heterogeneous lot of odds and ends in radio apparatus in the hopes that they will be able to dispose of it. They are learning now, by a stern process, that hysterical overstocking of apparatus in an effort to meet the spasmodic demand is not going to prove profitable in the long run.

"Manufacturers, too, are learning their lesson from this slump. They are learning now, if they didn't know it before, that in order to sell radio apparatus, they must give good value, serviceable merchandise, attractive prices and real service and dealer cooperation. Competition is very keen and hitherto there has been too little of this healthy form of competition."

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Failures Show Decided Decrease in Number

The decrease in the number of failures reported for last week is greater than would seem to be explainable by the five-day business week in the United States, due to the observance of the Fourth of July.

The number of defaults reported to R. G. Dun & Company this week totaled 306, compared with 364 for the previous week: the figure for the corresponding week a year ago was 290.

As against 7,517 defaults for $218,012,365 of indebtedness during the first quarter of this year, the second quarter's reports disclose 5,867 insolvencies for $155,703,973, exclusive of banking and other fiduciary suspensions. Thus, the statistics for the latest period reveal a decline of about 22 per cent in number of failures and a contraction of more than 28 per cent in amount of liabilities from those of the first three months of the present year, and the June defaults, 1,740 in number, mark the smallest monthly total which has occurred since last October.

Active Demand and Low Stocks Cause Conduit Advance

Active demand and depleted stocks brought on by heavy summer construction have caused general price advances in the conduit market in important centers of the country during the past week. The average decrease of two points in the discount lists amounts to about a 4 per cent advance in quotations.

In the New York district a majority of jobbers report excellent sales. Shipments for the last two weeks have been normal, and no fears of depleted stocks have been heard. In Chicago, the ½-in. black pipe sells for $45 per 1,000 ft. in 5,000-ft. lots. Active demand with low stocks and slow shipments is causing some anxiety in this market. In Atlanta a price advance of two points has not caused any let-up in demand, all jobbers reporting strong sales.

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Apparatus Manufacturing in England Decreased

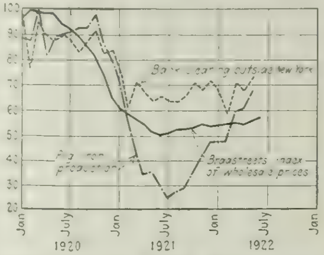
Simultaneously with the diminishing of activities in industry generally, the manufacture of electrical apparatus in Great Britain experienced a gradual slowing down from the middle of 1920 until the end of the year 1921, according to reports recently issued by the Department of Commerce. At the same time, work was going forward step by step in the development of plans for the future electrification of Great Britain industrially and domestically, with particular attention paid to railroad electrification.

The 1920 production of electrical machinery and apparatus, exclusive of telephone apparatus, but including all types of cable, was in quantity about the same as that produced in 1913, but the values were increased 100 per cent, 1913 production totaling about £22,500,000 and 1920 about £45,000,000. Approximately 33⅓ per cent of these goods was exported. A rough division of the 1920 total production indicates that 45 per cent was made up of machinery (including small motors), 35 per cent of cables and 20 per cent of supplies and accessories. In 1921 the total production dropped to £35,000,000, of which £18,000,000 worth was for export. Machinery production suffered the larger part of this drop, the business in cables being quite well maintained by overseas trade and the production of lamps continuing on a fair scale because of domestic demand.

◆

Bank Clearings Continue to Show Gains Over 1921

Returns of bank clearings this week are for five business days only, owing to the holiday. The statistics for twenty cities in the United States, as reported to *Dun's Review*, show an aggregate of $6,520,252,000, which is 11.6 per cent in excess of the $5,842,802,612 of the corresponding period of 1921.



BANK CLEARINGS, OUTSIDE NEW YORK, PIG IRON PRODUCTION AND BRADSTREET'S INDEX OF WHOLESALE PRICES ARE SHOWN IN THE ABOVE CHARTS

Average daily bank clearings for July to date and for preceding months are given here for three years.

	1922	1921	1920
July	$1,304,050,000	$1,168,560,000	$1,321,932,000
June	1,155,786,000	990,131,000	1,279,333,000
May	1,143,911,000	982,676,000	1,331,217,000
Apr.	1,115,478,000	957,996,000	1,321,113,000
Mar.	1,042,360,000	975,088,000	1,321,007,000
Feb.	1,052,112,000	1,060,726,000	1,322,870,000
Jan.	1,087,235,000	1,190,774,000	1,374,249,000
	1921	1920	1919
Dec.	1,095,600,000	1,255,276,000	1,409,930,000
Nov.	1,091,856,000	1,291,574,000	1,444,048,000
Oct.	1,070,232,000	1,343,698,000	1,392,663,000
Sept.	969,200,000	1,214,388,000	1,351,396,000
Aug.	877,464,000	1,135,201,000	1,192,969,000

◆

Prohibit Radio Apparatus Sales in Constantinople

The Department of Commerce is advised that the President of the Allied Police Commission at Constantinople has published a notice prohibiting the sale of wireless apparatus in Constantinople and in the zone of Allied military occupation. The notice permits the sale of wireless apparatus outside of the zone occupied by the Allies, but requires firms wishing to make such a sale to obtain permission from Headquarters, Allied Police Commission, Constantinople, before making delivery of the goods, giving the name and full particulars concerning the buyer and of the destination of their apparatus.

According to Consul Harold D. Clum, of Santiago, Cuba, there is an increasing interest in that city in radio telegraphy and telephony, and it is intended to install a broadcasting station powerful enough to be heard in every town in Oriente Province.

The majority of receiving stations now in use have been constructed by amateurs or assembled from parts obtained from the United States, but as American firms are oversold, much difficulty has been experienced in getting deliveries on orders placed in this country.

The proximity of Cuba to the broadcasting facilities of the United States adds to the possibilities for developing a market there for radio sets.

◆

Metal Market Situation

Much improvement in the copper market was noted during the past week. Good tonnage of electrolytic has also been sold for September delivery at 14 cents, showing the strong price to apply generally. Price of lake copper for domestic shipment is 14 to 14⅛ cents a pound delivered for July, August and September.

June sales of copper, foreign and domestic, are estimated at around 140,000,000 lb. by men in close touch with the industry. This compares with 200,000,000 to 210,000,000 lb. sold in May, and 140,000,000 in April. It is estimated that foreign sales by Copper Export Association and independents totaled between 60,000,000 and 70,000,000 lb., or slightly under half of the business for the month.

Sales for the second quarter of 1922 totaled 480,000,000 lb., it is estimated, or at the average rate of 160,000,000 lb. a month, compared with 350,000,000 lb. for the first quarter, or an average rate of about 115,000,000 lb.

Price table follows:

NEW YORK METAL MARKET PRICES

Copper	July 5, 1922	July 12, 1922
London, standard spot	£ s. d. 63 2 6	£ s. d. 63 2 6
	Cents per Pound	Cents per Pound
Prime Lake	13.87½	14.00
Electrolytic	13.75	13.87½–14.00
Casting	13.25	13.35
Lead, Am. S. & R. price	5.75	5.75
Antimony	5.05	5.05
Nickel, ingot	36.00	36.00
Zinc, spot	5.45	5.50
Tin, straits	31.50	31.37½
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	10.50–11.00	10.50–11.00
Brass, heavy	5.50– 5.75	5.50– 5.75
Brass, light	4.87½–5.00	4.87½–5.00
Lead, heavy	4.62½–4.65	4.62½–4.65
Zinc, old scrap	2.87½–3.00	2.87½–3.00

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

SALES of electrical materials to industrial and manufacturing plants are steadily increasing, reports from all over the United States indicate. Conduit prices advanced about 4 per cent during the past week. Transformer sales for customer substations are reported excellent. Fan sales have fallen off greatly and jobbers report very light demand for this time of the summer. Some manufacturers of outlet boxes have announced an increase in prices from 15 to 16 per cent. Despite the summer lull and poor static conditions, radio equipment business is holding up well in most sections. Cable and wire demand maintains strength and deliveries are becoming longer, three months being required on certain grade of high tension cable orders in the St. Louis district. Dealers report a better demand for cleaners and washers and more response to sales initiative. A steady call for good grades of lighting fixtures continues due to the large construction programs. The industrial lighting market, a trifle sluggish at this time, is expected to become active in a few months. Floor lamps moved slowly last week.

New York

Industrial Business on Increase—Conduit and Outlet Boxes Higher—Fan Sales Slow

Conditions in the electrical trade this week remain at about the same levels as last noted, although in some quarters there is perhaps slightly less activity. To offset this, however, are the reports by jobbers that their sales to industrial and manufacturing plants are steadily increasing. Jobbers specializing in that class of business are particularly encouraged by the way their sales have held up for the past month or six weeks. One jobber stated that his June sales were the largest in the history of his business and sales so far this month are showing up equally as well.

Prices generally are unsettled. Quotations on flexible armored conductor are easier, while conduit manufacturers have advanced the price of pipe about 4 per cent. An increase in outlet boxes has also been announced. Stocks are in good shape.

Rigid Conduit.—Manufacturers have announced an increase in the price of pipe. Card No. 51, decreasing the discount by two points, became effective July 5. This is an increase of approximately 4 per cent. Under the new schedule quotations are as follows: For ½-in. black pipe in 2,500-ft. lots, $47.94; ¾-in., $61.41, and 1-in. $87.38 per 1,000 ft. Quotations on galvanized pipe in the same sizes and quantities are $53.04, $68.31 and $97.58 per 1,000 ft. Not all jobbers have made these prices effective as yet.

Rubber-Covered Wire. — Quotations remain unchanged. No. 14, two-wire, single-braid sells for $6.25 to $6.50 per 1,000 ft. in 5,000-ft. lots. Demand is fair and jobbers are inclined to hold their stocks, apparently in expectation of a better market.

Flexible Armored Conductor.—Sales are good and most jobbers' stocks are ample to large. A good deal of business is being done on competitive prices, and quotations show considerable variation. Two-wire, single strip is quoted from $41.50 to $43 per 1,000 ft., and double-strip from $44 to $47 per 1,000 ft. for that quantity.

Outlet Boxes.—Effective July 15 some manufacturers have announced new list prices on boxes increasing the price between 15 and 16 per cent.

Fans.—Sales have fallen off sharply and jobbers report a very light demand at this time.

Chicago

Conduit Prices Advance, Stocks Lower—High Tension Business Active—Cleaner Demand Improving

The electrical trade is steady and prices on wiring materials have strengthened due to increased steel costs and uncertainties arising from the coal strike. Business in high-tension poletop switches and farm-light equipment is active. Home lighting fixtures of better grades are favored by the buying public. Demand for industrial lighting fixtures has not fully developed. Action on heating appliances is unaffected by recent price change. Sales efforts on cleaners and washers are producing better results since people seem more open for this type of merchandise.

Conduit.—Price of conduit has advanced. The ½-in. black pipe now sells for $45 per 1,000 ft. in 5,000-ft. lots. An active demand together with low stocks and slow shipments from manufacturers is creating some anxiety in this market.

Flexible Armored Conductor.—Movement has been steady without any pronounced sales. No. 14, two-wire, single-strip in 5,000-ft. lots still sells for $42.50. Stocks are ample.

Wire.—Rubber-covered wire is gradually strengthening although the No. 14 is still available in 5,000-ft. lots for about $6.25 per 1,000 ft. Stocks are fair. Bare and weatherproof wire ranges around 16¾ cents per pound, but demand is rather sluggish.

High-Tension Equipment. — Orders for two 44,000-volt, 2,400-kva., steel tower outdoor substations for the South and six 2,200-volt, 500-kva. substations for the Northwest were received by one company. This company reports a 32 per cent increase in June business over that of June, 1921. Another firm sold twelve 37,000-volt lightning arresters to a utility in California.

Fixtures.—Call for good grades of home lighting fixtures is steady due to activity in building industry. Action on industrial lighting, while a little sluggish, is expected to become active in the fall. Floor lamps are moving slowly.

Fans.—Cool weather has hindered active trade in fans. All dealers are well supplied with stocks.

Cleaners and Washers.—Dealers report action picking up and more response to sales initiative than previously. One dealer reports his sales are ahead of last year's. Cleaners are moving best.

Boston

Ranges and Electric Refrigerating Plants Orders Active—Lamp Demand Reported Unusually Good

Electrical apparatus makers report better business, the payroll of one large plant near Boston has been increased to 9,000 employees, the 1920 peak being about 13,000. Ranges and electric refrigerating plants are moving actively. Prices are stiffening somewhat on rigid conduit and flexible armored conductor.

Refrigerating Machines. — Active sales are reported, recent orders covering about 70 outfits for Boston apartment houses.

Lamps.—Manufacturers' stocks are being built up to meet the anticipated heavy fall business. Trade is unusually good for this season, dominant sales covering 25, 40 and 50-watt ratings. Prices steady.

Wire.—Bare copper wire is very dull, but weatherproof is moving faster, central-station buying on a 16.5-cent base featuring the market. Rubber-covered wire is moving slower around $6.25 per 1,000 ft. in 5,000-ft. lots. Sharp competition prevails.

Ranges.—Twenty-one ranges have been sold for apartment service by a Boston distributer on a single order. Deliveries are excellent and interest in this class of equipment is increasing. Vigorous competition in bids is apparent.

Sockets.—A steady demand is being served from stocks, easily meeting the current requirements. In case lots, pull sockets sell at 32 cents each, keys moving at 18½ cents and keyless at 17 cents.

Magneto Sets and Motor Starters.—Business is improving in this line, notwithstanding a somewhat spotty automobile trade. One factory reports monthly gross earnings at $900,000 compared with $476,000 in February. Sales for farm tractor equipment are fairly good.

Flexible Armored Conductor.—Buying is active for new building construction and stocks are in excellent shape. Single-strip No. 14 quotes $60 per 1,000 ft. on less than coil lots and $44.20 per 1,000 ft. in lots of 1,000 ft. or more. Corresponding double-strip prices are $65, $55 and $48.

Appliances.—Electric irons are moving exceptionally well in the retail trade. Toasters are in fair demand and washers are moving better than of late in cases where vigorous sales effort is being applied. The demand for electric radiators for summer homes is dull and fan sales are sluggish on account of adverse weather.

Atlanta

Industrial Motors Market Slow—Panel Boards in Good Demand—Oil Switches Dull

Considerable irregularity is to be noted in conditions in the Southeast, but the general opinion seems to be that progress is being made toward normalcy. Electrical jobbers report their line as steadily improving, with an excellent business being done in fans and wiring materials. Weather conditions are excellent for the picking of the peach crop and shipments are going forward in large quantities.

Building activity in this section shows no signs of lagging, most of the cities reporting substantial increases in the number of permits.

Portable Drills.—As was expected, the increased activity in the automobile trade is being reflected in the movement of this specialty, jobbers in this section reporting the movement as good. Very satisfactory stocks are on hand and no recent price changes are reported.

Industrial Motors.—This line shows up as rather slow, though the number of inquiries is satisfactory. Stocks of the standard lines are in good shape and all shipments satisfactory.

Panelboards.—The continued building activity has created an excellent demand for the specialty, one of the largest jobbers reporting his stocks entirely depleted. No changes in prices are reported and shipments are good.

Fuses.—As expected at this time of the year, this line is showing up only fair. Jobbers' stocks are in good shape and shipments satisfactory.

Radio Equipment.—Despite the summer lull, this line is holding up in a desirable manner.

Oil Switches.—The dullness in the movement of industrial motors is reflected in this line, jobbers reporting only a fair number of orders, though a brisker movement is anticipated within the next thirty to sixty days.

Porcelain.—Jobbers report this line slow, with ample stocks on hand. Representative prices are: Nail-it knobs, $18 per 1,000; split knobs, $12 per 1,000; unglazed cleats, $13 per 1,000; tubes, 5/16 in. x 3 in., $5.60 per 1,000 in barrel lots.

Conduit.—A price advance of 2 points has not tended to slacken the movement in this line, all jobbers reporting excellent sales. Recent shipments have brought stocks up to normal.

St. Louis

Cable Demand Is Strong—Transformer Sales Exceptionally Good—Socket Market Better with Stocks Ample

Increased construction activity is shown in building permits for June, which amounted to $2,436,755, as compared with $2,396,880 for May and with $2,150,069 for June of last year. Industrial construction is becoming more important. Consumption of electric current for June is reported by Union Electric Light & Power Company to be 16 per cent heavier than for June of last year, occasioned principally by increased industrial usage.

Agricultural conditions continue good, except that the wheat being harvested indicates that the yield may be less than heretofore estimated, and recent rains have tended to injure the cotton crop.

Transformers.—Sales of equipment for customer substations were exceptionally good last week. Distribution transformers are selling in better amounts throughout the entire territory.

Cable and Wire.—Cable demand maintains strength and deliveries are becoming longer, three months being required on certain grades of high tension cables. No. 14 rubber-covered wire is quite active at $6 to $6.25 per 1,000 ft. The industrials are entering the market for the larger sizes of rubber-covered, on which representative prices are: No. 12, $9.75 per 1,000 ft.; No. 10, $12.50 per 1,000 ft., and No. 8, $15.74 per 1,000 ft.

Sockets.—Demand for the week was off because of the holidays, but average daily sales show improvement as the new houses of this season near completion. Stocks are conservative but complete. Representative prices are: Key, $18.15 per 100; keyless, $16.50 per 100; pull, $33 per 100; all in standard package lots.

San Francisco

Present Conduit Market Slow—Bushings and Locknuts Hold Steady—Radiator Demand Brisk

Building is booming. The value of building permits issued in June, 1922, in San Francisco, was $3,336,701 and in Oakland, $3,381,045. The corresponding figures for June, 1921, were $950,965 and $1,486,022, respectively.

Conduit—Nearly all big jobs have been billed and shipped. With the exception of two or three scattering carloads, comparatively little bulk business is in sight. The larger proportion of dwellings means that while the value of permits is high the amount of conduit demanded is comparatively small. There are, however, some exceedingly good school and apartment house jobs in sight.

Present prices on ½-in. galvanized run about $6.20 per 100 ft.; on black conduit, about $5.95 per 100 ft. Local stocks are good.

Bushings and Locknuts.—One-half inch bushings are quoted in any quantity at approximately $1.25 per 100; 1-in. at $3.25 per 100; ½-in. locknuts are quoted at 55 cents per 100; and 1-in., $1.25 per 100.

Boxes and Covers.—The market is quiet and gathering itself, it is said, for another advance in the latter part of the month.

Flexible Conduit.—Flexible metallic conduit is selling several hundred per cent better than this time last year. Local regulations prohibiting the use of flexible conductors are helping the demand for the small sizes of flexible conduit but the fact remains that more and more of the larger sizes are being specified. Jobbers' stocks are in fair shape.

Radiators.—A leading manufacturer reports that actual orders and advance orders now compare favorably with the business that was done in 1920. Prices remain as last year, with the standard single burner type listing at $10.50 each.

Salt Lake City

Satisfactory Fan Sales—Ranges Moving Well—Good Demand for Grills—Vacuum Cleaner Sales Slump

Some idea of the impetus in the building industry can be gained from the fact that June contracts for 1922 were more than double the total for June of 1921. In Salt Lake City in June a year ago there were ninety-two permits for new construction and forty permits for alterations with a cost of $244,614.50. In June of this year, there were 143 new building permits and thirty-five for alterations totaling $738,737.

Except for the strikers who are voluntarily idle, there is little unemployment in this territory.

Crop prospects continue good, with no serious untoward weather conditions. The fruit crop is moving to a good market. The canning industry is producing at a better rate than it has in several years.

With the fan season at its height, sales are reported only satisfactory.

Electric ranges are moving well.

Grills.—Standard price on single plate grills is around $12.50, call for them is good and stocks are in ample supply.

Vacuum Cleaners. — Sales have slumped considerably since the close of the spring and early summer campaign.

Portland—Seattle

Rubber-Covered Wire Market Steady—Great Activity in Electric Ranges—Improved Collections

General business conditions are not as satisfactory as desired for this time of year. Electrical jobbers, however, state that business is continuing to hold its own, and in many cases is appreciably improved. Greatest activity at the present time appears to be in full line equipment and electric ranges. No changes of any importance are reported for the week. Collections are materially improved.

Rubber Covered Wire.—No. 14 rubber-covered wire is quoted at $6.75 and No. 12 at $9.10 per 1,000 ft. in 5,000 ft. lots.

Weatherproof Wire. — Triple-braid weatherproof wire in sizes No. 8 to No. 0000 is quoted at $20.50 per 100 lb. in 500-lb. quantities.

Lamp Cord.—No. 18 cotton-covered lamp cord is quoted at $14.05 and No. 18 P. and S., at $20.30 per 1,000 ft. in coil lots of 250 ft.

Sockets.—Quotations on brass shell sockets are as follows: Key, $24.75; keyless, $22.50, and pull chain, at $45 per 100 in cartons of twenty-five.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Fixture Manufacturers and Dealers to Co-operate

For the purpose of co-operation, arrangements have been made by the Executive Board of the Lighting Fixture Dealers' Society of America and the officials of the National Council of Lighting Fixture Manufacturers to join together more closely in discussions regarding promotion of their activities and solution of their problems.

According to Charles H. Hofrichter, secretary of the National Council of Lighting Fixture Manufacturers, the affairs of both organizations will be administered from the same office. Each organization will maintain its own identity, have its own officers, collect and handle its own funds and in every way conduct the detailed work of the organization in an individual manner.

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Security Electric Increases Capacity

By changing quarters from 1463 West Ohio Street to 2635 Canton Street, Chicago, the Security Electric Manufacturing Company increased manufacturing floor space 250 per cent. H. Ostermann, general manager, stated that the better manufacturing facilities afforded in this new location was the main reason for this change, since the heating appliance business for the first six months of 1922 ran over three times the volume transacted in 1921. No organization changes accompanied this removal.

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Chambersburg Power Plant Orders New Equipment

Extension of the plant of the Chambersburg Electric Light Company at Chambersburg, Pa., has been necessitated through the increased demand for electric power. The equipment, consisting of a 1,000-kw. turbine generator unit, for the proposed extension has been ordered by the city of Chambersburg from the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

The projected extension of the Chambersburg municipal power plant is being made under the direction of A. C. Wood of Philadelphia, consulting engineer.

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General Electric to Build Warehouse at Atlanta

Construction will start soon on a four story reinforced concrete warehouse for the General Electric Company in Atlanta. Plans were made so that the building may be doubled in size in the future. In addition to the main warehouse there will be a one-story building adjoining which will be used as a service station and repair shop for General Electric equipment. It is estimated that the cost of this building will be between $150,000 and $200,000, and it is expected to be completed by Jan. 1, 1923.

The General Electric Company's southeastern office will remain in its present location in the Citizens & Southern Bank Building.

◆

St. Louis Fair Market for Converter Substations

Converter substations will form a large portion of the electrical apparatus sales in St. Louis this year. The United Railways Company has announced plans for the installation of five new automatic stations, two to be rated at 1,000 kilowatts each and three at 2,000 kilowatts each. The Union Electric Light & Power Company is now installing a 2,000 converter station to serve the down-town light and power load.

In addition, the Union Electric Company will build this year two transformer stations for distribution purposes in the residential districts.

Electric Furnace Company Closes Large Foreign Contracts

Two large foreign contracts have just been closed by the Electric Furnace Company, Salem, Ohio. The first calls for an aluminum melting furnace for Germany, and the second for a set of automatic heat treating units for Japan.

The United Aluminum Works, Lautewerke, Germany, has contracted for a 200-kw. tapping type electric furnace capable of holding 4,000 lb. of aluminum. This company is turning to electric melting as the one sure method of producing clean bright aluminum, free from gas occlusions.

Mitsui & Company, New York City, have purchased, for shipment to Japan, a complete automatic set for heat treating forgings. The hardening furnace will be rated at 80 kw. and will contain five rows along which the forgings will advance. The only manual operation will be the periodic placing of materials before the pusher of this furnace. Automatic arms will advance the material through the quench and 40-kw. drawing furnace. Time clock mechanism will control the operation and prevent any piece advancing before it has received exactly the treatment specified.

Two new Baily furnaces are also going into operation at the Port Huron plant of the American Bushings Corporation. The first is a 105-kw. brass melting furnace of 1,500-lb. capacity. The second is a 60-kw. annealing furnace for bronze bushings. This furnace has a magazine feed and contains eleven rows for advancing the bushings down to eleven discharge tubes, treating the product at the rate of one bushing every three seconds.

P. & F. Corbin, New Britain, Conn., have added another Baily to their brass melting battery. The new furnace pours the metal directly into the molds. It is rated at 75 kw. with 800-lb. hearth capacity.

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Ford Plans Electrical and Mechanical Engineering Laboratory

All mechanical and electrical engineering activities of the Henry Ford enterprises will be housed under one roof in Dearborn, Mich., it has been announced. A one-story laboratory, 800 x 200 ft., will replace thirteen temporary structures built during the war. It will cost $500,000.

Reports that all Ford office staffs about Detroit would be centralized in Dearborn were denied by Mr. Ford. He also declared that the erection of the laboratory does not mean that a great force of workmen would be taken to Dearborn.

He confirmed the report that in a short time the Lincoln Motor Car Company would be receiving its electric power from the River Rouge plant by means of underground wires, nearly all of which are now in place.

W. E. Creed Announces Formation of Large Steel Corporation

Wiggington E. Creed, president of the Pacific Gas & Electric Company and of the Columbia Steel Company, San Francisco, Cal., has announced that a new $15,000,000 corporation will soon start to build up the steel industry for the West. The new concern, to be known as the Columbia Steel Corporation, has acquired the coal properties of the Utah Coal & Coke Company in Carbon County and vast iron deposits in Iron County, Utah, as well as the Portland, Ore., steel foundry and the California steel foundry and rolling mill of the Columbia Steel Company.

In San Francisco Mr. Creed is associated in the enterprise with J. D. Grant, A. M. Clark, D. H. Botchford, A. E. Boynton, Joseph Sloss, W. P. Hammon, John S. Drum, Herbert Fleishhaker, Mortimer Fleishhaker and Alfred Esberg. These men represent some of the most important industrial as well as financial institutions in the West and bring to the corporation their strong faith in the important destiny of the undertaking.

In his statement Mr. Creed said:

"The Columbia Steel Company has acquired the coal properties of the Utah Coal & Coke Company in Carbon County and extensive iron properties in Iron County, Utah. The purchase will be effected through the organization of a new corporation to take over the rolling mills and steel foundries of the Columbia Steel Company and the assets of the Utah Coal & Coke Company. An intensive investigation, extending over a period of more than eight months, has demonstrated that the Utah coal and iron properties can be used to form the basis of an independent steel industry for the Pacific coast and mountain territory. Definite plans have not been matured except to the point of effecting the purchase and consolidation, but the program for future developments is now being worked out.

McGraw Company and Central Telephone Consolidate

Plans for the consolidation of the McGraw Company, Omaha, Neb., and Sioux City, Iowa, with the Central Telephone & Electric Company have been completed, it was announced by officials of the McGraw Company on July 1.

The consolidated company will be known as the McGraw Company, the adoption of this name being decided upon to shorten the name and because the volume of telephone business is now so small a part of the total business. Both companies have for years handled practically the same lines, among the most important being the Westinghouse agency. No change in its distributing agencies will be made.

With this consolidation, the McGraw Company becomes one of the largest and strongest wholesale electrical distributors in the United States. F. D. Phillips becomes vice-president of the McGraw Company and will remain in charge at St. Louis. William Saltmarsh, secretary and purchasing agent of the McGraw Company, will move to St. Louis, which will be the largest point at which the company is located.

Screw-Thread Standardization Reports Submitted

Reports were submitted to the National Screw-Thread Commission on July 7 by the sub-committees dealing with threads on electric fixtures and fittings, standardization and unification of screw threads, and with boltheads, nuts and wrenches. Pending certain detailed additions and changes, the reports will not be made public but it is expected that they will be ready for inspection by anyone interested within the next few days. The subcommittees expect to hold their next meeting the second week in August. The next meeting of the Screw-Thread Commission probably will be held in New York the second week in September.

Westinghouse Company Makes Important Changes

The business of the Pittsburgh High Voltage Insulator Company will be carried on in the future under the name of the Westinghouse High Voltage Insulator Company, according to announcement made by C. M. Semler, general manager. The change in name, which was made by vote of the company's stockholders, does not affect the management or method of conducting the business of the company, which will be carried on as it has been in the past, according to the announcement made.

Owing to the large increase in its business in Mexico the Westinghouse Electric International Company recently extended its offices in Mexico City, Mex. These offices are situated in the Boker Building, Isabel la Catolica and 16 de Septiembre Streets, which is one of the handsomest office buildings in the city.

Five large rooms are now used by the Westinghouse Company and three others are available for future extensions. All the offices are equipped in American style and business is conducted according to American methods. In addition to these offices, the Westinghouse Company also maintains a large warehouse on the outskirts of Mexico City, where quantities of stock are kept on hand at all times for the demand of the trade.

Increased business in the Argentine has resulted in the Westinghouse Electric International Company moving into larger offices. The new address of the company is Cia. Westinghouse Electric Internacional, S. A., Avenida De Mayo 1031, Buenos Aires, Argentina. Louis T. Peck is managing director of the Buenos Aires branch.

Nathaniel Baldwin Company Incorporated for $1,000,000

Nathaniel Baldwin, inventor of the Baldwin radio receiver and amplifier, has incorporated a new $1,000,000 company to be known as Nathaniel Baldwin, Incorporated, for the manufacture of radio apparatus. Associated with Mr. Baldwin in the company are David Neff, vice-president and treasurer; Lawrence Clayton, secretary; Seth Chamberlain, Ray Andrus, L. P. Fisher and Loren Wooley.

It will be the purpose of the company to increase its plant facilities to a considerable extent, to enlarge the output of receivers and amplifiers, and generally to endeavor to promote the manufacture and sale of Mr. Baldwin's inventions.

The Bureau of Mines has allotted $16,240 of its new appropriation for studies of the use of electricity in mining operations.

The Westinghouse Lamp Company, Watsessing, Bloomfield, N. J., is increasing operations and adding to the working force.

The Benjamin Electric Manufacturing Company, Chicago, Ill., is disposing of a bond issue of $1,500,000.

Electric Power from Lignite.—By utilizing several existing mines in the Province of Teruel, Spain, a British owned company has undertaken the production of electric power from lignite. The mines are located in the coal basin known as Castellote, about 50 km. from Alcaniz.

The Mechanical Appliance Company has changed its name to the Louis Allis Company, officials of that company announce. According to Louis Allis, president, "The company is earnestly striving to come closer to standards of excellence and integrity which long since have been set as a pledge which the name Allis implies."

The United States Light & Heat Corporation, Niagara Falls, N. Y., is perfecting plans for the immediate establishment of a branch plant at Oakland, Cal., to provide for Pacific Coast trade. A site and building have been selected. The branch will be in charge of George F. Wray, Pacific Coast sales agent, and B. F. Bradley, formerly situated at the main works. Operations at the new branch will include a full line of batteries, lighting and starting equipment, etc.

The Horn & Brannen Manufacturing Company, 427 Broad Street, Philadelphia, manufacturer of electric fixtures, has purchased property, 84 x 208 ft., at 1814-1816 Spring Garden Street, for about $100,000. A new manufacturing building will be erected on a portion of the site.

The Rome Wire Company, Rome, N. Y., announces that it has taken an interest in the Atlantic Insulated Wire & Cable Company, which will continue to manufacture rubber-covered wires and cables.

Foreign Trade Notes

PROPOSED ELECTRICAL DISTRIBUTION FOR BALLARAT, AUSTRALIA.—The Electric Supply Company, Victoria, Australia, the *Electrician* states, has submitted a proposal for the distribution of electricity supplied from the Morwell coal fields in Ballarat and adjacent districts, provided the municipalities will provide the funds required for converting plant and mains, and also if an extension of its recent lease be granted.

EXPOSITION OF MECHANICAL AND ELECTRICAL INDUSTRIES IN GHENT, BELGIUM.—An international exposition of mechanical and electrical industries, *Commerce Reports* states, will be held at Ghent, Belgium, from June 1 to Oct. 1, 1923. The exposition will be held in the former buildings of the Ghent World's Exposition of 1913. The classes of goods to be exhibited will include mechanical plants and processes, metallurgy and mining, machine tools, electrical equipment and appliances, transport accessories, etc. Requests for information in regard to the exposition may be addressed to Comité de l'Exposition de 1923, Royal Casino, Paic, Ghent, Belgium.

PROPOSED ELECTRIC PLANT FOR CARTAGENA, COLOMBIA, S. A.—The Cartagena Water Works, according to *Commerce Reports*, has submitted a proposal to the city government for the construction of an electric light plant in connection with the proposed reservoir for securing a water supply for the city.

HYDRO-ELECTRIC EXTENSION IN JAPAN.—Arrangements have been made, according to *Commerce Reports*, for increasing the capital of the Inawashiro Hydro-Electric Supply Company from 21,000,000 yen to 40,000,000 yen, the proceeds to be used for construction of new plants.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A hotel corporation in Madeira (No. 2,720) desires to purchase electric table lamps for restaurant and night tables, electric self-winding clocks, etc.

A company in England (No. 2,749) desires to purchase radio-phone apparatus, installations for radio telephone messages and accessories.

A merchant in Norway (No. 2,770) desires to secure an agency for the sale of railway supplies and electrical material.

A merchant in Greece (No. 2,851) wishes to purchase pocket electric lamps, etc.

A merchant and manufacturer in Spain (No. 2,868) desires to purchase and secure an agency for automatic and electric pianos, etc.

RECONSTRUCTION OF BURNED DISTRICTS OF CORK, IRELAND.—Plans are rapidly maturing, according to *Commerce Reports*, for the reconstruction of those parts of the city of Cork, Ireland, which were destroyed by fire on December 11 and 12, 1920. Among the materials required are: Iron and steel (structural and reinforcing materials), general hardware, elevators, electrical equipment and wiring supplies, etc. The Bureau of Foreign and Domestic Commerce is in receipt of the following lists, which may be obtained by referring to BE-3006-Building trades in Cork, including plumbers, architects, electrical engineers, contractors, etc.

New Apparatus and Publications

INSULATING MATERIALS.—The Garfield (N. J.) Manufacturing Company is distributing a sixteen-page pamphlet describing its various types of insulating material, including "Gummon," "Tegit" and "Hemit," for use in connection with the electrical industry.

GLUE POT.—A glue pot with a rheostat control which permits an almost unlimited variation in temperature has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

SAFETY SWITCHES.—The James E Gleason Company, 650 West Monroe Street, Chicago, is distributing bulletin S-2, describing its safety switches, panel boards and outlet cabinets.

SMALL STEAM TURBINE.—The De Laval Steam Turbine Company, Trenton, N. J., has recently placed on the market a small steam turbine for driving power plant auxiliaries, including exciters, circulating pumps, etc.

ELECTRIC FURNACES AND BOILERS.—The Electric Furnace Construction Company, 908 Chestnut Street, Philadelphia, has issued two new catalogs, one describing various types of electric furnaces for melting, refining and superheating of iron and steel, and particularly a new feature of the "Graves-Etchells" steel melting furnace. The other describes the "Electro" steam boiler developed by F. T. Kaelin, chief engineer of the Shawinigan Water Power Company, Canada, and developed in the United States by the Electric Furnace Company.

TESTING INSTRUMENT.—A new armature-testing instrument, "Chapman Armeter," for instantaneous testing of armatures and commutators, has recently been developed by the P. E. Chapman Electrical Works, Tenth and Walnut Streets, St. Louis.

TURBINES.—The Pelton Water Wheel Company, Nineteenth and Harrison Streets, San Francisco, is distributing a sixteen-page booklet entitled "The Kern River No. 3 Plant of the Southern California Edison Company." Attention is called to the prime-mover equipment, consisting of two 25,000-hp. Pelton vertical turbines operating under a head of 810 ft., and other novel features of the design of both turbines and accessory apparatus.

WASHING MACHINE.—"It Will Save Your Hands Too" is the title of a four-page leaflet distributed by the Laundryette Manufacturing Company, 1190 East 152nd Street, Cleveland, describing the "Laun-Dry-Ette" electric washing and drying machine.

SWITCHES.—"Get the Most Out of Electricity in the Home" is the title of a small folder distributed by the Beaver Machine & Tool Company, Inc., 625 North Third Street, Newark, N. J., covering the "Beaver" controlling switches for household electrical appliances.

NICKEL.—The American Nickel Corporation, Clearfield, Pa., is distributing bulletin No. 101 entitled "Pure Malleable Nickel," which describes the "American Nickel," its properties and uses.

METER BOX.—The Safety Meter Box Company, Erie Building, Cleveland, is distributing a leaflet describing its safety meter box.

RADIO RHEOSTAT.—The Cutler-Hammer Manufacturing Company, Milwaukee, will soon place on the market its new "C-H" vacuum-tube rheostat for radio use. It will be furnished in two styles, one with vernier adjustment for control of detector tubes, or without vernier for control of amplifier tubes.

MILLING MACHINE.—Bulletin No. 58 issued by the Newton Machine Tool Works, Inc., Twenty-third and Vine Streets, Philadelphia, describes and illustrates the "Newton" continuous milling machine. The company is also distributing bulletin No. 57, covering its radius link-grinding machine.

DIMMERS.—The Ward Leonard Electric Company, 31-41 South Street, Mount Vernon, N. Y., is distributing a leaflet showing several views of a switchboard pre-set installation of Ward Leonard "Vitrohm" dimmers.

New Incorporations

THE WILLOW RIVER POWER COMPANY, Hudson, Wis., has been incorporated by F. P. Buckhardt, A. P. Schultz and B. A. Buckhardt, all of Hudson. The company is capitalized at $500,000 and proposes to construct and operate hydro-electric and steam generating plants and distributing and transmission systems.

THE LUSK (WIS.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $25,000 by P. M., A. K. and O. L. Pederson, all of Lusk, to construct and operate hydro-electric generating plants and to furnish electricity for lamps and motors.

THE CAPROCK LIGHT & POWER COMPANY, Crosbyton, Tex., has been incorporated with a capital stock of $40,000 by S. A. Guy, J. C. Orr and E. H. Wheat.

THE FOLEY (ALA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $30,000.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

ATTLEBORO, MASS.—A one-story power house will be erected at the Sturdy Memorial Hospital. The R. D. Kimball Company, 6 Beacon Street, Boston, is consulting engineer.

CAMBRIDGE, MASS.—Preliminary work has started on the removal of overhead electric wires from the streets in Cambridge and placing them underground. Under the present arrangements two miles of streets will be cleared each year.

LEE, MASS.—The Lee Electric Company is planning to erect a large transformer station near its Canal Street yard, which will be equipped with six large outdoor type transformers. The company will also install a static condenser at the Tayford plant in East Lee, to cost about $4,500.

PITTSFIELD, MASS.—The Pittsfield Electric Company has petitioned the Board of Aldermen for permission to erect a transmission line to connect with the transmission system of the Turners Falls Power & Electric Company, Turners Falls.

NEW HAVEN, CONN.—The United Illuminating Company has acquired a site on Ferry Street, near Middletown Avenue, on which it will erect a substation.

WATERBURY, CONN.—The construction of another large dam on the Housatonic River in the vicinity of West Cornwell and Lime Brook is reported to be under consideration by the Connecticut Light & Power Company.

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Middle Atlantic States

ELMSFORD, N. Y.—Motors, electric power equipment, conveying machinery, etc., will be installed in the proposed plant to be erected at Elmsford by the Horace L. Day Company, 4 White Street, New York City, to cost about $250,000.

HOLLAND, N. Y.—The Depew & Lancaster Light & Power Company, Lancaster, has been granted permission by the Public Service Commission to build a transmission line to Holland and install a local distributing system.

LOCKPORT, N. Y.—Plans are under consideration for the installation of a new ornamental lighting system in the business district, to cost about $4,000. The plans call for 72 magnetite arc lamps.

MT. VERNON, N. Y.—The Westchester Lighting Company is preparing plans for the construction of a two-story service building and meter shop on East Seventh Street, to cost about $250,000, with equipment. William C. Morris, 130 West Fifteenth Street, New York, is architect.

NEW YORK, N. Y.—The American Smelting & Refining Company, 120 Broadway, will build a power plant in connection with its proposed byproduct coke plant in the Coahuila district, Mexico, to cost about $5,000,000.

NEW YORK, N. Y.—Plans have been approved by the Cities Service Company involving an expenditure of several million dollars on the properties of the Ohio Public Service Company, a subsidiary, serving the northeastern section of Ohio, and which include the erection of a 60-mile, 130,000-volt transmission line from Lorain to Mansfield, Ohio; a similar line between Warren, Alliance and Canton (55 miles), where it will tie in with the system of the American Gas & Electric Company. Also for the installation of a 20,000-kw. turbine at the Edgewater plant at Lorain, and a 30,000-kw. turbine at the Toledo (Ohio) Edison Company's plant. A new 10,000-kw. turbogenerator has been authorized for the plant of the Empire District Electric Company, Joplin, Mo., together with other equipment for subsidiary utility properties of the Cities Service Company, calling for an additional $1,000,000.

DOVER, N. J.—The New Jersey Power & Light Company is preparing to extend its transmission lines from Broadway to Hackettstown.

MILFORD, N. J.—The Warren Manufacturing Company, which furnishes electricity to operate the municipal light and power plant, will build a new line to supply electricity to the mill of the Ingham & Tirrell Silk Company.

PASSAIC, N. J.—A power house will be installed in connection with a proposed five-story addition to the St. Mary's Hospital, to cost about $300,000. Crow, Lewis & Wick, 200 Fifth Avenue, New York City, are architects and engineers.

PATERSON, N. J.—The Board of Public Works has granted the Main Street Business Men's Association permission to install an ornamental street lighting system on Main Street, to cost about $30,000.

FAYETTE CITY, PA.—The H. C. Frick Coke Company, Pittsburgh, will construct an underground electric railway system in connection with a new coal-loading harbor to be constructed on the Monongahela River.

HARRISBURG, PA.—The Western Union Telegraph Company, 195 Broadway, New York, is completing plans for the construction of a service building in Harrisburg, to cost about $40,000. Stone & Webster, 147 Milk Street, Boston, are architects.

LEBANON, PA.—Plans are under consideration for the installation of an ornamental street-lighting system on Cumberland Street, from Sixth to Ninth Street.

PHILADELPHIA, PA.—Horace T. Potts & Company, 316 North Third Street, will build a power house at their new iron and steel works at East Erie Avenue and D Street. The entire plant will cost $500,000.

PITTSBURGH, PA.—Local interests are organizing the Coraopolis Electric Company, to construct and operate a plant and system in the vicinity of Coraopolis. Application for a charter will be made at once. The company is represented by A. W. Robertson and J. R. McNary, 435 Sixth Avenue.

PITTSBURGH, PA. — The Pittsburgh Railways Company contemplates extensions to its system including additions to substation, erection of new feeder lines and underground conduits and the installation of additional equipment, to cost about $1,000,000.

SUNBURY, PA.—Bids will soon be asked for the construction of a one and two-story power house at Mark M. Packer Hospital. W. H. Rockefeller, Sunbury, is architect.

WILKES-BARRE, PA. — The Wilkes-Barre Company has issued $102,000 in bonds, part of the proceeds to be used for extensions and improvements.

BALTIMORE, MD.—The Board of Estimate has approved an appropriation of $10,000, for the purchase of underground cable, for the fire alarm system. Charles F. Goob is chief engineer of the Electrical Commission.

BALTIMORE, MD.—The power plant of the Baltimore & Ohio Railroad Company was destroyed by fire, July 4, with the grain elevator and pier at Locust Point, causing a loss of about $4,000,000.

BALTIMORE, MD. — The proposed six-story municipal warehouse and pier to be built at Locust Point by the Port Development Commission, Baltimore, to cost about $3,000,000, will be equipped with electric loading and unloading machinery, industrial trucks, conveying equipment, etc.

HAGERSTOWN, MD. — The American Water Works & Electric Company, New York, has acquired the Potomac Public Service Company, formerly known as the Hagerstown & Frederick Railway Company. Extensions and improvements will be made to the power plant and system.

RONCEVERTE, W. VA.—The West Penn Power Company, Pittsburgh, will soon take bids for the construction of an addition to its local power plant, to cost about $500,000. The J. G. White Engineering Corporation, 43 Exchange Place, New York, is engineer.

NORFOLK, VA.—The Virginian Railway Company plans the construction of an electrically-operated coaling pier at Sewell's Point, to cost about $3,000,000, including power equipment, etc.

PORTSMOUTH, VA. — The Council is considering improvements to the lighting system on upper High Street.

WASHINGTON, D. C. — The Board of District Commissioners is considering the erection of a one-story power house, 50 x 120 ft., at the Gallinger Hospital.

North Central States

NORTH MUSKEGON, MICH.—An electrically-operated pumping plant will be installed in connection with the proposed new waterworks, to cost about $300,000

ST. JOSEPH, MICH.—Plans are being prepared for a new power house for the Whitcomb Hotel Company. Cahill & Douglas, 217 West Water Street, Milwaukee, are engineers.

SPRINGFIELD, OHIO.—The Springfield Light, Heat & Power Company has awarded contract for extending its underground conduit system in the downtown district this year to the G. M. Gest, 277 Broadway, New York City. The cost is estimated at $175,000. Under the terms of its franchise the company is required to install 2,000 feet of underground conduit each year.

LOUISVILLE, KY.—The city of Louisville has applied to the Federal Power Commission for a preliminary permit covering a power development at the United States dam in the Ohio River at the Falls of Louisville. The dam and lock at that point have been recommended for reconstruction. Primary power to the extent of 28,000 hp., it is estimated, would be available at that point. The city plans to install a plant of 50,000 hp. capacity.

JACKSONVILLE, IND. — The Green Valley Mining Company plans rebuilding the power house at its properties, destroyed by fire, June 29, with loss of about $50,000.

WHITEHALL, ILL.—Bids will soon be asked for extensions and improvements to the municipal power plant, to cost about $75,000. The Caldwell Engineering Company, Ayers Bank Building, Jacksonville, is engineer.

HUDSON, WIS. — The Willow River Power Company, recently incorporated with a capital stock of $500,000, is planning to build an extensive hydro-electric project on the St. Croix River and the Willow River branch. F. P. Buckhardt, A. P. Schultz and B. A. Buckhardt, all of Hudson, are interested in the project.

RICE LAKE, WIS.—Plans are being prepared for the construction of a new power plant, electric distribution system, etc., in Rice Lake, to cost about $75,000. J. H. A. Brahtz, Metropolitan Opera House Building, St. Paul, is engineer.

TOMAHAWK, WIS.—The property and holdings of the Tomahawk Light, Telephone & Improvement Company have been purchased by the Wisconsin Valley Electric Company, Wausau. Plans are being prepared by the Wisconsin Valley Company to develop the water power at Grandfather Dam (a 67-ft. head) on the Wisconsin River, between Tomahawk and Merrill, at a cost of about $200,000. The company also contemplates extending its high-tension transmission line from Merrill to Tomahawk.

WEST BEND, WIS. — The West Bend Aluminum Company will build a one-story addition to its power house.

MINNEAPOLIS, MINN.—The Ford Motor Company is reported to be planning the erection of a hydro-electric power plant near the high dam, in connection with proposed local automobile and tractor plant, to cost about $1,500,000.

ST. PAUL, MINN.—An electric crane, air compressors and other mechanical equipment will be installed in the new mines experiment station at the State University.

WIOTA, IOWA.—The proposal to install an electric-lighting system has been approved by the voters. Arrangements will be made to supply electricity to the farmers between Aita and Wiota. Electricity will be supplied by the Guthrie Center (Iowa) Power Company.

CARROLLTON, MO. — The property of the Water, Light & Transit Company has been acquired by the Kansas City (Mo.) Power & Light Company, including the transmission lines to Bogard, Tina, Bosworth, Wakenda, Miami Station, DeWitt, Brunswick, Glasgow, Menden, Triplett and 50 miles of rural lines in Carroll County. The Kansas City company, it is understood, will erect a high-tension transmission line from Kansas City to the local plant.

ST. LOUIS, MO. — The erection of a power plant, at the Robert Koch Hospital, to cost about $75,000, is under consideration by the Board of Aldermen.

ST. LOUIS, MO.—The Broderick & Bascom Rope Company will build a one-story power house in connection with its proposed new wire rope plant, to cost about $250,000.

CANOVA, S. D.—Plans are under consideration to install a municipal distributing system and to erect a transmission line to Spencer to secure electricity from the system of the Minnesota Electric Distributing Company, a subsidiary of the Northern States Power Company, Sioux Falls. The cost is estimated at $12,000.

WICHITA, KAN.—Electric and power equipment, conveying apparatus, hoisting machinery, etc., will be installed in the new elevator to be erected by the Victory Mill & Elevator Company.

WICHITA, KAN.—The Kansas Gas & Electric Company is reported to be interested in a project to build a large power plant on the Neosho River, east of Parsons, to cost about $1,000,000.

Southern States

CARTHAGE, N. C.—Plans are under way by the Sandhill Power Company for the erection of a steam-driven electric plant at the mines of the Carolina Coal Company in Chatham County, as an auxiliary to the present water power plant. John R. McQueen is president of the Sandhill company.

CAMDEN, S. C.—Arrangements are being made by the Palmetto Power & Light & Power Company to erect a transmission line from the dam of the Wateree Power Company to Camden, a distance of 9 miles. The Palmetto company has a contract to furnish electricity to the local municipal electric plant and to the Wateree mills for a period of five years.

AUGUSTA, GA.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until July 26, for lighting fixtures in the United States Public Building here.

MEMPHIS, TENN. — Plans are being prepared by the Dixie Power Company for a hydro-electric plant on the White River, to cost including machinery and transmission machinery, about $750,000.

MEMPHIS, TENN.—The Clover Farm Dairy Company will build a power house at its proposed new ice cream plant, to cost about $75,000. L. M. Learned is general manager.

FOLEY, ALA.—The Foley Light & Power Company, recently organized with a capital stock of $30,000, plans to establish an electric plant in Foley.

SELMA, ALA. — The Alabama Power Company contemplates extending its transmission line from Selma to Marion.

TUSKEGEE, ALA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 21 for the installation of two push-button control electric passenger elevators, and one electric freight elevator at United States Veterans' Hospital, Tuskegee.

HOT SPRINGS, ARK. — The Missouri Lumber Co. is planning to rebuild its power house recently destroyed by fire, with other portions of the plant.

PINE BLUFF, ARK.—The Saline River Hardwood Company, it is reported, contemplates the construction of a power house in connection with remodeling its local mill. The cost is estimated at $100,000.

ADA, OKLA.—The Oklahoma Portland Cement Company will build a power plant at its local mill.

FAIRLAND, OKLA. — Contract for the construction of a municipal transmission line, to cost $13,300, has been awarded to the Peabody Electric Company, Muskogee. H. G. Olmsted & Company, Oklahoman Building, Oklahoma City, are engineers.

JEFFERSON, OKLA.—Plans are being prepared for the construction of a transmission line and distributing system for municipal service. H. G. Olmsted & Company, Oklahoma City, are engineers.

JENNINGS, OKLA.—The Oklahoma Gas & Electric Company will build a new transmission line here, and install a local distributing system. A line will also be constructed to Cleveland, Okla., and distributing system built. The municipal power plants at both places will be discontinued.

OKEMAH, OKLA.—The City has granted a ten-year light and power franchise to the Oklahoma Power Company, which will build a transmission line at once. Heretofore service has been rendered by a municipal plant, which, it is understood, will be abandoned.

CURRIE, TEX.—A company has been formed to take over and operate the power plant of the Currie Electric Company. The plant will be enlarged and machinery installed to double the present capacity. T. H. Williams and H. P. Tate head the new company.

DALLAS, TEX.—The Dallas Power & Light Company will rebuild its transformer station on Griffin Street, damaged by fire, June 27, causing a loss of about $60,000.

DENISON, TEX.—The Missouri, Kansas & Texas Railroad Company, Railway Exchange Building, St. Louis, will build a power house in connection with new shops and yards here, to cost about $100,000. A. L. Sparks is architect for the company.

FORT WORTH, TEX. — The Lighting Department contemplates the installation of an ornamental street-lighting system, on Park Avenue and on other thoroughfares in North Fort Worth.

ORANGE, TEX.—The Council will install a street-lighting system on a number of streets in the North Orange district.

WACO, TEX.—The Missouri, Kansas & Texas Railroad Company, Railway Exchange Building, St. Louis, will build a one-story power house in connection with its new car and locomotive shops here, to cost about $800,000. A. L. Sparks is architect for the company.

WELLINGTON, TEX.—An ornamental street-lighting system will be installed in the business section.

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Pacific and Mountain States

DEER PARK, WASH.—Mark F. Mendenhall, president of the Mount Spokane Power Company has petitioned the Public Service Commission for permission for a franchise to operate an electric railway between Deer Park, Clayton and Loon Lake to Springfield.

LIND, WASH.—Surveys are being made for the new Palouse 60,000-volt transmission line of the Washington Water Power Company from Lind to Colfax. A substation will be erected at Lind to step down the current from 110,000 volts to 60,000 volts.

SEATTLE, WASH. — The transmission line being erected by the Puget Sound Power & Light Company into the Wenatchee Valley by the way of Cle Elum, to furnish electricity to the Washington Coast Utilities Company, Arlington, will be completed by the summer of 1923. The line will be about 120 miles long and will cost with transforming and switching equipment about $800,000.

TACOMA, WASH. — The Council has approved an ordinance for the installation of ornamental lighting systems on North I and North Twenty-first Streets.

WALLA WALLA, WASH.—A committee has been appointed to make investigations in regard to establishing a municipal power plant.

ANTIOCH, CAL.—The city is negotiating with the Pacific Gas & Electric Company for the installation of an ornamental lighting system on Second and G Streets.

KEYES, CAL.—The Modesto and Turlock Irrigation Districts, Modesto, will construct a joint transmission line from the Don Pedro power plant to Keyes and vicinity, to cost about $300,000, with substations and transformers. Percy Jones, chief engineer, Modesto district, and R. V. Meikle, chief engineer, Turlock district, are in charge.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Company has issued $5,000,000 bonds, part of the proceeds to be used for extensions and improvements.

MODESTO, CAL. — Bids will soon be asked for the installation of ornamental lighting systems on portions of Sycamore and Morris Avenues. George Freitas is city engineer.

MODESTO, CAL. — The irrigation districts of Modesto and Turlock have voted to distribute power generated at the Don Pedro plant. Favorable action was also taken on the proposal to issue $1,000,000 in bonds to erect a power house, transmission lines and transformer stations.

SAN FRANCISCO, CAL. — The Great Western Power Company has been granted permission by the State Railroad Commission to use a fund of $1,653,073 for extensions and improvements.

PALO ALTO, CAL.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until July 27, for lighting fixtures in the United States Veterans' Hospital at Palo Alto.

SAN PEDRO, CAL. — Council has approved an ordinance for the installation of an ornamental lighting system on Sixth Street.

BASIN, WYO.—Plans are under consideration by the Midwest Refining Company, Greybull, and the city of Basin for the erection of an electric transmission line from the Cody dam to Greybull and from Greybull to Basin, a distance of 66 miles, to cost about $50,000.

LOVELAND, COL. — The Council has passed an ordinance authorizing the Mayor to advertise for bids for construction of a hydro-electric plant on the Big Thompson River in Loveland Canyon and also providing for the sale of bonds not to exceed $425,000 for its erection and maintenance.

MONTROSE, COL.—The Western Colorado Power Company has completed surveys for the erection of a new transmission line between Montrose and Ouray, a distance of 36 miles.

MORA, N. M.—The Council will install a lighting system on all streets.

SANTA FE, N. M.—The Council is considering a proposition to purchase the power plant and property of the Santa Fe Water & Light Company. If taken over by the city extensions and improvements are contemplated to the system.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 20, 1922)

1,420,515. Current Interrupter; C. E. Bennett, Atlanta, Ga. App. filed Sept. 9, 1919. Liquid lightning arrester in which the electrode touches a liquid and a lightning discharge generates steam, forcing liquid out of contact with the electrode, and breaks arc.

1,420,541. Splice and Sectional Insulator; Zack Grass, Heiner, Ky. App. filed Oct. 31, 1921. For different sizes of trolley wires with a switch attached.

1,420,561. Electric Furnace; Knut Leander, Albany, N. Y. App. filed May 19, 1920. Body can be withdrawn from under roof.

(Issued June 27, 1922)

1,420,629. Teledynamic Orientation System; J. H. Hammond, Jr., Gloucester, Mass. App. filed March 29, 1918. Control of bodies by wireless.

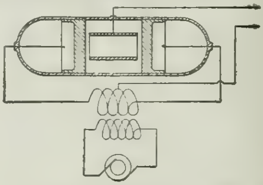
1,420,633. Audible Speedometer; J. E. Kennedy, Glens Falls, N. Y. App. filed Dec. 17, 1919. Warns driver who exceeds predetermined speed.

1,420,636. Electrically Heated Garment Presser; B. W. Macy, Jacksonville, Fla. App. filed Feb. 16, 1921. Heating element submerged in oil.

1,420,675. Storage-Battery Terminal; E. F. Andreae, Newark, N. J. App. filed Sept. 4, 1918.

1,420,687. Electric Furnace; S. N. Castle, New Rochelle, N. Y. App. filed Aug. 13, 1918. Induction type.

1,420,692. Electric Water Heater and Steam Generator; H. E. Cohen, Brooklyn, N. Y. App. filed Oct. 12, 1920. Generates small amounts of steam.



Electron tube for full wave rectification. (No. 1,420,824.)

1,420,693. Electric Boiler; H. E. Cohen, Syracuse, N. Y. App. filed March 4, 1922. Float carries heating elements.

1,420,694. Switch Box; W. M. Gore, Toledo, Ohio. App. filed Jan. 12, 1920. Multiple-unit iron box for house switches.

1,420,735. Welding Machine; T. E. Murray, Jr., and J. B. Murray, Brooklyn, N. Y. App. filed Feb. 1, 1921. Welding segments having flanges transverse to edges welded.

1,420,759. Submerged Heater for Tanks; J. G. Sawicki, Essexville, Mich. App. filed Jan. 26, 1922. Heater placed in bottom of washing machine.

1,420,761. Arrangement for Exciting Continuous Current Generators; L. Schön, Essen, Germany. App. filed Sept. 4, 1920.

1,420,770-1,420,771. Binding Post; O. A. Smith, Cleveland, Ohio. App. filed Aug. 2, 1919. Two patents for dry cell carbon electrode binding post.

1,420,801. Rotary Annunciator; F. W. Wood, Montclair, N. J. App. filed Oct. 24, 1919. Balanced vane operated by magnets.

1,420,806. Lighting Fixture; F. C. Baker, Portland, Ore. App. filed April 1, 1918. Semi-indirect unit.

1,420,817-1,420,820. Electric Regulation; J. L. Creveling, White Plains, N. Y. App. filed Nov. 1, 1916. Four patents on an automatic regulator for charging set.

1,420,824. Rectifier; Harold P. Donle, Meriden, Conn. App. filed May 31, 1921. Utilizes two cold electrodes within a vacuum tube.

1,420,840. Portable Water Heater; George W. Hewitt, Bakersfield, Cal. App. filed April 16, 1921. Heats small quantities of water only.

1,420,842. Electrical Controller for Series-Paralleling; R. B. Hunter, Milwaukee, Wis. App. filed July 19, 1920. For mine locomotives operating on two voltages.

1,420,846. Connection for Electric Conductors; A. G. Karkau, Cleveland, Ohio. App. filed July 12, 1917. Clamping screw.

1,420,858. Controlling and Regulating Apparatus and System; F. W. Meyer, Milwaukee, Wis. App. filed March 12, 1920. Electroionic valve used as corrective means on circuits.

1,420,859. Trolley-Pole Adjuster; A. Peterson, St. Louis, Mo. App. filed Sept. 29, 1919. Automatically replaces trolley wheel after dislodgement.

1,420,885. Regulating Means for Alternating-Current Circuits; E. R. Stoekle, Milwaukee, Wis. App. filed June 14, 1920. For constant voltage.

1,420,895. Time-Indicating Apparatus; H. E. Warren, Ashland, Mass. App. filed July 21, 1920. Synchronous motor-driven secondary clocks.

1,420,896. Control System; H. E. Warren, Ashland, Mass. App. filed Oct. 2, 1920. Operating clocks on central station lines.

1,420,911. Apparatus for Building up Laminate Insulation and Like Structures; C. W. Davis, Edgeworth, Pa. App. filed March 29, 1920. Wraps insulating material on cables.

1,420,931. Keyboard Tape Perforator; Edward E. Kleinschmidt, Brooklyn, N. Y. App. filed July 16, 1919. Similar to the Baudot system.

1,420,980. Process of Manufacturing Electrical Resistance Material; F. Eichenberger, Aarau, Switzerland. App. filed Nov. 6, 1920. Made from silicon carbide, calcium carbonate, oxides of iron and graphite.

1,420,989. Telephone Transformer; W. Fondiller, New York, N. Y. App. filed Nov. 15, 1917. Repeating coil for high- and low-frequency currents.

1,421,015. Telephone; M. C. A. Latour, Paris, France. App. filed April 18, 1916. Laminated receiver core.

1,421,017. Battery Connector; G. E. Lundberg, Kewanee, Ill. App. filed Feb. 3, 1920.

1,421,041. Variometer; J. S. E. Townsend, Oxford, England. App. filed Aug. 22, 1921. Two fixed and two movable coils.

1,421,069. Electric Regulation; J. L. Creveling, White Plains, N. Y. App. filed Nov. 1, 1916. Control system for car-lighting generator.

1,421,084. Electric Heating Core; W. W. Hicks, San Francisco, Cal. App. filed Aug. 16, 1920. Non-inductive winding of heating coils.

1,421,093. Flashlight; L. C. Matson, Dunbarton, Wis. App. filed June 17, 1921. Bulb in each end of tube.

1,421,122. Lamp Socket; D. E. Bown, Crafton, Penn. App. filed Nov. 5, 1918. Key switch type.

1,421,157. Control System and Apparatus; E. M. Bouton, Wilkinsburg, Pa. App. filed May 12, 1919. Control of motor through predetermined cycle of operation.

1,421,160. Controller; J. M. Brown, Pittsburgh, Pa. App. filed Nov. 19, 1917. Controllers for automatic electrically-operated circuit breakers.

1,421,165. Regulating System; A. H. Candee, Pittsburgh, Pa. App. filed Aug. 26, 1918. Constant current system.

1,421,166. Drier for Paper Ruling Machines; J. H. Cannon, Los Angeles, Cal. App. filed May 8, 1920. Radiant heat reflected onto paper.

1,421,168. Container for Electric Wires; Hyman Charm, Dorchester, Mass. App. filed April 5, 1920. Usual cover plate of wire molding dispensed with.

1,421,170. Circuit Interrupter; L. W Chubb, Pittsburgh, Pa. App. filed Jan. 14, 1918. For rectifiers used in railway work.

1,421,179. Control System and Switch Mechanism Therfor; R. E. De Camp, Wilkinsburg, Pa. App. filed Nov. 16, 1918. For motor-accelerating systems.

1,421,180. System of Control; R. F. De Camp, Wilkinsburg, Pa. App. filed May 12, 1919. To insure proper sequence of contactor operation on motors.

1,421,185. Electric Furnace; R. A. Driscoll, Great Falls, Mont. App. filed Dec. 5, 1919. Ore, flux and fuel fed by rotary drill.

1,421,217. Electric Storage Battery; E. Hacking, Pawtucket, R. I. App. filed May 11, 1922. Electrolyte consists of gelatinous mass containing sulphuric acid and silicate of soda permeated with oil.

1,421,229. System of Control; R. E. Hellmund, Swissvale, Pa. App. filed June 18, 1919. Prevents overvoltage during regeneration of railway motors.

1,421,242. Control System; H. D. James, Edgewood Park, Pa. App. filed Jan. 8, 1919. Automatic control of contactors by relays.

1,421,243. Control System; H. D. James, Edgewood Park, Pa. App. filed Apr. 4, 1919. Push-button control for motors.

1,421,244. Control System; H. D. James, Edgewood Park, Pa. App. filed Nov. 4, 1918. Reversing system operated by relays.

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To Analyze Distribution

FACTS are needed if we are ever to find out definitely what is the matter with our system of distributing electrical goods. We are constantly hearing that something is wrong. But there is very little true knowledge.

It is clear, however, that before much progress can be made toward an improvement in the situation, curative and constructive measures must be undertaken. Present methods, costs and purposes must be studied and compared as they apply to different electrical commodities. And these facts must be known broadly before any common principles can be established and any general understanding of the subject can be hoped for.

SUCH an analysis will not crystallize out of thin air. It will mean work. It will cost money. It will need the experience of long contact and practical familiarity with every phase of our distribution on the part of the investigator. Which is very much the same as saying that each branch of the electrical industry must accept responsibility and undertake its own share of the job of working out the common problem.

The question is: What can the jobber do individually? What can the manufacturer do individually? What can the contractor and dealer do individually? What can the industrial plant do individually? What can these five groups do co-operatively through their associations? What can the Society for Electrical Development do? What can the electrical press contribute?

Perhaps it might be best to organize a "Joint Commission on Electrical Distribution," to initiate a comprehensive inquiry. If so, it should be officially representative of the major associations of these five groups concerned. It should have but this single purpose—to survey, study and report. It should be made up of men carefully chosen, adequately compensated and provided with competent legal guidance.

Out of such an inquiry would come a wealth of facts, from which it should be possible to fabricate a comprehensive picture of electrical distribution as it exists today and as it has operated in the past. In it each man's function, influence and responsibility should stand out clearly.

THE appointment of such a joint commission is not to be lightly undertaken, however. We have already far too many organizations in the electrical industry, and such a purpose might well fall within the scope of the Society for Electrical Development. But if the society plays the full part that it should in the campaign to "electrify America," it will have its hands full for some time. Meanwhile the problem waits.

The Electrical Supply Jobbers' Association has taken a first step in its study of jobbers' costs. What next—and who should do it? We must have facts—not only as to the cost of distribution, but also on the goodness and the badness of our habits.

Anson Wood Burchard

A promoter and organizer with an international reputation in the electrical industry.

IN THE president and chairman of the board of directors of the International General Electric Company and the vice-chairman of the board of directors of the General Electric Company one expects to find a man of a superior degree of executive ability and possessing a broad administrative vision cultivated by extensive experience. Anson Wood Burchard, who was recently elevated to these positions in the councils of the General Electric Company, fulfills in a peculiarly successful manner these requirements. It is men of his type who have made possible the progressive and economical development of the electrical industry by a broad policy of production, distribution and finance which has never permitted the industry to lag on account of internal weaknesses.

With other men who are influential in engineering and financial circles, Mr. Burchard has been a leader in formulating policies for developing the financial resources and credit of public utilities, enabling them to enlarge their buying power and expanding the importance of the central station. In the period from 1900 to 1905 and after he was very active in the consolidation of the several manufacturing units of the General Electric Company. The Stanley Electric Company, the Fort Wayne Electric Company, the General Incandescent Arc Light Company, the Northern Electric Company and the Sprague Electric Company were among the units consolidated under the management of the General Electric. Of late years he has contributed greatly to the development of manufacturing facilities, financial resources and sales methods of foreign manufacturing and sales agencies in such a way as to stimulate the expansion of the electrical industry abroad.

Mr. Burchard is a native of Hoosick Falls, N. Y., and was born April 21, 1865. Completing his studies at the local high schools, he matriculated into that favorite Alma Mater of engineering science, the Stevens Institute of Technology. The institution, of which he is now a trustee, graduated him in 1885 with the degree of mechanical engineer. Under this designation and in the same year he became connected with the J. M. Ives Company, engaged in steam and general factory engineering at Danbury, Conn. The transition from a technical to an executive position followed in 1891, when he became treasurer and manager of the T. & B. Tool Company of Danbury, continuing there almost to the end of the century. At this point his chief interest was temporarily diverted to the mining of copper. From 1900 to 1902 he was vice-president of the Cananea Consolidated Copper Company, operating mines at Cananea, province of Sonora, Mexico. Mr. Burchard, however, soon returned to the destined channel of his labor, which has widened greatly since the year 1902, when he joined the organization of the General Electric Company. Until 1904 he was comptroller at the company's headquarters in Schenectady, at which early date he became assistant to the president.

Mr. Burchard's counsel is sought by numerous interests outside the immediate sphere of his activity, particularly in the field of electric power development. Besides being a director of the General Electric Company, he is on the boards of the American Power & Light Company, the American Gas & Electric Company, the Worthington Pump & Machinery Corporation, the Western Power Corporation, the Central States Electric Company, the Republic Railway & Light Company, the Adirondack Power & Light Company and the Electrical Utilities Corporation. He was influential in the engineering and financial development of the Great Western Power Company. Nor are his electrical affiliations all strictly of a business kind. He is a member of the A. S. M. E., the A. I. E. E., the A. S. C. E. and Iron and Steel Institute of Great Britain. Catholicity of taste in recreation accounts for his membership in many clubs.

Editorial Comment

Electrical World, July 22, 1922

Volume 80

Number 4

The Rejection of Ford's Muscle Shoals Offer

THE Senate of the United States is a deliberate body not easily swayed or cajoled by claptrap oratory or flamboyant propaganda. For that reason it was expected that its agricultural committee would penetrate the mass of jingoism and fanaticism surrounding the bid of Henry Ford for Muscle Shoals and reject his trumpeted offer. That Senator Norris' committee has done with admirable grace. Nor could it very well have done otherwise. Had any one else made an offer like Ford's, neither the Senate nor the House of Representatives would have wasted a year considering it. Congress would have rejected it forthwith. The terms and conditions laid down by Ford were never fair or just to the taxpayers. They were opposed to the fixed policy of the government, and so flagrant was the effrontery that all the red herrings of fiat money, hundred-mile cities, cheap fertilizer, revitalized South, etc., were never strong enough to throw thoughtful men off the trail.

The Ford offer will now come before the full Senate, where it is certain to meet the doom that is its due. We believe that, in the best interests of the South and of the country as a whole, the Tennessee River at Muscle Shoals should be developed by a public utility company. Unfortunately, the Ford propaganda has been effective enough to make such a disposition of the project to the particular public utility which logic would indicate out of the question at this time. Eventually the public of the South, particularly of Alabama, will get a proper perspective of the Muscle Shoals controversy and wonder why it was so short-sighted as not to see the advantages which would accrue through public utility operation. We have every reason to suppose that even were the government to complete the project it would lease the water power to a public utility corporation and that it would feel, in so doing, that it was acting for the best interests of Southerners as well as the taxpayers in the country as a whole.

Protective Value of Choke Coils Is Questionable

CONSIDERABLE discussion has arisen lately regarding the value of using series inductance (choke coils) or shunted capacity to protect transmission lines and attached equipment against lightning disturbances. Either device will cause a reflected wave, and sustained oscillations may be set up in relation with the line constants. In this case the original strain may be increased and the time of application prolonged. This danger may be minimized by providing resistance in which the original energy starting the oscillations may be dissipated in successive cycles; consequently the suggestion has often been made that protective choke coils be shunted with a relatively high resistance. In the case of the condenser the resistance is placed in series with the condenser, the combination being shunted between line and ground. The addition of this resistance to the choke coil has rarely been adopted, probably because of uncertainty as to its value. In fact, the whole question as to whether this type of auxiliary apparatus should be installed at all is now the subject of considerable discussion. This is doubtless because of the wide variation of the type of the disturbing lightning impulse and the fact that the choke coil has a frequency limit below which it offers little protection. The shunted condenser has not been regarded with favor in this country owing to the lower cost and greater practicability of the choke coil. Moreover, the apparatus to be protected usually has itself a higher protective value than any permissible choke coil because of its inherent reactance. The suggestion is now frequently heard that an equivalent, if not greater, measure of protection may be had by putting the cost of the choke coil into increased insulation of the line terminals of the equipment. This tendency away from the use of choke coils, already noticed in this country, has been given the emphasis of open expression in Europe, at the international conference on high-tension transmission held in Paris several months ago.

Dangerous Lure of Statistics

WE HAVE been greatly entertained of late by the revival of the public ownership debate, with the Hydro-Electric Power Commission of Ontario, W. S. Murray et al. as active participants. The end is not reached and the single taxers and fundamentalists have yet to be heard from. The striking part of the discussion is not its novelty but the fact that both sides draw their bows (it would be impolite to say long bows) with arrows from the same quiver. As we have often reiterated, one cannot safely draw conclusions from one generating plant for another unless guided by practical omniscience; the facts in this case emphasize this view.

It seems indeed remarkable that simple things like the costs to the consumer cannot be so stated as to be definite, but to the mind of a confirmed statistician all things in the way of averages are horrible. For example, what is the average price of electrical energy from the consumer's standpoint? One answer is given by reckoning from the total output and the total receipts therefor, quite another by averaging the rates paid by the individual consumers. And the fact that John Doe is paying 1 cent per unit is no consolation to Richard Roe, who is paying 10.

Only when everybody pays the same rate per unit does the problem become definite, and this is a condition notoriously undesirable from the viewpoint of costs of service, which, however much publicists may grumble, somebody must pay. And is it fair to shovel Roe's costs upon Doe? After matters like this are fairly threshed out, one can profitably take up distribution of depreciation, whether bonded indebtedness is perpetual or payable, the segregation of charges between public departments and other casual phases of the situation.

The evidence thus far presented shows that the data at hand are an unfailing fountain of irreconcilable conclusions. Nobody but the men who compile statistics on a large scale knows exactly what is implied, and even they may have forgotten. From the whole matter, however, we are inclined to draw three theses that may be generally defended:

First: That the clash of statistical data is the meeting of an immovable body and an irresistible force.

Second: That the Hydro-Electric Power Commission within its necessary limitations has done an unusually effective job.

Third: That any honest person who, knowing the political history of New York, Chicago, Boston, Philadelphia et al., desires to see public ownership of electric utilities undertaken by them should be sent to the psychopathic ward for observation.

Stifling Generator Fires with Inert Gas Has Advantages

THE very complete experiments of the Union Electric Light & Power Company at St. Louis to determine the effectiveness of using carbon-dioxide gas for extinguishing generator fires (reported elsewhere in this issue) open up a new method of fighting electrical fires which seems to have marked advantages over other methods proposed. Steam and water as fire extinguishers have the disadvantage that systems which can be operated promptly are difficult to install without incurring the danger of introducing moisture at the wrong time. Besides, the moisture will permeate the windings, which must be carefully dried out before being restored to service. Even then, there is a question of whether breakdown may not occur as a result of the wetting.

The system in use in St. Louis has none of these disadvantages. According to the tests, it required a little more than 15 per cent of CO_2 to smother a fire. To produce this concentration in a 20,000-kw. generator in a short enough time to be effective in preventing extensive damage involved some difficulties at first. However, they were overcome, and the required saturation was obtained in one and one-quarter minutes.

This use of a closed-circuit ventilating system into which an inert gas can be injected when a fire is detected is a step in the right direction and seems worthy of more extensive application.

Farm Interests Taking Hand in Rural Lines Question

IT SEEMS that some utility executives are not yet awake to the meaning of the demand for electric service on the farm. In a discussion of the subject a short time ago one man declared that his company had investigated its rural lines and as a result had decided to get rid of them as soon as possible. In conversation he took the position that it was up to the farmer to get the service and that the utilities should assume no responsibility. This certainly does not represent the attitude of the electric light and power industry. Utility commissions have taken cognizance of the demand for farm service, and a considerable amount of progress has been made in developing methods of establishing the service. In this work the electric light and power industry has co-operated. The feeling exists that the central station must assume some responsibility for farm service, whether it wishes to do so or not.

In deciding policies on this subject it will be well to bear in mind that there are some strong organizations in the country representing the farmer and his interests. In fact, in one or two cases some of these agencies have already been pulled into the question. The most notable case is the one recently before the Illinois Commerce Commission in which the Farm Bureau was formally represented and took an active part. It is unfortunate that in this particular case serious misunderstanding of the conditions involved in farm service prevailed, and it is more unfortunate in view of the fact that much of the misunderstanding seemed traceable to the prevalence among a very few central-station men of an attitude like that noted above. This attitude seems to have been a real factor in the creation of a condition that led the commission to rescind the existing rules covering the establishment of rural service and open up the whole question on a more or less controversial basis. Fortunately, broader-visioned central-station men have taken hold in this case and an effort to work out the solution in a co-operative way has been begun.

One way in which the situation can be worked out in a satisfactory manner is to get all interests together for a friendly study of the problem. "Buck passing" in the effort to avoid responsibility may end in thrusting the whole question of rural service on the farm into the political arena. It is too close to that status for comfort right now in some localities, and the question is no longer one that can be confined to utility circles. Others are already taking a hand.

Prompt Service and Accurate Accounting Essential to Storeroom Operation

THAT materials in the storeroom should be handled as carefully as cash is a statement that has been made so often that it may sound trite. Unfortunately, practice has not measured up to the theory among many central stations and untidy, slipshod storerooms are all too prevalent. In addition to careful buying and accounting for supplies there is a third essential in good storeroom practice that is almost entirely overlooked, or else allowed to dominate the stores force to the exclusion of all else. This essential is prompt service in providing the supplies needed and in getting requisitions filled with the least possible loss of time. In one case the stores system is built on the theory that securing of material must be made as difficult as possible to impress the working forces with the value of the articles they use. The result is a stores department that hampers all company operations and is continually at odds with other departments. The other extreme exists where getting material out promptly is insisted on to an extent that prevents proper accounting. In such cases the working forces are allowed to grab material and let the stores force account for it as best it can.

There is a happy medium in which the stores system is built up with an eye to both proper accounting and system service. Both objects require careful co-operation between the various departments and the storekeeper. The function of the latter is the provision of such working materials as the executive officers decide are necessary for the welfare of the property. He also has the duty of seeing that all material passing through his hands is fully accounted for as to issuance from the storeroom on proper authority and charged to the correct accounts. Beyond this the responsibility becomes one belonging to the department heads.

An excellent example of how the problem can be worked out was presented by Paul Hoheisel in the July 15 issue, where he referred to the system used by the Oklahoma Gas & Electric Company. The record system which he outlined is not particularly new, but a study of the manner in which the details have been handled to enable service along with proper accounting should be beneficial to every one. The method of arranging stock to save time in issuing material is a rather valuable feature that can be copied with profit. One of the serious faults of many storerooms is that the stock is arranged so haphazardly that the storekeepers never know just what they have. This problem has been given a careful study by the Oklahoma company. The solution has been found not only in a careful arrangement of storage facilities but also in a thorough tying together of the actual stock and the records on the ledgers. The use of materials on hand (by substitution) until frozen stocks have been used up is an important practice in which the storekeeper must play a prominent part. Most important of all is the standardization of materials used in the most common operating and construction activities. This is one of the most potent factors in the elimination of frozen stocks, which are usually due to lack of judgment in purchasing or to allowing department heads to follow their own fancies in the use of materials without any effort to co-ordinate those fancies.

A Correction as to Fact, but Not as to Opinion

IN THE June 17, 1922, issue of the *Electrical World*, on page 1207, an editorial under the title "Over-regulation of Radio Installations Undesirable" was in error in stating that an ordinance establishing control of radio installations in the city of Chicago had been passed. A news item on page 1240 of the same issue gives the true status of the measure, which is that of an ordinance introduced and on which hearings will be held to give those interested an opportunity to present their views.

The intent of the original editorial as a protest against over-regulation is, however, again called to attention. The underwriters have proposed certain changes in the insurance rules that are simple, cost little and will make for improvement in the installation of radio sets. There have been some regrettable accidents due to ignorance or carelessness in the installation of radio apparatus, notably in the putting up of antennas. However, the ordinary receiving set is in no way connected with the house-lighting system. The installations involving house wiring, conflicts with light and power conductors and any situation in which danger is created by reason of the proximity of conductors carrying high potential are undoubtedly covered under existing ordinances in any city exercising control over electrical installations, unless there are defects in the ordinances. Until there are developments in the radio field that indicate the need of elaborate supervision and inspection systems the reasonable course would seem to be the use of existing facilities and ordinances with such corrections of defects as are found necessary.

Compensation of Current Transformers a Distinct Advance

NOT the least important characteristics of electrical apparatus in general, as bearing on its reliability, efficiency and satisfactory performance, are the variety and simplicity of available principles of compensation and the facility with which they may be applied. Voltage drop in direct-current generators is corrected by the series field winding. The same auxiliary serves to adapt the motor to the special speed and torque requirements of its load, and in the synchronous converter to give proper adjustment of power factor. The compensating pole, the induction regulator and various modifications of differential windings are but a few of the numerous instances in which compensation for inherent limitations is accomplished by the simple addition of an extra coil or two, or at most an auxiliary pole or transformer.

A new application of this general principle was announced in the recent paper of Brooks and Holtz before the annual convention of the A. I. E. E. on the current transformer, an instrument which is subject to well-known inaccuracies in the matters of ratio and phase angle. The transformer is inherently one of the most perfect types of electrical equipment as regards voltage regulation and ratio, but at light loads the current ratio and the phase difference of primary and secondary currents suffer wide variations, due to the superposed magnetizing current in the primary circuit. This fact, of little consequence in power transformers, assumes great importance in the current transformer when connected to wattmeters for measuring the power of the primary circuit. The Brooks transformer aims to correct these errors, and its principle is so simple as to excite surprise that it has not been adopted before.

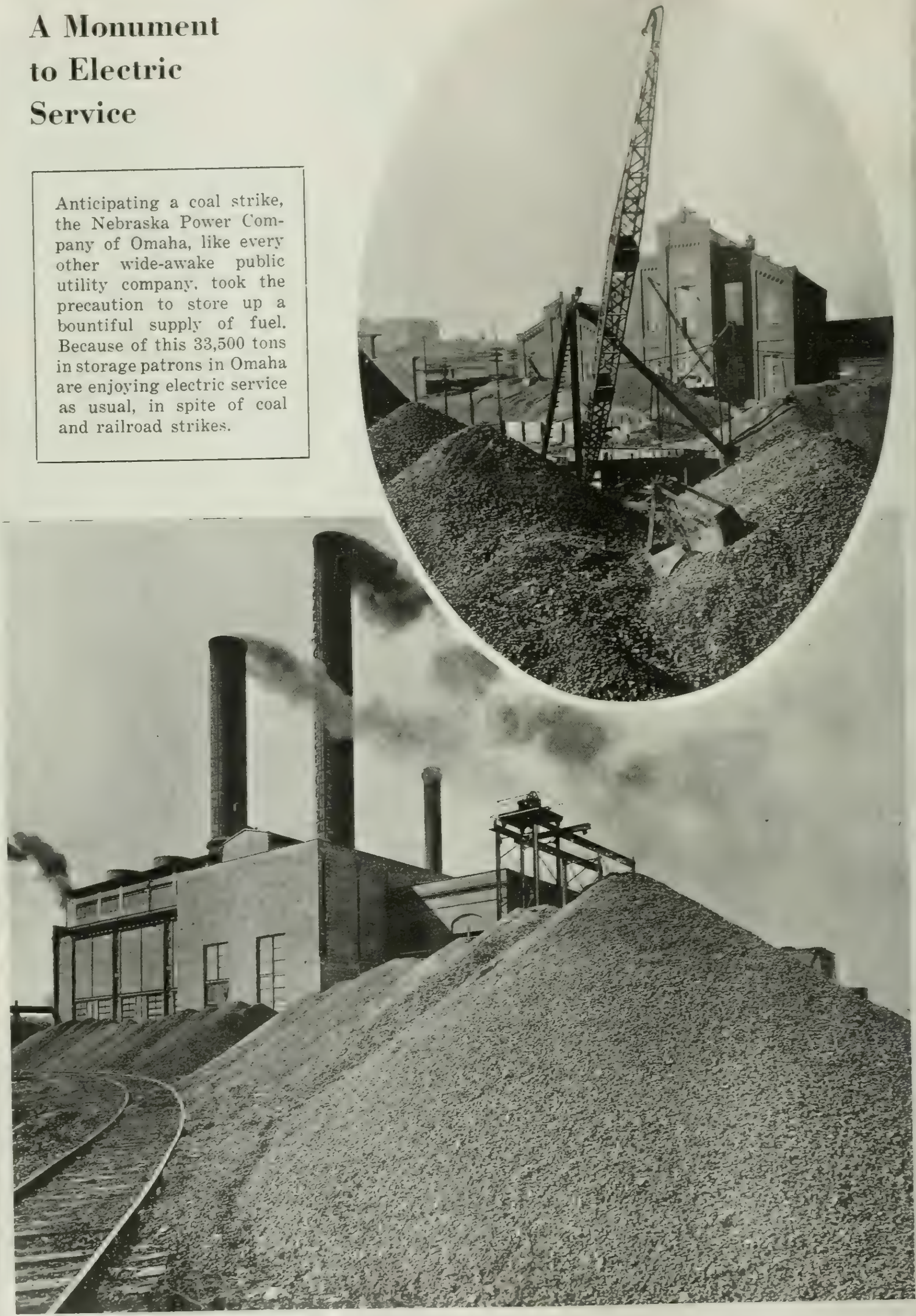
Recognizing that two currents may be combined vectorially by passing both around the same magnetic circuit, primary and secondary currents of the usual current transformer are carried through two windings on a branch magnetic circuit, and a tertiary winding on this circuit receives an electromotive force due to flux set up by the resultant of primary and secondary currents. As it is this resultant, with its varying value and phase, that causes the principal errors, the tertiary circuit carried to a separate winding on the wattmeter affords a large measure of compensation, as evidenced by greatly improved ratio and phase-angle curves.

Naturally the compensation so afforded is not obtained without certain disadvantages. The weight and cost of the transformer are increased, and an additional winding is required on the wattmeter. Further, in the case of high-voltage primary circuits especially, there are certain types of error, arising in secondary leakage reactance, which are not completely compensated by this method. In many commercial designs secondary leakage reactance is frequently comparable in magnitude to the rated secondary burden, and if not inherently balanced in the primary both ratio and phase relation between primary and secondary may be upset. However, the added weight and cost are relatively unimportant as compared with the increase in accuracy obtained, and the reactance errors are negligible in many cases and can probably be reduced by careful design in others.

The new transformer appears to be a distinct advance in the problem of metering large power systems.

A Monument to Electric Service

Anticipating a coal strike, the Nebraska Power Company of Omaha, like every other wide-awake public utility company, took the precaution to store up a bountiful supply of fuel. Because of this 33,500 tons in storage patrons in Omaha are enjoying electric service as usual, in spite of coal and railroad strikes.



Extinguishing Generator Fires with CO_2

Arrangement of the Fire-Extinguishing Equipment at the Ashley Street Plant of the Union Electric Light & Power Company - Percentage of Gas Necessary to Be Effective Shown

By J. B. WHEELER
Assistant Chief Engineer Union Electric Light & Power Company, St. Louis

WITH the advent of turbo-generators of increased capacity we are confronted with many problems, among which the protection of generators against fire is a vital one. Particular importance attaches to this task by reason of the monetary loss involved in the destruction of these large types of equipment as well as the reduction in capacity caused by the loss of a single unit. The excessive volumes of air required for ventilation impose added tasks in the prevention as well as control of these fires.

It is common practice in the construction of the larger types of turbo-generators for the ventilating fan to be made integral with the generator rotor, requiring the air supply to be under suction at all times. This permits foreign material to enter through crevices and other places despite the protective screens. Even though the suction chambers are isolated and provided with screens and air washers, a certain amount of foreign matter, oil, etc., is brought into the generator. This dirt accumulates in the generator windings, particularly the end turns, and, with high temperatures caused by electrical troubles within the unit, by the distribution system or by static electricity within the machine, provides fuel for rapid combustion when once ignited.

ARRANGEMENT OF EQUIPMENT

The larger types of units require air capacities of 55,000 cu.ft. per minute and upward, this figure representing the volume required for a 20,000-kw. General Electric unit. The weight of air passing through one of these machines per hour is approximately equal to the weight of the unit itself. Under these conditions the need of fire protective devices is apparent, and many systems and methods have been developed for this purpose. Water and steam have been used for some time and have proved quite efficient. At the Ashley Street station of the Union Electric Light & Power Company are installed three 20,000-kw. units, one 10,000-kw. horizontal unit and one 4,000-kw. horizontal unit. About a year ago experiments were undertaken to determine the practicability of carbon dioxide (CO_2) gas for extinguishing such fires. The excessive volume of air supplied for ventilation proved the greatest obstacle to this method, and it was only after extensive experiments that a successful installation was completed. A typical arrangement of the installation is shown in Fig. 1, the principal features of which are two. First, a set of dampers is so situated in the discharge duct that when closed they completely block off the discharge, leaving an opening from the discharge duct to the suction and thereby short-circuiting the discharge back into the suction. Having no outlet, no additional air is brought in, and with the exception of a small leakage, this constant quantity of air is revolved in the generator and suction chamber. Second, after the dampers are closed sufficient carbon dioxide gas is injected into the suction chamber from a common storage tank to extinguish the fire, the quantity of CO_2 being based on experiments described later in this article.

To determine the saturation of air with CO_2 gas that

TABLE I—ACTION OF CANDLE FLAME WITH VARIOUS PERCENTAGES OF CO_2

Per Cent CO_2	Remarks
21.5	Flame extinguished immediately on entering neck of bottle.
20.8	Flame extinguished immediately on entering neck of bottle.
19.4	Flame extinguished immediately on entering neck of bottle.
17.2	Dropped about 2 in. farther into bottle before being extinguished.
17.0	Dropped about 2 in. farther into bottle before being extinguished.
15.6	Dropped half way to bottom of bottle, diminishing in size gradually until extinguished.
14.0	Gradually diminished in size and was extinguished about 1 in. from bottom of bottle.
13.8	Gradually diminished in size and was extinguished just as it reached bottom of bottle.
12.7	Flame gradually diminished in size, being very small when it reached bottom of bottle, but was maintained and gradually increased as it was raised, burning brightly as it left the bottle.

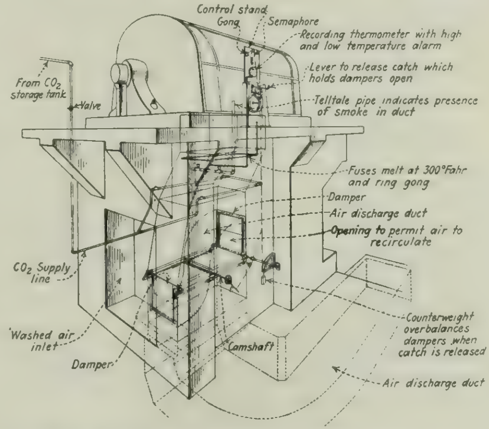

Control stand
Gong
Semaphore
Recording thermometer with high and low temperature alarm
Lever to release catch which holds dampers open
From CO_2 storage tank
Valve
Telltale pipe indicates presence of smoke in duct
Fuses melt at 300°Fahr and ring gong
Damper
Air discharge duct
Opening to permit air to recirculate
CO_2 Supply line
Counterweight overbalances dampers when catch is released
Washed air inlet
Camshaft
Damper
Air discharge duct

FIG. 1—TYPICAL ARRANGEMENT OF VENTILATING DUCTS, FIRE INDICATING AND CONTROL APPARATUS

Washed air for generator ventilation enters through opening in left foreground, passes up through suction chamber which surrounds the discharge duct, and after circulating through generator passes down through discharge duct to discharge tunnel in right foreground. There being a constant pressure in the air chamber, the presence of fire will be evidenced by smoke issuing from the telltale pipe at left of control stand. High temperature will also be indicated by the recording thermometer, which operates an alarm bell. Attached to this alarm are also fusible links set to fuse at 300 deg. and thereby operate the alarm. After assurance that a fire exists, the damper-closing lever on control stand is operated, allowing counterweight to drop and close dampers in discharge duct. Their position is indicated by a semaphore. The operation of the dampers also uncovers an opening between discharge duct and suction duct, permitting recirculation of cooling air. Immediately upon closure of dampers, the cam shaft operates to wedge the doors against supporting angles and thereby prevent air leakage. CO_2 gas is then admitted to the closed ventilating circuit to stifle combustion, by operating valve in CO_2 supply line.

would not sustain combustion, observations were made of the action of various percentages of CO_2 gas on a tallow-candle flame. The CO_2 gas was supplied from a commercial tank 8 in. in diameter and 4 ft. high. The gas was mixed with the air in a 5-gal. glass bottle. A candle fastened to a wire was then lowered into the bottle and the effect on the flame noted. The percentage CO_2 gas was measured with an Orsat apparatus, samples being drawn through a glass tube from the center of the bottle, the tube being held by a rubber stopper in its mouth. A small hole was put in the stopper to allow a little air to enter while drawing a sample into the Orsat apparatus. Carbon dioxide was liberated into the bottle for a few seconds through a hose. The bottle was then turned bottom side up several times to agitate the mixture of CO_2 gas and air. A sample of the mixture was then drawn into the Orsat apparatus and the percentage of CO_2 gas determined. The lighted candle was lowered into the bottle to a point where the flame was extinguished and then withdrawn. The bottle was next held with the mouth down for about fifteen seconds to allow some of the CO_2 gas to escape. The above performance was repeated and more CO_2 allowed to escape until, with decreasing percentage of CO_2, the candle burned when lowered to the bottom of the bottle. The results of the experiments are shown in Table I.

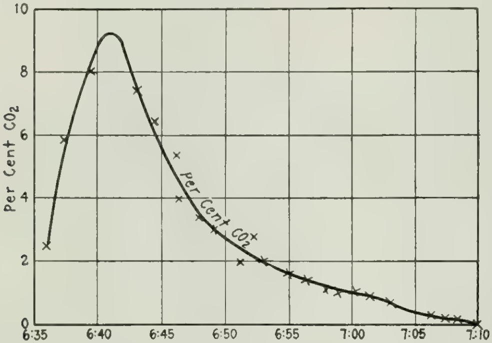


FIG. 2—PRELIMINARY TEST OF TIME REQUIRED TO LIBERATE CO_2 AND OBTAIN MAXIMUM PERCENTAGE OF SATURATION OF AIR IN THE GENERATOR VENTILATING DUCTS

The results indicated that, despite the agitation of the mixture, the CO_2 gas tends to settle to the bottom. The samples being drawn from the bottle at a point about half way up from the bottom, the percentage of CO_2 at which the candle was extinguished at this point is taken as the amount necessary to quench a candle flame, or 15.6 per cent CO_2. It is evident, therefore, that sufficient CO_2 should be liberated into the generator to form a saturation of not less than 15.6 per cent by volume.

The saturation of CO_2 that could be obtained and the length of time which it could be maintained by admitting a known quantity of CO_2 into the suction chamber of the generator with the discharge dampers closed was also determined. This was done by liberating two 50-lb. drums of liquid CO_2 simultaneously into the suction chamber and measuring the CO_2 percentage with two Orsats. The samples were taken as quickly as possible out of the telltale pipe previously described. Considerable difficulty was encountered in the liberation of the liquid CO_2 owing to the rapid expansion causing freezing of the pipe lines, particularly at the throat of the drums. By alternately opening and closing the valves most of the CO_2 was released. The time required, however, was greater than would have been necessary if the gas had been admitted at lower pressures. A record (Table II) was kept of the actual time each tank was discharging to obtain the relation of time of maximum saturation to maximum input of CO_2.

The saturation obtained is plotted in Fig. 2 with relation to time. The maximum CO_2 saturation by analysis was 8.9 per cent at 6:41:30, the previous reading being 8.0 per cent at 6:39:40. Both tanks were recorded as being on discharge at 6:42:10, or forty seconds later, and it appears reasonable to assume, owing to difficulties in recording the time accurately at the several locations, that the maximum saturation was obtained when the two tanks were open at the same time. The curve indicates a maximum saturation of 9.2 per cent. The tanks contained approximately 400 cu.ft. each, or 800 cu.ft. of free gas. Assuming 80 per cent liberated, 640 cu.ft. was discharged into the generator. The volume of the suction chamber is approximately 6,000 cu.ft., and with no leakage the saturation would have been 10.6 per cent. The difference between this and the actual results indicate the amount of leakage. It will also be observed from Fig. 2 that a trace of CO_2 remained as long as thirty-six minutes, showing the leakage to be quite small. Manometer readings were taken in the suction and discharge tunnels after blowing out the CO_2 and reclosing the dampers. No readings could be obtained to indicate any appreciable air flow.

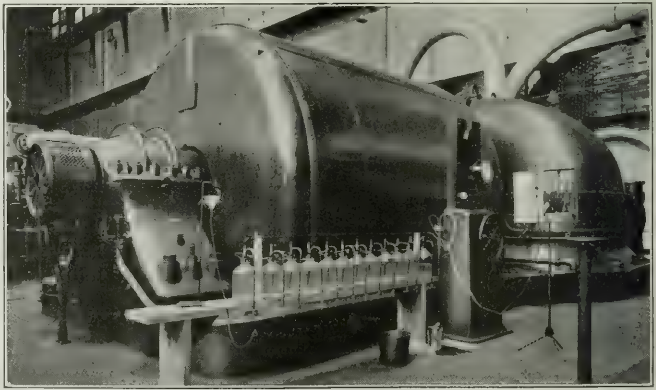


FIG. 3—APPARATUS FOR TAKING SAMPLES OF AIR IN GENERATOR VENTILATING DUCTS ON FINAL TEST OF FIRE-EXTINGUISHING APPARATUS

From the previous experiment it was established that 15.6 per cent saturation will not sustain combustion, and from the above test it was found that with the equipment as set up we could utilize 86 per cent of the CO_2 supplied. On this basis it was calculated that a generator with a supply chamber containing 6,000 cu.ft. would require: $6{,}000 \times \frac{15.6}{100} \div \frac{86}{100}$ = 1,088 cu.ft. CO_2.

As it was preferable from the standpoints of both practicability and hazard to supply this gas at a pressure not to exceed 150 lb. (gage) pressure, the above results indicated a required storage capacity of approximately 110 cu.ft. Consequently a storage tank 3 ft. in diameter by 16 ft. long was installed and connected by common header to all machines.

TEST OF FIRE-EXTINGUISHING EQUIPMENT

To determine the maximum saturation that could be obtained and the length of time over which it could be maintained tests were conducted by releasing a storage tank of 113 cu.ft. capacity through a 2-in. pipe line into generator housing. Because of the quantity of gas released instantaneously considerable care was given to the method that was used of obtaining and analyzing samples.

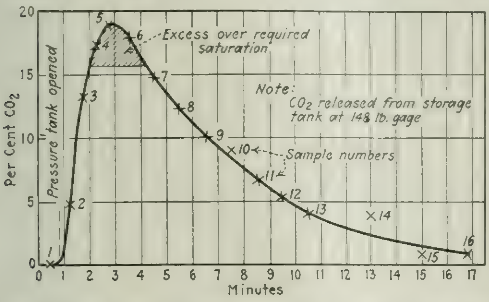


FIG. 4 — THE FINAL ARRANGEMENT OF APPARATUS PERMITTED EMPTYING SUFFICIENT CO_2 INTO THE GENERATOR VENTILATING DUCTS TO SMOTHER FIRE

The required saturation of 15.6 per cent was reached in one minute and fifteen seconds, and it was maintained for a period of two minutes and fifteen seconds at this or a greater value.

A series of gallon glass jugs were set up as shown in Fig. 3 and filled with water from the bottom, driving all air out. By siphoning the water out of each jug consecutively a continuous gas sample was obtained. These samples were analyzed with an Orsat immediately after all samples were taken. The saturation obtained and the length of time maintained are shown in Fig. 4, which indicates that the required saturation of 15.6 per cent was available in one minute and fifteen seconds and was maintained for a period of two minutes and fifteen seconds. A trace of CO_2 was maintained over a total period of seventeen minutes, indicating very little leakage in the generator housing or dampers. Manometer readings were taken just after dampers were closed and before CO_2 was admitted. No air flow was recorded.

TABLE II—TIME REQUIRED TO EMPTY CO_2 TANKS INTO GENERATOR VENTILATING DUCTS ON PRELIMINARY TESTS

No. Tanks Discharging	Time		No. of Minutes
1	6:35:20	—6:39	3⅔
1	6:39	—6:42:10	3⅙
2	6:42:10	—6:44	1⅚=3⅔
1	6:44	6:44:30	½
1	6:50	—6:51	1
1	6:54	—6:57	3
1	7:00	—7:00:30	½
1	7:02	—7:03	1
Total time to empty tanks			16½

NOTE—During previous test six and one-half minutes was required to empty three-quarters of a tank, or approximately 300 cu.ft.

Water Power in North Carolina

A RAPID metamorphosis has occurred in North Carolina in the past decade by which the state has moved from twenty-third to about tenth in value of its industries and from nineteenth to about fourth place in value of crops, as well as becoming the greatest industrial state in the South. Accompanying this has come a tremendous demand for power to meet the needs of the growing industries. This has been met in large part by the creation of a gigantic water-power development. Nowhere east of the Rocky Mountains is so large a proportion of the total power for industrial use supplied by hydro-electric development. Even so, there is a dearth of power in the state today, and the hydro-electric industry is bound to be greatly extended within the next decade.

To discover the present distribution and concentration of power development in North Carolina and the exact situation as to power output and power needs, the State Geological Survey, under the direction of Thorndike Saville, hydraulic engineer, and in co-operation with the United States Geological Survey, is now conducting a power census covering the following subjects: Total amount of power used, whether water power, steam or oil; type of installation; number of wheels; height of dam; use of power; method of using power, that is, whether machinery is directly connected, belt-driven or served by individual motors; whether power is purchased, and if so, from what source, and whether more power is needed and, if so, whether it can be purchased. Very comprehensive data are being obtained as to the power situation in the state. When the census is completed the shortage of power and the location of markets for new power will be definitely known. The survey will then be in a position to investigate immediately the water-power resources of those districts where the power shortage is most acute and advise to what extent new water power can be advantageously developed. If sufficient water power cannot be economically developed, other methods will be outlined for supplying power needs.

Operating Company	Total Horsepower
Bridgewater plant, Southern Power Company	30,000
Lookout Shoals, Southern Power Company	33,000
Blewitt Falls plant, Carolina Power & Light Company	32,150
Buckhorn Falls plant, Carolina Power & Light Company	3,350
Badin plant, Aluminum Company of America	93,000
Narrows of Yadkin plant, Aluminum Company of America	20,000
Cheoah plant, Aluminum Company of America	72,000
Tuxedo plant, Blue Ridge Power Company	8,000
Ivy, Marshall and Weaver plants, North Carolina Power Company	7,750
Other public utility plants less than 5,000 hp.	14,292
Manufacturing plants, census of 1914	41,181
Estimated manufacturing development since 1914	5,277
Total	360,000

Until this census is completed exact figures as to water-power development in North Carolina are not available. From the best data at hand the present water-power development is approximately as given in the accompanying table.

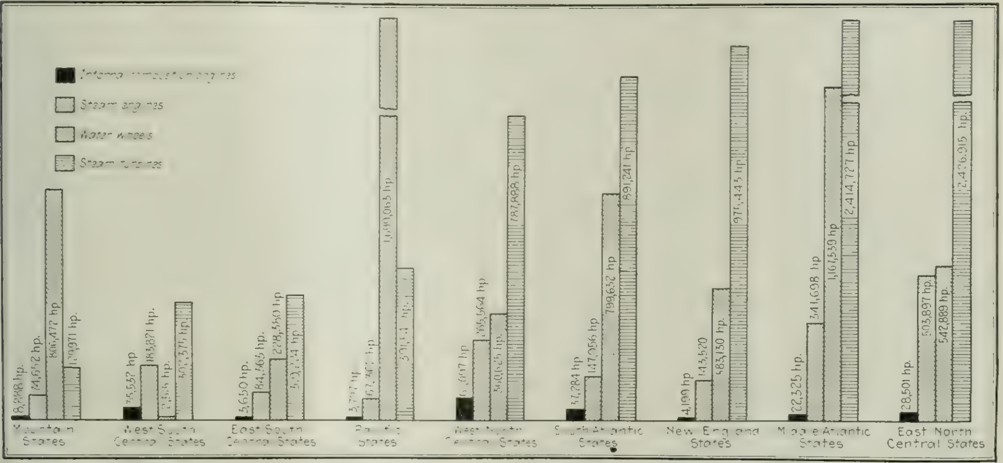
Of the total of 360,000 hp., 80,000 hp., or 22 per cent, is transmitted for use outside the state, and 113,000 at Badin, or 31 per cent, is used in the local reduction of aluminum. The remaining 167,000 hp. available for general, industrial and public use amounts to only 46 per cent of the total developed in the state. Of this approximately 45,000 hp. is developed and used for private manufacturing establishments in relatively small units.

Generator and Prime-Mover Equipment of the Central Stations of the United States as of Oct. 1, 1921

States and Sections	Number of Operating Companies	Number of Generating Plants	Rating of Installed Generators, Kw.	Prime Movers									
				Steam Engines		Steam Turbines		Internal Combustion Engines		Waterwheels		Boilers	
				Hp.	Per Cent of Country	Kw.	Per Cent of Country	Hp.	Per Cent of Country	Hp.	Per Cent of Country	Hp.	Per Cent of Country
United States	5,624	5,532	14,466,915	1,812,833	100.0	8,639,325	100.0	205,183	100.0	6,200,245	100.0	4,042,922	100.0
SECTIONS													
New England	350	341	1,343,542	143,520	7.9	975,443	11.3	4,199	2.0	583,130	9.4	308,421	7.6
Middle Atlantic	592	575	3,257,974	341,698	18.9	2,414,727	27.9	22,325	10.9	1,167,539	18.9	967,236	23.9
South Atlantic	659	633	1,777,373	147,956	8.1	891,241	10.3	37,284	18.2	799,632	12.9	386,149	9.6
East North Central	1,174	1,095	3,548,763	503,897	27.9	2,426,915	28.2	28,501	13.9	542,889	8.6	1,139,742	28.2
West North Central	1,419	1,286	1,313,292	265,564	14.7	787,888	9.1	61,097	29.8	360,625	5.8	499,399	12.4
East South Central	358	368	517,569	84,363	4.6	319,224	3.7	3,650	1.8	228,380	3.7	198,866	4.9
West South Central	545	572	485,063	183,821	10.1	302,375	3.5	35,532	17.3	12,515	0.2	246,119	6.1
Mountain	300	365	683,930	74,652	4.1	129,971	1.5	8,888	4.3	806,472	13.0	125,295	3.1
Pacific	227	297	1,539,409	67,362	3.7	391,541	4.5	3,707	1.8	1,699,063	27.5	171,695	4.2
NEW ENGLAND:													
Maine	75	82	116,281	14,868	0.8	17,950	0.2	250	0.1	156,549	2.6	15,425	0.4
New Hampshire	49	56	52,157	23,085	1.3	17,075	0.2	1,110	0.5	112,865	1.8	26,642	0.7
Vermont	56	72	87,619	7,995	0.4	9,450	0.1	9	0.0	72,651	1.2	11,682	0.3
Massachusetts	119	82	739,917	67,522	3.8	635,226	7.4	580	0.2	157,605	2.5	160,790	3.9
Rhode Island	12	6	143,283	5,980	0.3	124,370	1.4	1,125	0.6	3,510	0.0	24,362	0.6
Connecticut	39	43	204,285	24,070	1.3	177,372	2.0	1,125	0.6	79,950	1.3	69,520	1.7
MIDDLE ATLANTIC:													
New York	306	301	1,586,443	129,401	7.2	1,072,842	12.4	5,665	2.8	993,601	16.1	385,018	9.5
New Jersey	60	68	349,556	74,911	4.1	273,050	3.2	2,220	1.1	8,883	0.1	147,870	3.7
Pennsylvania	226	206	1,321,975	137,386	7.6	1,068,835	12.3	14,440	7.0	165,055	2.7	434,348	10.7
SOUTH ATLANTIC:													
Delaware	13	10	34,315	5,885	0.3	28,725	0.3	0	0.0	0	0.0	13,735	0.3
Maryland	45	37	191,523	21,724	1.2	105,450	1.2	955	0.5	2,120	0.0	61,936	1.5
District of Columbia	3	3	90,000	5,800	0.3	145,000	1.7	0	0.0	0	0.0	25,050	0.6
Virginia	92	99	167,941	8,701	0.5	82,162	1.0	5,747	2.8	76,551	1.2	40,052	0.9
West Virginia	64	55	351,620	14,957	0.8	310,280	3.6	19,090	9.3	8,410	0.1	83,385	2.1
North Carolina	140	121	221,117	21,268	1.2	63,875	0.7	350	0.2	126,070	2.2	35,355	0.9
South Carolina	72	73	396,819	10,115	0.6	46,000	0.5	3,562	1.7	321,250	5.2	22,113	0.6
Georgia	152	144	250,718	37,843	2.0	59,725	0.7	3,345	1.6	262,495	4.2	68,978	1.8
Florida	78	91	73,320	21,663	1.2	50,024	0.6	4,235	2.1	2,736	0.0	35,545	0.9
EAST NORTH CENTRAL:													
Ohio	271	234	1,098,433	164,718	9.1	898,662	10.5	11,218	5.5	24,236	0.4	363,040	9.0
Indiana	199	163	373,113	62,633	3.4	251,702	2.9	6,060	2.9	21,236	0.3	164,792	4.1
Illinois	247	255	961,814	150,132	8.4	734,720	8.5	4,127	2.0	73,591	1.2	346,122	8.6
Michigan	190	217	712,624	56,451	3.1	357,615	4.2	2,069	1.0	228,353	3.6	162,418	4.0
Wisconsin	267	226	402,779	69,963	3.9	184,216	2.1	5,027	2.5	195,473	3.1	103,370	2.5
WEST NORTH CENTRAL:													
Minnesota	219	199	299,131	39,878	2.2	116,687	1.4	7,970	3.9	145,247	2.3	83,479	2.1
Iowa	224	215	298,244	63,298	3.5	115,872	1.3	4,286	2.1	169,614	2.8	106,096	2.6
Missouri	234	198	397,911	64,026	3.6	389,452	4.5	6,366	3.1	17,670	0.3	152,171	3.8
North Dakota	119	128	25,433	19,435	1.1	6,600	0.0	3,100	1.5	0	0.0	24,276	0.6
South Dakota	112	110	30,760	7,597	0.4	12,875	0.2	9,253	4.5	6,050	0.0	15,045	0.4
Nebraska	251	226	112,106	27,748	1.5	51,790	0.6	11,646	5.7	12,036	0.2	50,240	1.2
Kansas	260	210	149,707	43,582	2.4	94,612	1.1	18,476	9.0	10,008	0.2	68,092	1.7
EAST SOUTH CENTRAL:													
Kentucky	111	119	109,483	22,237	1.2	94,275	1.1	2,210	1.1	115	0.0	46,446	1.1
Tennessee	92	91	172,280	17,585	0.9	67,025	0.8	375	0.2	125,865	2.0	48,412	1.2
Alabama	62	64	192,918	26,837	1.6	131,108	1.5	0	0.0	102,400	1.7	76,951	1.9
Mississippi	93	94	42,888	17,704	0.9	26,816	0.3	1,065	0.5	0	0.0	27,057	0.7
WEST SOUTH CENTRAL:													
Arkansas	82	86	59,277	27,130	1.5	38,417	0.4	1,361	0.7	720	0.0	34,625	0.9
Louisiana	67	64	87,674	33,667	1.9	55,327	0.6	4,190	2.0	0	0.0	34,630	0.9
Oklahoma	156	165	104,328	47,594	2.6	48,034	0.6	10,110	4.9	1,718	0.0	61,161	1.5
Texas	240	257	233,784	75,430	4.1	160,597	1.9	19,871	9.7	10,077	0.2	115,703	2.8
MOUNTAIN:													
Montana	58	67	227,791	12,141	0.7	3,000	0.0	878	0.4	342,480	5.6	14,146	0.4
Idaho	39	54	121,160	2,745	0.1	0	0.0	40	0.0	222,471	3.6	2,990	0.0
Wyoming	34	38	21,699	6,925	0.4	16,316	0.2	1,613	0.8	7,560	0.1	14,342	0.4
Colorado	64	73	136,605	23,034	1.2	68,845	0.9	380	0.1	79,708	1.3	51,910	1.3
New Mexico	27	27	10,506	7,008	0.4	3,010	0.0	2,895	1.5	799	0.0	6,472	0.1
Arizona	30	31	58,439	9,965	0.6	17,400	0.2	2,800	1.4	38,760	0.6	18,115	0.5
Utah	36	58	85,380	11,919	0.7	20,000	0.2	0	0.0	101,844	1.6	15,820	0.4
Nevada	12	17	22,350	915	0.0	1,400	0.0	282	0.1	12,850	0.2	1,500	0.0
PACIFIC:													
Washington	86	92	416,278	16,629	0.9	70,155	0.8	430	0.2	443,139	7.2	44,722	1.1
Oregon	58	70	144,708	16,845	0.9	40,000	0.5	202	0.1	125,970	2.0	35,961	0.9
California	83	135	978,423	33,888	1.9	281,386	3.2	3,075	1.5	1,129,954	18.3	91,012	2.2

Prime Movers in Central Stations Total 19,737,361 Hp.

Analysis of Development of Electric Light and Power Companies Indicates a Total of 13,331,933 Hp. in Steam Motors, of Which 87 per Cent Is for Steam Turbines—Boiler Installation Totals 4,042,922 Hp.



PREDOMINANCE OF THE STEAM TURBINE AND WATERWHEEL AS A PRIME MOVER IN THE CENTRAL GENERATING PLANTS OF THE COUNTRY

ON OCT. 1, 1921, there were 5,532 central generating plants in the United States with a total prime-mover rating of 19,737,361 hp. and a total installed generator rating of 14,466,915 kw. The total rating of the prime movers of the central stations in 1902 was only 1,818,413 hp., indicating an increase during the nineteen-year period of about 900 per cent. This is slightly less than the increase in generator rating for the same period, which was about 1,092 per cent. The increase in prime mover rating during the period from Jan. 1, 1920, to Oct. 1, 1921, was 1,170,712 hp., or at the rate of 3.9 per cent per annum. This yearly increase is about 7 per cent below the average reported from 1907 to 1920.

Detailed data on the central generating plants of the country will be found in the accompanying table. A similar analysis covering the period from 1902 to 1919 inclusive appears in the Aug. 14, 1920, issue of the *Electrical World*. The data have been based almost entirely on reports submitted in connection with the preparation of the 1921-1922 McGraw Central Station Directory and Data Book.

The total rating of the steam motors was reported as 13,331,933 hp., of which 86.5 per cent was attributed to steam turbines. The first reliable data comparing the total rating of steam engines and steam turbines in the central stations of the country were as of Jan. 1, 1920. At that time the total rating of the steam motors was reported as 11,476,600 hp., of which 84.5 per cent was attributed to steam turbines. The growth in the use of the steam turbine to the gradual elimination of the steam engine is further emphasized by the fact that during the twenty-one-month period from Jan. 1, 1920, to Oct. 1, 1921, the total rating of the installed steam turbines was increased by 1,487,367 hp., while the total rating of the installed steam engines was increased by only 31,733 hp.

The East North Central States lead in the total rating of both steam engines and steam turbines, although the total rating of the steam turbines is about six and four-tenths times the total rating of the steam engine. Ohio leads in the percentage of installed steam engines, and New York leads in the percentage of installed steam turbines.

The figures on the total rating of the installed waterwheels are those given out by the United States Geological Survey and based on its recent detailed investigations. These figures indicate that the rating of the waterwheels installed in central generating plants increased by 822,845 hp. subsequent to Jan. 1, 1920, an increase of about 15.3 per cent.

California and New York are in a distinct class as regards total hydro-electric development by central stations. California leads with 1,129,954 hp., New York following closely with 993,601 hp. Washington is third, reporting a development in central-station hydro-electric plants of 443,139 hp. The Pacific States lead in the total hydro-electric development by central stations, followed by the Middle Atlantic States.

The accompanying diagrams indicate the importance of the four types of prime movers in the various sections of the country.

Average Street-Lighting Cost About $2 per Capita*

The Highest Cost Is $4.81—That for the Entire United States Is About 75 Cents—Ornamental Systems and "White Ways"

By A. F. Dickerson
Chief Engineer Illuminating Engineering Laboratory, General Electric Company, Schenectady, N. Y.

The average total municipal expenditure per capita in 1919 for all cities in the United States of more than 30,000 population was $21.23. Of the $5.25 spent for safety and protection, only 72 cents was for street lighting. The over-all service purchased by the expenditure of $5.25 could be greatly improved by a reallotment which would increase the street-lighting budget by a few cents.

What is a fair yearly expenditure per capita for street lighting? Local conditions, electric rates, area, per capita and many things influence this figure. For the whole United States it is about 75 cents. There are a few cities spending more than $3, the highest being $4.81. The average for the fifty best lighted cities will be about $2.05.

In New York State, among all cities and villages of more than 5,000 population, only one expends over $2.50 per capita for street lighting. Three expend between $2 and $2.50, five between $1.50 and $2, and twenty-four between $1 and $1.50. Others are below $1. The best-lighted cities both in New York and in the entire United States are now paying from $1.50 to $2 per capita for street lighting.

The yearly cost of street lighting will vary from about 2 cents per linear foot of street for the poorly lighted village to more than $5 for an intensive "white way" system such as that on Market Street, San Francisco. The latter figure may seem extravagant and would be for a municipality, but such lighting is considered as a commercial investment and its cost is usually borne by abutting property owners and merchants.

Small Initial Cost

Street lighting occupies an important place in the "city beautiful" movement. A line of ornamental standards forms the one unifying architectural element of a street. Practical needs should not be given consideration ahead of the esthetic, for it is always possible to combine the two satisfactorily and economically. The visible portion of an ornamental street-lighting system represents less than half the total cost. The fixed-charge part of a rate, covering interest and depreciation, is usually from one-seventh to one-eighth of the total installation cost, so that for each dollar additional in the yearly rate approximately $15 may be added to the initial cost of the standard and lighting unit. Therefore it is usually "penny wise and pound foolish" to consider first cost in the selection of these items.

In an ornamental system nearly one-half the rate is usually the interest and depreciation on the original installation. Operation, maintenance of the entire system, power, taxes, commercial costs, insurance, overhead costs and profit make up the rest. In the overhead system these latter items represent a much larger portion of the total than in the underground, so that greater consideration should be given to efficiency of the unit and ease of maintenance. In either case a large saving may always be effected by the use of as few large lamps as possible rather than a great number of small ones. Cleanness is of extreme importance, as often a few months' accumulation of dirt will decrease the output of a fixture by a third or more.

The successful "white way" system must brilliantly illuminate the street and abutting building façades at night and be an architectural ornament in the daytime. For such lighting, the 6.6-amp. ornamental luminous arc and the 600, 1,000, 1,500 and 2,500-cp. tungsten lamps, in a great variety of fixtures, are available. In many large cities it is often desirable to install two or more of these units on one standard, making an "intensive" or "super-white way." Examples are the main streets of Salt Lake, San Francisco, Los Angeles and Saratoga.

Large units, such as the 4, 5 and 6.6-amp. pendent luminous arc and the 250, 400, 600 and 1,000-cp. tungsten lamps, are usually spaced from 150 ft. to 300 ft. on one or both sides of the street, depending on traffic conditions. These should be mounted from 20 ft. to 25 ft. above the street, and the tungsten lamps should usually be equipped with refractors, especially where the spacings are long.

RECOMMENDATIONS ON LIGHTING STREETS*

Class	Available Lamps	Mounting Height (Ft.)	Spacing (Ft.)
Intensive "White ways"...	6 6-amp. luminous - arc 1,000, 1,500 and 2,500-cp. tungsten lamps..	18–25	100–150
"White ways"............	4-amp. and 6.6-amp. luminous arc 600, 1,000 and 1,500-cp. tungsten lamps..	14–16	80–125
Wholesale manufacturing districts and thoroughfares....	4-amp. and 6 6-amp. luminous arcs, 250, 400, 600 and 1,000-cp. tungsten lamps	20–30	150–300
Residential streets, boulevards and parks ...	4-amp. luminous arc, 250, 400 and 600-cp. tungsten lamps	12–25	100–300
Outlying districts and alleys	100-cp. and 250-cp. tungsten lamps	15–18	100–300
Highways..............	250-cp. lamps	30–35	250–400

* The suggestions as outlined above are general and naturally each proposition will demand thorough investigation and specific recommendations.

Most residential streets now have 250, 400 and 600-cp. pendent tungsten lamp fixtures or 4-amp. luminous lamps at street intersections and sometimes at intermediate points, with mounting heights from 20 ft. to 25 ft. The modern tendency, however, is toward ornamental standards with small lamps, usually 250 cp., spaced staggered, or in central parkings, with one standard to each 80 ft. to 125 ft. of street, or opposite on wide streets, with approximately 100-ft. to 125-ft. spacings. The most satisfactory lamp height is about 12 ft. In parks it is customary to light the important roadways as described above and the large open areas with high pendent units equipped with large lamps.

In unsettled portions of cities and in small villages a low roadway illumination is sufficient and can best be secured with 100-cp. and 250-cp. tungsten lamps in center span or bracket-type fixtures. In most cases spacings should be from 100 ft. to 250 ft., but longer spacings may be used with 250-cp. or larger lamps when equipped with a refractor. Mounting heights should be from 15 ft. to 25 ft., depending on the distance between units and the size of lamps used. When the main street of a village is also a through state highway, much higher intensities are required, and often it is desirable and advantageous to install ornamental fixtures.

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*Excerpts from remarks made recently before the New York State conference of mayors and other city officials at Poughkeepsie, N. Y.

Investment Charge as Applied to Electric Power Rates

Interest and Depreciation Are Constant Regardless of Energy Used—How Diversity Factor Benefits Customers—Power Company Virtually Acts as Banker for Its Customers—Law of Average

By R. E. RICHARDSON
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CENTRAL station companies in serving power customers have occasion from time to time to adjust the demand bases upon which power bills are rendered. Usually this involves an increase in the demand charge, and many customers are prone to question the necessity of such an increase. They all realize that the power company must carry an investment in plant and equipment in order to stand ready to give service at any time, but many of these customers are frequently loath to admit the equity of these charges. Mr. Richardson in his article has made a clear and careful analysis of the fundamental reasons for investment charges, drawing an interesting comparison of the demand charge with a loan from a bank. Many of the questions which customers have raised regarding the determination of their demands are fully explained here. The article contains many points of value to the central station company in the application of its power schedules.

WHAT is the necessity of the charge frequently spoken of as the demand charge or the investment charge in an electric power rate, and how should it be applied to be equitable to both consumer and producer?

The so-called demand charge in every power rate is, or should be, such as to protect the investment which the power company makes in the way of plant, line capacity, etc., or supplies to the consumer being served, the consumer thus being relieved of the investment and the power company assuming the burden.

As different diversity factors are obtained, varying from one up to six or possibly higher, in the case of very small motors, with various kinds or classes of business, the power company in the designing of rates for these different classes or sizes of installations endeavors to make this fixed investment charge such as will return monthly an amount sufficient to cover interest and depreciation (at the rate approved by the state commission) on the money invested by the power company for the benefit of the consumer. This investment by the power company, represented by engines, dynamos, transmission lines, distributing lines, transformers, meters, buildings, etc., essential to give this service is actually, not theoretically, held for the exclusive use of the consumer.

Interest and Depreciation Constant

Any one who will intelligently and honestly analyze the situation will see that this interest and depreciation cost to the power company goes on from month to month entirely independent and entirely irrespective of whether or not the consumer uses any energy; in other words, just as long as the power company holds this investment for the consumer's use, which it does until the consumer's contract expires. As each consumer has the right and privilege at any moment during any day to throw a switch and take from the power company energy to supply him power not only up to but in excess of the amount on which his monthly investment charge has been based, it must be evident to any intelligent and fair-minded person that the power company, to be reasonably sure of even getting interest and depreciation on those moneys which it has invested for the consumer's benefit, must get an amount which is directly proportioned to the call or demand upon the power company which a consumer is entitled to, can and in all probability will make.

If he makes a demand upon the power company's equipment of 100 hp. during one month it is not only possible but more than probable that he will make an equal or greater demand the next or some later month. And he demands from the power company that it be ready, upon a fraction of a second's notice or, to be absolutely accurate, without any notice, to furnish him the necessary capacity in station, lines, transformers, etc., to supply his demand.

Two Distinct Cost Factors

To serve any consumer, a power consumer especially, the power company incurs two specific and separate costs; one, a fixed or overhead cost, which includes interest and depreciation on the investment in machinery lines and line equipment for the consumer's use and other fixed overhead costs, regardless of whether or not the consumer takes any energy; the other, a production cost, whose unit cost varies to an extent with the number of units of energy or kilowatt-hours he consumes per month, the regularity per day with which he consumes the energy and the time of the day at which the energy is consumed, i.e., whether that time is at an hour when the power company's plant is carrying a load nearly or up to its capacity, or when it has capacity to spare.

In the designing of a rate it is attempted to embody all of the above factors, giving to the consumer all the advantages possible due to the average diversity which his class of business gives, the regularity of his consumption, time of day of use, and to the quantity of kilowatt-hours he uses per month, which last item, in connection with his maximum demand, determines his load factor. On the other hand, a rate should be such that if the consumer fails to use the service during the month, he should at least pay interest and depreciation on that investment which the power company is holding for his use and cannot promptly dispose of or sell.

If the preceding statements are correct, then it must follow that the power company must have a payment each month based on that investment represented by plant, line equipment, etc., which it has made and is holding in readiness for the exclusive use of any one consumer.

If a power user requires 100 hp. during the month of January, we will say, it is no more than reasonable to expect that he will again require some day or hour in February or March, 100 hp. or more, but whether he actually does or does not, if he has called for 100 hp. in January the power company is obligated to and is not filling its obligations to the power user if it is not ready to deliver to him 100 hp. in February, March or any other month while he is taking service from its lines, unless he actually reduces the size of his motor equipment. Even then the power company must be properly notified, otherwise it still will be holding the full 100 hp. of its investment for his use.

As previously stated, in the designing of a rate, the endeavor is made to take into consideration all controlling factors and, as a matter of fact, the consumer is given the benefit of the doubt in almost every case, as the investment portion of the rate (namely the so-called demand charge) is, it might be said, always considerably less than would cover the actual investment cost to the power company.

This can be most readily proved by assuming that for one month all consumers fail to use any energy, in which case the power company would be entitled to bill only on the basis of the demand or minimum charges contained in the rates. If such is done it will be found that in 90 per cent or more of all the power companies in this country, the sum of all those demands or minimum charges would not begin to equal the investment and other overhead charges incurred by them during that month's period.

Power Company Acts as Banker

It is evident, therefore, that a power company in reality acts as a banker and a manufacturer for the consumer.

The investment portion of a rate is a banking rate, or, in other words, the power company invests certain moneys in machinery and electrical equipment, relieving the consumer of making this investment and, due to the diversity factor obtained by furnishing service to many consumers, the investment made by the power company per horsepower or kilowatt-hour maximum demand requirement of the consumer is materially less than though the consumer had to make the investment in a private plant, and the consumer necessarily gets the advantage of this decreased investment coming from the average diversity factor. This the power company recognizes and gives the full benefit to the consumer.

The power company in reality says to the consumer, "We will loan to you enough money or loan to you sufficient power-producing machinery to run the power end of your business."

If the consumer asks for a 100-hp. loan during any month, it certainly is reasonable to suppose that he will do as much or more business some other month and will, therefore, require that full loan again; just what day, hour or month the power company has no means of knowing, and, therefore, as previously pointed out, it must hold this 100 hp. ready to loan to him whenever he calls for it.

It is evident that this investment which the power company makes cannot be made on the basis of a month's loan, as the very nature of the business is such that it cannot base its charge on a month's loan, as it is not possible for the power company to know the demand. Consequently the loan demanded will be good until the month has passed, and therefore the power company must hold ready for the consumer's use an amount of power represented by dollars equal to the maximum amount which he used or borrowed during any of the preceding months.

Delivery of Service Must Be Instantaneous

All those who have followed the electrical industry for any reasonable period know that there is a vital investment factor in the electric power business which differs from any other business in the world, namely, that the instant any consumer requires, as per his contract, a maximum rate of delivery of service and product which represents investment, the power company must fulfill this contract, and must be ready with sufficient machinery and means of conveyance to deliver instantly and manufacture at that instant and in the units demanded this maximum service required.

In the case of telephone service, if the main switchboard or main trunk lines are full or busy, you are told to wait. A telegram is not sent until a company has a free wire or the operator has the time. With a street railway or subway, if the car is not there you wait for it. In the case of a steam road, there are prescribed times when you can start from this or that point. In the case of water or gas service you are supposed to get instantaneous service. In the case of those two latter services, however, both gas and water can be stored in holders or reservoirs prior to the required time of delivery.

As before stated, the power company has no means of knowing what minute or hour of day any one of these consumers may require their full quota of service, and, further, as the amount of service and the time the service is required varies with almost every consumer, it is absolutely impossible for a power company to make an equitable rate based on anything other than the average service requirements of this or that class of consumer. Such being the case, the fairest, most equitable and only safe way for both producer and consumer is to base the investment charge on that average investment per horsepower or kilowatt-hour demand which has been found through experience, tests, records, etc., to be a true average for any class of service. This average is based on a period of not less than one year, and the investment portion of a rate is accordingly based on not less than one year's loan.

As the first part of a rate contains the banking features, let us compare that part with the banker. When a consumer establishes a 100-hp. demand on an electric power plant he in effect borrows from the power company a 100-hp. plant or an amount of money represented by the investment which the power company must hold in readiness to give this 100-hp. service. We will say, in the case of the power company plant, that, diversity considered, this is $15,000. It thus follows that the power company is holding $15,000 worth of capacity for this consumer's use. If he did not get his power from the power company the consumer would have to take from his own capital or go to a bank and borrow more than $15,000 with which to build his own plant. And the amount would probably be considerably more than $15,000, as he would have no diversity which would be credited to him in the power company's rate.

If on the one hand he demands that the power company shall be ready to deliver to him 100 hp. at any moment, the power company surely cannot loan that $15,000 or any part of it to some one else. On the other hand, if the customer borrowed the amount from the bank and could use or check against that $15,000 at any moment, the bank would certainly not charge against him interest on only that part of the money he checked against, but would charge him interest on the full $15,000, because it could not loan it to any one else owing to the customer's right to check against it at any moment. If the customer had a standing loan of $15,000 on the bank or had the privilege of drawing against the bank for that sum at any time, be it for one year, thirteen, fourteen or twenty-four months, or any period, the bank, at the end of any fiscal or calendar year, would certainly not reduce the monthly interest charge based on $15,000 unless the customer actually returned a portion or all of the loan, thereby decreasing or entirely canceling the bank's obligation.

A power company in reality acts as a banker and a manufacturer for the consumer. When a power user establishes a maximum demand it is like establishing a maximum loan from a bank. The difference between the two is that if the borrower from the bank returns a portion or all of the money, the bank's obligation not only ceases to the extent of the remaining loan, if any, but it is not obligated to make any further loan to the customer even if it has the money on hand.

In the case of power consumers, when they establish a maximum demand it is like establishing a maximum loan from a bank. The difference between the two is that if the borrower from the bank returns a portion or all of the money, the bank's obligation not only ceases to the extent of the remaining loan, if any, but it is not obligated to make any further loan to the customer even if it has the money on hand to loan.

In the case of the power company, when a consumer once establishes a monthly demand that demand really represents the loan that it is reasonable to suppose he will require as long as he does business, or is likely to and is entitled to demand from the power company unless he either reduces his business or reduces his demand on the power company, by putting in some machinery of his own, or there is some marked increased economy in the use of power. Just as long as he continues to operate his business in a way similar to the manner in which he advised the power company he intended to operate when he contracted with the power company, or in a manner as shown later on when he was being served by the power company, the power company is not safe or justified in assuming for a moment that the consumer is not likely to call upon it for an amount of power equal to the amount contracted for or the maximum shown that the consumer required during any month during which service was given to him. Such being the case, the maximum demand or loaned investment once established should continue for a period of not less than one year.

POWER COMPANY MUST RENEW CONTRACT

In making the comparison between the banker and the power company it must not be overlooked that there is one other marked difference in favor of the banker, in that if a loan is made from a bank, at the end of the loan period (contract period) the banker is under no obligation to renew that loan even though the party making the loan may furnish adequate security as a protection to the loan and has promptly paid his interest charges. If it does renew the loan the bank may call for a higher rate of interest. On the other hand, the power company, being a public utility company, is obliged to take all kinds of chances as to the financial responsibility of the customers to whom it makes loans and is obliged not only to continue to make the loan originally asked for, but to increase that loan if the consumer's requirements demand an increase. It also must not be forgotten that a bank's dollar does not wear out, or if it does it is replaced at no expense to the bank. In the making of a power contract the first month's contract kilowatt charge should be based either on the initial requirements or demand. based on the consumer's assumed needs, or the demand developed during his first month of service if at the time of making the contract his requirements were not sufficiently known to predetermine the initial demand. This first demand would establish his first month's bill and he should be billed on that demand continuously for a period of not less than another eleven months, unless he creates a higher demand, in which case the new higher demand should be taken as a basis (an increased loan), and this new increased demand should be used for billing purposes for another eleven-month period. If, however, during that month he created another demand in excess of the one on which he was being billed, then and at the end of this twelfth month he would be billed on the highest demand developed during the preceding eleven months.

HOW ESTABLISHED DEMAND CAN BE DECREASED

When the consumer had operated for twelve months on that highest demand, dating from the time it was first created, he would go on to a lower demand, provided that he had not equaled or exceeded the maximum demand developed during the preceding eleven months.

A reasonable insurance for, or the security of, a power company's investment would be absolutely lost if a monthly basis was established, and it would also be practically lost and the greatest injustice would be done to many consumers if some were permitted to establish a new demand at the end of every twelve months regardless of the demand that was created during the preceding twelve months. In order to protect its investment the power company would immediately have to establish new and much higher monthly investment charges per kilowatt-hour demand and these charges would have to be in the nature of a guess or gamble, and would result in the most inequitable and unfair condition to both the consumer and the power company. If a power company was fortunate it might fix rates so as to get back just a reasonable return on its investment; it might get back a great deal more than it was entitled to or wanted and, on the other hand, it might and probably would fail to begin to get back anything approaching a fair return on the investment made to serve its consumers.

Copper-Clad Steel Wire Advocated for Transmission Circuits

Its Non-Corrosive Qualities, Great Strength and Low Cost Make It Useful for Rural Lines, Long Spans and Lightly Loaded High-Voltage Lines—Reliable Data Now Available

By B. C. DENNISON
Carnegie Institute of Technology

BECAUSE of certain qualities which are peculiar to copper-clad steel wire it may be used to advantage in many cases to replace aluminum, copper or galvanized steel in long spans, in telephone lines paralleling high-tension lines, in overhead ground wires, in rural districts with light loads, in messenger strands supporting power or telephone cables and in various signaling systems.

Normal copper-clad steel wire is about 8 per cent lighter than copper and has a breaking strength exceeding that of copper by an amount varying from 20 per cent for the larger sizes (No. 4/0) to 55 per cent for No. 12. Stranded cables of copper-clad steel may be expected to be at least 50 per cent stronger than the corresponding cables of hard-drawn copper. A so-called "extra-high-tensile" copper-clad steel wire is now on the market which has a strength 150 per cent greater than copper owing to the use of a high-carbon steel core.

Obviously, copper-clad steel wire cannot always be substituted for copper to advantage. Its general field of usefulness is in those applications where the size of wire is determined by requirements of mechanical strength rather than conductivity, or where galvanized wire is subject to corrosion and depreciation.

For long spans where the strength of hard-drawn copper is insufficient the copper-clad steel wire finds a ready application. Compared with silicon-bronze or phosphor-bronze wire, copper-clad steel has about the same strength and conductivity with materially lower first cost. Extra-high tensile-strength copper-clad steel adds to the advantage of lower cost a strength twice that of bronze. Several examples of river crossings are given in Table IV.

A special case of the use of copper-clad steel for long spans is for power-company telephone circuits strung on the steel towers of the transmission system with spans that are too long to permit the use of copper conductors. Typical loading tables for normal copper-clad steel wire and cables are given in Tables II and

TABLE I—COMPARATIVE VALUES OF WEIGHT AND RESISTANCE PER 1,000 FT. FOR HARD-DRAWN COPPER-CLAD STEEL AND COPPER WIRES

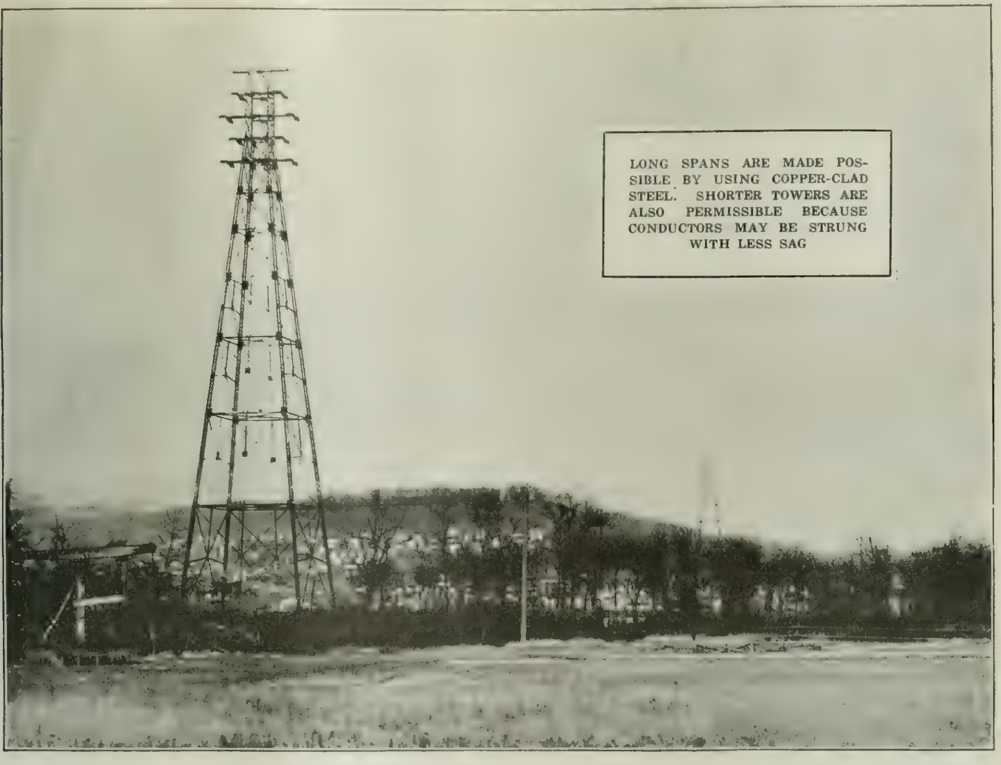
Size A.W.G. (B.&S.)	Diam. (In.)	Av. Weight in Lb. per 1,000 Ft.		Av. Breaking Load (Lb.)		Av. Resistance in Ohms per 1,000 Ft. at 68 deg. F.			Size A.W.G. (B.&S.)
		Copper-Clad Steel	Copper	Copper-Clad Steel	Copper	Copper-Clad Steel 30% Cond.	Copper-Clad Steel 40% Cond.	Copper	
4/0	0.460	585	641	9,850	8,140	0.165	0.124	0.0495	0000
3/0	0.410	467	508	8,280	6,730	0.208	0.156	0.0624	000
2/0	0.365	370	403	6,850	5,540	0.262	0.197	0.0787	00
1/0	0.325	293	319	5,700	4,520	0.331	0.248	0.0993	0
1	0.289	231	253	4,800	3,680	0.421	0.316	0.126	1
2	0.258	184	201	4,000	3,000	0.531	0.398	0.159	2
3	0.229	146	159	3,200	2,440	0.670	0.503	0.201	3
4	0.204	116	126	2,650	1,970	0.844	0.633	0.253	4
5	0.182	92	100	2,200	1,590	1.06	0.799	0.320	5
6	0.162	73	79.5	1,800	1,280	1.34	1.01	0.403	6
7	0.144	58	63.0	1,450	1,030	1.69	1.27	0.508	7
8	0.128	46	50.0	1,200	828	2.13	1.60	0.641	8
9	0.114	37	39.6	970	663	2.69	2.02	0.808	9
10	0.102	29	31.4	800	528	3.39	2.55	1.02	10
11	0.091	23	24.9	645	423	4.28	3.21	1.29	11
12	0.081	18	19.8	520	337	5.39	4.05	1.62	12
13	0.072	14.38	15.7	415	268	6.80	5.11	2.04	13
14	0.064	11.55	12.4	330	214	8.58	6.44	2.58	14

TABLE II—LOADING TABLES FOR COPPER-CLAD STEEL BARE HARD-DRAWN WIRE

Based on the requirements of the National Electrical Safety Code (Compiled by the Copper-Clad Steel Company for copper-weld wire)

A.W.G.	Diam.	Cross-Section		Breaking Load (Lb.)	Allowable Tension (Lb.)	Lb. per Linear Foot			Max. Load in Plane of Resultant—Lb./Linear Ft.			Modulus × Area	Ohms Resistance per 1,000 Ft. at 68 Deg. F.	
						Vertical								
		Circ. mils	Sq. In.			Dead Wt	Dead Plus ½-in. Ice	Horizontal Wind Pressure, 8 Lb. Sq.Ft.	Heavy	Medium, (⅔ Heavy)	Light, (⅔ Medium)		40 per Cent Cond.	30 per Cent Cond.
4/0	0.460	211,600	0.1662	9,850	4,925	0.585	1.183	0.973	1.532	1.102	0.732	3,324,000	0.124	0.165
3/0	0.410	167,800	0.1318	8,280	4,140	0.467	1.034	0.940	1.398	0.933	0.622	2,636,000	0.156	0.208
2/0	0.365	133,100	0.1045	6,850	3,425	0.370	0.909	0.910	1.285	0.857	0.572	2,090,000	0.197	0.262
1/0	0.325	105,500	0.08289	5,700	2,850	0.293	0.807	0.883	1.195	0.797	0.531	1,658,000	0.248	0.331
1	0.289	83,690	0.06573	4,800	2,400	0.231	0.723	0.859	1.125	0.750	0.500	1,315,000	0.316	0.421
2	0.258	66,370	0.05213	4,000	2,000	0.184	0.656	0.839	1.065	0.710	0.474	1,043,000	0.398	0.531
3	0.229	52,640	0.04134	3,200	1,600	0.146	0.600	0.819	1.017	0.677	0.452	826,800	0.503	0.670
4	0.204	41,740	0.03278	2,650	1,325	0.116	0.554	0.803	0.974	0.649	0.433	655,600	0.633	0.844
5	0.182	33,100	0.02600	2,200	1,100	0.092	0.517	0.788	0.942	0.628	0.419	520,000	0.799	1.06
6	0.162	26,250	0.02062	1,800	900	0.073	0.485	0.775	0.914	0.610	0.406	412,400	1.01	1.34
8	0.128	16,510	0.01297	1,200	600	0.046	0.437	0.752	0.870	0.580	0.387	259,400	1.60	2.13
10	0.102	10,380	0.008155	800	400	0.029	0.403	0.735	0.838	0.559	0.372	163,100	2.55	3.39
12	0.031	6,530	0.005129	520	260	0.018	0.379	0.721	0.815	0.543	0.362	102,600	4.05	5.39

Young's modulus—20,000,000 inch-lb. units. Coefficient of linear expansion—0.0000072 per deg. fahr.



LONG SPANS ARE MADE POSSIBLE BY USING COPPER-CLAD STEEL. SHORTER TOWERS ARE ALSO PERMISSIBLE BECAUSE CONDUCTORS MAY BE STRUNG WITH LESS SAG

III. (See report of the overhead-systems committee of the N. E. L. A. for 1921.)

Although the use of the overhead ground wire is still a matter for debate among transmission engineers, it is felt that the advantage of its employment for protecting the transmission system would be greater if the conductors used for ground wires were less subject to corrosion and loss of strength, or to breakage under severe weather conditions. The "mechanical grade" of copper-clad steel wire can be used to good advantage for this service. This type has a conductivity 30 per cent less than that of copper, but is not subject to rust and has greater strength and longer life than galvanized wire.

In the support of telephone and signal cables, in carrying trolley feeders over streams and rights-of-way, and in general for carrying the weight of wires which require messengers, the copper-clad messenger strand

TABLE III—LOADING TABLES FOR BARE HARD-DRAWN COPPER-CLAD STEEL STRAND

Based on the requirements of the National Electrical Safety Code
(Compiled by the Copper-Clad Steel Company for copper-weld wire)

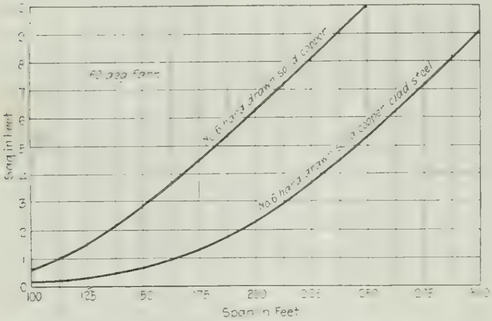
Nominal Diam. (In.)	A.W.G No.	Actual Diameter of Strand (In.)	Number of Wires and Size (A.W.G.)	Cross-Section		Breaking Load* (Lb.)	Allowable Tension (Lb.)	Lb. per Linear Foot			Max. Load in Plane of Resultant—Lb Linear Ft			Young's Modulus	Modulus × Area	Ohms Resistance per 1,000 Ft. at 68 Deg. F.	
				Circ. mils	Sq. In.			Vertical		Horizontal Wind Pressure, 8 Lb. Sq Ft	Heavy	Medium (⅔ Heavy)	Light† (⅔ Medium)			40 per Cent Cond	30 per Cent Cond.
								Dead Weight	Dead Plus ½ In.								
5/8	.	0.612	7 No. 4	292,200	0.229	18,550	9,280	0.836	1.528	1.075	1.868	1.245	1.045	15,000,000	3,435,000	0.093	0.124
9/16		0.546	7 No. 5	231,700	0.182	15,400	7,700	0.663	1.304	1.031	1.662	1.108	0.829	16,000,000	2,912,000	0.118	0.160
	4/0	0.523	7 No. Sp	211,600	0.166	14,300	7,150	0.606	1.236	1.015	1.599	1.066	0.758	16,400,000	2,722,000	0.129	0.172
1/2	.	0.486	7 No. 6	183,700	0.144	12,600	6,300	0.526	1.139	0.991	1.510	1.007	0.671	17,000,000	2,448,000	0.148	0.197
	3/0	0.465	7 No. Sp.	167,800	0.132	11,640	5,820	0.481	1.079	0.977	1.458	0.972	0.648	17,200,000	2,270,500	0.162	0.216
7/16		0.432	7 No. 7	145,700	0.114	10,160	5,080	0.418	0.998	0.955	1.381	0.921	0.614	17,800,000	2,029,000	0.186	0.248
	2/0	0.414	7 No. Sp	133,100	0.105	9,460	4,730	0.382	0.951	0.945	1.339	0.892	0.595	18,100,000	1,900,000	0.205	0.272
3/8		0.384	7 No. 8	115,600	0.0910	8,400	4,200	0.332	0.882	0.923	1.277	0.851	0.568	18,600,000	1,695,000	0.236	0.313
	1/0	0.368	7 No. Sp	105,500	0.0829	7,780	3,890	0.303	0.842	0.912	1.241	0.827	0.552	18,800,000	1,559,000	0.258	0.344
11/32		0.342	7 No. 9	91,630	0.0719	6,790	3,400	0.266	0.791	0.895	1.194	0.796	0.531	19,000,000	1,366,000	0.297	0.396
5/16		0.306	7 No. 10	72,660	0.0571	5,600	2,800	0.209	0.710	0.871	1.124	0.749	0.500	19,300,000	1,102,000	0.375	0.499
9/32		0.273	7 No. 11	57,640	0.0452	4,550	2,280	0.166	0.647	0.849	1.067	0.711	0.474	19,600,000	886,000	0.472	0.629
1/4		0.243	7 No. 12	45,710	0.0360	3,640	1,820	0.129	0.591	0.829	1.018	0.679	0.452	19,800,000	713,000	0.597	0.793

Note: Sp. = special gage wire.
* Ultimate strength of strand is taken as 90 per cent of the sum of the breaking strengths of the individual wires, of the quality used in strand manufacture.
† Light loading is never less than 125 per cent of the dead weight.

has an advantage over galvanized-steel cable in that it is free from rust and deterioration. In railway tunnels or other places where corrosive gases are present this advantage is especially pronounced. Another use for such messengers is in the support of trolley wires in catenary construction. The higher conductivity of the copper-clad messenger permits its use as an auxiliary feeder.

IMPROVES RELIABILITY OF RURAL SERVICE

The size of conductor for rural lines is frequently determined by considerations of safety from breakage due to wind and sleet loads rather than by conductivity. Thus, compared with solid copper wire, No. 6 copper-clad might frequently replace No. 6 hard-drawn copper with a saving of 30 per cent of the poles and insulators because of the use of longer spans, although strung with the same sag and possessing equal safety. Some saving in the cost of the conductor would also result because only 92 per cent as great a weight of wire would be used and the cost per pound would be less. Table V shows such a comparison of conductors, with the values given in the same form as those given in comparing copper and steel-cored aluminum in the article on "Rural Distribution" published in the *Electrical World* for Dec. 10, 1921.



MUCH SMALLER SAGS ARE PERMISSIBLE WITH COPPER-CLAD STEEL WIRE

Curves of sag are based on ½-in. ice load and 8 lb. per square foot wind load.

As an example of a comparison based on regulation, consider a single-phase line 10 miles long operating at 4,600 volts, 60 cycles, and delivering a load of 20 kva. at 80 per cent power factor. Assuming the load to be concentrated at the far end of the line, the following tabulation would result for lines of No. 6 copper and copper-clad steel with 30 in. spacing between wires:

	Copper	Copper-Clad Steel
Resistance per mile of wire, ohms	2 09	5 25
Reactance per mile of wire, ohms	0 784	0 87
IR drop at 4 35 amp., volts	182	456
IX drop at 4 35 amp., volts	65	76
Regulation, per cent	4 01	8 93
Per cent loss due to resistance	4 94	12 4

The regulation and loss are not excessive for the copper-clad wire, and it is possible to use a 185-ft. span which would make an appreciable saving in first cost.

In high-tension distribution in city streets the necessity for safety makes possible the use of copper-clad steel conductors. In street-lighting circuits, for example, the current could be transmitted by a very small copper wire, yet safety requirements may force the use of No. 6 wire. Using a No. 8 copper-clad steel wire would give same mechanical strength, give satisfactory conductivity and permit installation at a material saving.

TABLE IV—CHARACTERISTICS OF SOME IMPORTANT CROSSINGS EMPLOYING COPPER-CLAD STEEL WIRES

Crossing	Length of Span, Ft	Difference in Tower Elev., Ft	Sag, Ft	Size of Cable	Voltage, Kv
Niagara River at Buffalo	2,200	None	65	198,000 circ mil (19-wire No. 10 B & S)	22
Allegheny River at C. Pax, Pa	1,785	382	151	No. 4 0 (7-strand)	22
Ohio River at Vanport, Pa	2,130	220	110	No. 4 0	22
Connecticut River at Springfield, Mass	1,640			½-in., stranded	66
Susquehanna River at Danville, Pa.	1,700	426		½-in. (19-wire)	25
Ohio River at Ambridge, Pa	1,650	None		½-in. (7-wire)	65

Other miscellaneous applications are in railway signal circuits, police and fire-alarm signal systems, trolley spans and fittings, tie wires and in overhead work for railroad electrification applications which are subject to corrosion from steam-locomotive gases.

The data in this paper refer particularly to the copper-clad steel wire made by the molten method. In this method, after the steel ingot has been brought to a welding temperature within a graphite mold, molten electrolytic copper is poured around the steel, and as the two metals cool a composite cylinder of copper firmly welded to the steel core results. Three general grades are produced—40 per cent conductivity, 30 per cent conductivity and mechanical grade. As suggested by the name, 40 per cent conductivity grade has 40 per cent the conductivity of pure copper of the same gage number. Mechanical grade has no guaranteed conductivity, but corresponds to a conductivity of about 25 per cent. An interesting development is a composite cable made of strands of pure copper and copper-clad steel wire. This makes a cable which has high conductivity and great strength which fills in the gap in conductivity between the 40 per cent copper-clad steel and copper.

The writer is indebted to the Copper Clad Steel Company of Rankin, Pa., for the opportunity to examine this process and resulting product and for certain data regarding its properties.

TABLE V—COMPARATIVE COSTS OF A MILE OF 2,300-VOLT, SINGLE-PHASE DISTRIBUTION LINE.

A. No. 6 copper, 125-ft. spans. B. No. 6 copper-clad steel, 185 ft. spans

	A		B	
	125-Ft Span (Copper)		185-Ft Span (Copper-Clad Steel)	
Material	Quantity	Cost	Quantity	Cost
30-ft. poles, Western cedar, butt-treated	43 (6-in. top)	$387 00	29 (7-in. top)	$307 40
Fir cross-arms with braces and pins	45	56 25	31	38 75
Lag screws	45	1 35	31	0 93
Through bolts	43	4 73	29	3 19
Double-end bolts	2	0 30	2	0 30
Anchor rods	2	2 50	2	2 50
Guy wire	100 ft	1 20	100 ft	1 20
Three-bolt clamps	4	0 88	4	0 88
Strain insulators	2	1 10	2	1 10
Porcelain insulators	90	45 00	62	31 00
Line conductors (T B W P.)	11,000 ft.	201 00	11,000 ft.	185.50
Labor and Hauling:				
Digging holes		41 00		28 00
Hauling, placing and setting poles		301 50		209 50
Guying		10 00		10 00
Stringing		104 50		94 50
Total, material and labor		$1,158 31		$914 75
15 per cent overhead		173 74		137 21
Total		$1,332.05		$1,051.96

Storage Batteries Undergo a Severe Endurance Test

Four Standard Makes of Batteries Subjected to 100,000 Jolts While Being Charged and Discharged Showed Negligible Depreciation

BY L. C. ILSLEY* AND H. B. BRUNOT†

AS PART of its work for the improvement of safety conditions in mines, the Bureau of Mines has undertaken to establish a list of permissible storage-battery locomotives for use in gaseous mines, and to this end has issued Schedule 15, "Procedure for Establishing a List of Permissible Storage-Battery Locomotives for Use in Gaseous Mines." Up to the present time two approvals‡ have been issued under this schedule, and considerable testing work done on four other applications which have been made for approval.

Prior to the publication of Schedule 15, the bureau conducted both field and laboratory investigations to determine the hazard from the batteries used in mine locomotives.‖ These investigations indicated that the safety of the locomotive would depend largely on proper care of the battery, also on the use of a battery as mechanically rugged as possible. For this reason the bureau staff, in testing locomotives submitted for approval, considered it advisable to subject the batteries to a jarring or bumping test to prove their adequacy as regards mechanical endurance and ruggedness. These tests on the batteries of the locomotives are described below.

FOUR STANDARD MAKES TESTED

Battery cells manufactured by four of the leading storage-battery companies have been tested. The sizes, types and approximate weights and dimensions of the batteries used in the tests are given in the table.

All the jars of the lead-acid type cells had a wall thickness of ¼ in. or over, and the rubber compounds used in their construction had been made under one or the other of the two following specifications for physical properties, namely:

1. Normal tensile strength, 5,000 lb. per square inch. Elongation, 6 per cent. Tolerance: Tensile strength, 4 000 lb. per square inch, elongation 7½ per cent; tensile strength, 6,000 lb. per square inch, elongation 5 per cent. For intermediate values product of figures for tensile strength and per cent elongation not to be less than 30,000.

2. Nominal tensile strength, 3,000 lb. per square inch. Elongation, 5 per cent. Tolerance: Tensile strength, 3,600 lb. per square inch, elongation 3 per cent; tensile strength, 3,300 lb. per square inch, elongation, 4 per cent; tensile strength, 3,000 lb. per square inch, elongation, 5 per cent; tensile strength, 2,700 lb. per square inch, elongation, 6 per cent.

CHARGED AND DISCHARGED WHILE UNDERGOING 100,000 JOLTS

The tests consisted in jarring or bumping the cells, as assembled in their trays, 100,000 times, by dropping them vertically on a timber framework or foundation from a height of about 2 in., at a rate of forty to sixty times per minute. While this test represented only one type of jolt which might result from actual service, and that in an approximate and possibly exaggerated manner, it probably was sufficient to reveal any undue mechanical weakness or lack of endurance in the battery cell.

Except for the first make of cells tested, which were open-circuited during the entire jolting period, all of the cells were charged and discharged during the greater part of the test. Recording instruments were connected in circuit to give a continuous record of conditions. Upon the completion of the 100,000 jolts, each tray of cells was put through one or more cycles of charge and discharge to determine whether or not the test had caused any noticeable loss of capacity, after which one or more of the cells were disassembled for inspection. Neither the record of the recording voltmeter nor current measurements made during charge and discharge gave any indication that any of the cells had been damaged by the jolting, and as far as was discovered by electrical measurement no internal injury had been done to the cells.

MAKES, TYPES AND APPROXIMATE SIZES, WEIGHTS, ETC., OF BATTERIES TESTED

Manufacturer	Electric Storage Battery Company		Philadelphia Storage Battery Company		Gould Storage Battery Company	Edison Storage Battery Company
	"Iron-Clad" MV 17-Plate	"Exide" MV 9-Plate	WML 11-Plate	WMLX 11-Plate	L 149, 29-Plate	G-14
Discharge rate, amp.	56 (4½ hr)	28 (4½ hr)	30 (5 hr)	30 (5 hr)	78 (5 hr)	70 (5 hr)
Size of plates:						
Width, in.	5¼	5½	5⅜	5⅜	5¾	4¾
Height, in.	8¾	8¾	8⅝	8⅝	8¾	9½
Outside dimensions of container:						
Length, in.	6½	3½	3 9/16	3 9/16	9¼	6
Width, in.	6¼	6¼	6 1/16	6 1/16	6½	5¼
Height, in.	12¾	12¾	13 11/16	13 11/16	13¾	12¾
Sediment space, distance bottom of plates to bottom of cell, in.	1¼	1¼	2¼	2¼	2⅜	½
Over-all height of cell, bottom of container to top of terminal, in.	13½	13½	14¾	14¾	15¼	13¼
Weight in pounds:						
Element	44	22	24	24	69	23
Electrolyte	7½	4¼	6	6	14	8
*Complete cell	57	30	32	32½	90	34
Number of cells per tray	4*	4	2	2	2	4
Weight of tray and cells, lb.	265*	148	75	75	203	147
Number of spacers per tray	3	0	0	0		1

* The two end cells were removed from the tray in the tests to lighten the load on the testing machine. The weight with the two cells removed was, therefore, about 150 lb.

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*Electrical engineer Bureau of Mines.

†Junior electrical engineer Bureau of Mines.

‡Approval No. 1500, issued to the George D. Whitcomb Company, Rochelle, Ill.; approval No. 1501, issued to the Jeffrey Manufacturing Company, Columbus, Ohio.

‖L. C. Ilsley and H. B. Brunot, "Preliminary Investigations of Storage-Battery Locomotives," Technical Paper No. 261, Bureau of Mines, 1921.

Examination of the disassembled cell showed (1) that the container of one of the cells had a small crack which gave rise to a slow leak, (2) that in another cell one plate had broken away from its connection with the rest of the element, (3) that the plates in four of the cells had been grooved by the bottom support, and (4) that several of the plates in two of these cells were cracked or broken at these points. It is not clear that the crack in the container of one cell and the breaking away of one plate in another cell were entirely caused by the jolting, as a cell from the same lot which had not been jolted was found to have a similar leak, and examination of the broken plate indicated that it may have been defective to start with. The four cells in which the bottom of the plates were injured became loose in their trays during the test and were therefore probably subjected to a more severe jolting than they would have been otherwise. This is borne out by the fact that the cells which became loose first were injured to the greatest extent. Moreover, observation of the testing machine showed clearly that the weight of cells being tested had a marked effect on its action and therefore on the severity of the resulting jolts given the cells.

As was to be expected, all of the cells spilled more or less electrolyte during the test, although with some of the cells the spillage was remarkably small.

One intertray and one intercell connector were broken by the tests. The first breakage was the result of the threshing about of a heavy brass terminal with which the connector was equipped, and the second resulted from the excessive movement of the cells that came loose in their tray.

The tests indicate that the battery cells at present supplied for mine locomotives have sufficient mechanical endurance to withstand the ordinary jolts they are likely to receive in service. However, the damage to the bottom of the plates and to the intercell connector of the cells, which became loose in the trays, points to the advisability of having the cells tight in the tray to avoid unnecessary movement with the resulting wear on the cell.

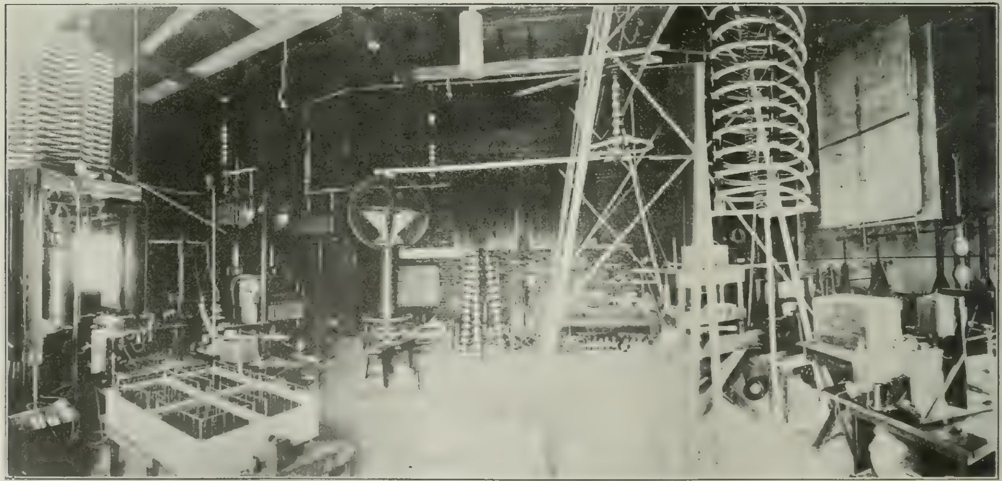
From the results of the tests it would appear probable that no great hazard will result from the use of properly installed and cared-for batteries in permissible locomotives.

Localized Radio Landing Signals for Airplanes

SEVERAL years ago the Bureau of Standards at Washington was called upon to develop a method to assist airplanes in accurately locating the landing field when the airplane was quite close at hand. A method was desired that would give a signal heard over a comparatively large area when the airplane was at a high altitude but which would be localized within a small area when the plane was near the ground. A method employing a large horizontal coil tuned to 500 cycles was tried but did not prove satisfactory. The use of radio-frequency waves was therefore undertaken, and two horizontal coils, one above the other, with current flowing in opposite directions, were used. A fairly high radio frequency, such as 300 kilocycles, was employed in this case.

A calculation was made which indicated that the signals radiated from the two coils would be the strongest for an airplane flying in a given horizontal plane whenever the airplane was within a comparatively small ring-shaped area above the landing field. The results of these calculations were verified in practice. The bureau has published a paper giving the theory of the radiation from an antenna consisting of two horizontal coils such as that described above, No. 431, which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents per copy.

The University Laboratory a Place for Co-operative Research



Through the proper type of co-operation and co-ordination university laboratories can become a medium through which more investigation can be conducted that will be of value to electrical industry as a whole. This is the laboratory at Leland Stanford, Jr., where Professor Ryan has conducted many investigations on high-voltage insulators which have been of inestimable value to manufacturer and electric service companies. More research of this caliber is needed.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Going Value and the Galveston Case

To the Editors of the Electrical World:

Your editorial in the issue of the *Electrical World* of May 6 on the Federal Supreme Court's decision in the Galveston case is appropriate and timely. This whole matter deserves some prompt consideration and action on the part of the utilities. You point out some consolation in the fact that the court appears to reject development costs only and that the opinion should not be interpreted as a rejection of going value. The fact that these two are confused and that this opinion is capable of being interpreted as a rejection of going value is entirely the fault of the appraisal engineers.

The bottom of the trouble is that the valuation engineers, as well as some commissions, in attempting to find a yardstick for measuring going value have forgotten the original idea of going value and have substituted the gage for measurement for the thing itself. The result is that so many people have used early losses or development costs as the estimate of going value that they have forgotten that going value means anything else than such development costs. Development costs are real and tangible costs and should be included in the list of actual and proper expenditures, whereas going-concern value is entirely intangible and is in no way related to early losses or development costs. To understand this one should refer back to the early keynote decisions of the Supreme Court. On the basis of that court's statements, commissions were very reluctant to make a separate finding for going value, and usually set out the total "fair value" in round figures, "taking into account the fact that the plant was in successful operation."

This method was a great handicap to the companies in a court review, and so much emphasis has been placed on the methods of *estimating* going value that these theories have come to be regarded as the thing itself; hence the very confusing decision in the Galveston case.

The valuation engineers should get back to first principles and present the theory of going concern value, not as some actual and necessary expenditure for non-physical property, but as the value which accrues to the actual costs because of certain favorable conditions. Just what conditions and circumstances should be considered were very ably enumerated in the report of the special committee of the American Society of Civil Engineers, which submitted its report under date of Oct. 28, 1918. On pages 1917 to 1921 inclusive, the report sets out certain intangible items of value which may enter into the value of a going concern and which are not necessarily represented in the original cost figures. Some of these are as follows:

1. The fact that the system is in successful operation with an established business.
2. Present worth of estimated earnings including those of future business growth.
3. Favorable or "strategic" location.
4. Exceptional efficiency in design, construction or management.
5. Traffic and operating agreements.

None of the above items consider early losses or development cost. In fact, the report treats development cost separately and among the items of actual expenditure. If we will consider these ideas, the Galveston decision, while rather indefinite, is still capable of a reasonable interpretation, and the valuation engineers could not do better than to adopt the report of the above-mentioned committee and apply each of the principles outlined to each individual case and thereby determine the true going-concern value in each instance.

J. A. WHITLOW.

Arkansas Light & Power Company,
Pine Bluff, Ark.

* * *

Tests for Sludging of Oil Being Investigated

To the Editors of the Electrical World:

In an article by C. J. Rodman in the July 1 number of the *Electrical World,* which discusses desirable qualities of transformer and switch oils, reference is made to work being done on the development of methods of testing these oils.

The committee on electrical insulating materials of the American Society for Testing Materials has been working on this problem of testing transformer oils, among others, for some time. Of several methods which have been tentatively adopted by the society one deals with insulating oils and is entitled: "Tentative Methods of Testing Transformer and Switch Oils."

It will be noted that one of the most important tests for transformer oil, namely, the so-called sludging test, is omitted. A satisfactory test procedure had not been agreed upon at the time this tentative standard was issued—about a year ago—but it was confidently expected at that time that the extensive co-operative research work which was being started would give us the desired information very promptly.

Unfortunately, our optimistic predictions have not been fulfilled. It has been found that apparently variations in some of the minutest details of the various methods which were being considered have a marked influence on the result. Furthermore, the various methods give widely different results, so that an oil which would be considered high grade from a sludging standpoint by one method would be classed as decidedly inferior by another method.

However, the problem is being vigorously attacked by a very competent committee, under the chairmanship of F. R. Baxter of the Vacuum Oil Company, which, after studying four different methods and finally agreeing upon the smallest details of procedure, is having analyses made of several samples of oil in each of about six different laboratories—all laboratories having specimens of exactly the same samples and all following exactly the same procedure in each of the four methods. The four methods being investigated are tentatively described as follows: Deposit test (formalite test), iodine or bromide value, sludging test (modified Michie procedure), tar test.

It is expected that the results of this co-operative work will show just what can be done and what cannot be done in the way of setting up a satisfactory standard test for so-called sludging of transformer and switch oils.

F. M. FARMER,
Chairman A. S. T. M. Committee D-9
on Electrical Insulating Materials.

New York.

Industrial and Station Practice

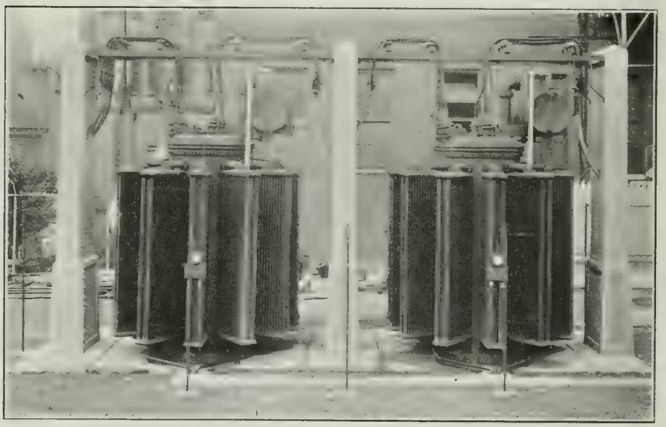
Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Concrete Columns Inclose Connections with Underground Circuits

A RATHER difficult problem of an outdoor tranformer installation was solved by the New York & Queens Electric Light & Power Company as shown in the accompanying illustration. The transformers are installed at the Hamilton Street substation in Long Island City, and the plans provide for an ultimate installation of ten 7,500-kva., three-phase, 60-cycle, 13,200-volt delta to 2,300/4,000-volt Y transformers. The buses and switching equipment are inside the substation building, and the arrangement of the property is such that the transformers must be installed at the rear or short end of the building. Direct overhead connection to the transformers was therefore impossible, and instead both primary and secondary connections were made underground through 4-in. fiber ducts.

The primary leads are three-conductor 450,000-circ.mil cable, and each secondary lead consists of two 800,000-circ.mil single-conductor cables run in one conduit. All cables are lead-incased. Because of the large number of conduits in the ultimate installation (ten for primary cables and thirty for secondary) it was found necessary to place the transformers 25 ft. from the building to allow large radius bends.

These conduits are carried up through concrete columns between the transformers, the primary for one transformer and the secondary for the adjacent transformer being inclosed in the same column. The conduits are turned at the top and brought out through the side of the column, at which point the potheads are installed. A light steel structure supported between columns carries the leads to the transformer bushings. Tanks and a pump are provided for removal of oil from the transformers.



MINIMUM AMOUNT OF EXPOSED WIRING PRODUCES A NEAT APPEARANCE

The transformers and columns are placed on independent concrete foundations with joints of plastic material between them to avoid the possible shearing off of the conduits entering the column in the event of any settlement of the transformer foundation, and the conduits are so arranged that they do not pass under the transformer foundation. This arrangement presents a very neat appearance, and the small amount of exposed wiring makes it extremely safe.

W. C. BLACKWOOD,
Electric Engineer.
New York & Queens Electric Light & Power Company.

Feed Water Treated at a Cost of 9.8 Cents per 1,000 Gal.

IN THE treatment of boiler water there is no remedy that will overcome all the troubles encountered, but there are in use methods which aid in its purification. These methods include the use of boiler compounds, the continuous-treating process, the intermittent treating process, the use of artificial or natural zeolite, and evaporation.

Boiler compounds are usually composed of a gelatinous substance, tannic acid, soda ash and maybe one or more salts. This method of treating boiler water was the first method used in boiler plants. The compound is either introduced before the water goes to the heater or afterward as it is going to the boilers, or, as in some cases, it is introduced directly into the boilers. If the compound is introduced before the water enters the heater, there is a possible chance for certain reactions in the heater and purer water enters the feed-water system. The plan will, however, necessitate blowing down the heater oftener as well as speeding up the cleaning periods. When the compound is introduced after the water has come from the heater, the reaction takes place in the boilers, and it is necessary after a certain concentration to blow down the boilers.

The continuous-treating process is the method usually found in plants where jet or barometric condensers are in use. For this process it is necessary to have a feed-water heater, a sludge or settling tank, two or more filters and a chemical feeding device. This system of treatment was installed in the Water Street station of the Toledo Edison Company in 1917. Although certain troubles and difficulties developed at the start, it is still in service and doing good work. At the present time this plant is treating 1,000 gal. of water for 9.8 cents.

The intermittent process requires two or more sedimentation or settling tanks with agitators, two or more filters and a means of mixing and pumping chemicals to the water in settling tanks. With this method, as in the continuous-process method, the water is treated with lime, soda ash and iron sulphate, with caustic soda or whatever the analysis of the raw water may show to be required for the treating.

This is the process that is in use at the Acme station of the Toledo Edison Company, and it has a capacity of 12,500 gal. per hour. The cost is 14.1 cents per 1,000 gal. of water treated. The analysis of the water from the Maumee River is given in the accompanying table. With this method of treatment the hardness of the make-up water has been reduced by 15.5 grains per United States gallon. The difference between the condensate returns and condensed steam off the header is due to a condenser leakage which amounts to 0.43 per cent.

ANALYSIS OF THE BOILER-FEED WATER TREATED BY INTERMITTENT PROCESS

Place from Which Sample of Water Was Taken	Grains per U. S. Gallon Salt	Alkalinity	Causticity	Hardness
Raw-river water..	1.6	9.4	0.0	17.0
Treated water	1.8	4.5	3.0	1.5
Condensate from condensers	0.3	0.25	0.1	0.5
Water from heaters	0.3	0.5	0.1	0.6
Steam from header.	0.2	0.2	0.0	0.2

The fourth method of feed-water treatment is comparatively new. It takes its name, the zeolite method, from a mineral ore. The name applies to certain bases which make up the silica-alumina structure. In using this system the water is passed through filter-like beds of zeolite, which exchange their bases and make the water virtually pure. This process continues till the zeolite has spent itself; then the beds are regenerated by a treatment of a concentrated brine solution. This method appears to be the best devised, but, like the others, it has its drawbacks. For instance, it is impossible to use this method with acidic water as the acid destroys the zeolites.

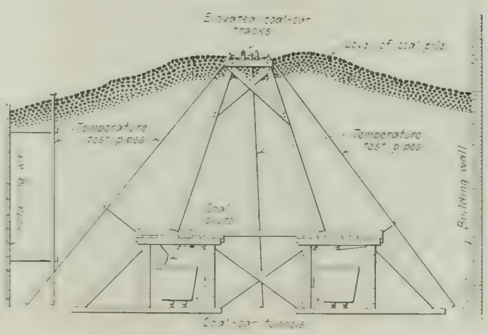
The fifth method of water treatment is by the use of evaporators which evaporate the water and afterward condense it. This method looks like a panacea for feed-water ills, but it too has its drawbacks. One of the chief ailments is that with certain waters the evaporators themselves prime, causing as much trouble as if the water were used directly in the boilers, if not more.

C. E. Lewis.

Toledo Edison Company,
Toledo, Ohio.

Storing Bituminous Coal to Depth of 40 Ft.

Large reserve stocks of coal must be stored by central station companies in emergencies like the present coal strike, and where space is limited the normal maximum depth of 8 ft. to 10 ft. in the pile sometimes has to be exceeded by several hundred per cent. To overcome the danger of spontaneous combustion from overheating, the Rockingham County Light & Power Company of Portsmouth, N. H., has installed a series of test pipes in the pocket at the Daniel Street generating station, as shown in the accompanying illustration. These pipes are used as runways for thermometers lowered and raised by strong cords marked at regular intervals by knots which enable the depth at which readings are taken to be noted, and by reference to an appropriate drawing the behavior of the coal in any section of the pile can thus be studied.



INEXPENSIVE METHOD OF STORING LARGE STOCKS OF COAL WITH A SUBSTANTIAL DEGREE OF SECURITY FROM FIRE RISK

When a new cargo of coal is placed in the pocket, tests of the temperature are made daily in each pipe until the exact conditions in all parts of the pile are determined. The pipes are 2 in. in diameter and are placed at frequent intervals and permanently clamped into position. The tunnels from which the coal is drawn for station use are numbered, and chutes 5 ft. apart are installed. If any spot shows signs of overheating, coal is drawn from the nearest chute until the hot spot is removed. The thermometers are inclosed in wooden frames to prevent breakage.

The arrangement was inexpensive to install and has permitted the storage of large stocks of coal to a maximum depth of 40 ft. with a very substantial degree of security from fire risk. The pocket installation was designed by W. H. Allen of the company's engineering department and has given excellent service.

Frank W. Randall,

Assistant to General Manager,
Rockingham County Light & Power Co.
Portsmouth, N. H.

Automatically Regulated Motor Field

By placing one turn of the negative lead of a direct-current generator on each of two field poles of the exciter provided for exciting the synchronous motor driving the generator the set was enabled to carry overload as high as 200 per cent without hand regulation.

The set consisted of a 750-kw., 1,200-volt direct-current generator driven by a synchronous motor. Because of the heavy overloads it was formerly required to use close hand regulation to maintain the exciter voltage. The extra single turns were placed on two poles of the 18-kw. non-interpole exciter and connected in series with the negative lead of the generator. With the extra winding at no load the exciter operates at 85 volts and with 150 per cent load increases to 129 volts. The cost of the job was $80, which included a voltmeter for the exciter

Field Editor Electrical World.

San Francisco, Cal.

Motion Study Reduces Handling of Distribution Orders

A CAREFUL study of the routine handling of estimates and orders in connection with the electrical distribution of the Denver (Col.) Gas & Electric Light Company considerably reduced expense, largely eliminated the possibilities of errors and of delayed orders and simplified the work.

This study was made easy by using a chart similar to the one reproduced herewith. By studying this unnecessary handlings were seen and eliminated from the system. Then a guide chart of the same kind was drawn for directing the movements along the lines found best. The chart shown is this perfected guide chart. On it is shown the course of each order from one employee to the next and the number of copies which are handed on. For example, a requested estimate, known in that company as a "can-we-light," goes first to a contract clerk, who makes a memorandum and sends it to the head contract clerk. This man "O. K.'s" it and sends it to the contract stenographer, who fills out a regular "request for estimate" form in triplicate. This form passes through the hands of the house card clerk to the triplicate file clerk, who detaches and files one copy and sends the other two to the data clerk. He puts on the essential data and forwards it to the head clerk in the electrical department for recording. It then goes to the distribution engineer for making his estimates and then to the superintendent of electric distribution and the superintendent of the electric department for approval and back to the head clerk, who files one copy. The remaining copy is returned to the contract department, where the head contract clerk informs the applicant of the cost. Later this copy goes to the card clerk, the triplicate file clerk, and finally to the data clerk, where it is held until the contract is signed. The estimate accompanied by the contract is then sent to a stenographer, and the regular "connect" or meter order is made. The routine handling of the successive forms is shown in the chart, which is posted in the various departments for reference.

Curve	Particular Duty Done at Each Point
	REQUEST ESTIMATE
A	Memorandum
B	Request made in triplicate
C	For entry
D	To be recorded
E	For filing engineer's copy
F	Applicant informed as to cost
G	For additional entry
H	For pulling of triplicate copy
I	Held for signing of contract; then accompanies contract to C, where connect order is made out
	"CONNECT" OR "METER SET" ORDER
A	Estimate detached and accompanies order
B	Recorded and engineer's copy of estimate attached
C	Rough draft of local requisition and job order made. If less than $200, a work order only is made
D	Order typewritten and estimate detached and filed; both copies of "connect" order accompany work order
	LOCAL CONSTRUCTION REQUISITION
A	If authorized work order is sent forward for execution, then held until all charges are in
B	For permanent file
	JOB OR WORK ORDER
A	For setting meter
B	For entries on maps
C	For filing
	"METER SET" ORDER NOT REQUIRING CONSTRUCTION, OR POWER METER SET ORDER NOT REQUIRING CONSTRUCTION
A	If requiring a service loop, a memorandum order in duplicate is forwarded to the assistant superintendent in charge of loops for execution.

R. A. HAMMOCK,
Superintendent of Distribution.
Denver Gas & Electric Light Company,
Denver, Col.

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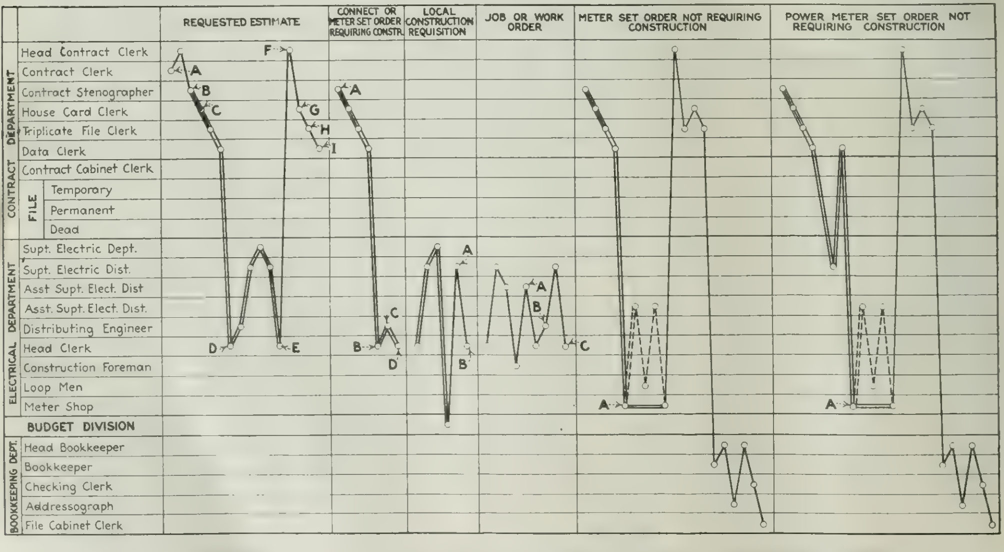
Increasing Air Gap Corrects Starting Troubles

NOT infrequently it happens that trouble develops in electrical equipment for which a ready remedy cannot be found in the experience of the repair man or in the literature of the industry. Such a problem presented itself some time ago in starting a standard-make 75-kw. direct-current, 112-hp., three-phase, 25-cycle, 440-volt motor-generator unit.

In the starting position, with the half-voltage tap on the compensator, the motor took about 600 amp. or five times full load current. It barely turned over and chattered violently. The unit was of the two bearing pedestal type with the base firmly grouted in. The alignment of the stator frame was adjusted by means of shims to secure an even air gap when the machine was at rest. When



A CLEAR CHARTED INDICATION OF ROUTINE ELIMINATES ERRORS IN HANDLING DISTRIBUTION ORDERS

The table above the chart specifies the special duties of various employees as each order passes through their hands.

the unit was started the rotor apparently attempted to cling to the top of the stator and rubbed against the stator iron. It was thought that the current distribution in the winding, which was a two-path star connection, might not be equalized. An ammeter in each circuit and an equalizing connection between pole-phase groups eliminated this possibility. Evidently it was essential to eliminate all vertical movement of the rotating element in the bearings that was possible, prevent any possible shifting of the stator frame and to investigate possible vibration of the shaft of the unit. After concluding this investigation and slightly increasing the air gap at the top of stator as compared with the bottom the starting performance was slightly improved. However, the machine would not come up to speed on starting and took about four times full load current on the starting position.

After consulting the manufacturers with regard to increasing the air gap it was found that this could be increased 0.012 in. without seriously affecting the performance of the motor. A cut of 0.012 in. was taken off the rotor iron in a lathe and the machine reassembled. The machine then quickly came up to speed on the lowest tap of the compensator with a maximum starting current under two times full load current and showed normal performance as to heating at full load.

SILVER SOLDER WITHSTANDS SEVERE STARTING CONDITIONS

While the rotating element was out of the machine some of the rotor bars were found to have loosened up due to the strain imposed by the severe starting conditions. These bars were silver soldered before the rotor was replaced. It is practically useless to use ordinary solder on rotors, as any severe overload will cause the rotor bars to heat and throw out the ordinary solder. It is comparatively easy to silver-solder rotor bars if the copper section is large enough to prevent melting the copper under the oxyacetylene flame. There is one point to observe and that is to have the copper absolutely clean before soldering. In this case the cleaning was accomplished by suspending the rotor by means of a crane over a small tank of a chemical cleaning compound which was kept boiling by means of a gas heater. The rotor was revolved in this cleaner and all dirt, grease and foreign matter was quickly removed, after which the rotor was silver-soldered.

J. E. HOUSLEY,*

Aluminum Company of America, Kansas City, Mo.

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*Formerly assistant power superintendent of the Aluminum Ore Company, East St. Louis, Ill.

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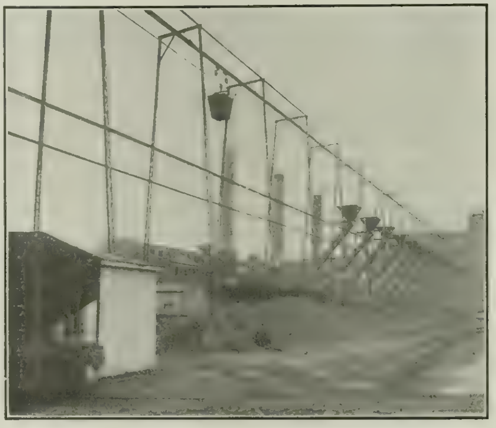
Reduce Coal-Handling Time by Conveyor System

THE rate at which coal cars can be emptied by a monorail type of conveyor is shown in the accompanying table. This information was derived from a contest held by the Godfrey Conveyor Company in which records were sent in from coal dealers and industrial plants using the type of equipment shown in the illustration.

In each case submitted one man dumped the car, filled the bucket, operated the hoist and closed the dumps on the car. The coal bucket was lowered to the pile before emptying and not dumped from the raised position of the bucket. The majority of the results shown were achieved by coal dealers who at the time of year when the record was made had occasion to unload several cars of coal daily to meet the fall and winter demands of the retail business. The speed that these dealers have made is significant owing to the fact that the average coal yard does not maintain a man with technical knowledge to operate the conveyor. During the limited time the contest was conducted there was probably an insufficient amount of coal handled by industrial plants to warrant many taking part. Still better results could doubtless be made by these plants were there a thorough understanding of the mechanical equipment by the operatives.



CAR WITH 50 TONS OF COAL UNLOADED BY THIS CONVEYOR IN ONE HOUR AND EIGHTEEN MINUTES

The records made showed that with one man operating the equipment the average power and labor cost was from 5 cents to 7 cents per ton. Remembering that it costs 30 cents to 50 cents per ton to unload coal by hand, it will be seen that a large saving can be made by the use of a conveyor.

M. M. MUMMERT.

Godfrey Conveyor Company,
Elkhart, Ind.

RECORD FOR UNLOADING COAL CARS BY COAL DEALERS AND INDUSTRIAL PLANTS

Contest Rating	Weight of Coal, Lb	Kind of Coal	Average Size of Lumps	Distance Conveyed, Ft.	Distance Bucket Raised, Ft.	Unloading Time
1	96,600	2-in lump	2 in x 6 in.	87	30	1 hr. 18 min.
2	94,200	6-in. lump	6 in.	150	30	1 hr. 40 min.
3	103,000	Egg	3 in x 6 in.	50	50	1 hr. 30 min.
4	96,800	6-in. lump	6 in.	32	56	1 hr. 32 min.
5	96,600	Illinois	3-in. x 6-in. egg	40	40	1 hr 28 min.
6	93,600	6-in. lump	9-in	110	52	2 hr. 57 min.
7	133,400	Franklin County	3-in x 6-in	70	40	3 hr. 15 min
8	89,740	Anthracite stove	1¾-in screen	20	40	1 hr. 40 min

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

The Fly in the Ointment

Costs of Raw Material and of Labor as Seen by a Public Utility Purchasing Agent

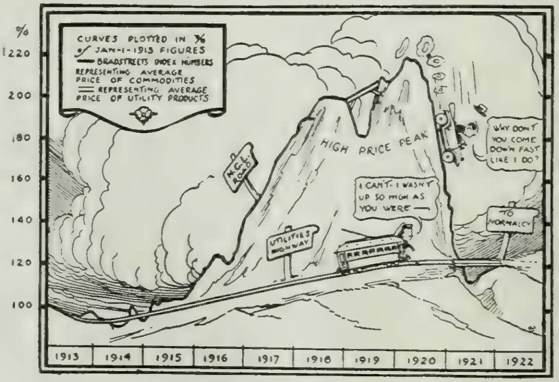
By L. C. Haskell
Secretary-Treasurer and Purchasing Agent
Southern Canada Power Company, Montreal, Que.

PURCHASING for public utilities is in a class by itself. The purchasing agent of an industrial corporation knows that whatever he has to pay for his purchases will be absorbed in the price asked for the manufactured product of his company and will be passed on to the ultimate consumer. Not so with the purchasing agent of the public utility corporation. He knows that the price of the product of his company—service to the public—is fixed by franchises or public service commissions, and therefore any increase in the cost of his purchases goes directly to the reduction of net earnings through increased cost of operation and maintenance.

It is interesting to note the different arguments put forth by salesmen in their attempts at justification of continued high prices of some lines of commodities used by public utilities. During the war, when the prices of copper, steel, aluminum, rubber, oil, cotton and other raw materials as well as of labor were abnormally inflated, salesmen justified their quotations on electrical machinery and other manufactured electrical supplies by the assertion that the predominating element was copper.

When the price of copper declined after the cessation of hostilities in Europe, the sellers of public utility requirements were wont to say that the drop in copper made very little difference in their costs, as steel and labor, not copper, were the controlling factors in the cost of electrical supplies. The prices of steel, lead, cotton and practically every item of raw material entering into the price of manufactured supplies used by public utilities have approached the June, 1914, level, and rubber, aluminum and copper are far below that level. Indeed, 17-cent rubber to-day as compared with 70-cent rubber in June, 1914, makes one wonder if the millennium is not near at hand.

Now the salesman, eager to justify his prices, pins the blame on labor. "You know," he says, "our firm has not reduced wages," or "Our firm has reduced the wages of our employees only 20 per cent, which is a mere bagatelle when compared with the inflation of wages over those of 1914," or "Really, you know, the raw materials make up a small part of our product—labor is the big item."



THE HIGHER THEY GO THE FASTER THEY FALL

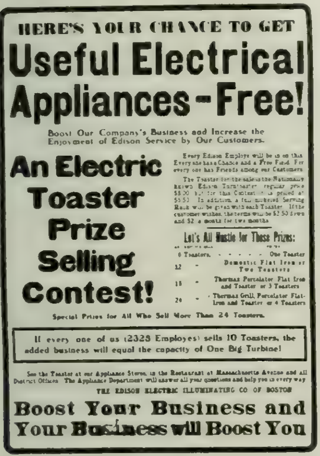
It is true, and no one knows it better than the public utility purchasing agent, that the iniquitous schedule of wages and salaries foisted, for political purposes, on the railways and the public under the cover of "a war necessity" has been and continues to be "the fly in the ointment." Granted, however, that wages in those industries affected by the "railway schedule" are still inflated—and most industries are affected directly or through high freight rates—yet one item is still being overlooked by the manufacturers, and that is the increased efficiency of labor. A recent report of one of the largest tire manufacturers makes very pleasant reading where it says that to-day 24,000 tires are turned out daily with 10,000 men, whereas in 1919 it took 33,000 men to manufacture 31,000 tires; that is, one man is to-day turning out two and one-half times the work he did in those rollicking days when almost everything, including inflated prices, could be passed on to the long-suffering public. If the tire industry can bring about such an increase in efficiency, cannot the same thing be done in the manufacture of such machinery and supplies as enter into the development of the country's resources and the operation of such resources by public utility corporations?

The public utility corporation is one of the biggest factors in the development of any country. It is, as its name implies, the servant of the public and as such deserves and must get its sinews of life and growth upon such a basis as will enable it to keep pace with the demands and ambitions of the public it serves.

This article was written in Canada, yet so close are the trade relations of Canada and the United States and so nearly identical are the economic conditions of the two countries that it might well have been written in New York.

Better Business Developed by Sales Contest

FIELD Day on the Boston Edison system was utilized as an opportunity to call the attention of every one of the company's 2,325 employees to an appliance sales contest, planned along the line of stimulating more and better business both locally and nationally in the electric utility industry. Electric toasters were chosen for competitive sale, and it was announced in a striking poster reproduced here that any employee selling six toasters will be awarded one toaster; if twelve are sold, the employee is given either two toasters or a flat-iron; if eighteen, the prize is a percolator, flat-iron and toaster, or three toasters; and if twenty-four are sold, the employee is awarded a grill, percolator, flat-iron and toaster, or four toasters, with special prizes for those selling more than two dozen. Toasters are sold on either cash or part-payment bases, and the value of the toaster load was strikingly emphasized by the statement that if every one of the employees sold ten, the added load would equal the capacity of one of the company's large generators.


HERE'S YOUR CHANCE TO GET

Useful Electrical Appliances-Free!

Boost Our Company's Business and Increase the Enjoyment of Edison Service by Our Customers.

An Electric Toaster Prize Selling Contest!

Every Edison Employe will be in on this. Every one has a Chance and a Free Field. For every one has Friends among our Customers.

Let's All Hustle for These Prizes:

6 Toasters	One Toaster
12	Domestic Flat Iron or Two Toasters
18	Thermax Percolator, Flat Iron and Toaster or 3 Toasters
24	Thermax Grill, Percolator, Flat-Iron and Toaster or 4 Toasters

Special Prizes for All Who Sell More Than 24 Toasters.

If every one of us (2325 Employes) sells 10 Toasters, the added business will equal the capacity of One Big Turbine!

See the Toaster at our Appliance Stores, in the Restaurant at Massachusetts Avenue and all District Offices. The Appliance Department will answer all your questions and help you in every way.

THE EDISON ELECTRIC ILLUMINATING CO. OF BOSTON

Boost Your Business and Your Business will Boost You

BOSTON'S BUSINESS STIMULATING POSTER

Handling Service "Complaints"

By F. M. HOUSTON

Sales Engineer, Elmira Water, Light & Railroad Company, Elmira, N. Y.

WHEN a customer has something wrong with any appliance, or his lighting, we endeavor to treat him as if he were doing us a favor in notifying us, instead of acting as if he was making trouble for the company. The word complaint, we believe, is a misnomer, for 99 per cent of the trouble calls are not complaints, but merely the result of something wrong which the customer wishes remedied. We, therefore, try to make the customer feel that he is doing us a favor in reporting this trouble rather than saying nothing to us about it and telling his neighbor what a poor device he purchased from the company.

All service calls are now handled by one man. He enters them in a book made out in triplicate. The original goes to the service man, who makes the calls and repairs. The duplicate goes to the accounting department if there is to be any charge for the work done and the triplicate remains in the book. On all articles which are guaranteed for a year and on which the time has not expired there is no charge for any repair work or service done. On all other articles a charge is made for the material used and the time of the repair man. This charge more than covers the salary of the repairman and the cost of material. We do not believe in giving material away and see no reason why people should expect a public utility company to do it any more than they would a merchant or dealer.

A number of years ago we had one man busy running around putting in fuse plugs, for which we charged people merely the cost of the plugs. Now, if we have a call which requires replacement of fuses, a minimum charge of 50 cents is made in addition to the price of the fuses used, and we find that the people will pay this charge without any objections.

Each salesman we have out carries a small kit of tools and is instructed to make such minor repairs as he can whenever he finds appliances which need adjustments. This often gives him a chance to talk to the customer, otherwise he could not get inside of the house.

Each year during the months of January, February and March we make a survey of the town. At that time the salesmen get a list of the appliances in each house, and we have found that many times an electric appliance is not being used because the people were afraid it would cost a large sum of money to repair it. The salesmen all have a list of what the various repair jobs cost, and we find that the people are very glad to get this information and that invariably we get the repair work.

In conclusion we wish to emphasize the fact that we do not want the customer to get the idea he is making a complaint, because he is merely doing what any one would naturally do under like circumstances. As stated before, we are trying to make the customer believe he is doing us a favor in reporting the trouble.

What Other Companies Are Doing

Chicago, Ill.—Total sales of appliances made by the Public Service Company of Northern Illinois have shown the following monthly increases over the corresponding period in 1921: January, 1922, 47 per cent; February, 11 per cent; March, 35 per cent, and an increase of 115 per cent for May. The increase for the five months of 1922 ended May 31 was 54 per cent over the same period of 1921. The sale of flat irons, curling irons, grills and cooking utensils has been the noticeable feature of the business.

Kiefer, Okla. — The following from the Kiefer *Enterprise* is an encouraging sign of the changed attitude of many newspapers toward the utilities: "The Oklahoma Gas & Electric Company got busy recently and painted its plant here. Then, to add more to its appreciation by Kiefer people, it has made a voluntary decrease in electric rates. 'Who says that a corporation has no soul?' "

Wisconsin.—The tendency in this State, according to the records of the State Railway Commission, is for municipal electric plants to purchase current from private companies. Out of sixty-nine publicly owned plants a year ago but thirty are now generating their own energy. Since 1915 seven municipal plants have been built in the state, while seventeen have been sold to private companies.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Using Exhaust Energy in Reciprocating Engines.—J. STUMPF and C. C. TRUMP.—There are a surprising number of cases where oil, gas or steam engines still show better economy than purchased power and electric motors, and this may be emphasized where the exhaust from steam engines is valuable for heating or process work. Any development which will improve the efficiency of reciprocating engines and at the same time simplify their construction should be of interest. The theoretical problems encountered are presented in this paper and practical applications to either single-cylinder or multi-cylinder engines are suggested and illustrated. — *Paper presented at spring meeting of the American Society of Mechanical Engineers, Atlanta, Ga.*, May 8, 1922.

Developments in Power Station Design.—The practical application of the laws governing the flow of fluids in pipes has hitherto involved the use of mechanical contrivances, but an electrical system which is claimed to give a high degree of accuracy and which merely involves the use of standard ammeters and watt-hour meters has recently been developed. The way in which this method is applied to the various meters used in a central station boiler room is described. — *Engineer*, May 19, 1922.

Generation, Control and Switching

Oil Switches for Direct-Current Circuits.—W. WILSON.—Although the oil switch is an essential feature of practically all alternating-current systems, it has been used very little on direct-current systems, with the result that considerable uncertainty exists as to its fitness for this purpose. The author considers the need of an oil switch in connection with direct-current circuits, the principles involved in rupturing the circuit, the peculiarities of direct-current circuits as compared with alternating-current and the effect of these differences upon the oil break principle, and concludes with some examples of this particular apparatus in use today in direct-current installations. It was found after a series of tests that there was no risk of high peak voltages in opening a purely lighting load. With series motors or other slightly reactive loads similar to those used in an alternating-current circuit no more serious surge was developed than with an alternating-current oil switch. With other motors the starting and controlling apparatus must insure a complete circuit for the shunt field at all times to prevent serious surges. A complete installation of these switches for controlling three incoming and eight outgoing feeders is at work upon a direct-current colliery system, and has already cleared a short circuit without suffering in any way.—*Beama*, May, 1922.

Boiler-Room Performance and Practice of the Colfax Station of Duquesne Light Company.—C. W. E. CLARKE.—The purpose of this paper is to describe in some detail the operation of the boiler plant in this station. The first part of the article is taken up with a description of the fuel and fuel handling apparatus, stokers and clinkers grinder, ash-handling system and boilers. It then goes on to describe the operating conditions, giving tables of water evaporated, coal consumed, etc. A heat balance sheet for the four last months of 1921 is also included.—*Mechanical Engineering*, May, 1922.

Transmission, Substations and Distribution

Comparative Merits of Grounded and Insulated "Y" - Point Systems. — M. KÖCHLIN.—A short study, giving the advantages and disadvantages of star-connected three-phase systems with grounded and with insulated "Y"-point. If the central station is connected with the distribution center with only one transmission line, the use of a grounded system would be dangerous. Only where a multiplicity of feeders is available, so as to cut off a faulty feeder without disturbing the others, is a Y-grounded system permissible. — *Revue Générale de l'Electricité*, May 6, 1922.

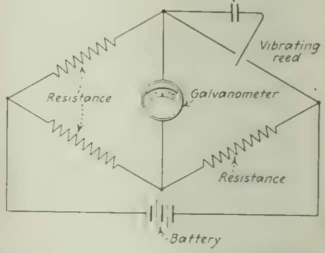
Outdoor Switching Station at Gösgen for 135,000 *Volts.*—Plans and description of a Swiss high-voltage outdoor switching station, interesting on account of its arrangement in two stories. The disadvantage of more difficult manipulation is compensated for by the more logical arrangement and the smaller floor space. Besides, it is not expected that the disconnecting switches in the upper story will have to be opened and closed very frequently. Gas pipes with a heavy copper coating are used as busbars.—*Zeitschrift des Vereines Deutscher Ingenieure*, May 6, 1922. (From *Schweizerische Bauzeitung.*)

The Influence of Condenser and Choke Coil Protective Devices on Traveling Electric Waves. — S. A. STIGANT.—Traveling waves such as occur from switching, arcing earths, lightning, etc., pass into the circuit with rectangular fronts. If this circuit is composed of coiled inductive windings, such a wave is a menace to the insulation of windings, and it becomes highly desirable to modify the shape of the wave from the rectangular form to a more gradual sloping one. This can be effected by shunting an electrostatic condenser from the transition point to ground. — *Electrical Times*, May 11 and 18, 1922.

Units, Measurements and Instruments

The Development of the Induction Meter.—C. PAULUS.—A survey is given of the development of modern driving systems for alternating-current induction meters. The author comes to the conclusion that there has been no novel feature introduced in late years, all the improvements being restricted to the most suitable dimensioning. Most concerns today favor the three-legged iron core construction, arranged tangentially to the driven disk, and it is hoped that this design will ultimately be adopted as the universal standard type.—*Elektrotechnische Zeitschrift*, May 25, 1922.

Development of Maxwell's Capacity Bridge. — V. A. BAILEY. — One of the most accurate and convenient methods for determining capacity in electromagnetic units is that devised by Maxwell. In this method one side of the condenser, shown in the accompanying illustration, is made to touch *A* and *B* alternately by means of an electrically driven tuning fork. The author proves that in any general network which may also have several sources of emf. for which the variables have been adjusted so as to give no galvanometer deflection the permanently connected plates of the condenser may be connected to any point in the network without disturbing the galvanometer's state of deflection.—*Philosophical Magazine*, June 1922.



METHODS OF ACCURATELY DETERMINING CAPACITY

Motors and Control

Reducing Power Bills on Mine Fans with Synchronous Motors.—FRANK W. CRAMER and A. A. MACDONALD.—The solution of the energy supply for mines is to purchase power from the public service corporations, as few mines are large enough to justify the installation of turbo-generators to furnish electric power. Even if they are, water conditions are such that it is impossible to use condensers. The power lines of these corporations are now available in practically all mining districts and the rates are such that electrification is a money-saving proposition. Previous to the war the Midvale Steel & Ordnance Company acquired the Marianna, Acme and Hazel Kirk mines. A careful study revealed that the boiler plants in these mines were very inefficient and wasteful. After an investigation it was decided to buy all electrical energy and to replace all steam drive by electric drive. After a careful analysis of the various types of drives for mine fans the synchronous drive was adopted. The successful operation of these motors now justifies their adoption.—*Association of Iron and Steel Electrical Engineers*, May 1922.

Commutation in Continuous-Current Dynamos.—ALFRED STILL.—The author explains the theory of commutation by emphasizing the physical aspects of the problem and avoiding mathematical expressions and formulas of which the meaning and derivation cannot be easily understood. The article covers the theory of commutation, magnetic flux due to armature currents, formulas for calculating armature flux and end flux in the zone of commutation, commutating poles, methods of resisting flux pulsations under the commutating pole, leakage flux and pole-face windings.—*Journal of the Franklin Institute*, May, 1922.

Heat Applications and Material Handling

American Electrochemical Society Convention at Baltimore.—A symposium which covers the manufacture of pig iron in electric furnaces, manufacture of synthetic cast iron from steel scrap or iron turnings, melting pig iron by electricity, desulphurizing cupola-melted gray iron, etc.—*Chemical and Metallurgical Engineering*, May 3 and 10, 1922.

Instructions in the Welding of Iron and Steel.—E. WANAMAKER.—The practice which influences the production of good welds is enumerated, together with the procedure followed for repair and maintenance work in the shops of the Chicago, Rock Island and Pacific Railroad. These practices are: (a) Careful preparation of the parts; (b) skill in the manipulation of the arc, and (c) a thorough knowledge of the thermal effects produced by the welding process.—*Electrical Review and Industrial Engineer*, May, 1922.

Electrophysics, Electrochemistry and Batteries

Experiments with Alternating Current in Direct-Current Electrolysis.—W. B. JONES.—An investigation to study the cathodic overvoltage of lead electrodes in sulphuric acid during direct-current electrolysis by superimposing alternating current in an amount sufficient to give no reverse current, reverse current with and without corrosion, or reverse current equal to or greater than cathodic current. A study was also made of the cathodic overvoltage using an intermittent direct current. The method of making these analyses and the results are given.—*Paper presented at the American Electrochemical Society, Baltimore, Md.*, April 27, 1922.

Crystal Growth in Metals.—G. R. FONDA.—The author shows how the crystals in a metal vary in size and form according to the strains the metal is subjected to and according to how the metal is worked.—*General Electric Review*, May, 1922.

The Rate of Combination of Copper and Phosphorous at Various Temperatures.—C. A. EDWARDS and A. J. MURPHY.—A research carried out to determine the temperature at which rapid combination between copper and phosphorus commences, and to follow the effect of time on the progress of the reaction velocity.—*Engineering*, June 2, 1922.

Traction

Single-phase Locomotives with Individual Shaft Drive.—BUCHLI and COUWENHOVEN.—Exhaustive studies, covering the last three years, have convinced one company that the multiple-rod drive for express locomotives, as used on the Swiss Federal Railways, is not as advantageous as the individual drive of each shaft by its own motor over a reduction gear. Particularly the vibration phenomena on engines with a rod drive are of a much more severe character than on the individual drive. Consequently a new series of locomotives has been developed, eight of which have been ordered for the Swiss Federal Railways. They are of the 2-C-1 class, and their very detailed mechanical description is given in this paper. The engines have a total weight of 92 tons and are driven by three 700-hp., 500-r.p.m. motors. Great advantages are claimed for the use of three bearings for each motor shaft. A number of vibration curves, recorded during normal operation of engines with a specially designed vibrograph, show the difference between rod drive and individual drive. A theoretical analysis of the new drive is given in a mathematical appendix to the paper.—*Brown-Boveri Mitteilungen*, May, 1922.

Telegraphy, Telephony, Radio and Signals

The Provision of Power for Wireless Telegraphy.—J. H. WHITTAKER-SWINTON.—A survey has been made of the various forms of high-tension power which have been used in connection with continuous-wave wireless telegraphy. The present practice in experimental working in connection with transmitting sets of small power is reviewed with a statement as to the probability regarding the future. The essential requirements for producing "pure continuous waves" are set out and a description is given of successful methods. The conclusion is reached that direct current directly generated is inherently the best form of power to use.—*Beama*, May, 1922.

Short-Wave Directional Wireless Telegraphy.—C. S. FRANKLIN.—Investigations made with reflectors and wave lengths below 20 meters were commenced by Mr. Marconi in Italy in 1916, and then taken up later by the author in England. A coupled-circuit spark transmitter was developed, the primary having an air condenser and spark in compressed air. By this means a moderate amount of energy was obtained and the small spark-gap in compressed air proved to have a very low resistance. —*The Electrician*, May 19, 1922.

Miscellaneous

Oil Supplies.—Four papers presenting the oil possibilities and reserves in Brazil, the United States, the West Indies and Colombia (Central America). Under the auspices of the U. S. Geological Survey, the American Association of Petroleum Geologists made an estimate of the oil reserves of the United States as of Jan. 1, 1922. This survey states that there was at that time 9,150,000,000 bbls. of oil of which over 4,000,000,000 bbls. are in the heavy-oil group, including fuel oils, and 5,000,000,000 bbls. in the light-oil classes. Contrary to the statement that the oil reserves in the United States will be exhausted in twenty years as has been erroneously reported, a long time will be required for the exhaustion of our oil fields. The West Indies do not constitute a promising area of oil reserves. On the other hand, Colombia presents a promising field for the production of oil in commercial quantities. This country (Colombia) is ideally situated, which should aid in the development of the oil fields.—*Mining and Metallurgy*, June, 1922.

Fixation and Utilization of Nitrogen.—A report prepared to correlate and make available under one cover the information on the fixation and utilization of nitrogen collected by the Nitrate Division of the War Department since its organization in 1917. It is based to a considerable extent on reports, papers and articles prepared by the officers and civilians associated from time to time with the activities of the Nitrate Division, as well as on the published technical and economic papers on the subject. In it is included a discussion of the world's nitrogen supply and demand, including a brief discussion of the prices of nitrogen. A résumé of the development of nitrogen fixation both in this and in foreign countries is given, followed by a technical and engineering description of the several nitrogen fixation and conversion processes, a discussion of research in its bearing both on the present and future possibilities of fixation, a history of the government activities in nitrogen fixation, a description of the United States Government's nitrogen plants and the bibliography referred to above.—*Document No.* 2041 *from the Nitrate Division, War Department.*

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

Municipal Plants Beginning to Feel Effects of Coal Strike

While one effect of the coal strike has been to add industrial load to the circuits of the electric light and power companies owing to the inability of some industries to obtain fuel, the continuation of the strike, coupled with the strike of the railroad shopmen, is beginning to make itself felt. This is particularly true of numerous municipal plants which because of inability to obtain funds and lack of foresight had not stored sufficient coal to carry them over the long period of the strike. The privately owned electric public utilities have prepared for the strike better than other industries, and reports from various sections of the country indicate that private companies have no fear of coal shortage for some time to come.

Trouble has been experienced by municipal plants in Trenton, Carlyle, Highland, Staunton and Divernon, Ill. In addition the rates in Carlyle have been raised 50 per cent since the strike began. Reports from Iowa indicate that most of the plants there have sufficient coal to operate for a few weeks. Manifestations of coal scarcity are reported from northern Missouri. Other reports from Illinois indicate that some private companies have enough fuel to operate from six to eight months. No news of shutdowns has been reported from the New England, Middle Atlantic and Southern States.

President Smith Appoints N. E. L. A. Chairmen

The following appointments of committee chairmen for the new administrative year of the National Electric Light Association were announced Thursday by President Frank W. Smith and ratified by the national executive committee in session at headquarters on that day:

Public Policy: Martin J. Insull, Middle West Utilities Company.

Customer Ownership: Milan R. Bump, Henry L. Doherty & Company.

Joint Committee for Business Development: E. W. Lloyd, Commonwealth Edison Company.

Accident Prevention: Charles B. Scott, Bureau of Safety, Chicago.

Company Employees' Organization: Robert B. Grove, United Electric Light & Power Company, New York.

Membership: Howard K. Mohr, Philadelphia Electric Company.

Wiring: R. S. Hale, Edison Electric Illuminating Company of Boston.

Rural Lines: G. C. Neff, Wisconsin Power, Light & Heat Company, Madison, Wis.

Constitution and By-laws: W. C. L. Eglin, Philadelphia Electric Company.

Doherty and Billings Prizes: A. S. Loizeaux, Consolidated Gas, Electric Light & Power Company, Baltimore.

Electrical Resources of the Nation: M. S. Sloan, Brooklyn (N. Y.) Edison Company.

Exhibition: C. L. Peirce, Jr., Hubbard & Company, Pittsburgh.

Electrification of Steam Railroads: Louis A. Ferguson, Commonwealth Edison Company.

Finance: Joseph B. McCall, Philadelphia Electric Company.

Insurance: Charles B. Scott, Bureau of Safety, Chicago.

Lamp: W. W. Freeman, Union Gas & Electric Company, Cincinnati.

Rate Research: Alex Dow, Detroit Edison Company.

Water-Power Development: Franklin T. Griffith, Portland (Ore.) Railway, Light & Power Company.

National Fire Protection Association: Member electrical committee, W. H. Blood, Jr., Stone & Webster.

National Industrial Conference Board: John W. Lieb, M. S. Sloan and Frank W. Smith.

Chamber of Commerce of the U. S.: National Councilor, John W. Lieb.

Babson Boosts Electric Light and Power Securities

"Babson's Reports" of July 11 ("Barometer Letter" and the "Babson Chart") is devoted entirely to electric light and power securities. While there will be a wide diversity of opinion, some not at all complimentary to the compiler, the conclusions of the Wellesley Hills statistician are given herewith for what they are worth.

"At various times," he says, "different classes of local securities offer the best opportunity. At present electric power and light securities are the best local purchase. Manufacturing corporations depend almost wholly on the men in control. Railroads and tractions will for a while show up better, but they always will have labor and the automobile with which to contend. Gas companies have probably seen their best days. Water companies are being taken over by cities and towns. Merchandising—through the shortsightedness of local merchants—is fast getting into the hands of chain stores and mail-order houses. This leaves the electric power and light company as the most attractive local investment."

North American Company Gets Squier Wireless Patents

The North American Company has just closed a contract with Gen. George O. Squier under which the company receives the exclusive license to use "wired wireless" under the Squier patents in the United States, as applied to central-station distributing systems and power-transmission lines for all purposes, such as broadcasting, signaling, telephone and telegraph, time-clock service, etc. Under the contract the North American Company is allowed to issue sub-licenses to other companies.

The North American Company has been making extensive experiments in Cleveland during the past two months and has obtained some results which indicate that there is a real future for this sort of central-station service. An article describing the Cleveland experiments, results obtained, circuits used, etc., will appear in the *Electrical World* in an early issue. A 50-watt set was used on the part of the system under test, and the area on which satisfactory reception was had was such that it took about 1 watt per square mile for satisfactory broadcasting.

According to Edwin F. Gruhl, vice-president of the North American Company, it is the purpose of the company to co-operate with the central-station industry as a whole, and it has taken this step because it believes control of "wired wireless" broadcasting over central-station lines should be within the central-station industry. Negotiations for the North American Company have been conducted by C. W. Hough, engineer for the company, who is in active charge of the radio-electric work.

R. D. Duncan, Jr., who has been chief engineer of the Signal Corps Laboratory, Bureau of Standards, has been granted a leave of absence from the War Department to accept an appointment as radio engineer with the North American Company, to carry on its experiments and developments.

St. Louis Company to Use Powdered Fuel

Pulverized fuel will be used in the new plant of the Union Electric Light & Power Company at St. Louis. An order has been placed with the Combustion Engineering Corporation for complete pulverized-fuel equipment. This plant, according to the present order, will have eight large boilers using pulverized fuel.

Senate Committee Rejects Ford Proposal

Chairman Norris Denounces the Endeavor of the Detroit Manufacturer to Gain Control of Muscle Shoals—Senator's Own Proposal Also Disapproved

FINAL action on the Muscle Shoals proposals, so long before it, was reached last Saturday by the committee on agriculture of the United States Senate, when it rejected by a vote of nine to seven Henry Ford's offer for the lease and operation of the government power project at that site. The proposition submitted by Senator Norris, chairman of the committee, for operation of the plant by a government-controlled corporation was also rejected, the vote being nine to five. Both propositions now come before the Senate in the form of minority reports.

Senator Norris, in his report, after recounting at some length the purpose and the history of the Muscle Shoals development, proceeds to analyze Mr. Ford's bid for the property, which he regards as utterly inadequate and as designed for the aggrandizement of the bidder with scant regard for the interests of the nation or even of the farmers whose benefit it ostensibly promotes by the implied promise of cheap fertilizer. Some of Senator Norris' arguments, in condensed form, follow:

Five Million Dollars for Property Costing Ninety Million

"The property that is to be conveyed to Mr. Ford has cost the government of the United States nearly $90,000,000. When the government commenced the construction of these great plants it was necessary to build homes for the workers. In fact, the government bought sufficient land and built a town at Nitrate Plant No. 1 and another town at Nitrate Plant No. 2. In addition to all this the federal government, under Mr. Ford's offer, will turn over to him more than $2,000,000 worth of personal property, much of which is absolutely new and has a definite market value.

"The two steam plants, capable of developing more than 120,000 hp., are as modern as any steam plants in the world. Nitrate Plant No. 2 is complete in every respect. There is nothing in the world superior to it. It can be started in full operation upon a day's notice.

"In consideration of the transfer by warranty deed of all of this property, the Ford corporation proposes to pay the sum of $5,000,000.

No Guarantee of Cheap Fertilizer

"It is true that this corporation, by Mr. Ford's bid, is obligated to operate Nitrate Plant No. 2 to its full capacity, but there is no obligation to sell fertilizer or fertilizer ingredients at any fixed price. There is no agreement that the cost of fertilizer shall be reduced one penny, either to the farmer or to any one else. Contrary to the general opinion that the real estate speculators have so assiduously spread over the country, this corporation not only does not agree to sell fertilizer at a reduced price, but there is provided in its contract an agreement that on the fertilizer operations it shall have the right to 8 per cent profit. There is no limitation on the profit that can be made by the corporation either in its real estate operations or in its commercial activities other than fertilizer.

"After it has supplied the necessary power to operate Nitrate Plant No. 2, it will still have from 500,000 to 800,000 cheap horsepower to do with as it pleases, without any regulation whatever from the federal government or the state authorities of Alabama."

What the 100-Year Lease Involves

After alluding to the possible need, in case of war, of the government's buying all this property back from Ford at greatly enhanced prices, Senator Norris goes on:

"Yet that part of the Ford offer sinks into insignificance when compared with that part of the proposition which provides for the leasing to the Ford corporation for 100 years of Dams Nos. 2 and 3.

"It is provided that these dams shall be constructed at the cost of the government. Every dollar that is expended comes out of the Treasury of the United States. Mr. Ford's corporation does the work of construction, but everything is paid for by the government. When the dams are completed a lease is given to this corporation for 100 years. The lease includes all of the government property, consisting of valuable real estate and improvements thereon, located on the banks of the river adjacent to Dam No. 2, and all of the government's personal property there in use. This personal property alone amounts to a very large sum of money, and the government has constructed there another town, complete in every way and modern in every particular. The government there owns 2,300 acres of land. All of this property is included in the lease. The government has constructed a railroad across the river. Everything is in absolute readiness for the Ford corporation to put its men into modern homes and set them to work.

"The government has already expended at Dam No. 2 $17,000,000. If the Ford offer is accepted, every dollar that has been paid from the Treasury of the United States for the construction of these homes, the railroad and the railroad equipment, and for the partial construction of the dam, is absolutely leased to this corporation without any pay whatever for 100 years. There is not even a pretense in the Ford offer to pay one penny for the 100-year lease to this town, fully equipped as it is, or for the benefit that accrues to the corporation on account of any of the other expenditures made by the government at Dam No. 2. All of these expenditures are absolutely donated to the Ford corporation.

Scrapping the Water-Power Act

"Mr. Ford's offer is that Dams No. 2 and No. 3 when completed, together with all of the abutting property, shall be leased to this corporation for a period of 100 years. This provision of itself ought to be sufficient reason for the unqualified rejection of the offer. The question of the development of water power on our navigable streams has received a great deal of attention at the hands of Congress. The discussion finally culminated in the passage of the existing water-power act, which fixed the leasing term at fifty years. To lease this valuable water power to this corporation as proposed in the Ford offer would in effect repeal our water-power act. If this offer is accepted, it will be unfair to the water-power men who, after the long fight over the conservation of our water-power resources, have accepted the water-power act. It makes the water-power act in effect a scrap of paper."

Taxpayers to Lend for 100 Years at 2.85 Per Cent

Senator Norris then takes up in detail the consideration for the 100-year lease proposed in the Ford offer, summarizing the situation as follows:

"The general public has been led to believe not only that the Ford corporation will pay 4 per cent interest on the government's investment in these two dams, but that by a plan of amortization it will repay the government's entire investment at the end of the 100 years, and it is said, therefore, that at the end of the 100 years the government will have received back the money it has invested. The plain, cold facts are, however, that giving this corporation credit for every cent of money that it pays at the time it pays it, either for interest or the so-called 'amortization,' we find that the cold mathematical conclusion is that the corporation has not only not paid any of the principal but it has paid only 2.85 per cent interest on the government's investment. In other words, it means that the government has, in effect, loaned to this corporation from $70,000,000 to $75,000,000 at 2.85 per cent interest for 100 years and has never received back one cent of the principal.

"We must not forget, however, that this great financial gift to this corporation does not end the privilege that comes to it under the Ford offer. Not only are the taxpayers financing this corporation at 2.85 per cent interest on a 100-year basis, but they are giving to this corporation unrestrained and unlimited liberty to sell the products which it manufactures without any regulation whatever.

Ford's proposal that the government shall maintain both dams in return for insurance premiums from the corporation amounting to $55,000 annually is then denounced as absurdly unfair. "It is easily conceivable," Senator Norris says, "that this liability alone might cost the government not millions but billions of dollars before the 100-year period has expired."

"Greatest Gift Ever Bestowed Upon Mortal Man"

Recapitulating the points of his attack on the offer of the Detroit manufacturer, Senator Norris declares:

"The country has been given to unstand that Mr. Ford has guaranteed to reduce the cost of fertilizer by one-half. He has done nothing of the kind. He has made no guaranty of any kind in the way of the reduction of the cost of fertilizer. The country has been given to understand that he pays the government 4 per cent interest on its investment in the two dams. He does nothing of the kind. He has not made any such offer and no such proposition is included in his bid. The country has been given to understand that the Ford offer provides for the repayment to the government within the 100-year period of the entire investment that the government has made. His offer does nothing of the kind. The people of the country have been led to believe that the Ford offer means a reduced price for electricity to the consumer. It means nothing of the kind. He has not agreed to furnish a single kilowatt to any home or to any manufacturing concern except his own. The mighty power at Muscle Shoals will be devoted exclusively to the use of the great corporation which Mr. Ford will organize."

Putting the possible total profit to the corporation at the end of the 100-year period at fourteen and a half billion dollars, or more than one-half the United States' expenditure for the world war, Senator Norris exclaims:

"There is nothing in the history of the world with which this can be compared. It is the greatest gift ever bestowed upon mortal man since salvation was made free to the human race."

Public Relations Section Begins Active Work

Under the chairmanship of H. T. Sands, of C. H. Tenney & Company, Boston, the Public Relations Section of the National Electric Light Association mapped out a year's work at a meeting of its executive committee in New York on Wednesday. Authorization was given for a continuation of the National Electric Light Association's good-will advertising and publicity program, and the committee announced that the annual convention program of the section will include papers on and discussion of the work of state committees on public utility information.

J. W. Carpenter, vice-president and general manager of the Dallas (Tex.) Power & Light Company, was appointed a member at large of the section's executive committee to fill the vacancy caused by the resignation of A. Hardgrave of Dallas, who has retired from the industry.

Appointments of committee chairmen were approved by the executive committee and announced as follows—Employee relations with the public—L. B. Herrington, Kentucky Utilities Company, Louisville; manufacturers' advertising—Phil Thomson, Western Electric Company, New York; public speaking—A. C. Marshall, Detroit Edison Company; Information Bureau organization—H. C. Abell, Electric Bond & Share Company, New York; uniformity of state regulatory laws—W. W. Freeman, Union Gas & Electric Company, Cincinnati; women's public information, Miss O. A. Bursiel, Boston; relations with financial institutions (a consolidation of the committee on relations with bankers and the committee on relations with savings banks), M. S. Sloan, Brooklyn Edison Company.

I. E. S. Convention to Be at Swampscott, Mass.

Instead of holding its forthcoming annual convention at the Hotel Vendome, Boston, Mass., as planned, the Illuminating Engineering Society will meet at the New Ocean House, Swampscott, Mass., Sept. 25-28. This site, about 15 miles north of Boston and directly on the Atlantic shore, is at the gateway of a region of marked natural and engineering attractions. The general character of the convention program is unchanged from that outlined in the *Electrical World* for July 15, page 141.

General Electric Jobbers Discuss Plans

The new policy of more intensive merchandising announced recently by the General Electric Company, by the establishment of a merchandising department, received its first active expression this week in the annual gathering of the General Electric Distributing Jobbers' Association at Association Island, Henderson Harbor, N. Y. The presence of Gerard Swope, the newly elected president of the General Electric Company, and George P. Baldwin, newly appointed merchandise manager, gave particular interest to the discussion of the broader aspects of the problem of distribution. F. M. Bernardin, Kansas City, was chairman.

Mr. Baldwin in his address stressed the fact that rights, not wrongs, must be considered the basis of any merchandising platform organized around the fundamentals of quality goods at a fair price, quick response to the market demand by distributors, an active practical sympathy by the factory and a constant service at all points. This address will be reported more fully next week.

F. S. Price, Boston, read a paper discussing the future of the jobber in which he analyzed the jobber's place and responsibility in the distribution of electrical goods and the needs of the moment. This paper will also appear in an early issue.

W. E. Robertson, Buffalo, made a very able analysis of the market for socket appliances, which he said is increasing more rapidly than any other market in the world. He urged definite commitments by jobbers, less frequent changes in design by manufacturers and better ethics in the multiplying of the agencies of distribution, as practical measures for the reduction of the cost of distribution.

In an exceedingly well-balanced program other manufacturers and jobbers presented the outlook in the different commodity markets. The spirit of the sessions was one of district optimism and purpose to proceed along intensive lines of merchandising development.

New Orleans Utility Property Soon to Be Auctioned

The plan embodied in the ordinance adopted by the Commission Council of New Orleans, and reported in the *Electrical World* for April 22, page 798, looking to the reorganization of the New Orleans Railway & Light Company, is now in effect, the holders of 98 per cent of the company's 4½ per cent bonds having deposited their securities with the bondholders' protective committee, of which R. S. Hecht is chairman.

It is now proposed that, pursuant to to the reorganization plan, the property of the New Orleans Railway & Light Company shall be put up at auction some time in August, when it will be bid in by the protective committee representing the bondholders. The date of the sale, to be fixed soon by the special master, will be advertised for thirty days previously. Following the purchase of the property, another month may elapse before the receivership is finally discontinued, after which the new company will be launched.

To Make Fertilizer in South

The manufacture of fertilizer on a large scale by electrochemical processes in North Carolina in the near future is not only a possibility but a strong probability. One commercial plant already is in operation and could be enlarged indefinitely if power were available. The plant referred to is the plant of the Piedmont Electrochemical Company, a subsidiary of the Southern Power Company of Charlotte, and is located at Mount Holly. The raw material used is Florida phosphate rock, which is imported by the carload. The product turned out is double superphosphate, which analyzes 48 to 54 per cent acid phosphate as compared with 16 per cent in the best of the old types of acid phosphate manufactured by the acidulation process by the use of sulphuric acid.

The prospect of the manufacture of

super-fertilizers on a large scale by the new process is largely based upon the plans for development by the Southern Power Company, the parent company of the Piedmont Electrochemical Company. Many of those in touch with the power company executives, though unwilling to be quoted, believe that the building of the two big plants now under construction by the Southern Power Company marks the resumption of a construction program that will embrace a number of new plants. Surplus power from these plants under construction and from other plants when they are built will, it is believed, be used in the manufacture of fertilizer. It is a well-known fact that the power company since its early days has kept in touch with the various processes for the utilization of electricity in this process. W. S. Lee, vice-president of the company, has made several trips to Europe to investigate methods of manufacture.

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Government Forms a Committee for Broadcasting

The membership of the interdepartmental advisory committee on governmental radio broadcasting, suggested by Secretary of Commerce Hoover, was recently announced by the Department of Commerce. The committee has made a preliminary classification of the kinds of material the several departments may have to broadcast, including market prices and data, weather and hydrographic news, standard radio signals (such as wave length and time signals), executive announcements, statistics and educational material. One of the functions of the committee is to advise regarding priority of the type of material to be broadcast.

It is possible the scope of the committee's activities may be extended beyond the subject of broadcasting and that it will act in an advisory capacity to the Secretary of Commerce in matters of government radio recognition and will consider all radio questions of interdepartmental interest.

The chairman of the committee is Dr. S. W. Stratton, and the secretary Dr. J. H. Dellinger, chief of the radio laboratory, Bureau of Standards.

In accordance with recommendations of the committee, an experimental system of government broadcasting by "primary" broadcasting stations has been established, utilizing only previously existing government stations and equipment. The "primary" stations broadcast official government news by continuous-wave (code) telegraphy to local broadcasting stations for rebroadcasting by radiophone.

The eight stations thus far included send out daily bulletins of government news, mostly agricultural market data. They are: Arlington, Va. (5,950 m.); Great Lakes, Ill. (4,900 m.); Washington, D. C. (1,980 m.); Omaha, Neb. (2,500 m.); North Platte, Neb. (4,000 m.); Roch Springs, Wyo. (3,000 m.); Elko, Nev. (3,000 m.); Reno, Nev. (3,200 m.).

O.E.L.A. Discusses Rural-Service Problems

New-Business, Meter, Operating and Illuminating Topics Considered at Cedar Point—National President Smith Outlines Future N. E. L. A. Activities

WHILE explaining his report on rural-line extensions at the Ohio Electric Light Association's convention at Cedar Point on July 14, G. E. Miller, chairman, stated that it was not his purpose to set up any mandatory rules, but rather to suggest a plan which may serve as a guide for various localities when pressure for this service becomes strong. The report favored a plan, similar to the Wisconsin rules, where the lines were to be built by the customers, then turned over to the utilities, which would maintain them, making a service charge to cover maintenance, depreciation, taxes, operating costs and losses plus the regular urban rates for energy at the origin of the extension. Using the urban rate schedule, Mr. Miller maintained that this would serve as an effective selling point because too often the high minimum charges scare off a prospective consumer. Various methods of refunding to the consumer his distribution credit on similar urban installations ranged from direct substraction of this value at the start to allocating it over a period of time by furnishing free service for a year.

In a stirring plea for the proper consideration of this subject, D. L. Gaskill, secretary of the association, declared that it was one that central stations could ill afford to ignore and that they must keep in advance of the procession if they did not wish to be compelled to give this service under enforced legislation. He felt that the average farmer would not be a large user of energy, since the average consumption is from 15 kw.-hr. to 20 kw.-hr. per month, but with just rates there was no reason why the utilities should lose money on this service. By properly educating the farmer through his grange and similar associations, electricity on the farm, Mr. Gaskill predicted, would be as indispensable within ten years as the telephone is today. He recommended that because of future expansion a voltage lower than 6,600 should not be used. He also urged that the initial rates be high enough to avoid undue trouble and difficulties when an advance in rates becomes necessary.

J. C. Martin of Columbus said that it is the duty of the utility itself to see that the construction of rural lines was up to the standard and not of the kind that lasts for only two or three years. Considering the energy demand, he found, from the little information at hand, that various classes of farmers existed. The demand of a dairy farm run by an agriculturist would be far different from that of a "dirt" farmer. A study of these various demands by the association would aid in the solution of the problem.

The discussion of new-business problems was opened by H. N. Wood's report of the year's work, which considered two points in the question of central-station finance. These were how to place the problem effectively before the public and the selling of junior securities to consumers. Keeping up the value of the property was one of the best solutions in maintaining the value of these junior securities. C. G. Eichelberger, Union Gas & Electric Company, Cincinnati, dealt with the commercial industrial lighting problem. He felt that in this field, together with a proper study of highway lighting, an increased load could be obtained. Discussing the field of industrial heating, A. C. Shepard declared that the question of rates should be calculated on a basis of unit cost of production before a heating rate was discarded as apparently too high.

PRESIDENT SMITH'S ADDRESS

Frank W. Smith, president of the National Electric Light Association, in his first address before the O.E.L.A., outlined the future activities of the parent body. He recognized the customer-ownership movement as a healthy one and thought that the 1,600,000 security holders in electrical utilities must gain a much better understanding of the problems confronting the management of these utilities. The public, as the real owner of this business, Mr. Smith said, has the control of it through the commissions. Mr. Smith favored a uniform national accounting system which, following broad lines, could give due consideration to local conditions. He said that he was opposed to the California water and power acts because they were against private enterprise and that they were patterned after the Hydro-Electric Power Commission of Ontario. Tracing the outcome of the activity which in 1920 was termed "public relations" and which has now led to the establishment of public utility information bureaus in eighteen states, Mr. Smith declared that, while it may take a long time to reverse public opinion, nevertheless this work must go on, because a utility is a public servant and can serve the public effectively only when relations are amiable. He thought the rural-lines situation would be one of the most important in the coming year and said there was no questioning the fact that the farm of the future would be electrified.

METER COMMITTEE'S REPORT

S. C. Henton, Northern Ohio Traction & Light Company, Akron, chairman of the meter committee, in covering the year's work, declared that kilovolt-ampere apparatus was now available and that the problem of educating and training the meter personnel was growing. He recommended co-operation with the thirty-six colleges in Ohio in order to offset the growing lack of metermen. Considering the increase in time interval on demand-meter design, it was found that differences of but 1½ to 3 per cent were noticed when this interval was advanced from five to thirty minutes. Fewer complaints on these larger intervals have been noted. The longer a company has used these meters, it appears, the longer is the interval favored.

Pleasure at the way the O. E. L. A. has reached the smaller utility was expressed by J. C. Langdell, Jackson, Mich. He also dicussed the need for standardization of service entrance construction, since fire hazards are greatly increased by improper fusing, grounding and wire protection at the meter. With more than 10,000 ground wires installed at Jackson and Muskegon, satisfactory service has been maintained and hazards reduced. W. H. Pratt, General Electric Company, reported that as yet artificial sapphires for meter bearings have not proved satisfactory. In discussing the revision of Circular 56, Bureau of Standards, he favored the change in Rule 7(c) to place the meter not less than 4 ft. nor more than 7 ft. above the floor, since it facilitated reading and checking the meter.

Powdered Fuel and Other Topics

That boiler and furnace efficiencies of 90 per cent will be attained through the use of powdered fuel was a prediction made by H. M. Bromley of Youngstown, a member of the station-operating committee. Mr. Bromley traced the rise of powdered coal for fuel from the German experiments in 1893 to the modern practices. He considered three methods of transporting this fuel—namely, a screw combination with a bucket elevator, a mixture with air which is piped to the point of use, and a measured quantity delivered to storage tanks and then blown into the furnace.

Relation of Manufacturer to Merchant

In handling the subject "The Relation of the Manufacturer to the Merchandising Group of Business Men," George Bailey of Chicago said that this was more of a "gamble" for the manufacturers than was the building of larger equipment, since contracts are usually let for the latter type of work and rigid laws of economics function for the smaller equipment. Since distribution performs a service, he considers the cost of distribution entirely justifiable. Mr. Bailey outlined several tasks for the manufacturer. There were, first, improving the product by better designing and by lowering production costs; second, standardization; third, lowering packing cost; and, fourth, popularizing the convenience outlet.

Captain L. Davis of the National Contractor-Dealers' Association condemned the flat-rate basis for outlets since too often it afforded a chance to substitute inferior materials. Captain Davis also referred to the extremely high overhead charges and quoted figures showing that a 28 per cent average was found in companies with an annual combined total merchandising and contracting income of $100,000.

New Officers

The officers elected for the ensuing year are: President, E. L. Franklin, Warren; vice-president, Frank Espy, Canton; secretary-treasurer, D. L. Gaskill, Greenville. The executive committee consists of W. A. Wolls, Columbus; O. H. Hutchings, Dayton; T. O. Kennedy, Cleveland; Robert Lindsay, Cleveland, and W. W. Freeman, Cincinnati. The following are the new chairmen of their respective committees: J. Wright, Toledo, meter; R. R. Krammes, Newark, transmission and distribution; J. J. Dolan, Coshocton, station-operating; J. H. Truman, Jr., New Philadelphia, new business. The success of the convention may be determined by the registration of 624, which compares favorably with the 400 registered last year.

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Connersville Company to Build Semi-Automatic Substations

Work on the improvement program of the Hydro-Electric Light & Power Company of Connersville, Ind., is progressing rapidly, and the work of erecting additional power plants will be started soon, it was announced recently by William Insull, district manager of the organization. The plans call for dredging the hydraulic canal, which extends from the feeder dam 7 miles north of Connersville substation to a point just south of that city, and the construction of five substations. The cost of the improvements will be about $200,000. The amount of energy to be derived from the increased facilities will be six times that now received.

Turbines having a rating of 1,640 hp. and generating 1,380 kva. will be installed at the five stations. The largest of these will be built just south of Connersville. L. F. Harza, hydro-electric engineer of Chicago, made the plans and will supervise the work.

All power plants will be semi-automatic in operation and will be controlled from the central power plant. The central station is controlled by the Interstate Public Service Corporation, which operates at Newcastle.

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Expansion and the Message of the Lighting Engineer

The slogan "Electrify America" of the joint committee for business development was interpreted at the Cedar Point convention of the O. E. L. A. by A. K. Baylor of Schenectady as expressing the committee's purpose in stirring up national activity in the electrical industry. He explained that this committee, consisting of twelve members from the various national organizations, would not direct, but intended merely to point the the way to the electrical expansion of the country. With only $18 as an average annual revenue per consumer with ordinary lighting load, Mr. Baylor declared that the sum should increase to $50.

Characterizing the illuminating engineer's message as experience applied

Marconi Receives the John Fritz Medal

Copyright Underwood & Underwood

Left to right—Orville Wright, Gen. G. O. Squier, Guglielmo Marconi, Gen. G. W Goethals, Ambrose Swasey, Prof. Elihu Thomson, Prof. C. A. Adams.

satisfactorily through common sense, G. H. Stickney, Edison Lamp Works, Harrison, N. J., expressed the thought that there was as much style in lighting as there is the correct design of clothes. He urged better lighting in the homes of central-station men since this would give them effective selling points for increasing their station loads.

M. Luckiesh of Cleveland declared that the entire lighting job was not more than half done, since this represented the relative proportion of renters to home owners, of the lighted rural homes to the urban homes and of the lamps per home to those needed for effective illumination. Mr. Luckiesh quoted figures taken from a survey of 1,500 middle-class urban homes which indicate that the average home has only 5.7 rooms, with a lamp wattage of 863, an average of 2 convenience outlets, 1.6 portable lamps and 2 wall brackets; whereas there should be 9 convenience outlets, 9 portable lamps and 9 wall brackets for real lighting.

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Los Angeles Enlarging San Francisquito Plant

As a result of taking over the city distribution system of the Southern California Edison Company, the city of Los Angeles is preparing to increase its generating facilities. When the San Francisquito No. 1 plant was constructed ten years ago, provision was made for a fourth unit in addition to the three placed in service at that time. This fourth unit is now to be installed. Contract for furnishing the impulse turbine, which will develop a maximum of 16,000 hp., has been awarded to the Pelton Water Wheel Company of San Francisco, which furnished the other three turbines. The 12,500-kva. generator will be furnished by the Westinghouse Electric & Manufacturing Company. The Pelton company will also supply a 57-in. needle valve. The effective head at this plant ranges between 800 ft. and 900 ft.

SAN FRANCISQUITO PLANT SUPPLIED LOS ANGELES WITH MORE THAN 63,000,000 KW.-HR. IN 1920-1921

President R. F. Del Valle of the Department of Public Service of Los Angeles says in his annual report that the San Francisquito hydro-electric plant No. 2 has proved very profitable. Against a total cost for the plant development of $3,310,000, Mr. Del Valle states it has made a saving of $1,023,704 to the city during its two years of operation. Announcement is made that taxes will be collected this year from the people of Los Angeles to pay the interest and principal on about $20,000,000 outstanding electric bonds. This item amounting to nearly $1,700,000 will be met from power revenues.

During the year 1920-1921 63,500,000 kw.-hr. was produced and distributed at a cost of $274,320. Basing the saving on cost to the city of purchased energy, Mr. Del Valle says that the first year's operation saved $462,414.

Hartford Utility Aids Railroad to Maintain Electrical Service Despite Strike

Offers Linemen to Railroad and the Entire Force of a Power Station — Railroad Uses Linemen and Station Operators

REALIZING that the strike of maintenance forces on the New York, New Haven & Hartford Railroad on July 1 threatened the continuity of service in the electric zone east of New York City, Samuel Ferguson, vice-president of the Hartford Electric Light Company, offered the services of linemen, substation and power-plant workers to the transportation company, and as a result of the temporary employment of central-station men in maintenance activities the situation was promptly relieved. On July 3 Mr. Ferguson wired General Manager C. L. Bardo of the railroad as follows

> HARTFORD, CONN., July 3, 1922.
>
> C. L. BARDO, General Manager N. Y., N. H. & H. R. R. Co., New Haven, Conn.
>
> DEAR MR. BARDO:—I regret to see by the papers that, guided by bad leadership, a large number of your men have placed themselves in the position of flouting a decree of Congress as expressed through its authorized representative, the Railway Labor Board. Under such circumstances it is obviously the duty of every citizen to uphold the government of this country and to assist in every possible way to overcome a misguided effort of a small class of employees to tie up the transportation of the country and to bring suffering and discomfort to all law-abiding citizens. Experience has shown that the employees of this company are true Americans, and I feel confident that you can count on their assistance to do their part in supporting the government in such capacities as you may specify. Already our linemen have reported to your Bridgeport superintendent. You will pay them the standard wages as fixed by the United States government, in addition to the full pay which they will receive from this company while performing their volunteer duties in the interest of law and order.
>
> In case of dissatisfaction at your Cos Cob power station we are prepared on sixty minutes' notice to shut down one of our steam plants and to transport the entire force, from janitor to superintendent, to Cos Cob. This we can do without imperiling the power supply of the city, but at a very considerable sacrifice of operating efficiency. I cannot but believe that as soon as your men understand what an impossible situation their leaders have got them into they will repudiate such leadership, as, except for some hotheads, they are as good and law-abiding citizens as the rest of us.
>
> Yours very truly,
>
> THE HARTFORD ELECTRIC LIGHT COMPANY,
> S. FERGUSON, Vice-President.

Mr. Bardo accepted the services of a number of men experienced in the maintenance of high-tension lines and in power-plant electrical maintenance, and these promptly reported for duty at Stamford and Cos Cob, the headquarters respectively of the overhead-line and power-plant departments of the electric zone. As a result of the temporary service of these men the integrity of the overhead-line service was unimpaired, and within a few days some 114 striking maintenance employees from the road's electrical department not only returned to work but withdrew from the union. In appreciation of the Hartford company's services, the following letter was written to Mr. Ferguson by Mr. Bardo:

> DEAR MR. FERGUSON:—Confirming my telegram of last evening concerning the return of the high-tension men you so kindly loaned us to help out through the trouble at Cos Cob and on our electrified line: Messrs. ——, —— and ——, who have been assisting Mr. Gilliam, were released and left for Hartford by train late yesterday afternoon. Messrs. ——, ——, —— and —— were also released and left for Hartford in an automobile during the evening. It is impossible for me to express through the medium of a letter the very deep appreciation we feel for the very real and much-needed help you afforded us during this trouble. Over and above the immense value of the actual physical service the men rendered, the moral effect of your offer and of the practical work of the men was the greatest help in straightening out the unsatisfactory tangle.
>
> While they were with us all of the men were, of necessity, paid the 70-cent-per-hour rate authorized by the United States Railroad Labor Board. It is my understanding that, in addition to this, your company continued them on your payroll at their regular rates, and I will consider it a favor if you will render us a bill for this amount plus the expense that both your company and the men must have been put to. The return yesterday of all of our high-tension men and the recruiting of some six or seven switchboard operators, together with the return of the remainder for whom jobs were still open, have straightened us out entirely so far as the power house and transmission system of our electrification is concerned, and I feel that the action of yourself and your company was in a very large measure, responsible for the early change in sentiment of those of our men who were involved.
>
> Again expressing our very deep appreciation of your efforts, and thanking you for all you have done, I am, yours very truly,
>
> C. L. BARDO,
> General Manager.

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Conviction for Stealing Electricity in Georgia

The Ware County Light & Power Company of Waycross, Ga., recently obtained a jury verdict of guilty against a former customer for theft of electrical energy by bridging around the meter, and the defendant was sentenced to pay a fine of $250 or serve twelve months on the county roads. The defendant's attorney brought out the fact that there was no record of a case of the kind ever having reached the Georgia Court of Appeals. Perhaps the argument most convincing to the jury was a reproduction of the meter board and the wiring arrangement used by the defendant to defraud the company. The guilty customer had been served through five residence and business meters and is endeavoring by an offer of restitution to obtain a resumption of service.

Brief News Notes

Department of Agriculture Extends Its Radio Service. — Government weather, crop and market reports are to be broadcast daily from the Arlington and Great Lakes wireless stations of the Navy Department, the United States Department of Agriculture has announced. This makes possible the receipt of agricultural reports by radio throughout virtually the entire United States and is the most important step yet made in broadcasting agricultural information, according to W. A. Wheeler, in charge of the radio work for the department. In less than two years the department's radio service has grown to be nation-wide.

Consolidation in Indiana.—The purchase of the Benton Harbor-St. Joseph Railway & Lighting Company by the Indiana & Michigan Electric Company of South Bend, Ind., for $1,200,000 gives the South Bend company control of the electric power distribution to practically all important towns in St. Joseph and Elkhart Counties in Indiana, and Berrien, Cass and St. Joseph Counties in Michigan. The deal also gives the South Bend company control of the interurban lines connecting St. Joseph with Dowagiac and Watervliet, Mich. The company will further expand by erecting a dam costing $1,000,000 in the St. Joseph River.

Seattle Holds First Radio Show on Pacific Coast.—Seattle's first radio show was held at the Dreamland Rink on June 5 to June 10. This was the first show of its kind to be held on the Pacific Coast. It included an exhibit by the United States Navy of a receiving station, with a 600-ft. aërial, through which messages were received from Nauen, Lyons and other European stations. There was also a transmitting station, operated by the American Radio Relay League, by means of which radiograms were forwarded to any location in the United States, free of charge. The Western Electric Company presented a vacuum tube film, brought from New York, showing the action of a radiophone.

Mr. Webster on Electrical Progress in Japan.—Edwin S. Webster of Stone & Webster, who has just returned from Japan, where he inspected the hydro-electric plant on the Sho River which the company is constructing, says that Japan is making excellent progress, particularly in the hydro-electric field. There is being constructed a comprehensive network of electric transmission lines throughout the empire. Coal is comparatively expensive so that the possibilities for economy in industrial operation with hydro-electric power as contrasted with steam stations are attractive. Electric lighting of homes is quite general in Japan, even in rural districts Mr. Webster said, instancing one country place where a tiny 30-kw. hydro-electric plant in full operation supplied energy for residences in the surrounding rural district, many of which use only one lamp.

Development in Eastern Oklahoma.—The Eastern Oklahoma Light & Power Company, with headquarters at Tulsa, is building high-tension lines and distributing systems from the Sand Springs line to Avant, Osage and other places. Fourteen miles of poles have been set and the distributing system at Avant is almost completed.

Nally Prophesies Early Transoceanic Conversation.—Speaking at a dinner given at New York in honor of Guglielmo Marconi, E. J. Nally, president of the Radio Corporation of America, indicated that the development of the electron tube opened the way to telephone conversation between New York and London and Paris within a few years. Success in experiments is expected before the end of 1922. The tone of the human voice, it was asserted, already has been hurled across the sea from wireless telephone sets, but only in one direction, so that the radio engineers who made the test did not know until they had received notice by wireless telegraph some minutes later that they had actually reached their scientific goal.

New Rate Schedules Filed.—New rate schedules for domestic consumers have been filed with the Ohio State Public Utilities Commission by the Springfield (Ohio) Light, Heat & Power Company, to continue in effect pending settlement of the domestic rate controversy in Springfield. The new schedule provides for a rate of 10 cents for the first 15 kw.-hr., 7 cents for the next 45 kw.-hr., and 3 cents for all additional energy consumed. The former rate was 11 cents for the first 15 kw.-hr. and 7 cents for all additional current. The rate became effective July 10. The city will file a protest against the new schedule, officials announced July 7. A rate of 8-6-3 has been demanded by the city and rejected by the power company, which maintains it would lose money under that rate.

Cities Service Resumes Cash Dividends.—The directors of the Cities Service Company have authorized the announcement of a plan for the payment of dividends in cash on the preferred stock on Sept. 1 and the preference stock on Oct. 1 and the redemption of all scrip issued for dividends on these stocks. It is proposed to give the holders of preferred and preference stocks or the holders of the scrip issued in lieu of lash dividends on these stocks either in cash or, at their option, a special debenture bond created solely for this purpose. This special bond will bear 8 per cent interest and will be convertible into 85 per cent of preference stock and 15 per cent of common stock, with the cumulative feature on the common stock as in previous issues of debentures. It will carry an initial call price of 115 per cent of par.

Glossary of Electrical Terms Finds Wide Distribution.—Six hundred copies of the glossary of electrical items prepared by direction of the Electrical Manufacturers' Council have been taken by the Bureau of Foreign and Domestic Commerce for distribution to customs officials throughout the United States. It has, besides, been placed in the hands of the entire electrical trade of the United States and has received general approval.

Associations and Societies

Pennsylvania Electric Association.—The fifteenth annual convention of the Pennsylvania Electric Association will be held at Bedford Springs, Pa., Sept. 6, 7, 8 and 9.

Accounting and Commercial Sections, N. E. L. A., Fix Dates for Meetings.—At a recent meeting of the executive committee of the N. E. L. A. Accounting Section in New York, a schedule of group meetings was adopted as follows: Salt Lake City, Sept. 4-6; Atlantic City, Oct. 25-27; Cincinnati, Jan. 15-17, 1923. On the first two days meetings of the committees of the section will be held and on the third day the meeting of the section's executive committee. At a Commercial Section executive committee meeting the following schedule of meetings was arranged: Section executive committee, Association Island, Henderson Harbor, N. Y., July 28; group meetings: French Lick Springs, Ind., Sept. 28-30; Boston, Nov. 15-17; Denver, Jan. 24-26, 1923.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

A. I. E. E., Pacific Coast Convention—Vancouver, B. C., Aug. 8-11. F. L. Hutchinson, 33 West 39th Street, New York, N. Y.

Michigan Electric Light Association—Ottawa Beach, Aug. 21-23. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

International Association of Municipal Electricians—New Bedford, Mass., Aug. 22-25. C. R. George, Houston, Tex.

N. E. L. A. Geographic Divisions — New England, New London, Conn., Sept. 5-8; Rocky Mountain, Glenwood Springs, Col., Sept. 18; Great Lakes, French Lick Spring, Ind., Sept. 28-30. M. H. Aylesworth, 29 West 39th Street, New York.

Association of Iron and Steel Electrical Engineers—Cleveland, Sept. 11-15. J. F. Kelly, Empire Bldg., Pittsburgh, Pa.

American Electrochemical Society — Montreal, Sept. 21-23. A. D. Spillman, Columbia University, New York City.

Illuminating Engineering Society—Swampscott, Mass., Sept. 25-28. Samuel G. Hibben, 29 West 39th Street, New York.

American Institute of Mining and Metallurgical Engineers—San Francisco, Sept. 25-28. F. F. Sharpless, 29 West 39th Street, New York.

National Association of Railway and Utilities Commissioners — Detroit, Sept. 26. J. B. Walker, New York Transit Commission, New York.

Empire State Gas and Electric Association —Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.

American Electric Railway Association—Chicago, Oct. 2-6 J. W. Welsh, 8 West 40th Street, New York.

Commission Rulings

Evil Results of Competition.—The keen competition between the electrical utilities for the light and power business of Indianapolis has not, the Indiana commission declared in rate-fixing proceedings, reduced the rates to the general public, because "a duplication of utility facilities is economically unsound and wasteful and the public bears the burden. The competition has, however, benefited certain large consumers whose business is so desirable that agents of the utilities have attempted to outdo each other in stretching the provisions of the published schedules, sometimes, in their enthusiasm, forgetting the published schedules entirely."

Employee Pension System.—The San Joaquin Light & Power Corporation urged in the recent rate proceedings before the California Railroad Commission that an allowance be made in operating expenses for the estimated actuarial cost of a pension system for its employees. The plan favored requires a permanent annuity of approximately $120,000 per year, and this amount was included in the company's estimate of operating expenses for 1922. The commission points out that if the system were put into operation immediately the actual out-of-pocket cost for the first year would be small and it is not of particular importance whether the permanent annuity be set aside at the time of the inauguration of the system or a year or two later, but if there is to be any such system it should be within a reasonable time put on a permanent actuarial basis; otherwise the cost in later years would be prohibitive. The decision whether to inaugurate such a system is, the commission says, part of the responsibility of the management, rather than of regulation, and the company, if it wishes, can establish the system and then justify its cost as a part of the operating expenses.

Massachusetts Commission Sustains Capitalization of War-Time Plant Costs.—War-time plant construction costs incurred by the North Adams Gas Light Company were sustained by the Massachusetts Department of Public Utilities in a recent decision authorizing the company to issue additional capital stock of $605,000 par value. The city opposed the company's petition partly on the ground that a substantial part of the plant expenditure was incurred during the period of excessive war costs. In its finding the commission pointed out that the company postponed as long as was deemed prudent the installation of additional generating capacity and equipment required for the adequate supply of its territory. In this connection the board said: "We are not prepared to decline to approve securities to an amount reasonably necessary for plant additions clearly required for the public convenience merely because the cost at the time the work is done exceeds the cost of like work prior to the war or its probable cost when normal conditions return. However, this circumstance has a direct relation to the provision for depreciation."

Condemnation of "Present-Value" Theory of Rate Base.—In fixing a rate base for the San Joaquin Light & Power Corporation the California Railroad Commission said: "Any attempt to substitute 'present value,' or reproduction cost new, depreciated, for the methods of fixing the rate base heretofore followed by the commission would result finally in disaster to the companies themselves. It would have to be followed in periods of declining as well as of rising costs, and this would be particularly calamitous to a company like the San Joaquin, which has been compelled by its obligations to its consumers to make very large investments during a period of high prices. . . . It ought not to be compelled by a false theory of valuation applied to its obligatory investments in public service to take a speculative risk on its investments from which unregulated businesses may exempt themselves. To the extent that its expenditures have been reasonable and wisely made, considering the conditions existing, it is entitled from the public, if reasonable rates for the service permit, to compensation for its expenditure, in the form either of a continuing return or of a chance to amortize a part of the investment during periods of prosperity. On the other hand, if the 'present value' cannot safely or soundly be applied to high-cost improvements during a subsequent period of declining costs, it also cannot be applied in the reverse conditions to properties constructed during low-cost periods and now still in the public service at a time when it would cost more to reproduce them. The consumers are entitled to the advantages of stabilization in the one case, just as the company is entitled to its safety in the other. It happens that at the moment the 'present value' theory would result in a valuation advantageous to the company and unattractive to the consumers. There is therefore a tendency on the part of utility companies to favor and of consumers to oppose it. The method of valuation followed by the commission results at the present time in lower rates. But the time is bound to come, at least in some utilities, when the reverse will be the case. The more stable method of valuation hitherto followed by the commission is sound and just in both instances and ought not to be charged either against the consumers on a rising market or against the companies on a falling market. The sound basis is to take reasonable costs as of the date of construction, regardless of whether the cost new would be higher or lower."

Recent Court Decisions

Commission Has Power to Order Refund Because of Inadequate Service.—The Supreme Court of the United States has sustained the Oklahoma Corporation Commission in ordering the Oklahoma Natural Gas Company to refund part of the payments made for its service during a period when this service was inadequate, declaring that by its charter the company was required to render efficient service and that it was competent for the state to compensate the deficiency in the service by ordering a rebate, no infringement of the Fourteenth Amendment being thereby entailed.

Delegated Police Power Subject to Revocation.—In deciding that the authority to fix street-railway rates is vested in the Municipal Council of New Orleans and not in the Public Service Commission of Louisiana, the Supreme Court of that state pointed out that the constitutional provision that the exercise of the police power of the state shall never be abridged does not preclude the state from delegating the police power to an administrative board or commission, or to a municipality or other political corporation, but merely prohibits an irrevocable surrender of the police power and requires the delegation of any part of the police power to an administrative board or municipality to be subject to revocation by act of the Legislature of the state. (91 So. 533.)*

Structure Attractive to Children Offers Implied Invitation to Boy Not Trespassing.—A petition in McCoy vs. Texas Power & Light Company to recover for the death of a boy fourteen years old, which alleged that defendant maintained on the land of the boy's father a steel tower carrying high-tension electric power lines without any warning of the danger therefrom and having thereon steps whereby one could ascend to the top of the tower where he was in danger from the electric currents, even though he did not come in contact with the wires; that the people in the neighborhood had no knowledge of the danger from such currents if they did not touch the wires, and that the defendant thereby impliedly invited the boy to climb upon the tower, as a result of which he was killed without coming in contact with the wires, was held insufficient by the inferior courts and, on the plaintiff's refusal to amend the complaint, the case was dismissed. The Commission of Appeals of Texas has found that, on the doctrine of attractive nuisance, a cause of action was stated and has ordered the suit tried. (239 S. W. 1105.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and **Activities of Men**
Engaged in all Branches of the Electrical Industry

Walter Neumuller Treasurer of N.E.L.A.

Walter Neumuller, who was elected treasurer of the National Electric Light Association at its recent convention held at Atlantic City, has taken an active part in association affairs for many years. For five years he occupied the office of assistant secretary of the Association of Edison Illuminating Companies, and he also held the secretaryship of the exhibition committee of the N. E. L. A. from 1909 to 1912, during which time exhibitions were held in Chicago, Atlantic City, St. Louis and Seattle. He has, besides, served on many committees of the national societies. Mr. Neumuller was born on June 21, 1886, and was graduated from the New York public schools in 1899 and from business college in 1900, after which his education was continued through attendance at night schools and private study. He entered the employ of the New York Edison Company in 1900 as an office boy in the contract and inspection department and in 1903 was transferred as a clerk to the statistical bureau. In 1907 he was appointed private secretary to Arthur Williams, who was then general inspector of the company. His next promotion was to be special representative in 1914, and in 1917 he became assistant to the general commercial manager, the duties of general agent, retail, being added in 1918. Mr. Neumuller was appointed an assistant secretary in the latter part of 1919 and at the following annual meeting of the company was appointed secretary of the company. In addition, Mr. Neumuller is also secretary of the Yonkers Electric Light & Power Company and the Thomson-Houston Electric Light Company of Yonkers, treasurer and director of the Electrical Show Company, president and director of the New York Electric Garage Corporation and president and director of the New York Electric Vehicle Association. He is a member of numerous clubs and associations, both local and national, and is the president of the New York Electrical League, a life member and past-vice-president of the New York Electrical Society, a member and past-chairman of the New York Companies Section of the National Electric Light Association, an honorary member of the Association of Employees of the New York Edison Company and a member and past-vice-president of the Gas & Electric Choral Society.

WALTER NEUMULLER

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Robert Sibley, who has been editor of the *Journal of Electricity and Western Industry*, published by the McGraw-Hill Company of California in San Francisco, and also of its predecessors, since 1911, has been made editorial director of that paper and also Pacific Coast editorial director of the *Electrical World* and *Electrical Merchandising*. Mr. Sibley is a well-known figure in the electrical industry of the Mountain and Pacific States. He has been connected with various engineering and public utility enterprises in that region, has served as professor of electrical and mechanical engineering at the universities of Montana and of California and, as editor of the *Journal*, has long been in intimate contact with the industry. In his new post, as Pacific Coast editorial director of the three McGraw-Hill electrical papers, Mr. Sibley is in a position to do a great deal toward interpreting the problems of the electrical industry on the Pacific Coast and in the Mountain States and in promoting the interest of the industry in general.

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A. Hardgrave Leaves the Public Utility Field

A. Hardgrave, who has been in active charge of the Middle West Utilities properties in the Southwest, with headquarters at Dallas, Tex., has removed to Kansas City to take active charge of the City Ice & Cold Storage properties there, which with several associates he has purchased. Mr. Hardgrave has been in the public utility field for eighteen years and since 1913 has been associated with the Insull interests. For the last two years he has been active in association affairs in the Southwest, one year as president of the Southwest Utilities Association, and for the entire two years he has been the president of the Southwestern Geographic Division of the National Electric Light Association.

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G. Grenville Hunter Publicity Manager I. G. E. Co.

G. Grenville Hunter has been appointed publicity manager of the International General Electric Company, succeeding Don Cameron Shafer, who resigned as advertising manager on June 1 to take up literary work. The broader title of publicity manager has been chosen for the position, the advertising managership having been merged into it. Mr. Hunter was born at Southampton, Long Island, in 1892 and attended Trinity College at Hartford, Conn. On leaving college he took charge of the publicity department of a New York banking house and subsequently engaged in mercantile business. Early in 1919 he entered the service of the General Electric Company and was successively employed in the accounting, production and advertising departments. A year later he was placed in charge of the International General Electric Company's commercial service work and also appointed editor of the *Digest*, the house magazine of the International General Electric Company. Mr. Hunter will have his headquarters at Schenectady, N. Y.

G. G. HUNTER

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Philadelphia Electric Elects New Officers

The board of directors of the Philadelphia Electric Company has recently been increased to eleven members through the election of Horatio G. Lloyd and William A. Law. Three additional vice-presidents were also chosen, A. B. Huey, vice-president in charge of the legal department; C. J. Russell, vice-president in charge of the commercial department, and W. C. L. Eglin, vice-president in charge of the engineering department. W. H. Johnson is still the senior vice-president of the company.

W. S. Heald Elected President N.C.E.A.

W. S. Heald, the newly elected president of the North Central Electric Association, is a graduate electrical engineer of the University of Michigan, class of 1912. The summer of 1912 he spent with the Whitman & Barnes Manufacturing Company in Chicago. He then was employed by the Stone & Webster Corporation on design work at Keokuk, Iowa. He was with the Mississippi River Company in 1914-15 as assistant engineer and in 1915 went to Duluth, Minn., as manager of the commercial service department and engineer, and he has remained in that city until the present. "Wally" or "Shorty," as his friends know him, is one of those fortunate men who join to physical stature a vigorous and well-balanced mentality that makes for real leadership. In his work in Minnesota he has come to be known and liked for his sound judgment and ability to make things "go" in any job given him to do.

W. S. HEALD

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Major Raymond A. Wheeler, on duty at Fort Benning, Ga., has been recommended to succeed Major Cary H. Brown as assistant engineer commissioner of the District of Columbia. It is expected that he will take office on Aug. 1.

Lieut. Col. Harold L. Trotter has opened a consulting engineering office at Montreal. Colonel Trotter has had a large experience in electrical construction and will specialize in that branch of engineering.

A. H. Midgley, connected with Scholey & Company, Ltd., electrical and mechanical engineers, London, is visiting the United States for a short time. Mr. Midgley is conspicuous among his associates for his brilliancy as a designer of electrical machinery. He is visiting the States to negotiate the sale of some of his electrical patents.

Frank Vaughan of the Vaughan Electric Company, St. John, N. B., was the recipient of the degree of doctor of science from the University of New Brunswick at the recent convocation exercises. This honorary degree was granted by reason of Mr. Vaughan's unusual standing as an electrical engineer.

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Marconi Leaves America

After spending three weeks in America, during which time he was honored by American scientists and engineers, Guglielmo Marconi sailed for home July 8. While here he visited many radio stations and several large manufacturing plants. He was honored by the Institute of Radio Engineers through the bestowal of a medal of honor and was presented with the John Fritz medal by the other engineering societies.

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R. S. Hale Again Chairman N.E.L.A. Wiring Committee

It is not surprising that a man who has engaged so actively in association work as has Robert S. Hale for several years should again be selected to direct the work of the wiring committee of the N. E. L. A. Mr. Hale has not confined his activity to this committee but has taken a prominent part also in the rate research committee of the association. At the present time he is superintendent of the special research department of the Edison Electric Illuminating Company of Boston, after having been first assistant to the general superintendent and later superintendent of the sales department of the company.

Mr. Hale was born in Boston, Oct. 3, 1869, and was graduated from Harvard with the degree of A. B. in 1891 and from Cornell with the degree of M. E. in 1893, besides taking a degree of A. M. at Harvard in 1892. After graduation from Cornell he became associated with the Edison Electric Illuminating Company of Boston, but resigned after two years to become an expert for the Steam Users' Association, a body composed chiefly of the New England cotton mills. After the completion of his work with this organization Mr. Hale entered the service of the Mutual Boiler Insurance Company as engineer and also entered the electrical business, first alone and later in partnership under the firm name of R. S. Hale & J. S. Codman. It was in 1904 that he again became associated with the Boston Edison company. Mr. Hale was the founder of the Sales Managers' Association.

R. S. HALE

Obituary

David D. Faris, manager of the marine department of the Westinghouse Electric & Manufacturing Company, died suddenly in his office at the East Pittsburgh works of the Westinghouse company on Monday, July 10. Death was due to apoplexy. Mr. Faris became associated with the Westinghouse Electric & Manufacturing Company in 1915, when the Westinghouse Machine Company, with which he had been connected since 1904, was absorbed by the electric company. At the time of the consolidation Mr. Faris went to East Pittsburgh and was made assistant to the manager of the power department of the company. In 1919 he became assistant manager of the marine department and on July 1 of this year was appointed to the managership of the department.

Col. B. A. Enloe, chairman of the Tennessee Railroad & Public Utilities Commission, died July 8 at Nashville, Tenn. He had been ill for a number of months.

Martin S. Decker, of Albany, N. Y., formerly a member of the Interstate Commerce Commission and chairman of the Public Service Commission for the Second District of the State of New York, died recently in his room in the Prince George Hotel, New York. His death resulted from heart disease, induced by an attack of acute indigestion. He was sixty years old and was born at Rosendale, N. Y., of an old New York family. His long connection with the Interstate Commerce Commission began in 1886 when he was appointed docket clerk. His selection by Governor Hughes as one of the Public Service Commissioners in 1907 was no surprise, for Mr. Decker had long been recognized as an authority on transportation law and practice. During 1909 and 1910 he was president of the National Association of Railway Commissioners and he served as chairman of the Public Service Commission for the Second District of the State of New York in 1913 and 1914.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Blanketed Distribution—The Other Side

Group Organizations of Jobbing Houses Do Not Restrict the Small Manufacturers Who Create Market

By F. M. Bernardin
President the B-R Electric Company, Kansas City, Mo.

I WOULD like to add a word to the discussion of the small manufacturer's distribution problem. My point is that the electrical business will progress in proportion to the education given to the general public in the uses and advantages of electrical appliances. The expense of this promotion must be provided by the manufacturer, distributor and by the dealer. Any manufacturer who sells his products without giving this consideration to the public who will ultimately use his article is not functioning as a constructive factor in electrical merchandising. I ask the question, Is the small manufacturer contributing any creative effort in this direction?

Of course, this also applies to an electrical jobber who simply issues a monthly price bulletin and depends upon a mail order business for his existence. A creative jobber, besides issuing a general catalog annually, must maintain a high grade corps of salesmen and also a publicity department. Without these factors in his organization it is impossible for him to educate the dealer and promote the general use of electrical appliances.

Helps All Manufacturers

A recent article which appeared in your paper states that the small manufacturer and the small jobber are able to underbid the larger companies because their overhead is so much lower, but I feel positive that if the small manufacturer would add a promotion charge to his overhead in the same proportion to that of the larger manufacturers, and would apply this appropriation to the creative development of business, he would soon find his costs as great as those of the large manufacturer. This is also true of the small jobber. In reviewing the promotional support which electrical manufacturers have given to their products in the process of selling to the ultimate consumer, you will find two things. The two large electrical manufacturers whom the small manufacturer accuses of having blanketed the field by allying themselves with the prominent distributors in different territories are advertising and creating a market with the ultimate consumer, not only for their own products but the products of all electrical manufacturers. If the small manufacturer would assist in this his products would be given full consideration by the consumer on their merits and in this way he would automatically create a distributor for his wares.

F. M. BERNARDIN

Need Not Lose Territory

It is not true that a distributor who allies himself with a large manufacturer is compelled to give up lines of merchandise which have been identified with his organization prior to this alliance. It all depends upon the merits of the product, plus the promotion and advertising support which the manufacturer will apply. But suppose a condition does arise whereby a small manufacturer is unable to secure a creative jobber in a particular territory. In this event the small manufacturer can put a direct representative in this territory and solicit his merchandise direct to the dealer, asking a price for this merchandise which would take care of his selling overhead.

I feel positive that, with the proper constructive representation in this territory, in a short time this manufacturer would have created a demand for his merchandise which would be a welcome additional line to any jobber regardless of his manufacturing associations. The trouble today is that the small manufacturer, by eliminating a promotion overhead, comes to the jobber who has an established line and asks him to change simply because there is a few cents difference in price. If this small manufacturer would create his market he could soon find a jobber who would continue this promotion.

Build by Direct Sales

A case was cited in the article before mentioned where a certain manufacturer has lost twenty-two large distributors in seven years because these houses were taken over by a big jobbing system. Had this same manufacturer immediately placed direct sales representation in these jobbing centers and kept his creative market active, I believe that he soon would have found ample distribution in these territories. I can cite an instance in our own territory where a large electrical manufacturer has no distributing outlet for his rubber-covered wires. But instead of giving his distribution to a non-creative jobber he solicits this product direct from the dealer and central station, asking approximately the same price for this merchandise which is being charged by the constructive jobbers in this territory. This manufacturer will eventually have the opportunity of selling this product through a distributor, because he is earnestly promoting the sale of his product to the trade and ultimate consumer.

Therefore, in summing up this whole subject, I believe that if all the electrical manufacturers and their allied distributors would give more thought to promoting the use of electricity in the 5,000,000 homes which at the present time are not wired but are in reach of central station lines the general demand for electrical appliances would increase so that all electrical manufacturers, large or small, would secure a volume in proportion to their creative effort. This, of course, applies to the electrical jobber as well.

The Price Element in Wire Buying

Why Wire Prices Based on Fair Profit Over True Costs Give Practical Protection to Buyer and Seller

By L. S. HORNER
Vice-President the Acme Wire Company,
New Haven, Conn.

THE magnet wire industry is in the throes of price cutting, which is resulting in a decided disadvantage both to the producer and consumer. The situation is not dissimilar to that recently described in your article by Leroy Clark.

A general improvement in business is evident. Reacting from this, there should, also, be evident a growing trend toward fair prices, based on true costs. For the buyer who prides himself on forcing down the price of his regular supplier below what he should know is the cost of production, in my opinion, is doing his own firm a decided injury. One of two things must be the result. Either the quality of the product must be lowered to meet the price or the ability of his supplier to continue to supply him will be reduced.

WHY A FAIR PRICE?

"Why should I pay a 'fair price,'" the buyer says, "when a perfectly reputable company is willing to cut its price below cost?" My reply is this. You can't afford to have your wire manufacturer, or whatever regular supplier it may be, forced to accept your orders below cost. Your supplier must be strong financially, able to meet his obligations, and continue his development and research work to improve the product which the buyer must have. Also, you must make it possible for this supplier to have at least the nucleus of a trained, skilled corps of workers on which to build a force when business becomes more normal. But if your supplier cannot prosper he cannot do this.

The electrical business is strong and growing fast. The days will come again when the demand will equal, possibly exceed, the supply. And the firms who in these days pay a fair price and stand by the suppliers are the ones who will then get the deliveries and also a continued fair price based on true costs.

The memory of the cut price buyer is too short. He forgets, although 1920 is only two years back. Well may he recall, however, the prices he had to pay because he did not have one or more regular suppliers on whom he could rely to give him the quality and schedules he ordinarily requires.

The far-seeing buyer of the company competing with this cut price buyer had this kind of suppliers and relied upon them and was supported by them. And I firmly believe that fair prices and good deliveries in boom times far more than offset the saving in cut prices in times of moderate business. The earnings of the stockholders are greater in the long run, because the greater volume at fair prices is real, while the apparent saving on today's small volume is imaginary, due to the product that is so often being made to meet the price.

The shop does not register strongly enough with many executives to impress him with the fact that the product costs more because the quality has been lowered.

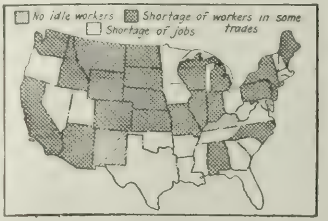
There is another important factor. The man who purchases goods on price only overlooks the necessity of service. By this is meant, broadly, that he must have support of manufacturers who possess the ability to meet special conditions of design or demand. Oftentimes a large contract for a finished article may depend on the ability to produce a sample promptly, determine its cost elements and submit them for test with the proposal. Also possibly a far more important element in service is the ability of a supplier to determine intelligently the cause of trouble in a customer's product, sometimes due to defective material supplied, more often due to conditions under which the material is being used in the manufacturing department of the customer. It requires knowledge and experience correctly to diagnose such conditions and this service costs money, but it often saves the customer many times his total purchases of wire for a month or more.

SELL THIS CONCEPTION

Another kind of service is the unusual demand of a regular customer requiring night work, Sunday and holiday overtime to produce special product costing many times the price asked. This service is what really ties the supplier and consumer together with bonds no cut price can break, provided that the buyer is really protecting the best interest of his own company by tying up to the suppliers who can give this kind of service.

Manufacturers of wire must sell this conception of the practical worth of service and of quality along with the wire that they deliver to each customer. Buyers must be informed, instructed and gradually educated as to what is actually purchased with fair price that cannot be sold by any man who is compelled to accept a cut price for his goods.

Present Labor Distribution



THIS nap shows the crying need for some kind of a "labor load dispatcher" to guide the workers to the work. At present in twenty-three states there is a shortage of jobs; in twenty-three a shortage of workers.

Increased Demand for Radio Parts Noted

Jobbers in the Chicago district report an active demand for standard parts in radio material. Complete sets are not selling well, it is said, but these stocks are being built up for the fall business, which is expected to be very large. Head telephones and vacuum tubes are now available in better quantities than formerly. Improved radio market conditions are reported in New York and Boston districts.

No product of electrical manufacturers has ever taken the world so by storm as has the radio-telephone receiving set, according to a statement just made by the electrical division of the Department of Commerce. "Outside of a few countries where existing political conditions have imposed restrictions, the use of radio is being taken up universally. The development has been most rapid in this country, but in Europe, in South America, in Australasia, and to some extent in Africa and Asia, broadcasting stations are being installed, with a resultant increasing demand for receiving sets.

"In spite of an enormously increased manufacturing capacity, makers of radio equipment are still behind on their domestic orders, and this has naturally limited their interest in export trade. Nevertheless, the total value of equipment shipped abroad during the first five months of this year is more than 60 per cent of the total for the calendar year 1921, and the inquiries from abroad have increased considerably. As productive capacity here catches up with the domestic demand a strong export trade may be expected."

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Conduit Sales Continue to Increase

Conduit sales in all parts of the country continue to increase. Demand in the New York territory is unusually strong, jobbers asserting that the great amount of new construction during the summer months is making itself most felt in this market now.

In Chicago the situation has changed very little. Prices range from $45 to $46 per 1,000 ft. for the ½-in. black pipe in 5,000-ft. lots. Stocks are low.

Prices of conduit in St. Louis are: ½-in. black, $47.75 per 1,000 ft.; ½-in. galvanized, $54.60 per 1,000 ft. Demand is reported improving and stocks are larger than they were three weeks ago.

The conduit market in San Francisco is slow. With the exception of two or three scattering carloads, there is little business in sight. Prices: ½-in. galvanized, $6.20 per 100 ft.; black, $5.95 per 100 ft. Stocks are reported fair.

Bank Clearings Last Week Gained 23.7 per Cent

The margin of increase in bank clearings over last year's figures widened appreciably this week, an aggregate of $6,946,163,924 at twenty cities in the United States, as reported to *Dun's Review*, representing a gain of 23.7 per cent over the $5,615,997,835 of the same week in 1921. The decrease from the clearings of two years ago continues, the loss this week being 9 per cent. Compared with last year's totals, Kansas City alone reports smaller clearings this week, the reduction being only 0.3 per cent, and the increases elsewhere range from 6.2 per cent at Minneapolis to 36.7 per cent at Portland, Ore. For the centers outside of New York which are included in the statement, the week's clearings of $2,439,963,924 are 13.3 per cent in excess of those of a year ago, while New York City, with $4,506,200,000, reports a gain of 30.1 per cent.

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Refrigerating Plants Are in Good Demand at Boston

Marked activity in the sale of electrically driven refrigerating plants has been evident at Boston during the past fortnight, according to W. J. Debler, manager of the home office of the Boston Kelvinator Sales Company. Twenty-four outfits, including refrigerators, were purchased for one apartment house and twenty-one sets without refrigerators for another within ten days, and new business inquiries are coming in at a rapid pace. Two units have just been ordered by one of the large Boston hospitals, and nearly two dozen units have just been sold through the Edison Electric Illuminating Company's appliance department. To a representative of the *Electrical World* Mr. Debler stated that the outlook is exceedingly attractive and that deliveries vary from stock shipments to about three weeks' maximum, according to the size and type of apparatus desired. The building boom in New England is unquestionably stimulating the demaand for motor-driven labor-saving equipment of various kinds, and there appears little prospect of a curtailment in the demand for refrigerating plants for many weeks to come.

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Safety Switches in Greater Demand

Solenoid-operated switches are in much greater demand than a year ago, all sections of the country being represented in orders received, said G. E. Palmer, president of the Palmer Electric & Manufacturing Company, Cambridge, Mass., last week to a representative of the *Electrical World*. Industrial plants in particular are showing increased interest in safety switches, and sales are running about 50 per cent ahead of last year.

Inquiries are also fairly active from foreign sources. The Cambridge factory is operating on a fifty-hour weekly schedule, and the working force is double that employed a year ago.

Concise Data Table Shows Progress in Business

	Latest Report	Preceding Month	Year Ago
TRADE INDICATORS			
Pig-iron production, daily average, tons	74,409	69,070	39,394
Unfilled orders, U. S. Steel Corp., tons	5,254*	5,097*	5,482*
Iron and steel exports, monthly	$17,559	$18,837*	$25,911*
Twenty railroads' gross earnings, monthly	$250†	$280†	$258†
Freight cars loaded, weekly average	798,300	786,700	762,800
Bank clearings, weekly average, N. Y	$4,400†	$4,700†	$3,900†
Checks cashed, weekly average, N. Y.	$5,300†	$5,000†	$3,900†
Failures, number.	1,803	1,948	1,326
Building permits, value, 163 cities	$229†	$217†	$141†
Merchandise exports, U. S. monthly.	$308†	$321†	$330†
Merchandise imports, U. S. monthly	$254†	$217†	$205†
BANKING FUNDS			
Bank of England gold holdings	$628†	$628†	$622†
Bank of France, circulation, francs.	35,852†	35,827†	37,494†
Federal Reserve Banks, total reserves	$3,148†	$3,135†	$2,626†
Federal Reserve Banks, total loans and investments.	$1,099†	$1,189†	$2,061†
Federal Reserve Banks, circulation	$2,126†	$2,128†	$2,635†
Sterling exchange, demand	$4.40	$4.44	$3.75
Balance of trade, monthly	$54†	$104†	$125†
PRICES			
Iron, bessemer, Pittsburgh	$26.96	$26.96	$24.46
Petroleum, Kansas and Oklahoma, per bbl	$2.00	$2.00	$1.00
Cotton, spot, N. Y., lb	$0.222	$0.215	$0.112
Wheat, No. 2 red, cash, Chicago	$1.20	$1.28	$1.44
Corn, No. 3 white, cash, Chicago	$0.63	$0.61	$0.61
Railroad stocks, average 20	$83.73	$86.33	$66.45
Industrial stocks, average 20	$93.07	$95.05	$65.36
Railroad bonds, average 20	$87.03	$86.90	$72.88
Cost of food, Annalist Index ($145 in 1914).	$185.25	$184.37	$163.83

*Thousands. †Millions.

Electrical Market Conditions for First Two Weeks in July

	New York	Chicago	Boston	Atlanta	St. Louis	San Francisco	Salt Lake City Denver	Portland Seattle
Conduit	Active	Active	Active	Active	Active	Slow	Steady	Active
Armored cable	Active	Steady	Active	Steady	Active	Active	Steady	Steady
Wire	Slow	Active	Slow	Active	Steady	Steady	Active	Steady
Sockets	Active	Steady	Steady	Steady	Slow	Steady	Slow	Active
Knobs	Active	Steady	Steady	Steady	Active	Active	Steady	Active
Switches	Active	Steady	Steady	Active	Steady	Steady	Slow	Steady
Hollow ware	Active	Active	Active	Active	Steady	Active	Active	Active
Lamps	Active	Active	Active	Steady	Active	Steady	Active	Steady
Motors	Active	Steady	Steady	Slow	Steady	Active	Steady	Steady
Refrigerators	Active	Steady	Active	Active	Active	Active	Active	Steady
Soldering sets	Steady	Steady	Steady	Active	Steady	Steady	Steady	Steady
Washing machines	Slow	Steady	Active	Active	Active	Active	Active	Active
Vacuum cleaners	Slow	Slow	Active	Steady	Steady	Active	Active	Steady
Fans	Steady	Active	Steady	Active	Active	Active	Steady	Active
Trend of prices	Firm	Up	Up	Firm	Up	Firm	Up	Firm

Revenue Freight Loadings Decreased 960 Cars

Loading of revenue freight totaled 876,896 cars during the week ended July 1, compared with 877,856 cars during the preceding week, or a reduction of 960 cars, according to reports just filed by the carriers with the American Railway Association. This was an increase of 100,817 cars over the corresponding week last year, but a decrease of 14,725 cars compared with the corresponding week in 1920.

Coal loadings during the week amounted to 94,748 cars, a decrease of 2,212 cars compared with the preceding week and a decrease of 62,365 cars compared with the same week last year. It also was a decrease of 98,286 cars compared with the same week in 1920.

Merchandise and miscellaneous freight, which includes manufactured products, totaled 575,146 cars, an increase of 616 cars over the week before and 104,120 in excess of the corresponding week in 1921. It also was 74,667 cars above the total for the corresponding week two years ago.

Ore shipments continued the increase begun some weeks ago, the total being 64,776 cars, or 492 more than were loaded during the preceding week. While this was an increase of 34,010 cars over the corresponding week last year, it was a decrease of 6,896 compared with the corresponding week in 1920.

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Use of Electric Ranges Is Increasing Rapidly

Approximately 140,000 electric ranges are in use in the United States today, compared with 10,000 in 1915. It is estimated that at least 54 per cent of these ranges are installed west of the Rocky Mountains. About 6,000 communities with electric service have special electric cooking rates. The record of the Associated Manufacturers of Electrical Supplies shows that 21,739 electric ranges were manufactured in 1919 and 41,000 in 1920. Last year, it is estimated, 30,000 electric ranges were installed, and this year it is predicted 100,000 will be sold.

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Building Contracts in June Amounted to $343,440,000

Building contracts awarded during June in twenty-seven Northeastern states, according to the F. W. Dodge Company, amounted to $343,440,000. Except for the record figures of April and May of this year, this is larger than any previous monthly total. It is only 5 per cent under the record May figure and shows a 52 per cent increase over the month of June last year.

The continued high rate of activity has brought the total amount of construction started in the first six months of this year up to $1,690,984,000, which is by far the highest figure for the first half of any year. It is 59 per cent greater than the figure for the six-month period of 1921.

In the six months' record are the following items: $682,663,000 for residential construction, an increase of 89 per cent over the corresponding period of 1921; $288,932,000 for public works and utilities, being 19 per cent over last year; $280,329,000 for business buildings, 94 per cent more than last year; $164,641,000 for educational buildings, 56 per cent over last year, and $123,181,000 for industrial plants, an increase of 42 per cent over the corresponding period of last year.

Contemplated new work reported from Jan. 1 to July 1 has amounted to slightly more than $3,000,000,000, compared with $1,690,000,000 for work actually started in the same period.

Eastern and Southern Failures More Numerous

Failures for the past week were decidedly more numerous than those reported for the previous week, the increase being especially evident in the East and South, while the Pacific section showed no change in its total. Defaults reported to R. G. Dun & Company this week aggregated 455, compared with 306 for the week before. For the corresponding week a year ago 324 insolvencies were reported.

While the 225 failures with liabilities of $5,000 or more in each case are more than the 185 similar defaults reported in the week before, they form only 56 per cent of the total, as compared with 60.4 per cent a week ago. For the corresponding week in 1921 the number of such defaults was 171, and the percentage 52.7.

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German Radio Market Slumps

A heavy slump has hit the radiophone manufacturing industry in Germany as a result of a sudden cessation in demand from the United States, according to reports from that country. Several American agents now are attempting to cancel orders, it is said. The prices are dropping rapidly.

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Metal Market Situation

The recent advance of copper to 14 cents, delivered, is said to be a logical market increase in contrast with artificial advances when economic conditions did not warrant it. Many sales have been made at the high price and consumers seem very willing to pay it. The fuel and transportation troubles are causing some uncertainty in the trade, and it is felt that when these are cleared up there will be a wholesome buying movement.

NEW YORK METAL MARKET PRICES

Copper	July 12, 1922	July 20, 1922
London, standard spot	£ s. d. 63 2 6	£ s. d. 63 2 6
	Cents per Pound	Cents per Pound
Prime Lake	14.00	14.00
Electrolytic	14.00	14.00
Casting	13.35	13.35
Lead, Am. S. & R. price	5.75	5.55
Antimony	5.05	5.05
Nickel, ingot	36.00	36.00
Zinc, spot	5.50	5.50
Tin, Straits	31.37½	31.62½
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

	July 12, 1922	July 20, 1922
Heavy copper and wire	10.50-11.00	10.50-11.00
Brass, heavy	5.50-5.75	5.50-5.75
Brass, light	4.87½-5.00	5.00-5.12½
Lead, heavy	4.62½-4.65	4.62½-4.65
Zinc, old scrap	2.87½-3.00	2.87½-3.12½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

DEMAND in the electrical market continues to improve in all sections of the country. Steady calls are noted for conduit boxes, which were advanced approximately 10 per cent on July 15. Flexible armored conductor is in active demand with excellent deliveries. This material is becoming more popular than rigid conduit in many quarters owing to the present lower prices. Warmer weather has done much to increase fan sales during the last week. Stocks are reported ample. Rubber-covered wire demand is fair and stocks are good. Most orders for motors are for the smaller sizes. Sewing-machine sales are slow, there being poor response to jobbers' and dealers' efforts. Sporadic sales feature the washing-machine market.

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New York

Sales Increasing—Conduit Demand Is Good—Fan Sales Heavy—Outlet Boxes Advance

Sales of electrical materials are increasing in this district. Prices are generally firm, the only increase of the week being a slight advance in the price of outlet boxes. Dealers are reporting a greater response to sales initiative and a better demand for washers and cleaners. The industrial lighting market is a trifle sluggish at this time, and few orders of any size are noted.

Conduit.—Good demand is noted in this line. Recent price advances have not affected sales.

Fans.—Hot weather during the past week has caused record sales.

Outlet Boxes.—Prices have advanced materially, but demand continues to gain.

Lamps.—Stocks are being built up in order to meet the fall demand, which is expected to be very active.

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Chicago

Conduit Boxes Advance—Steady Demand for Wiring Materials—Lamp Trade Brisk

Business in the electrical trade has traveled another week on the plane established during the past month. The call for wiring materials is still progressing, although some scarcity of the smaller sizes of conduit is evident. The flexible armored conductor has not felt a very active demand since most of the construction has been on new houses. Conduit boxes advanced about 10 per cent on July 15. High-tension manufacturers are reporting a good volume of business transacted.

Wire.—The flow of rubber-covered wire is still steady, and the No. 14 sells for $6.25 per 1,000 ft. in 5,000-ft. lots. A slightly strengthened market is noticeable, but jobbers are attempting to maintain this price to consumers of standing. Stocks are normal. Action on bare and weatherproof has not changed, and they are moving slowly. Prices are the same at 16¾ cents per pound.

Conduit.—The conduit market has changed very little since prices range from $45 to $46 per 1,000 ft. for the ½-in. black pipe in 5,000-ft. lots. Stocks on this size are low, but the larger sizes are available.

Flexible Armored Conductor.—The building industry is calling for more wire and conduit than armored conductor. No. 14, two-wire, single-strip, is quoted at $42.50 per 1,000 ft. in 5,000-ft. lots. Stocks are good.

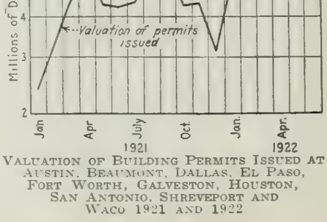
High-Tension Equipment.—A carload shipment of busbar supports and disconnecting switches for the Pacific Coast was reported by one manufacturer. This maker received orders for two 900-kva., 33,000-volt steel-tower substations for the Middle West and one 600-kva., 22,000-volt substation for the Northwest. Another firm reports a steady flow of high-tension fuses of all sizes and states that inquiries are constantly being received.

Radio.—Although the summer radio business has slumped, jobbers report an active demand for standard parts. The call for complete sets is sluggish, but stocks are being built up for the fall business. Head telephones and vacuum tubes are now available in better quantities.

Conduit Boxes.—An increase of 10 to 20 per cent in the list price of conduit boxes went into effect July 15.

Lamps.—Action on lamps of practically all sizes has been sustained, and dealers report active demand by industrials and railroads. Interest in colored lamps is growing.

Dry Cells.—Movement on dry cells has changed but slightly, and the No. 6 cell is available at $30.55 per 100 in barrel lots.



VALUATION OF BUILDING PERMITS ISSUED AT AUSTIN, BEAUMONT, DALLAS, EL PASO, FORT WORTH, GALVESTON, HOUSTON, SAN ANTONIO, SHREVEPORT AND WACO 1921 AND 1922

Sockets.—Prices on this material are unchanged and the demand has been steady. Stocks are in good condition. The pull chain sockets in 250-box lots sell for $133 per 100 the key for $18.15 per 100, and the keyless for $16.50 per 100, both in lots of 250.

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Boston

Wiring Materials in Chief Demand—Central-Station Outputs Growing—Traction Earnings Improving

Wiring materials are in chief demand. Increased sales of rubber-covered wire and porcelain are noted. General business continues good and building construction is still gaining. Central-station outputs are growing steadily and traction earnings are improving. Demand for telephone facilities is extraordinary.

Porcelain.—"Nail-it" knobs moved Monday at $13.50 per 1,000 in barrel lots. Sales are better than for some time. Tubes are moving well, the 3-in. size selling at $4 per 1,000 in barrel lots. Stocks are ample.

Flexible Armored Conductor.—No. 14 single-strip is in active demand, with excellent deliveries. In lots of 1,000 ft., $44.20 per 1,000 ft. in Boston is charged. This material is becoming more popular than rigid conduit in many quarters, owing to the present price.

Rigid Conduit.—A price advance of about 4 per cent has gone into effect. In 500-lb. to 5,000-lb. lots, ½-in. black sells at $53.25 per 1,000 ft., galvanized at $58.35. Elbows per 100 in the corresponding lots are quoted at $10.76 for black and $11.90 for galvanized. Black couplings per 100 in lots of 500 lb. to 5,000 lb. are quoted at $5.16, the price for galvanized being $5.58. Deliveries on pipe tend to increase in length.

Fans.—A spurt in sales has resulted from warmer weather. Stocks vary a good deal among jobbers.

Wire.—Rubber-covered wire is selling fairly well, with good stocks. No. 14 quoted $6.25 per 1,000 ft. in 5,000-ft. lots at Boston Monday. Spasmodic sales of weatherproof wire are a feature of the market, the base being steady at 16.5 cents.

Motors.—Scattered orders for smaller-sized units are reported. A good deal of small industrial-plant betterment work is under way, and while sales are not as a rule bunched to make a showing for particular localities, a good many motors are constantly being absorbed for improved machine driving. Prices are steady.

Radio Equipment.—Jobbers representing high-grade manufacturers are preparing for an active fall trade. Buying is very conservative as some distributors were heavily overstocked when the summer slump came.

Fixtures.—Business is extremely active. All classes of trade are in evidence from office equipment to residences. Considerable industrial lighting betterment work is also under way, but mercantile orders dominate the local market. Prices tend to stiffen somewhat and deliveries are excellent.

Atlanta

Metal-Molding Movement Slow—Glass and Porcelain Insulator Demand Is More Active

Metal Molding.—The movement in this line is somewhat slow, though a fairly reasonable volume of sales is still realized. Stocks are in first-class condition, with prices steady and shipments satisfactory.

Sewing Machines. — This specialty fails to respond to jobbers' and dealers' efforts to create interest. Unfavorable conditions in the small towns are in a large measure responsible, and little activity can be expected until early fall.

Washing Machines.—This line continues slow with only sporadic sales to be noted. Washing machines seem to be suffering from the same malady that affects sewing machines. Dealers' stocks are in splendid shape with no recent price changes recorded.

Insulators.—A fair movement in both the glass and porcelain types is to be noted, stimulated somewhat by a slight decrease in price. Most of the shipments in the glass type are going to the rural telephone lines, with the porcelain to larger central stations. Stocks are sufficient and shipments satisfactory.

Battery-Charging Outfits.—This specialty has not responded to the pick-up in automobile trade, though it is expected that increased activity will materialize as fall approaches. Radio outfits, however, are responsible for some sales in this line. Stocks are adequate.

Schedule Material.—A good movement in this line is reported, building construction which started in the spring now making itself felt. With continued building activity even brisker sales should be the prospect for several months to come. Stocks and shipments are both satisfactory.

Dry Batteries.—This item has not responded to the usual summer demand, and few orders are being received. Representative prices in barrel lots are as follows: Regular, $32.72 per 100; igniter, $33.72 per 100. Four-cell units are quoted at $1.78 each.

St. Louis

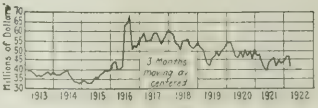
Line Hardware Prices Advance 5 per Cent—Demand for Wire Reported Increasing

The principal feature of last week's business was the prevalence of price changes—conduit, porcelain, line hardware, outlet boxes and wire being affected. Little change is noted in the demand for wiring materials and devices and for appliances, but there was a substantial increase in the sale of larger items, such as generators, transformers, motors, motor-generator sets and converters. Stocks continue to be conservatively maintained, and as a result buyers often have to call on several jobbers to get immediate delivery of certain items.

The buying of electrical goods by the railroads has declined slightly, but is still comparatively large, and quite a few large orders from them are pending. Most of the industrials are extremely active, and they are buying probably twice as much electrical equipment as a year ago. Credit conditions show slight improvement. The average time of collections is sixty days, and the long-standing obligations are being liquidated.

The railroad situation has had no material effect on business and shipments are being made as promptly as usual. Reports from the corn districts indicate that agricultural conditions were improved last week by abundant rains.

Conduit.—Prices have been advanced, and representative new prices are: ½-in. black, $47.75 per 1,000 ft.; ½-in. galvanized, $54.60 per 1,000 ft.; ¾-in. black, $60.60 per 1,000 ft. ¾-in. galvanized, $68.25 per 1,000 ft. Demand continues to improve, and stocks are larger.



THE TREND OF DIVIDEND PAYMENTS BY INDUSTRIAL CORPORATIONS

Porcelain.—Heavy reductions are being made. "Nail-it" knobs have declined from $15 per 1,000 in barrel lots to $12.75 per 1,000. Similarly, two-wire and three-wire unglazed cleats have fallen from $10.70 per 1,000 to $8.25 per 1,000, 2½-in. tubes from $3.73 per 1,000 to $3.35 per 1,000, 3-in. tubes from $4.50 per 1,000 to $3.75 per 1,000, 4-in. tubes from $5.50 per 1,000 to $4.95 per 1,000, and No. 5½ split knobs from $10.70 per 1,000 to $8.25 per 1,000. Stocks are not heavier than the demand requires.

Line Hardware.—A 5 per cent advance in prices is announced. Sales are irregular but show improvement.

Outlet Boxes.—New list prices are being established to eliminate irregular differentials which existed between the various sizes, and the resultant average prices will be slightly advanced.

Wire.—There is some tendency to stiffen prices as demand increases. One jobber reports the sale of 50,000 lb. of weatherproof last week. No. 14 rubber-covered is quoted at $6.50 per 1,000-ft. in 1,000-ft. lots. The base on both bare and weatherproof is around 17 cents per pound.

San Francisco

Fan Demand Excellent—Lamp Stocks Reduced—Range Competition Keen

The value of building permits for June, 1922, was: Los Angeles, $10,652,265; San Francisco, $3,336,901; Oakland, $3,318,085, and San Diego, $1,010,362. The value for June, 1921, was: Los Angeles, $6,269,546; San Francisco, $950,965; Oakland, $1,486,022; San Diego, $799,944.

Fans.—Unusually hot weather in interior valleys has resulted in excellent business, and local stocks may not last out the year.

Lamps.—Dealers' stocks have been reduced nicely, and while adequate are probably better proportioned than for years. This season, of course, is comparatively quiet, but has held up surprisingly.

Fixtures. — Big jobs approaching completion are demanding big shipments. Metal reflectors are moving very well. In fact, industrial building is an ever-increasing item. Residence fixtures of the better known sort are moving fairly well but are not getting a proper share in the acelerated residence building. Cheap fixtures predominate there, the final decision passing out of the hands of the architect and owner into those of the tract manager, who, of course, desires low first costs.

Schedule Material.—The same lamentable situation applies here. However, industrial and office building keeps schedule business at a high, well-proportioned level, shipments of 100,000 lots from the East to local warehouses being not uncommon.

Ranges.—Prices appear on the up grade, although dealers are not getting the profit rate of a year or so ago. Power companies are consolidating effective sales forces and report gratifying results. Exceedingly keen competition prevails among range manufacturers.

Salt Lake City–Denver

Leading Jobbers Plan to Offset Buying of Cheap Material by Extensive Advertising

Home building is progressing at an unprecedented rate in all towns and cities of importance. Electrical dealers are alert to the opportunity to wire for an ample number of convenience outlets. There is some tendency to use cheap materials in order to obtain contracts or to cut down the number of outlets adequate for complete electrical service. Some of the leading jobbing concerns plan to offset this by vigorously advertising to builders and home owners the advantage of using standard materials and specifying plenty of convenience outlets.

Interest in radio seems to be waning. It is believed, however, that the interest will revive at the close of the summer season. Just now people are not spending their evenings at home, and this is thought to have a depressing effect on the radio market. Despite a good fan season, so far as weather is concerned, some jobbers are expressing disappointment at the volume of business. It looks as if considerable stock will be held over to another season.

Portland–Seattle

Conduit Stocks Slow—Fan Demand Is Good—High-Tension Insulator Market Active

One jobber estimates that his July sales will be from 125 to 150 per cent better than a year ago. The electrifying of sawmills has offered a good market for electrical supplies and equipment, and this market will grow even better as conditions in the lumber industry improve. Stocks are in good condition.

Conduit.—An advance of from 3 to 5 per cent in the price of rigid conduit became effective last week. The demand is good and stocks in Seattle are low.

Fans.—Owing to the comparatively short hot period in the summers in the Northwest, fans do not as a rule move in very large quantities. This year, however, owing to a very long, hot dry spell during the months of May and June and continuing so far in July, fans have been quite active, and it is reported that May and June sales were greater than for the entire season last year.

Insulators.—The demand for high-tension insulators throughout the Northwest this year has been greater by far than for a good many years past. This is due to the large number of transmission lines under construction.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

New England Central Station Sold $112,359 of Appliances

Gross appliance sales in a New England central station serving 38,649 meters in 1921 totaled $112,359, yielding an estimated service income to the company of $24,085 per year. The total number of appliance units sold was 8,114, and these represented a connected load of 2,557 kw. Of the standard appliances sold the following totals were recorded: Automobile heaters, 10; chafing dishes, 6; vacuum cleaners, 1,042; curling irons, 176; fans, 162; flatirons, 3,793; heating pads, 159; immersion heaters, 14; ironers, 1; radiant heaters, 108; sewing-machine motors, 43; percolators, 144; portable lamps, 1,113; ranges, 19; sewing machines, 53; table stoves, 97; toasters, 895; vibrators, 9; water cups, 22; washers, 86; waffle irons, 31. The population served is about 175,000.

Industrial Electric Company Awarded Large Contract

The Industrial Electric Company of Dallas, Tex., has received a contract for installing electric equipment for the American Ice Company of Dallas and the Darco Corporation of Marshall, Tex. The plant of the American Ice Company, it is declared, will be one of the most modern in the entire country. The entire installation of ice machinery, compressors and auxiliaries is directly driven. There are two 100-hp., 4,160-volt, 164 r.p.m. Westinghouse synchronous motors directly coupled to 35-ton York ammonia compressors. In addition to these two large motors, there is approximately 100 hp. in small motors. Power for the installation is furnished by the Dallas Power & Light Company and distributed to the various motors, auxiliaries and transformers through a Westinghouse switchboard with overload protection and low-voltage release instruments.

General Electric Company Starts Home Wiring Sales Campaign

National advertising to reach the ultimate consumer, the home builder and owner, with the advantages of complete and adequate wiring for homes, rather than the promotion of individual wiring devices, is the keynote of a particularly interesting sales plant just started by the General Electric Company. The general advertising offers as a special feature a booklet entitled "The Home of a Hundred Comforts," which explains the comfort and convenience of completely wired homes.

The various wiring features of each room, the switches, outlets, etc., are pointed out, and just what they mean in terms of convenience and service is explained. The story is told in non-technical language, wholly understandable by the person who knows nothing about the electrical or mechanical features of house wiring. The man whose house, built some time ago, is inadequately wired is assured that it can be brought up to date in this respect without defacing the walls and at comparatively small expense.

Instead of referring the contractors to the inquirers who may write for the booklet, as has been customary in campaigns of this nature, the person writing for the information will be referred directly to the contractor-dealers in his vicinity and invited to discuss his problems personally with such contractors.

U. S. Electrical Manufacturing Company Erecting $500,000 Factory

Having broken ground on May 20 last for what it is declared will be the largest electrical factory west of the Mississippi River, the Austin Company, contractor, is rushing the erection of a new factory for the U. S. Electrical Manufacturing Company, Los Angeles. The factory is situated on a tract of land 5¼ acres in size and will be one of the most modern industrial units in southern California. It is stated that the plant and equipment will represent an investment of approximately $500,000.

The tract recently purchased by the company faces on Slauson Avenue and occupies an entire block between Los Angeles and Wall Streets. There is a frontage of 343 ft. on Slauson Avenue and the plot extends 970 ft. southward. The building for the first unit will occupy two acres of space and will be one of the largest daylight factories in the West. It will be constructed of steel and ornamental brick with the entire sides of glass. Several thousand dollars has been appropriated for the gardening features alone.

The first unit, which will have a frontage of 150 ft. will be two stories high and will furnish a space of 4,000 sq.ft. for administration, engineering and drafting accommodations. In the factory building proper special runways for electrical cranes and monorails are to be installed, and the production machinery will comprise seventy-five individual motor-driven machine tools, including not only the equipment at the company's present plant at Third and Central Avenues but many other machines that are being built for its special purposes.

Ample ground has been purchased to permit expansion for several years to come, and the new plant is designed to double the company's present production of electric motors. During the past twelve months the sales volume of this company has increased 250 per cent. Officials of the company state that the production could have been greater had the present facilities of the factory made it possible to take care of the heavy spring business, particularly the demand for irrigation motors.

U. S. Light & Heat Corporation of California Organized

The U. S. Light & Heat Corporation of California has been organized and incorporated as a subsidiary of the U. S. Light & Heat Corporation of Niagara Falls, N. Y., manufacturers of USL storage batteries, railroad-car lighting devices and electric arc welders.

A site has been leased by this company and construction started on a new plant in Oakland, Cal. The purpose of this new plant is to enable the U. S. Light & Heat Corporation to handle more efficiently its growing volume of business on the Pacific Coast. It is anticipated that construction will start in the new factory about Oct. 1.

◆

Hygrade Lamp Company Addition to Be Finished in August

The new four-story, 50 x 110 ft. addition to the plant of the Hygrade Lamp Company of Salem, Mass., will be completed early in August, officials of that company have announced. The complete plant will have over 105,000 sq.ft. of connected floor space and a capacity of 30,000 lamps a day.

◆

Westinghouse Gets Interesting Order from a Large Pulp and Paper Corporation

The Westinghouse Electric & Manufacturing Company has received an interesting order from the Washington Pulp & Paper Corporation, Port Angeles, Wash.

The order includes one complete sectional individual motor drive for a 164-in. Bagley-Sewell Foudrinier newsprint paper machine for paper production speeds of 400 ft. to 1,200 ft. per minute, including a 600-kw. synchronous-motor generator set; nine section motors and gear units and control equipment; three 1,000-hp., 240-r.p.m. synchronous motors for driving pulp grinders; one 200-kw. synchronous-motor exciter set for pulp-grinder motors; one 3,330-kva., 300-r.p.m. vertical waterwheel-type generator with direct-connected exciter, and one 2,500-kva., 120-r.p.m. engine-type alternating-current generator.

The apparatus ordered from the Westinghouse company will be used for increasing the capacity of the plant, which was built four years ago and is one of the most modern on the Pacific Coast.

◆

The General Electric Company has announced the formation of a merchandise department which will have charge of products that are handled through resale channels. The organization will consist of three divisions: Administrative, supply sales and motor sales, and will be headed by George P. Baldwin as general merchandise manager and H. C. Houck as assistant general merchandise manager.

The Federal Electric & Manufacturing Company, Chartiers Street, Pittsburgh, Pa., manufacturer of electric switches, etc., has acquired a four-story factory at McKees Rocks, Pa., for a consideration of $60,000 and will occupy the entire building.

Stockholders of the Volta Battery Company, 205 North Delaware Street, Indianapolis, Ind., manufacturer of electric batteries for automobile service, are arranging to purchase the plant and property from the receiver. A new company will be organized to operate the plant, and a number of improvements will be made. L. W. Jenkins, one of the principal stockholders, will be active in the new organization.

The Western Radio Sales Company has opened offices in the McIntyre Building, Salt Lake City, Utah. This company will handle products of the Radio Corporation of America, together with Westinghouse and General Electric equipment. The company also maintains offices at Ogden, Butte, Mont., Reno, Nev., Boise, Idaho, Denver, Col., and Cheyenne, Wyo.

The Standard Underground Cable Company's new St. Louis plant has been held up by strikes in the building trades, but the men are now ordered back to work, and it is expected that the plant will be producing cable in the next few months.

The Electrical Engineering & Manufacturing Company, Pittsburgh, has opened offices in the Mercantile Library Building, Cincinnati, Ohio. Mr. A. A. Morton, formerly with the Westinghouse Electric & Manufacturing Company's Pittsburgh office, is in charge as district manager.

The city of Superior, Neb., has negotiations under way with the Southern Nebraska Power Company, Superior, Neb., for furnishing electrical current for street lighting. L. P. Gregory, city clerk, and the Hollister Engineering Company, Bankers' Life Building, Lincoln, Neb., are conducting the negotiations.

The Kenney Electric Company, New London, Conn., recently incorporated under the laws of that state to manufacture electric devices, organized the past week and elected the following officers: President, Samuel Camputt; vice-president, William Weiner; vice-president, Samuel Gipstein; treasurer, Richard Hendel, and secretary Joseph Schwartz.

The Century Electric Company, manufacturer of alternating-current motors and fans, is building additions and improvements to its plant at 113 North Eighteenth Street, St. Louis, to cost approximately $100,000.

The Okonite Company, Passaic, N. J., manufacturer of Okonite insulated wires and cables, splicing tapes, etc., has recently opened a branch office in San Francisco, Cal., at 509 New Call Building. S. Herbert Lanyon is manager.

The Johns-Pratt Company of Hartford, Conn., whose selling arrangements through the Johns-Manville Company were recently dissolved, has established a Pacific Coast branch of its own. This office, located in the Call Building, New Montgomery Street, San Francisco, will be in charge of A. J. Moan.

The Electric Power Club will, effective Aug. 1, move its offices from St. Louis to the Kirby Building, Cleveland, according to S. N. Clarkson, its secretary. The new location was adopted because it is more centrally situated. The fall meeting of the club is announced for the week of Oct. 30 and will be held at Grove Park Inn, Asheville, N. C.

J. V. Wallace, for more than twenty years in charge of the second-hand apparatus department of the General Electric Company, announces that he has organized the J. V. Wallace Company, Inc., with offices in the Wedgeway Building, Schenectady, N. Y., to buy and sell new and used motors, generators, turbines, engine sets and power machinery.

Cincinnati, through its local electrical contractors' committee and with the cooperation of the Chamber of Commerce, is making elaborate arrangements to entertain the visitors to the annual convention of the National Electrical Contractors' Association, to be held in that city from Oct. 11 to 14.

The Edison Lamp Works of the General Electric Company, Harrison, N. J., has acquired a tract of about 175 acres of land at Parsippanny, N. J., to be used for future expansion.

R. M. Owen and associates have acquired the plant and property of the Dyneto Electric Corporation, Syracuse, N. Y., manufacturer of electric starting and lighting systems for automotive service. A consideration of $205,000 was given. The plant was sold for the benefit of creditors. The new owners propose to reorganize the company and resume operations at an early date.

The Pittsburgh Gage & Supply Company, Pittsburgh, Pa., manufacturer of electrically operated washing and ironing machines, etc., is disposing of a bond issue of $600,000, a portion of the proceeds to be used for expansion, liquidation of current indebtedness and for additional working capital.

The Commercial Electric Manufacturing Company, Pittsburgh, Pa., is being organized by Russel F. Clarke, James M. and Samuel M. Miller to manufacture electrical equipment and devices. The company is represented by J. M. Redden, 503 Farmers' Bank Building.

The Safety Car Heating & Equipment Company, Dixwell Avenue, New Haven, Conn., manufacturers of electric lighting and heating equipment, is completing plans for two plant additions, each one-story, 100 ft. x 194 ft. and 106 ft. x 115 ft. respectively, to be used for battery-plate manufacture and other production. Stovel & Brinkerhoff, 136 Liberty Street, New York, are engineers and contractors.

The Pennsylvania Power & Light Company, Allentown, Pa., has acquired a building at Hazelton, Pa., with adjoining property, for a consideration of $77,000, for the centralization of its offices and equipment department.

The Plainville Electric Products Company, Plainville, Conn., recently incorporated under the laws of Connecticut to manufacture electrical products, parts, supplies, etc., organized last week and elected the following officers: President, F. L. Benzon; secretary and treasurer, Donald Benjamin. Directors include Messrs. Benzon and Benjamin, and H. E. Smith. The plant of the company is on Whiting Street, Plainville.

Foreign Trade Notes

THE ERECTION OF A NEW POWER STATION IN SYDNEY, AUSTRALIA, TO BE POSTPONED.—The Sydney Electricity Committee, according to the *Electrician*, has decided to postpone the erection of a new power station and to enter into negotiations with the Railway Commissioners for furnishing electricity in bulk. A new power house would cost from £1,000,000 to £1,250,000 and would have to be ready in five years time, but the Commissioners can furnish a supply whenever it is required. Nearly £5,000,000 has already been expended on the undertaking.

NEW ELECTRIC PLANT IN SYRIA.—Through the American Consul at Damascus, *Commerce Reports* states, an opportunity is presented to American manufacturers to bid on a proposed electric lighting installation at Homs, Syria. The work is to be done in connection with the French Delegation at Damascus. The name of the adviser for public works of the French delegation, who can furnish information regarding the proposition, may be obtained from the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., or any of the bureau's district offices by referring to Exhibit No. 59,318.

NEW TELEPHONE SYSTEM CONTEMPLATED FOR ESTHONIA—The installation of a new telephone system, including a new central plant, George Gregg Fuller, a vice-consul at Reval, reports, is under consideration. The present plans provide for a switchboard of 25,000 lines.

EXPANSION OF THE UNION MINIÉRE DU HAUT-KATANGA.—By a royal decree dated Jan. 14, 1922, the duration of the Société Union Minière du Haut-Katanga (Belgian Kongo) was extended to March 11, 1990, as were also the concessions made to it under Articles 1 and 2 of the convention of Oct. 30, 1906. The purpose of this action was to permit the Union Minière to obtain the resources necessary to treat mineral (copper) by electrochemical process, the application of which necessitates the harnessing of important hydraulic forces and the erection of appropriate plants. It is stated that 300,000,000 francs will be expended for the above project.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired by a merchant in Italy (No. 2,883) for the sale of electric motors and electrical supplies.

A commercial agent in Australia (No. 2,886) desires to secure an exclusive agency for the sale of improved telephone devices, etc.

An industrial organization in Greece (No. 2,894) desires to secure an agency and an exhibition of products for demonstration purposes, such as those pertaining to public works, hydro-electric schemes, cold-storage installations, waterworks, etc.

A merchant in England (No. 2,917) desires to purchase spraying syringes in brass and copper for use in factories, public buildings and theaters; ear, dental and nasal syringes, electrical syringes, electrical floor polishers, etc.

PROPOSED HYDRO-ELECTRIC PLANTS IN CZECHOSLOVAKIA.—Tenders are now being asked, according to the *Electrical Review*, for equipment for the new power station which is to be erected by the Zentral Elektricitätswerke Aktien Gesellschaft at Seestadtl, near Komotau, Czechoslovakia, with financial aid of the provincial administration. The province has agreed to guarantee a loan of 25,000,000 Czech kronen, to be later raised to 38,000,000 kronen. A Franco-Swiss company has been organized, the *Electrical Review* states, to develop a hydro-electric plant on the Rama River, near Jablonica, to supply electricity in the towns of Konji and Prozor, to the Metkovic-Mostar-Sarajevo railway, to the proposed railway from Konjic to Dubrovnik, and also to various industries. (The initial installation will have a capacity of 40,000 hp., later to be increased to 63,000 hp. The cost of the project is estimated at 11,000,000 kronen.

ELECTRIC EQUIPMENT FOR NEW ZEALAND.—Tenders will be received by the Southland Electric Power Board, Wellington, New Zealand, until Sept. 30, according to the *Electrician*, for electric equipment as follows: (Section A) Distribution transformers; (B) bare and insulated cables and joining sleeves; (C) lightning arresters and choke coils; (D) pole-type switches; (E) pole-type fuse supports and fuses; (F) line insulators; (G) pole ironwork (bolts, pole steps, coach screws, hookhead); (H) service meters, testing meters and service fuses.

INSULATORS FOR MORWELL POWER SCHEME, AUSTRALIA.—Tenders are invited by the State Electricity Commission of Victoria, Australia, until Sept. 16, the *Electrical Times* states, for strain and pin type insulators (specification No. 261) for the Morwell power scheme. Further information may be obtained on application to the Agent General for Victoria, Melbourne Place, Strand, London, W. C. 2.

New Apparatus and Publications

TAPING MACHINE EQUIPMENT.—P. E. Chapman Electrical Works, St. Louis, has developed a motor-driven taping-machine equipment, consisting of an armature or field taping machine directly belted to a low-speed motor.

ELECTRIC VEHICLES.—The Edison Storage Battery Company, Orange, N. J., in a bulletin entitled "Haulage and Delivery," describes the electric vehicle system for bakers. This bulletin is the first of a series on electric delivery service in various industries.

BALANCING MACHINES, EXTENSOMETERS AND STRAIN GAGES.—The Tinius Olsen Testing Machine Company, 500 North Twelfth Street, Philadelphia, is distributing a circular covering the "Olsen-Carwen" static-dynamic balancing machines, "extensometers" and strain gages. Bulletin No. 3 issued by the company covers its transverse and beam-testing machines.

ACORNS.—Bulletin No. 17-13 distributed by Harvey Hubbell, Inc., Bridgeport, Conn., describes the "Hubbell" luminous (detachable) acorns.

DESK LAMPS.—A new line of desk lamps has been developed by S. Robert Schwartz & Brother, 729 Broadway, New York City, manufacturers of the "Esrobert" adjustable lamps.

LIGHTING DATA.—The Edison Lamp Works of General Electric Company, Harrison, N. J., is distributing bulletins L. D. 102A, L. D. 138 and L. D. 139, entitled "Effect of Walls and Ceilings on Resultant Illumination," "Fundamentals of Projection" and "The Lighting of Small Stores" respectively.

BATTERY RECHARGER.—The King Electric Manufacturing Company, Inc., Tonawanda, N. Y., has recently developed a new radio battery recharger "A," designed for use with parlor sets.

STEAM TURBINES.—The De Laval Steam Turbine Company, Trenton, N. J., has issued a sixteen-page catalog describing the "De Laval" velocity stage steam turbines designed to be directly coupled to high-speed centrifugal pumps, small generators, etc.

New Incorporations

THE DUNLAP (ILL.) LIGHT & POWER COMPANY has been organized to operate an electric lighting and power system in Alta, Dunlap and the surrounding district. The officers are: J. H. Sheehan, president; J. Steigele, treasurer, and C. E. Hitchcock, secretary.

THE CARROLL COUNTY ELECTRIC COMPANY, Carrollton Mo., has been organized to take over the property of the Water, Light & Transit Company of Carrollton. The incorporators are Hugh C. Blackwell, Harley C. Davis and Herbert A. Spokesfield, all of Kansas City.

THE ROCK LIGHT & POWER COMPANY, Crosbyton, Tex., has been incorporated by S. A. Guy, J. C. Orr and F. H. Wheat. The company is capitalized at $40,000.

THE HAMPDEN & NEWBURG LIGHT & POWER COMPANY, Hampden, Me., has been organized with a capital stock of $50,000 to generate and distribute electricity. The officers are: C. A. Nason, president; E. L. Hammond, treasurer, and R. L. Smith, clerk.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PEJEPSCOT, ME.—Tentative plans have been prepared by the Pejepscot Paper Company, Brunswick, for the erection of an addition to its local plant, to cost with machinery, power equipment, etc., about $1,000,000.

MONTPELIER, VT.—Arrangements have been completed by the Montpelier & Barre Light & Power Company for extending its system to the village of Warren. The transmission line will be extended from Waitsfield to Warren to supply the service. Plans have been completed for extensions to the service in Waterbury Center.

BOSTON, MASS.—Ornamental lamps will be installed on Boylston Street from Tremont Street to Copley Square.

BOSTON, MASS.—The Edison Electric Illuminating Company has awarded a general contract to George B. H. Macomber, 44 Bromfield Street, for the erection of a two-story addition to its power house at 256-274 Broadway.

NEW BEDFORD, MASS.—The Public Utilities Commission has granted the New Bedford Gas & Electric Light Company permission to issue $1,144,800 (par value) in capital stock, the proceeds to be used for extensions and improvements, including the installation of a 20,000-kw. generating unit (for which contract has been placed) and the erection of a high-tension transmission line to connect with the system of the Fall River Electric Light Company.

WESTFIELD, MASS.—Extensions of the electric lighting system to East Mountain, the brickyards and upper Western Avenue sections is under consideration by the Municipal Light Commission.

PROVIDENCE, R. I.—The construction of a new car barn and shop, to cost about $60,000, is under consideration by the United Electric Railways Company.

DANBURY, CONN.—The Danbury & Bethel Railway Company has entered into a contract with the Danbury & Bethel Gas & Electric Light Company for electricity to operate its system during the summer months. A number of changes and repairs will be made to the power plant of the street railway company.

HARTFORD, CONN.—Complete mechanical laboratories, machine shop and other manual training departments will be installed in the new Thomas Snell Weaver High School. The entire cost is estimated at $1,250,000.

Middle Atlantic States

MALONE, N. Y.—The Northern Light & Power Company, Inc., Malone, recently incorporated, is planning to construct another water-power development on the Salmon River, near Malone, where the Malone Light & Power Company has a large generating station. The Northern company has petitioned the Public Service Commission for permission to acquire the property of the Malone Light & Power Company and the Sulham Manufacturing Company. M. S. Wilder is president.

NEWBURGH, N. Y.—A power house will be erected in connection with the new local factory of the American Chocolate Products Company, 158 Broadway, New York, to cost $350,000. Andrews, Tower & Lavalle, 21 East Fortieth Street, New York, are engineers.

NEWBURGH, N. Y.—Arrangements have been made for the installation of electric lighting systems in the villages of Wingdale, Dover Plains, Wassaic, Amenia and surrounding hamlets. Electricity will be supplied from the Bulls Bridge plant. To meet the cost of construction, which is estimated at $120,000, the following amounts have been apportioned to the various towns: Wingdale, $20,000; Dover Plains, $35,000; Amenia and surrounding hamlets, $69,000.

NEW YORK, N. Y.—The New York Edison Company contemplates the erection of a transformer station at 12 Stone Street, to cost about $90,000. W. Whitehill, [illegible] Sixth Avenue, is engineer.

NEW YORK, N. Y.—A new two-story power house, 48 ft. x 68 ft., will be erected at the New York Homeopathic Medical College and Flower Hospital, Avenue A, Sixty-third to Sixty-fourth Street. Francis T. Joanes, 16 East Fortieth Street, is architect.

ROME, N. Y.—Bids will be received by Cyrus J. Severance, president board of managers, State School for Mental Defectives, Rome, until Aug. 7 for engines and direct-current generators (for lighting purposes) at the above institution.

VINELAND, N. J.—The Vineland Hospital Association will build a power house, 43 ft. x 60 ft., at the proposed Newcomb Hospital, to cost $150,000. Stearns & Woodnutt, Stephen Girard Building, Philadelphia, are engineers.

ALLENTOWN, PA.—The Jordon Electric Company is being organized by Elmer Bachman and D. S. Martin to construct and operate an electric plant in Hidelberg Township. Silas R. Rothermel, Allentown, represents the company.

CHESTER, PA.—The Delaware County Electric Company will increase its capital from $12,800,000 to $15,000,000, part of the proceeds to be used for extensions and improvements.

CRESSON, PA.—The Cresson Township Power Company has been organized to operate a local plant by C. A. McClure and F. W. Woodcock. James Collins Jones, Bullitt Building, Philadelphia, is representative.

EASTON, PA.—The Pennsylvania Edison Company has issued $57,000 in bonds, part of the proceeds to be used for extensions and improvements.

HOLTWOOD, PA. — The Pennsylvania Water & Power Company has issued $850,000 in bonds, part of the proceeds to be used for extensions and improvements.

PENNSBURG, PA.—The construction of a boiler house and the installation of new boilers at the municipal electric light plant is under consideration.

PHILADELPHIA, PA.—The Philadelphia Electric Company has increased its capital stock from $60,000,000 to $67,085,000. Work will be commenced at once on a new power house on Race Street, to cost $70,000, and an addition to the Franklin power house, Sixth Street. It will erect also a new power plant at American and Susquehanna Avenues.

PHILADELPHIA, PA. — The Excelsior Electric Light, Power & Gas Company, 834 Land Title Building, has been organized to take over a number of companies, including the West Rockhill (Pa.) Township Electric Light & Power Company and the East Rockhill (Pa.) Township Electric Light & Power Company. Daniel W. Simkins is secretary.

PHILADELPHIA, PA.—The Philadelphia Electric Company has contracted with the West Jersey & Seashore Railroad, Camden, for electricity to operate its third-rail system between Camden and Atlantic City. A transmission line will be erected to Westville via Bridesburg and Delair, where connection will be made with the West Jersey lines. The power plant at Westville, N. J., will be closed down.

PITTSBURGH, PA. — Officials of the West Penn Company are organizing the West Penn-Monongahela Company to take over the plant and system of the Monongahela Power & Railway Company. Extensions will be made to the system.

SCRANTON, PA.—Plans are being prepared by the Scranton Lace Company for the erection of a one-story power house on Albright Avenue, to cost about $150,000. Lockwood, Greene & Company, 101 Park Avenue, New York, are engineers.

SUNBURY, PA.—Extensions will be made to the ornamental lighting system in the business district.

WILMERDING, PA.—The United Electric Light Company has applied to the Public Service Commission for permission to operate a lighting system in North Versailles.

DOVER, DEL.—The Wilmington Traction Company contemplates the erection of a transmission line on the Kennett Pike.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company will soon take bids for the construction of an addition to its substation at 6-8 McClellan Street, to cost about $30,000.

BALTIMORE, MD. — Preparations are being made by the Western Maryland Railroad Company for extensions to its grain elevator plant at Port Covington, including the installation of mechanical and operating machinery to increase the capacity to 2,000,000 bushels. Work has begun on the foundation for a new locomotive and car repair shop, to cost about $50,000.

FRANKLIN, W. VA.—M. S. Hodges is reported to be interested in the construction of a hydro-electric plant on the south branch of the Potomac River.

HAMPTON ROADS, VA.—Bids will be received by the Bureau of Yards and Docks, Washington, D. C., until July 26 for coal and ash handling equipment at the local naval base. (Specification No. 4,667.)

WASHINGTON, D. C.—The District of Columbia Paper Company, Water Street, will begin work at once on a hydro-electric power plant, to cost about $50,000.

WASHINGTON, D. C.—Bids will be received by the Chief of Engineers, United States Army, Munitions Building, Room 2,060, until Aug. 1 for ten Diesel-engine generating sets, 90 kw. and 125 volts, and switchboards (Adv. 91). Also for four motor-driven air compressors (Adv. 90).

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies & Accounts, Navy Department, until Aug. 8 for electric wire for various navy yards, as follows: 13,800 ft. lighting and power wire; 11,000 ft. lighting and power wire, 1,300 ft. cable; 23,500 ft. incandescent lamp cord; and 2,500 ft. lighting and power wire (Schedule 51). Also, on the same date, for 44,000 ft. bell wire; 36,500 ft. bell wire; 83,000 ft. double-conductor wire; 171,000 ft. double-conductor wire; 4,300 ft., 3,600 ft., 19,000 ft. and 40,000 ft. lighting and power wire; 1,000 ft. interior communicating cable; and 2,500 ft. single-conductor ignition cable (Schedule 52).

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North Central States

ESSEXVILLE, MICH.—The Aetna Portland Cement Company, 412 Union Trust Building, Detroit, will build a power plant in connection with its new local cement mill, to cost about $1,000,000.

INDIANAPOLIS, IND.—Bids will be received by the Board of Sanitary Commissioners, Sanitary District of Indianapolis, City Hall, until July 31 for construction of section 2 of division 111 and furnishing and erecting mechanical equipment for sewage-disposal plant, including construction of power-plant building, electric power-plant crane and five electrically driven centrifugal pumping units. Charles H. Hurd, Merchants' Bank Building, is consulting engineer.

JACKSONVILLE, IND. — The power house and other mechanical departments at the property of the Green Valley Coal Mining Company were recently destroyed by fire, causing a loss of about $50,000.

MICHIGAN CITY, IND.—The electrically operated pumping plant at the municipal water works, recently destroyed by fire, will be rebuilt at once. The loss, including machinery, is estimated at $500,000.

PENDLETON, IND.—A power plant will be erected at the new Indiana State Reformatory to be erected in Pendleton, to cost about $3,000,000. Herbert Foltz, Indianapolis, is architect.

TERRE HAUTE, IND.—Plans are being prepared for the installation of an underground fire-alarm system in the business district. Harry Bledso is fire superintendent.

CHICAGO, ILL.—Work will soon begin on the installation of 54,000 additional street lamps in the city, for which $2,000,000 in bonds was recently voted.

DUNLAP, ILL.—Arrangements are being made to erect a transmission line to supply electricity in Alta, Dunlap and farms in this district from the substation of the Central Illinois Light Company in Peoria Heights. The Dunlap Light & Power Company, recently organized, will furnish the service. J. H. Sheehan is president of the company.

MATTOON, ILL. — The Central Illinois Public Service Company has petitioned the Public Service Commission for permission to erect an electric transmission line between Pawnee and Springfield.

SHELBYVILLE, ILL.—The City Council has approved a resolution providing for the sale of the municipal electric light plant and issuing certificates of indebtedness for $100,000 for the construction of a new electric plant.

WAUKEGAN, ILL.—An electrically operated pumping plant will be installed in connection with a new filtration plant at the municipal waterworks, to cost about $900,000. Hoad, Decker & Druary, Ann Arbor, Mich., are engineers.

WAUKEGAN, ILL.—The Public Service Company of Northern Illinois, 72 West Adams Street, Chicago, Ill., will take bids about July 24 for the first unit of its proposed power plant on Greenwood Avenue, to cost about $1,000,000.

BARABOO, WIS.—Plans are under consideration by the G. McCarthen Company for the construction of a hydro-electric plant, to cost about $45,000.

BELOIT, WIS.—The P. B. Yates Machine Company, 729 Fourth Street, contemplates rebuilding its power house and installing a 1,000-kw. generating unit.

HAWKINS, WIS.—F. Prochaski of Milan is planning to erect an electric light plant in Hawkins, to cost about $60,000.

CLEARWATER, MINN.—The St. Cloud Power Company has been granted permission by the Federal Power Commission to build a hydro-electric plant to develop about 4,500 hp.

MINNEAPOLIS, MINN.—The Northern States Power Company has issued $2,000,000 in bonds, part of the proceeds to be used for extensions and improvements. Permission has been secured from the Federal Power Commission to build hydro-electric plants at Otsego and Monticello, on the Mississippi River, to develop a total of 10,300 hp.

BOONE, IA.—The Iowa Traction Company, Cedar Rapids, is making surveys for a hydro-electric plant on the Des Moines River, near Boone. J. D. Wardle, Cedar Rapids, is engineer.

CARROLLTON, MO.—The Carroll County Power Company, recently organized, has petitioned the Public Service Commission for permission to acquire and operate the property of the Water, Light & Transit Company, Carrollton, and to erect a transmission line from the plant of the Kansas City Power & Light Company to Carrollton.

DONIPHAN, MO. — Samuel Danner is reported to be considering the construction of light, power and ice plants.

GRANT CITY, MO.—The Maryville (Mo.) Electric Light & Power Company contemplates the erection of a transmission line to Grant City, Sheridan and vicinity.

JOPLIN, MO.—The Empire District Electric Company will enlarge its power plant and make extensions to its transmission and distributing system. A 10,000-kw. generator will be installed.

KANSAS CITY, MO.—A power house will be erected at the City Hospital, 23 ft. x 40 ft., at Twenty-third and Cherry Streets. M. K. Robertson is secretary of hospital and health board.

MARYVILLE, MO.—The Maryville Electric Light & Power Company contemplates erecting transmission lines to Grant City, Parnell, Sheridan and Worth.

SEDALIA, MO.—The City Light & Traction Company contemplates building a new power house, to cost with equipment, about $360,000.

WEST PLAINS, MO.—The Federal Power Commission has granted the Dixie Power Company permission to construct a hydro-electric plant on the White River at the mouth of Buffalo River. The company also contemplates building a dam on North Fork River, near West Plains.

COLOME, S. D.—The local electric plant has been purchased by the Tri-State Utilities Company, Eldorado, Iowa. Service hereafter will be supplied from the Winner (S. D.) plant of the company.

PICKERELL, NEB.—Bonds to the amount of $12,000 have been voted for a municipal electric lighting system and the erection of a transmission line to connect with the lines of the plant at Beatrice.

BLUE RAPIDS, KAN. — The Marshall County Power & Light Company has petitioned the Public Utilities Commission for permission to distribute electricity for lamps and motors in the towns of Centralia, Corning and Goff. The company is planning to take over the contracts and service of the municipal electric plant, which has been supplying service in these three towns.

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Southern States

CHINA GROVE, N. C.—The China Grove Cotton Mills, Inc., will install an electric power plant and system in connection with its new local yarn mill. A. C. Lineberger, Belmont, is president.

ELIZABETH CITY, N. C.—The Council is considering building an electric light plant and waterworks or purchasing the local systems.

KINSTON, N. C.—The installation of ornamental lamps on Queen, Heritage and other streets is under consideration.

DENMARK, S. C.—J. B. Guess, Jr., R. A. Easterling and others are interested in a hydro-electric project on the Edisto River, 4 miles from Denmark, which will be operated in connection with the present local steam plant. It is proposed to develop 500 hp.

VALDOSTA, GA.—The electrically operated pumping plant at the waterworks, recently destroyed by fire, will be rebuilt. The loss is estimated at about $30,000.

BENTON, ALA.—The power house, sawmill and other portions of the plant of the Ward Lumber Syndicate were recently damaged by fire, causing a loss of about $100,000.

GREENSBORO, ALA.—The Greensboro Water Company, Birmingham, recently organized, has petitioned the Public Service Commission for permission to acquire the light and water plants at Greensboro and operate same.

MONTGOMERY, ALA.—The Atlantic Ice & Cold Storage Corporation contemplates extensions to its ice-manufacturing and cold storage plant, to cost, including machinery, about $300,000.

NEW ORLEANS, LA.—Contract has been awarded by the Consumers' Light & Power Company for the construction of a building at 409 Tchoupitoulas Street for a power plant.

POCAHONTAS, ARK.—The Central Power & Light Company has increased its capital stock from $2,500,000 to $5,000,000, part of the proceeds to be used for extensions and improvements.

OILTON, OKLA.—The Oklahoma Gas & Electric Company will build a transmission line to connect its local property with its main transmission system. A transmission line (about 11 miles) long, will also be erected to Fairmont.

PONCA CITY, OKLA.—The 101 Ranch Company plans to rebuild its power house, recently destroyed by fire. The loss is estimated at $50,000.

RED ROCK, OKLA.—A transmission line will be erected to Ponca City, to secure electricity to operate the proposed local municipal plant.

BASTROP, TEX.—The Texas Power & Light Company, Dallas, contemplates the erection of a power station here to supply electricity to plants operating in the lignite fields.

REFUGIO, TEX.—Plans are being prepared by the Refugio Glass Company, National Bank of Commerce Building, San Antonio, for the erection of a new plant on property recently acquired at Refugio for the manufacture of glass bottles and other glass containers, to cost about $75,000. The plans include a power plant.

WACO, TEX.—The Texas Power & Light Company has issued $2,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

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Pacific and Mountain States

SEATTLE, WASH.—The Washington Iron Works, Seattle Boulevard, will build a power plant, 50 ft. x 110 ft., in connection with plant additions, to cost about $500,000. Jerald Fink is president.

SPOKANE, WASH.—The Washington Water Power Company has been granted permission by the Federal Power Commission to construct a hydro-electric plant at Kettle Falls, Columbia River, to develop 153,000 hp. The company has recently acquired the property of the Intermountain Power Company.

FORT KLAMATH, ORE.—The Fort Klamath Meadows Company has been granted permission by the Federal Power Commission to construct a hydro-electric plant on Anna Creek, National Park.

FRESNO, CAL.—The San Joaquin Light & Power Corporation will build an addition to its substation at California and Orange Avenues, to cost $102,000. The output will be increased from 10,000 hp. to 17,000 hp.

OAKLAND, CAL.—Plans are being prepared by the Council for the installation of an ornamental lighting system around Lake Merritt, comprising 560 lamp standards.

OROVILLE, CAL.—City Trustees are negotiating with the Pacific Gas & Electric Company for the purchase of its electric distributing system, to be operated by the municipality.

SAN FRANCISCO, CAL.—Bids will be received by the Board of Public Works, until Aug. 9 for electrical equipment for the Mocassin Creek power plant of the Hetch-Hetchy water project, including transformers and accessories, to cost about $75,000, and switchboards, etc., cost $60,000.

SAN LEANDRO, CAL.—The Pacific Gas & Electric Company has completed surveys for a transmission line from Centerville to Ferry Lane, near San Leandro.

WILLITS, CAL.—The Central Mendocino County Power Company applied to the State Railroad Commission for permission to issue $200,000 in capital stock, the proceeds to be used for the construction of an electric plant and system.

PALISADES, COL.—The plant and holdings of the Palisades Service Company has been purchased by the Grand Junction (Col.) Electric, Gas & Manufacturing Company.

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Canada

VANCOUVER, B. C.—**The Pacific Mills,** Ltd., 510 Hastings Street, West, is considering the construction of a hydro-electric plant at Ocean Falls, to cost between $450,000 and $500,000.

VANCOUVER, B. C.—The British Columbia Gas & Electric Company contemplates the construction of a hydro-electric plant of 25,000 kw. capacity, to cost about $1,000,000.

VANCOUVER, B. C.—The British Columbia Electric Railway Company has started work on the construction of a new 640-ft. dam and the rebuilding of the present dam at Stave Lake, providing for the installation of a fourth power unit, to cost about $1,250,000. The company is also extending its Broadway West line in the city, to cost $75,000.

CORNWALL, ONT.—The counties of Stormont, Dundas and Glengarry have granted a franchise to W. W. Beach, Iroquois, to erect electric transmission lines on the highways in the three counties.

GUELPH, ONT.—Improvements contemplated by the Hydro-Electric Power Commission of Ontario on the radial system calls for an expenditure of about $116,379.

LINDSAY, ONT.—The Hydro-Electric Power Commission of Ontario contemplates rebuilding its system in Lindsay, in the district south of Kent Street, this season.

PETROLIA, ONT.—The Peninsular Sugar Company, Ltd., is planning to build a sugar factory in Petrolia, to cost about $800,000. The plant will be equipped throughout with electrically driven machinery.

SAULT STE. MARIE, ONT.—The Hydro-Electric Power Commission of Ontario will make a survey of the power still available in the rapids and prepare estimates of the cost of developing it.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 27, 1922)

1,421,246. Apparatus for Regulating the Voltages of Dynamo Electric Machines; A. J. Jullin, St. Cloud, France. App. filed May 20, 1920. Type used for lighting vehicles.

1,421,250. Conduit Plow; W. H. Kempton, Wilkinsburg, Pa. App. filed Nov. 26, 1920. Third rail contact for railways.

1,421,261. Control System, E. S. Lammers, Jr. App. filed May 7, 1919. Control of field excitation of generators.

1,421,269. Electromagnet; S. M. Lucas, Pittsburgh, Pa. App. filed Dec. 16, 1920. With neutral and polarized armatures.

1,421,272. Relay; P. MacGahan, Pittsburgh, Pa. App. filed Dec. 14, 1916. Means for protecting the contacts.

1,421,276. Electric Lamp; E. G. Mascarenhas, Juiz de Fora, Brazil. App. filed Sept. 5, 1919. Fith two filaments.

1,421,344. Audibility Meter; E. Garretson, Buffalo, N. Y. App. filed May 8, 1919. Measures strength of incoming radio signals.

1,421,350. Hair-Cutting Machine; E. B. Powell, Newark, N. J. App. filed Aug. 14, 1920. Clipper with self-contained driving mechanism.

1,421,355. Connector for Storage Batteries; H. E. Walker, Chicago, Ill. App. filed Oct. 27, 1920. Clamp arrangement.

(Issued July 4, 1922)

1,421,399. Battery Hand Pamp; C. F. Burgess, Madison, Wis. App. filed May 14, 1920. Removable reflector for dispersing light.

1,421,403. Switchboard Signal; G. Carlson, Rochester, N. Y. App. filed Aug. 22, 1919. Telephone clearing-out signal.

1,421,435. Electric Apparatus for Propelling Projectiles; A. L. O. Fauchon-Villeplee, Paris, France. App. filed Apr. 1, 1919. Direct current flowing through projectile subjected to magnetic field.

1,421,481. Combination Trolley Wire Stretcher and Splice; D. R. Hunley, Cofoco, W. Va. App. filed Aug. 22, 1921.

1,421,500. Axle Recording Device for Railways; W. Kolbe and J. Fritzen, Essen-on-the-Ruhr, Germany. App. filed Feb. 14, 1921. Records weight, time and number of trains passing.

1,421,516. Magnetic Healing Apparatus, S. Maeshima, Tokyo, Japan. App. filed May 2, 1918. Therapeutic device to stimulate nerves and cells.

1,421,528. Flash Light; L. A. Miller, New Haven, Conn. App. filed July 14, 1921. Internal latch for cover.

1,421,538. Direct Current Transformer; A. F. Nesbit, Wilkinsburg, Pa. App. filed Mar. 9, 1921. Three phase rotary converter.

1,421,549. Lighting System for Automobiles; W. F. Penrod, Blanchester, O. App. filed Aug. 15, 1917. Lamps supplied from magneto.

1,421,561. Battery Candle; E. Pugsley, New Haven, Conn. App. filed Nov. 3, 1921. Small flashlight in form of candle

1,421,584. Resilient Wheel; H. R. Shafer, Detroit, Mich. App. filed Jan. 19, 1921. Springs between the rim and hub.

1,421,586-1,421,589. Stand and Automatic Switch for Electric Irons; A. J. Shirk and S. Cohen, New York, N. Y. App. filed Jan. 28, 1920. Four patents describing iron of the type that is heated when on stand.

1,421,634. Electric Motor; C. L. Weltner, Looneyville, W. Va. App. filed June 21, 1921. Two wheels propelled by magnets on rims.

1,421,702. Testing Apparatus; R. G. McCurdy, Cresskill, N J. App. filed Aug. 19, 1920. For locating unbalance in transmission lines.

1,421,717. Pan with Overflow Alarm Device; A. Renda, New York, N. Y. App. filed Feb. 23, 1921. Operated by float.

1,421,720. Method of and Apparatus for Detecting the Presence of One Gas in Another; C. H. M. Roberts, Washington, D. C. App. filed June 3, 1920. Depends on mobility of the ions in gases.

1,421,734. Commutator; William Sparks, Jackson, Mich. App. filed July 16, 1920. Disk commutator for small motors.

1,421,756. Massage Apparatus; Charles Arnao, Brooklyn, N. Y. App. filed Nov. 4, 1921. Hood for steaming face.

1,421,828. Power Transmission and Electric Breaking; F. H. Pritchard, Schenectady, N. Y. App. filed Sept. 11, 1920. Applies to railway motors.

1,421,850. Stand and Automatic Switch for Electric Irons; A. J. Shirk and S. Cohen, New York, N. Y. App. filed Dec. 16, 1919. Iron heated only when on stand.

1,421,853. Pull Socket Switch; R. D. Smith, Boston, Mass. App. filed Oct. 27, 1916.

1,421,864. Telephony; H. S. Turner, Washington, D. C. App. filed Aug. 12, 1915. Busy line tests for semi-automatic exchange.

1,421,894. Power Transmission and Electric Braking; A. F. Batchelder, Schenectady, N. Y. App. filed Sept. 11, 1920. For railway operation.

1,421,899. Transformer; R. V. Bingay, Pittsburgh, Pa. App. filed Oct. 17, 1919 Oval shape coils.

1,421,931. Electric Braking; P. W. Forsberg, Schenectady, N. Y. App. filed Feb. 21, 1920. Resistance breaking for electric locomotives.

1,421,937. Electric Water Heater; A. M. Goldberg, Indianapolis, Ind. App. filed July 28, 1921. Transformer prin[illegible] surrounded by shorted secondary in form of pipes.

1,421,939. Air Heater; M. H[illegible], New York, N. Y. App. filed Oct. 11, 1918. Heated by gas, oil, electricity or steam.

1,421,998. Commutator and Battery Charging Outfit Including the Same; D. S. Scarborough, St. Louis, Mo. App. filed Apr. 11, 1919. Rectifier and storage battery set.

1,422,013. Thermionic Apparatus Applicable for Wireless Telegraphy and Other Purposes; L. B. Turner, Cambridge, England. App. filed Feb. 6, 1920. Regenerative control circuit.

1,422,026. Process and Apparatus for Electrostatic Separation of Finely Divided Discrete Material; G. R. Brown, Bondi, New South Wales. App. filed Jan. 7, 1920.

1,422,027. Automatic Electric Generating Unit; W. W. Bucher, Chicago, Ill. App. filed Mar. 20, 1919. Engine-generator set.

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Number 5

The Key Men

ALL men have marveled at the rise and growth of the automobile industry. The spectacular development of its elaborate distribution system, its splendid advertising and the rapidity with which it has been established in every town and hamlet in the land have no parallel in industrial history.

It is a familiar story to this generation, for it has all been done before our eyes. But there is this one aspect of it that merits a little further study by electrical men.

THE reason why the automobile industry has prospered so is because it has been well financed in each community. The local J. P. Morgan bought one of the first cars that came to town. This interested him in automobiling, and as he drove and watched the increasing number of cars upon the road he became interested in the automobile industry itself.

He saw the local possibilities and decided to invest some of his money in this new business opportunity, right at home where he could watch it. So he picked out some wise chap in town of the mechanical type and he set him up in the garage business. Perhaps he also financed his wife's nephew and opened a sales agency for a good family car. Then he arranged with the local bank of which he was president or a director to extend liberal credit to them.

The automobile industry became immediately established in that town as a local institution. Prominent local young men were selling cars. The garage was a conspicuous local business. Local people were buying cars. And the whole enterprise was not only sponsored but boosted by the local crowd.

BEFORE the electrical industry can take the place that it will occupy some day as a major business in each community, it must be established on the firm foundation of financial interest. There is greater opportunity in the electrical business than even in the motor car. The local J. P. Morgan has not discovered it yet — that's all. But he can be interested in the same way he became interested in automobiles.

The electrical business needs local financing because it wants better electric stores, stronger contractors and more prosperous central stations—all backed by greater public understanding and sympathy. And it will come when the local moneyed folks are using everything electrical themselves and so discover the possibilities in the electrical industry as a business for their own towns. They are the key men.

An interesting analysis of this situation appears in this issue. It points an urgent opportunity that merits study and an effort in each town.

Leonard Lord Elden

An electrical engineer who for thirty-seven years has served the electric light and power industry with distinguished ability.

ONE of the rarely discussed advantages of light and power system development on a large scale is the opportunity it affords engineers of exceptional foresight and thorough professional qualifications to apply their talents effectively in both local and national fields. This industry is fortunate in retaining the services of a number of such men who have literally grown up with it, and who bring to the problems of a great and troubled time the potent solvents of experienced judgment and mature enthusiasm. From modest beginnings these men have "made good" year by year as increasing responsibilities have been laid upon them, until today they stand among the acknowledged leaders of the electrical profession, honored by their colleagues and respected by their subordinates. Theirs has been the achievement, possible perhaps in no other profession, of advancing step by step with the industry they serve and intertwining from the very start its theory and its practice in their daily lives.

Leonard L. Elden, superintendent of the electrical engineering department of the Edison Electric Illuminating Company of Boston, Mass., has long been recognized as an engineer of the foregoing type. Since boyhood he has devoted himself to central-station engineering. In the spring of 1920 he was awarded a diamond service pin commemorating thirty-five years' continuous work for the Boston company and its predecessors. He was born at Buxton, Me., on May 16, 1868, and after graduation from the Quincy (Mass.) High School in 1885, entered the employ of the Massachusetts Electric Power Company, continuing with its successor, the Massachusetts Light & Power Company. Later this was merged with the Brush and New England Western Electric Light Companies in the Boston Electric Light Company.

Mr. Elden joined the present Boston Edison company in 1901 when it purchased the last-named system. He has been intimately associated with the electrical development of this, New England's largest light and power system, ever since, his work embracing practically every aspect of electrical service from the generating unit to the customer's installation. As his department has grown, he has devoted his attention more and more to the larger problems of forecasting the development of the system and dealing with outside companies and interests as its engineering representative. Mr. Elden was an early advocate of interconnection and has had no small part in its rapid advance during the past decade. His work as chief witness for the company in the 10,000-page Boston street-lighting rate case a few years ago was monumental in scope and added to his already noted reputation as an exhaustively informed engineer. Recent researches by him upon the loading capacities of distribution transformers mark a radical advance in practice and have aroused wide interest.

Many committees of the National Electric Light Association and of the American Institute of Electrical Engineers have had the benefit of Mr. Elden's membership He was president of the Association of Edison Illuminating Companies in 1918. His work as chairman of the electrical apparatus committee and underground systems committee of the N. E. L. A. embodied leadership of a high order.

Editorial Comment

Electrical World, July 29, 1922

Volume 80 Number 5

Development of Colorado Resources Largely Dependent on Cheap Power

EVERY branch of the industry is or should be interested in the power possibilities of the various portions of the country. These possibilities affect not only the sales of manufacturers and jobbers, but also of contractors and dealers, and are of vital interest to the central-station companies in the immediate vicinity. Of particular interest, therefore, is the discussion of the future of hydro-electric generation in Colorado by H. B. Dwight.

Colorado is rich in undeveloped resources. Its agricultural possibilities are tremendous, and the development of a large portion of these awaits the exploitation of the hydro-electric resources of the state. The mines of Colorado, although they have been somewhat highly developed in the past, have been hampered through lack of adequate transportation, and this problem again may be solved through the utilization of the commonwealth's latent water power.

Colorado is almost the key state in the tremendous development of the Colorado River basin which undoubtedly will be actively begun in the very near future. This state furnishes a large portion of the water which flows down the Colorado River and is deeply concerned with the equitable distribution both of the water and of the power which will be generated by this water as it runs down to the sea. It is therefore of particular moment that the power possibilities and market for power in Colorado be carefully considered in relation with similar problems in the other states in the Colorado River basin.

Tact an Essential in Dealing with the Public

"I AM convinced that in general we are not half so diplomatic as we should be," recently remarked a man deeply interested in central-station matters. He was telling how a central-station official had written a consumer blaming him for not following advice given and how he had also broken the news to a prospective customer that a deposit was needed on top of some weeks of waiting and a lot of red tape.

Tact is nine-tenths of the secret of keeping the good will of the people, as they are met in the course of the business day. The average consumer of central-station service is a seeker for information, and, like all human beings in that position, he is sensitive because he is afraid that his queries may seem extremely foolish. Sometimes also he is inclined to think that the information he receives has a selfish motive back of it, and therefore he often disregards it and gets into trouble.

Any man in the central-station field who is in such a position that he must deal with the public, but who has a feeling that he must exhibit his superior quality of brains and keep those he meets in a proper position of inferiority, is clearly not cut out for central-station work.

Kindliness and tact will draw from the most timid and embarrassed customer his whole story of troubles, and these qualities are the most valuable asset any central-station man can have. Through them can be won the confidence of the individual, which means the confidence of the public. One self-important employee can do more damage to public relations than a dozen tactful ones can right. One self-important official can wreck an entire enterprise by setting the public against an otherwise well-managed business.

Wisconsin Court Limits Powers of Railroad Commission

IN ITS decision in the Wisconsin-Minnesota Light & Power Company case the Supreme Court of the State of Wisconsin not only robs the Wisconsin Railroad Commission of its full rate-making powers but sets up a new principle in rate making, based upon location or proximity of communities to the generating station. That this will retard water-power development and have a restraining influence on transmission companies and interconnected systems is apparent. However unfortunate this may appear, there is no appeal from the decision, which now stands as the law of Wisconsin. The best that may be hoped for is that the court will grant a rehearing and, in the light of further testimony and consideration, reach a more reasonable conclusion. Otherwise the extension of electric service to small towns and villages, a consummation which is certainly to the best interests of the state and the inhabitants of rural communities, will be curtailed because of the exorbitant rates that would have to be charged for the service under the decision in question.

There was no contention that the utility was earning an unreasonable return. The complaint was lodged against the unreasonable distribution of costs. Undoubtedly this added to the cost of service at Chippewa Falls, but it would seem that that condition could easily have been remedied without so sweeping a decision, upsetting recognized rate structures and indicating that every town should have a rate of its own. It was generally supposed that when the Legislature of Wisconsin delegated its powers to the Railroad Commission there were no reservations as to rate making; but apparently the law was imperfect in this regard, otherwise the Supreme Court would not have questioned the policy of the state.

The national public policy is well defined in matters of public service. No one questions the wisdom of the federal water-power act or the rules and regulations of our transportation, communication and postal systems, and yet the spirit of the Wisconsin decision is at variance with all of them. If, as in the case of the Wisconsin-Minnesota Light & Power Company, a uniform rate is not equable, a happy medium could be found which would work no injustice and still encourage electrical development in the state. This, we feel, is a matter for the Wisconsin Railroad Commission to determine, and not the court, and any loopholes in the law should be quickly stopped by the Wisconsin Legislature.

The Use and Purpose of Accounting

DURING a recent discussion of uniform cost accounting as an aid to production before a meeting of the United States Chamber of Commerce, these questions were directed at the executives of American industries:

> Do your cost accountants realize that you, as executives, are busy men with any number of things to do and that you have neither the time nor the patience to wade through a mass of details? Do they accordingly make their cost reports simple and concise, touching the salient and principal points of information? Do they try to interpret cost results or do they force you to draw your own conclusions? Do they use graphical charts and percentages wherever possible, and do they afford ready comparisons with past or standard performances? Does your cost department keep its cost figures locked up tight within its own department or does it give them wide publicity so that the cost results may reach the entire organization down to your foremen and individual workmen? Is it a practice to call conferences in your organization to present and discuss cost results, and are preparations made to answer the questions the shop executives in particular will put at such conferences?

Here is something which every central-station executive and every electrical manufacturer, jobber and large contractor may well ponder and take to heart. The full use and purpose of accounting is too much neglected.

The Mechanical Evolution of the Storage Battery

EVER since the earliest development of the accumulator there has been a constant struggle to produce a battery of sound mechanical properties which will be able to stand up under trying conditions. Electrical failure from sheer abuse can be fairly guarded against by proper instruction, and while the final failure of a battery may be generally charged to improper use, it is greatly accelerated by faulty construction which makes the structure easily a victim of misuse.

The Bureau of Standards has done a good service in testing out for mechanical endurance some representative storage batteries. As reported by Messrs. Ilsley and Brunot in our last issue, the result was to show practical immunity from mechanical injury for all the batteries tested. A few slight faults developed, but they were not due to damage affecting the active elements as such. At the end of the bumping test none of the batteries showed any perceptible deterioration under electrical service.

This success shows a marked improvement over the conditions which existed in earlier years even in batteries heavier than those now in use. In fact, the modern batteries have tended to generally similar weight and bulk per kilowatt-hour in spite of the many forms experimented with in the early history of the art. Most of the freak types have completely vanished from the market, and he who buys a storage battery today from any reliable maker gets a pretty reliable article of fairly standardized quality. The best of it is that this condition is due, not to any conscious standardization, but to a general appreciation of sound electrical and mechanical design. The nickel-iron alkaline battery is the only material departure from the conventional type due to Planté and Faure—changed only in mechanical construction.

At all events there is no difficulty today in getting good batteries, and if intelligently used, they will give excellent service with small depreciation. To be sure, they are not foolproof; but if one goes wrong, the user has generally only himself to blame. Surely the results of the endurance test recorded last week are good evidence that even pretty rough mechanical treatment will not put a cell out of business or cause noticeable depreciation if the electrical treatment of the helpless victim is in the least humane.

The Costs of Modern Street Lighting

AVERAGES are somewhat deceitful things, yet one can draw reasonably sound conclusions from them provided his conclusions are in terms of averages and not specific to variations from them. Thus one may say that the average cost of electrical energy to the consumer is 5 cents per unit and be measurably correct for a given group of communities, but he is not thereby justified in calling 10 cents an exorbitant price for lighting in a particular place, or denouncing two cents as a ruinous figure for a chemical industry in another place. With this reservation we wish to call attention to the capital résumé of street-lighting costs in our last issue by A. F. Dickerson, which shows the prevailing conditions in American cities. It is on a per capita basis, which automatically averages local rates and conditions, leaving the net results as a factor in civic expenditures.

On the whole, the country over, the amount spent on street lighting is a little more than 3 per cent of the total budget, surely a trivial fraction considering the importance of lighting as a police measure. Experience shows the vital importance of good lighting for this purpose, and it must be constantly borne in mind in designing a street-lighting system, albeit one is not at liberty, if tactful, to call an alderman's attention to the need of more lighting in his ward because it is a notoriously tough quarter. When it comes to really good lighting the current figures become fairly consistent, wild as they are upon the whole. It seems to be well established that a city which is of fairly good size, and therefore as a matter of fact shows a somewhat dense population, can be thoroughly well lighted at a cost of somewhere about $2 per capita. Now and then this figure is materially exceeded, but generally only when "white way" or other quite flamboyant schemes are adopted.

We can hardly agree with Mr. Dickerson that a line of ornamental standards forms an important architectural element in a street. That it might do so is evident enough, but only at a staggering cost, in a community in which building laws reach further than they ever have in any American city. "Ornamental" standards cannot be produced cheaply and most of them suffer from the standard national vice of attempting to get an effect of regal magnificence for about $1.89. Really the highest compliment one can pay a street-lighting fixture is to say that it is so good that one's eye barely rests on it by day and realizes its complete effectiveness by night. Enough highly efficient sources are now available to do the necessary work very effectively, unostentatiously, and at moderate cost.

One of the very useful features of Mr. Dickerson's paper is the stress it lays on the relation that exists between spacing and mounting height, whatever the illuminant. This is all too seldom recognized by municipal lighting authorities. A "white way" in a neighboring city stirs their souls in emulation and up go some short and glaring fixtures, not so offensive when massed at 75-ft. spacing, but intolerable when spanned out to 200 ft. In particular the recommendation for highways should be noted with its open spacing and extra high placement which can be carried out even in shaded roads by long brackets or cross suspensions. Lighting from sidewalks is quite another matter. The long and the short of it is that means must be adapted to ends with the particular situation in mind, remembering always that results are the criterion of success. Costs, at the present usual rates for service, will ordinarily take care of themselves, if the safe rule is followed of not trying to attempt the impossible.

Reliable Service Should Be Aim of Small as Well as Large Utilities

SOME of the best brains of the central-station industry have been applied to the problem of service reliability during the last quarter century. To no small extent the popularity of electric service from local utilities rests upon this quality. Extraordinary precautions are taken in the larger plants of the metropolitan companies to prevent and limit interruptions, and many of the smaller utilities have enviable service reputations. It is not always realized, however, that reliability of supply, which fairly includes regulation of voltage and standard frequency within close limits, is an asset of the small company which may be worth more to the purchaser of energy than a less reliable service from a larger organization furnished at a considerably lower price per kilowatt-hour.

Recently a local steam station of a few thousand kilowatts rating secured an industrial power contract of some 2,000 hp. connected load in competition with a water-power system many times as large. Price of energy was of secondary importance to the manufacturer, and it is understood that he was willing to pay about 25 per cent more to the local central station because of its proximity to his plant and of its excellent record over a long period as regards interruptions. We hold no brief for either company, but it is suggestive to small properties retailing energy no less than to their larger corporate brethren that reliability has so high a cash value. Long-hour business involving the operation of machinery that is producing material by processes which cannot be interrupted for more than a few moments without heavy spoilage costs is particularly desirable patronage for many small stations having the generating capacity to serve such customers, if such plants are operated on the basis of reliability first. Conversely, many of the larger transmitting organizations cannot obtain and hold certain types of business unless their reliability records closely approximate those of their local competitors. It all goes back to over-all costs per unit of product, and thus in not a few cases the manager of a small utility has a very satisfactory "look-in" when the capture of big game in power business is on the commercial docket.

Where Reliability and Tensile Strength Govern

THE first essential in the design or installation of electrical equipment is reliability. The equipment must stand up to its work or it is not what it claims to be. Next in order come satisfactory performance as regards regulation, efficiency, temperature and the like, and finally moderate cost. Performance and cost are closely related to each other, and in many cases each may be altered at the expense of the other without involving any sacrifice of the first requisite—reliability. For example, in the case of transformers, efficiency and regulation may be improved by increasing weight and cost, without much influence one way or the other on reliability.

In the case of transmission and distribution lines, however, a different condition frequently arises. Copper, and less conspicuously aluminum, are selected principally for their high conductivity. They also have the no less important advantage of freedom from corrosion in the open. Neither, however, has high tensile strength, and it often happens that a line designed for satisfactory efficiency and regulation will fall quite short in the matter of reliability, when taken in relation to the normal length of span. Under these circumstances the size of conductor must be increased or the length of span shortened so as to provide the necessary factor of safety against mechanical failure. Therefore, additional cost is incurred on the score of reliability alone. These conditions have resulted in the development of various types of conductor in which a large measure of copper conductivity is retained, and in which tensile strength is added, usually by the introduction of steel.

New and important data on copper-clad steel wire and cable were presented in the last issue by B. C. Dennison. Such conductors are particularly valuable for long spans, such as are found in river crossings, and for telephone and overhead ground wires, which must be carried by transmission towers where the span is too long for small copper wires. Its non-corrosive properties make it preferable in a great many cases to galvanized steel for messenger and also for other types of supporting wire.

Additional tensile strength such as exists in copper-clad steel wire can only be obtained at the expense of some of the conductivity. The use of copper-clad wire, therefore, becomes merely a question of careful engineering analysis, and since regulation and efficiency are usually factors of the first importance, it appears probable that copper-clad wire will be limited to those instances in which the requirements of reliability and tensile strength predominate. This is especially true since apparently there is relatively little difference in cost between copper and copper-clad steel.

The new data now furnished will enable the engineer to compute with greater refinement than heretofore the relative advantages of the two types of conductor in any particular case. When making this comparison the economy of reducing the number of line supports, including poles or towers and insulators, made possible by conductors with higher tensile strength, must be balanced against the results of impaired conductivity and the possibilities of lines swinging together. However, in the case of rural lines the initial investment expense per mile of line may be the most important consideration.

Hydro-Electric Development on the St. Lawrence

EFFORTS are being made to negotiate a treaty between the United States and Canada governing the canalization of the St. Lawrence and the development of more than five million horsepower. When an agreement is reached it is hoped that nothing will hamper the maximum utilization of this wonderful source of power or prevent international exchange of surplus energy, which is so essential to the economical development and operation of hydro-electric plants on this international boundary.

Future of Hydro-Electric Generation in Colorado

Many Large Power Sites and Other Resources of Great Potentiality Await Development—The Principal Factor Delaying Development Is Inadequate Transportation—Highly Diversified Load May Be Obtained

By **HERBERT B. DWIGHT**
Electrical Engineer Public Utilities Commission of Colorado

FUTURE development of the hydro-electric resources of Colorado depends upon what is promised in the production of new load centers and the rejuvenation of old ones. Increase of the present power market will come as a direct result of the revival of some of the large industries of the state, such as metal mining, stock raising and farming, or it may come from the opening up and improving of certain large areas in which the natural resources and possibilities have been developed only in a most casual manner.

IN COLORADO ARE MANY RESERVOIRS. WOODEN FLUMES ARE USED EXTENSIVELY, BUT THEY ARE OFTEN SUBJECT TO LANDSLIDES

Left—Site of Barker Meadow reservoir of the Colorado Power Company's Boulder development; capacity is 500,000,000 cu.ft. Concrete dam in background. Right—This flume brings water to Electra Lake, Western Colorado Power Company, at Tacoma. It is 6 ft. deep, 8 ft. wide and 17,948 ft. long. A mud slide is shown on side hill.

That there are a considerable number of water-power sites in Colorado suitable for development is generally recognized. From 1905 to 1910 there was great activity in investigating hydro-electric projects, and upon most of the larger feasible ones filings were made and some of the preliminary work was done. It was during this period that the largest hydro-electric system in this state was built. This system is now the property of the Colorado Power Company, and its history in supplying and developing its prospective market will clearly indicate some of the most important factors which will enter into future plans.

It appears that the question of what can be obtained from the potential market in competition with other sources of power is much more important than the question of potential undeveloped horsepower based on the probable run-off and the study of available watersheds.

That steam standby plants are essential in this state has been clearly proved. The necessity for the utilization of water power whenever the water is available at a reasonable cost as an auxiliary to steam generation is almost axiomatic.

Just now it seems that more than sufficient provision has been made for the present market, and there is little incentive for the companies now in the field to replace steam stations by hydro-electric stations, even though the former predominate. None the less it is apparent that the dormant condition of some of the major industries in Colorado is nearly at an end, and those things will be done which are necessary to growth and progress. Much, too, will be accomplished in improving large areas in the southwest, the west and the northwest of the state, each of these sections being a large potential "empire" with the attendant possibilities of large load centers.

Colorado embraces about 93,000 square miles (241,000 sq.km.), being about 358 miles (576 km.) long by 260 miles (418 km.) wide, and nearly two-thirds of it lies in the mountainous region. East of a north and south line drawn through Denver, Colorado Springs and Pueblo lies a region of plains of the same general character as those found in Kansas and Nebraska. Dry farming predominates, and along the lines of the railroads are many prosperous towns, each with its lighting station. It seems highly improbable that any hydro-electric development will ever be able to reach this territory.

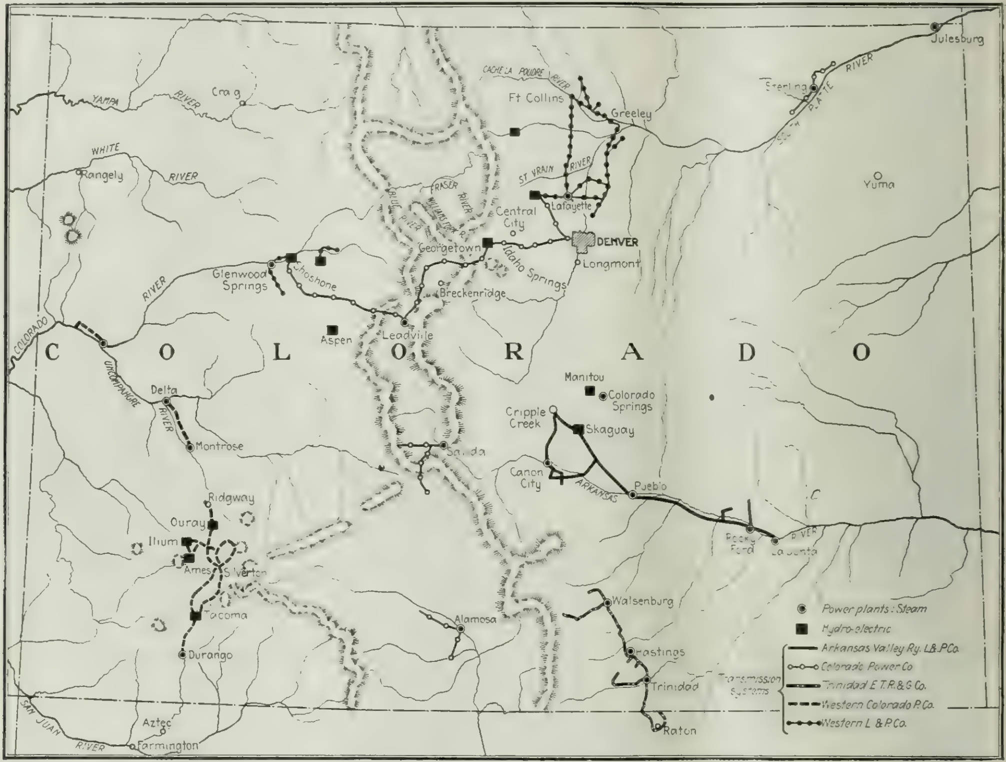
North from Denver to Fort Collins and Greeley lies a very fertile region which is largely under irrigation. This area is thoroughly covered by the transmission lines of the Western Light & Power Company and other public utilities purchasing power from this company.

The Western Light & Power Company generates 6,000 kw. in its Lafayette steam station and it also purchases considerable power from the Colorado Power Company at its Boulder substation. It would appear that this company may soon have to increase its generating capacity. This can be accomplished by adding a hydro-electric plant to the system. The question of ownership of water rights may control, but in so far as adequacy of supply is concerned, there are suitable sites for development in the front range adjacent to this area. These sites exist on the Cache La Poudre, just west of Fort Collins, and on the St. Vrain, west of Longmont. The Western Light & Power Company also serves several coal-mining camps near Boulder and Lafayette.

Another agricultural belt of a character similar to the one described above extends along the Arkansas River east from Pueblo to the state line. This belt is supplied from the transmission lines of the Arkansas Valley Railway, Light & Power Company, extending as far east as La Junta. This company generates its electricity in a high-head station at Skaguay, with a capacity of 1,500 kw., and in steam stations at Pueblo and Canon City. Small steam-station plants at Rocky Ford and La Junta are a part of the system. The total generating capacity is 19,320 kw.

The Trinidad Electric Transmission, Railway & Gas Company, operating steam stations at Trinidad, Walsenburg and Hastings, with a total capacity of 14,250 kw., is the other large system operating east of the mountains. Virtually its entire load is power service to coal mines scattered all over the area surrounding Walsenburg, Trinidad and Raton, N. M. There are no large hydro-electric sites in this vicinity.

The city of Colorado Springs obtains its service in part from a high-head hydro-electric station above Manitou. This station has a capacity of 2,250 kw. and operates in parallel with a steam station of 3,500 kw. This utility is the Colorado Springs Light, Heat & Power Company.



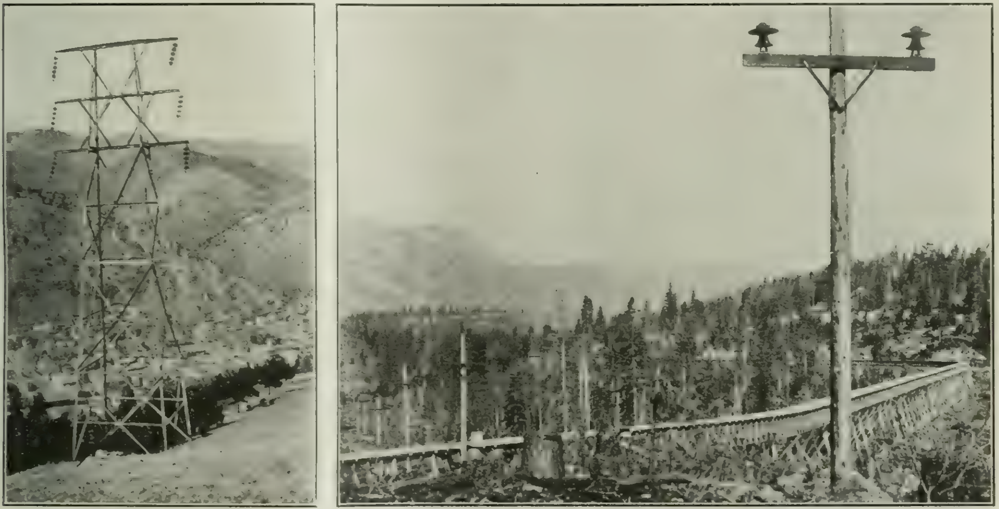
EXISTING POWER DEVELOPMENTS AND TRANSMISSION LINES IN COLORADO

The largest prospective market for power in the state was formerly in the metal-mining regions. Several large camps have flourished there, and the prospects were excellent at about the time the Central Colorado Power Company (now the Colorado Power Company) built its system. Its 100,000-volt transmission lines tap much of this territory, and it has a network of distribution lines running to all the important mines.

These camps near the Colorado Power Company's lines center about Leadville, Breckenridge, Georgetown, Idaho Springs, Central City and Boulder County west of Boulder. It is true that Aspen is also within reach of the Colorado Power Company's lines, but it has been served throughout its life by a direct-current hydro-electric station with a present capacity of 600 kw.

belonging to the Roaring Forks Electric Light & Power Company. In Teller County is another gold-mining district centering about Cripple Creek. Power is supplied from the Skaguay station of the Arkansas Valley Railway, Light & Power Company.

The Colorado Power Company operates large hydro-electric stations at opposite ends of its 100,000-volt transmission line, at Shoshone and at Boulder. It is a fact rather out of the common that the operating characteristics of these stations are such that each is a standby plant for the other. It is also of interest that the Shoshone station takes its energy from waters flowing to the Pacific and the Boulder station from those flowing to the Gulf of Mexico. The 100,000-volt transmission line connecting the two crosses the Continental Divide at an elevation of 12,500 ft. (3,800 m.). Parts of this line are inaccessible at times during the winter and at other times are reachable only on snowshoes. The Shoshone station uses the water of the Colorado River, which is diverted into a large flow-line tunnel driven through solid rock for 2½ miles (4 km.) parallel to the river. This tunnel was necessary because the character of the canyon through which the river flows is such that the stability of any type of pipe or flume was uncertain. Under a head of 169 ft. (51.5 m.) a maximum capacity of 14,400 kw. is possible whenever there is sufficient flow in the river. Very little storage is possible, although the water in the river is backed up for 4 miles (6.4 km.) in the canyon by the diversion dam. The storage has been limited at this site by the location of the main-line tracks of Rio Grande Western Railroad near the bottom of the canyon.


100,000-VOLT LINE BETWEEN SHOSHONE AND BOULDER; TYPICAL WOOD FLUME FOR HYDRO-ELECTRIC DEVELOPMENT IN COLORADO

Left—This line, which has a length of 186 miles, belongs to the Colorado Power Company and was one of the very first lines of this voltage. At present it has suspension insulators which have proved to have a very long life in this region. Sometimes the lines are inaccessible except on snowshoes. Right — Used by the Western Colorado Power Company in diverting the water of Big Cascade Creek into Electra Lake, Tacoma development. Crossing the flume is a 44,000-volt line. Many of the transmission lines in Colorado are of wooden-pole construction, as the high altitude and dry air are conducive to long life for such poles.

The Boulder station operates under an 1,820-ft. (546-m.) head and develops 10,000 kw. A storage reservoir with a capacity of 11,500 acre-feet (14,100,000 cu.m.) has been provided above Nederland by the construction of a solid concrete dam 624 ft. (190 m.) long and 177 ft. (53.9 m.) high. Auxiliary storage also is provided in several mountain lakes. Storage occurs during the months the Shoshone station is able to carry the bulk of the load and is utilized whenever the river flow at Shoshone is inadequate to give that station sufficient output to meet the demand. It would seem that the investment in hydraulic power works equipment is larger than might have been necessary if a steam standby station had been provided for either of the hydro-electric stations, but it is probable that the complete plans of the original company were not carried out on account of the failing power market in the mining region. As it now operates, the principal load on these stations is produced by the Denver Gas & Electric Company, which purchases power from the Colorado Power Company on a "dump power" basis, using its own steam stations for breakdown service.

At Leadville there is a steam auxiliary station of 1,925 kw. capacity, and at Georgetown a hydro-electric station of 1,300 kw. capacity under a 692-ft. (210-m.) head is operated in parallel with the system. The Colorado Power Company also operates independent steam stations at Sterling, capacity 1,150 kw., and at Salida, capacity 1,200 kw., as well as two hydro-electric auxiliary stations at Salida under 380-ft. (115-m.) and 265-ft. (80-m.) heads, having 600 kw. capacity each, and a steam station at Alamosa, capacity 500 kw.

The Western Colorado Power Company has its principal generating station at Tacoma between Silverton and Durango. This is a hydro-electric station operating under a 960-ft. (292-m.) head with a capacity of 4,500 kw. Water is impounded by the diversion of Big Cascade, Little Cascade and Elbert Creeks through long flumes into Electra Lake. This lake is 17,160 ft. (5,212 m.) long by 3,045 ft. (926 m.) wide and

43 ft. (13.1 m.) deep at the dam. This station was designed for a future increase of double its capacity. Another reservoir site of equal value exists just below the present one, and there are possibilities for the diversion of Lime Creek and other streams into this watershed.

At Durango the old lighting station of 1,000 kw. forms a steam standby plant. Silverton, Ouray and Telluride are separated from each other by high ranges, and the distribution lines connecting these districts cross these mountains at an elevation of 13,200 ft. (4,023 m.). These lines are for the most part standard wood-pole construction, but with an unusual number of guys. In bad places a combination of a push guy with an anchor guy along the top is usual. Most of this system is in a high altitude where long winters and heavy snows prevail. Snow slides are frequent, making duplicate circuits essential. Often the snow reaches a depth of 10 ft. (3 m.) and most of the lines are inaccessible except on snowshoes.

In the Telluride district at Ames there are two hydro-electric stations, one of 1,200 kw. capacity operating from two sources under 580-ft. (176-m.) and 901-ft. (274-m.) heads, and the other of 3,600 kw. capacity operating from the same sources under 560-ft. (170-m.) and 984-ft. (300-m.) heads. At Ilium is a hydro-electric station of 1,200 kw. capacity under 480-ft. (146-m.) head, this being a second development on the same river below the Ames stations. The water sources are Lake Hope, Trout Lake reservoir and the Lake and Howard's forks of the South Fork of San Miguel River. Another hydro-electric station has been erected in the canyon above Ouray, on the Uncompahgre River, with 480 kw. operating under a 390-ft. (118-m.) head. This company operates steam stations in Delta and Montrose having a combined capacity of about 450 kw.

Touching the Animas, San Juan, La Plata, Florida, Los Pinos and the Rio Piedra are thousands of acres suitable for irrigation by gravity or pumping which have been tested for years as suitable for growing corn, grain, hay, alfalfa and potatoes. The coal fields in this region are large and almost untouched. Another undeveloped agricultural area of great promise extends westward from Montrose and Delta.

The entire northwest corner of the state is unworked, awaiting cheap and adequate transportation facilities. Its response to suitable development in mineral, agricultural and live-stock production will be astounding. There are at least 1,200 square miles (2,590 sq.km.) underlaid with coal of excellent quality. Several high-grade copper mines have also been found.

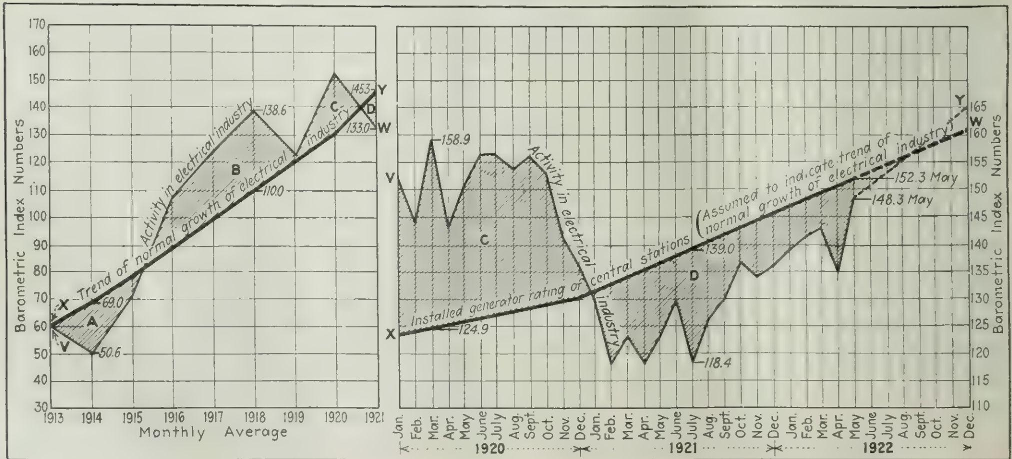
In any of the areas mentioned the response to improvement in production from natural resources can hardly be overestimated. Lack of capital has hampered the railroad in the past. Until these sections can be assured that they will have a suitable outlet to market at a fair cost, there will not be any large activity in hydro-electric development, although there are any number of feasible projects suitably located to meet any demands which the growth of the state may impose. It would seem that electrification might solve the transportation problem.

Improvement in Electrical Business Conditions During May

INDEX figures upon which the "Electrical World Barometer of Business Conditions in the Electrical Industry" is based indicate that during May every one of the primary industries of the country materially increased operations over April. The average daily total production of electrical energy by the public utility plants of the country in May was about 2.1 per cent more than that in April. This is highly significant when the fact is taken into consideration that the domestic lighting load was materially below April owing to the advancing season and also to the inauguration of daylight saving in many large cities of the country on May 1.

The "Electrical World Barometer" indicates that during the month of May business conditions in the electrical industry showed an increase of fourteen points on the barometer scale. The electrical industry as a whole during May was operating at practically four points below the point of normal demand if growth in the industry had been normal. In April it was operating at eighteen points below the point of normal demand.

Electrical World BAROMETER of ELECTRICAL BUSINESS CONDITIONS



Rate Decision Affecting Transmission

Wisconsin Supreme Court Holds that an Interconnected Generating and Transmission System Cannot Be Treated as a Unit for the Purpose of Fixing Rates for Electrical Energy

THE Supreme Court of the State of Wisconsin has handed down an important decision involving the Wisconsin Railroad Commission and the city of Eau Claire. In its findings the court decides against the commission's action in permitting a power company to base its rates on the total investment in the system as a whole where that system supplies a number of communities many of which are more or less remote from the power stations.

Prior to June 1, 1914, the Chippewa Valley Railway, Light & Power Company owned and operated certain hydro-electric generating plants depending on two dams on the Red Cedar River. It also operated a dam in the city of Chippewa Falls and owned and operated a leasehold interest in the so-called Dells dam in the city of Eau Claire. At that time it was furnishing electrical energy for lighting and power purposes to a number of cities, including Eau Claire. It had also built a transmission line and was furnishing electrical energy to Red Wing, Minn., and had contracted to supply certain Minnesota cities along the Mississippi River from Red Wing to Winona. The plants then owned and operated by the company were ample to meet the demands for energy from the communities which were then supplied or to which service was contemplated.

On June 1, 1914, the Wisconsin-Minnesota Light & Power Company acquired all of the stock of the Chippewa Valley Railway, Light & Power Company. The former company owned the lighting plant at Red Wing, Minn., and another at La Crosse, Wis., the power for which was generated by a large steam plant. After the Wisconsin-Minnesota Light & Power Company acquired the stock of the Chippewa Valley company, it entered into a contract with the Consumers' Power Company (now the Northern States Power Company) of St. Paul, Minn., by the terms of which it agreed that when it had completed what is now known as the Wissota dam it would furnish for a period of thirty years thereafter 23,000,000 kw.-hr. of firm energy per year, for which it was to be paid 5½ mills per kilowatt-hour at a substation at Stillwater, Minn. It further agreed to furnish a like amount of surplus energy each year, for which it was to be paid 3 mills per kilowatt-hour. This energy was to be delivered over a power line 74 miles in length, now known as the "St. Paul high line," reaching from the Wissota dam to the St. Croix River opposite Stillwater, Minn. The estimated cost of the proposed dam and the St. Paul high line was $3,000,000. However, approximately $7,000,000 was spent on the project, and hence the contract with the Consumers' Power Company, predicated on a cost of $3,000,000, proved to be unprofitable.

The contract was modified in May, 1917. The Wisconsin-Minnesota Light & Power Company started on a campaign to procure a larger market in Wisconsin. At the time of the order of the Wisconsin Railroad Commission fixing the rates (Oct. 9, 1920) the Wisconsin-Minnesota Light & Power Company was supplying thirty-three cities in Wisconsin and nine cities in Minnesota. The cities originally supplied by the Chippewa Valley company, as well as those now connected to the company's lines, constitute what is called a "loop" system. After the construction of the Wissota dam numerous communities were added to the lines, so that the loop system was substantially enlarged.

RATES PREDICATED ON ENTIRE COST OF SYSTEM

In fixing the rates the Railroad Commission treated the loop—that is, all of the cities furnished and supplied by the Wisconsin-Minnesota Light & Power Company—as a unit. It divided the cities into classes, placing Chippewa Falls, Eau Claire and La Crosse in one class, Menomonie and Red Wing in another class, and all other cities or villages in a third class. It also divided the individual consumers into classes. But aside from such classification all municipalities and all consumers were regarded as a unit. The city of La Crosse, situated at least 100 miles from the Wissota dam, was given the same rate as Eau Claire and Chippewa Falls, located in close proximity thereto.

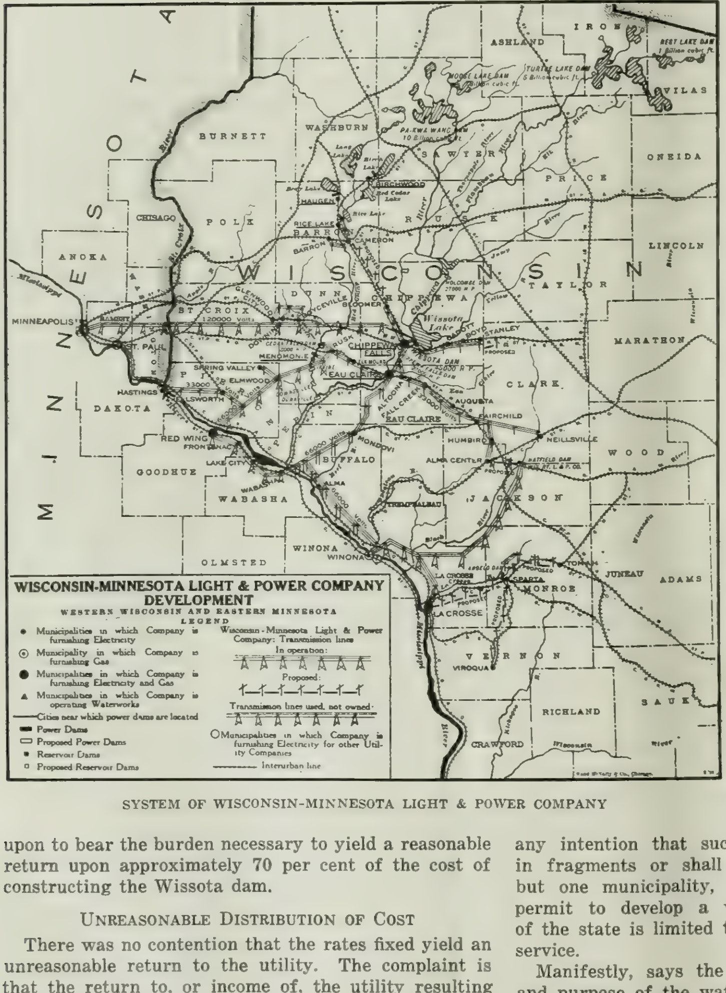
The Railroad Commission estimated that the plants originally operated by the Chippewa Valley company were unable to supply the demand for power coming from the present loop owing to the additional load and that the requirements of the present loop system for firm or constant power absorbed all of the firm or constant power generated by the original developments, as well as 71.68 per cent of the firm or constant power generated by the Wissota dam. In computing the investment chargeable to the loop system 71.68 per cent of the cost of the Wissota dam was therefore apportioned to the loop system.

In the lower court the appealing municipalities complained of this allocation and strenuously maintained that the commission had no right to regard the loop as an entity in fixing just and reasonable rates for service. The lower court, however, held that the action of the commission was lawful. It held, none the less, that an unreasonable proportion of the cost of the Wissota dam was apportioned to the loop and for that reason reversed the order of the commission. From the judgment so entered the Wisconsin-Minnesota Light & Power Company appealed.

INJUSTICE IN RATE STRUCTURE

In its decision affirming the judgment of the lower court the Supreme Court of Wisconsin said that it was deeply impressed with the thought that the fundamental basis upon which the commission proceeded in fixing the rates, and of which the plaintiff cities complain, results in great injustice to those cities and communities originally served by the Chippewa Valley Light & Power Company. As a result of the basis adopted by the commission those cities are now charged a higher rate to enable cities later brought into the loop to enjoy service at a lower rate than that at which they otherwise could be served.

The Wissota dam, the court says, would never have been built originally for the service of the Wisconsin municipalities. Its construction was prompted by the contract with the Northern States Power Company, and had that contract proved profitable it safely may be assumed that the utility would not have sought the market afforded by the various cities and villages which it added to the original loop system. The latter development, the court holds, was not economical, and by treating the loop system as a unit the cities originally furnished by the prior developments are now called upon to bear the burden necessary to yield a reasonable return upon approximately 70 per cent of the cost of constructing the Wissota dam.



SYSTEM OF WISCONSIN-MINNESOTA LIGHT & POWER COMPANY

Unreasonable Distribution of Cost

There was no contention that the rates fixed yield an unreasonable return to the utility. The complaint is that the return to, or income of, the utility resulting from the rates fixed by the order of the commission is unlawfully and unreasonably distributed among the municipalities constituting the so-called loop system. The question, therefore, before the court was whether the commission was acting within the legislative provisions in treating the loop system as a unit for the purpose of fixing the rates to be charged by the Wisconsin-Minnesota Light & Power Company to its consumers.

In its findings the court said: "Our water powers are no doubt an asset to our state. It is no doubt wise when a water-power site is developed that it be developed to its full capacity. It is probable that in the great majority of instances a market for the power cannot be found adjacent to or within convenient distance of the water-power site, and that in order to find a market for the developed power it will be necessary to conduct the same by transmission lines to distant cities. Whether or not a city adjacent to the power is to be deprived of the advantage of its location and made to bear the burden of a portion of the expense of carrying it to a distant city is a question of public policy which should properly be decided by the Legislature. It should not be established either by the Railroad Commission or by the court. . . . As to the wisdom of the policy we intrude no opinion. We simply say that when such policy becomes the policy of the state it should be by legislative declaration. . .

"Under existing statutes the commission is required to treat the municipality as a unit and to base its rates upon the cost to the utility of serving the individual municipality rather than the average cost of serving many distinct and scattered municipalities. Because the commission in fixing the rates under review treated the loop system rather than the individual municipality as the unit, it proceeded upon an erroneous fundamental basis and its order must be vacated and set aside."

In a dissenting opinion two of the judges maintain that there is no express or direct statutory language for the conclusion of the majority or in support of it by implication. Nowhere in the public utility law, they say, is there evident any intention that such utility shall be dealt with in fragments or shall be limited in its service to but one municipality, nor can it be said that the permit to develop a water power under the laws of the state is limited to any single municipal electric service.

Manifestly, says the dissenting opinion, the scope and purpose of the water-power legislation is an emphatic negation of the idea that the utilization of the "white coal" power of Wisconsin is based upon the theory of the existence of the right to any special or particular advantage by any particular community or set of individuals. If the theory adopted by the majority opinion is the proper one as to water power, there would seem to be no reason why it should not be equally applicable to steam railroads and all other utilities.

Improved Street Lighting That Assures Greater Safety to Traffic

Illumination Requirements of East Cleveland Thoroughfares and Residence Streets Analyzed—Nature of Fixtures Employed and Illumination Produced —Both Series and Multiple Circuits Adopted

By **EARL A. ANDERSON** and **O. F. HAAS**
Illuminating Engineers, Engineering Department,
National Lamp Works of General Electric Company

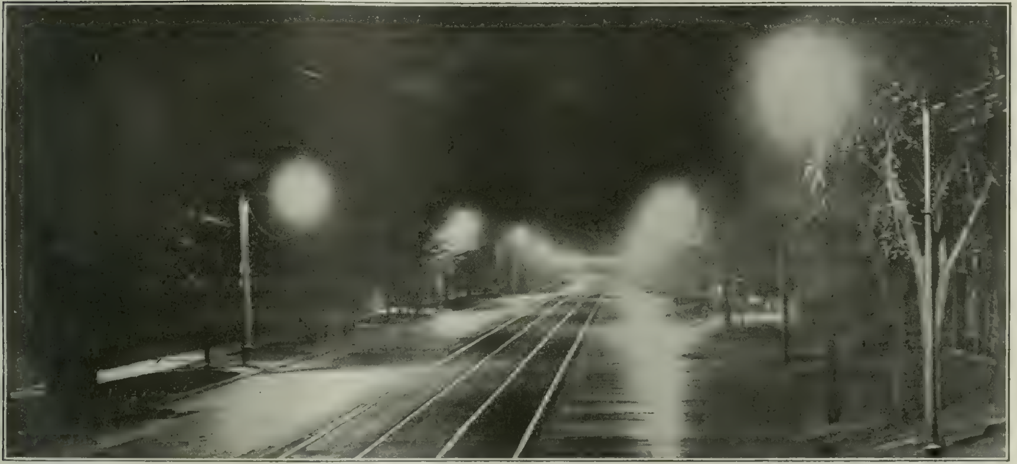


FIG. 1—NIGHT VIEW OF NEWLY LIGHTED STREET IN EAST CLEVELAND

THE same serious problem which has developed in nearly every city in the country in the past few years, namely, the revision of street lighting to provide an adequate system from the standpoint of safety, confronted the city of East Cleveland, Ohio, recently. Before the widespread use of the automobile the smaller cities had only local traffic of comparatively small volume on the streets. The tremendous growth of tourist and intercity passenger and truck automobile traffic, however, has meant not only a large general increase in the amount of street traffic but an especial concentration of traffic on the principal thoroughfares which lead through the cities. In effect, therefore, these streets in the smaller cities require lighting on the same level as was previously considered necessary only for thoroughfares in the large cities. Not only did this growth in volume of traffic develop new demands in lighting for traffic safety, but it also very largely destroyed the former isolation of the smaller city and made necessary an increased provision for lighting protection against crime and as an aid to the work of the police force.

The old street-lighting system in East Cleveland, which had been extended from time to time with the growth of the city, consisted of a total of 626 gas lamps and 108 magnetite-arc lamps. The comparatively low level of illumination provided by this system over the 43 miles of streets (39 miles paved) would have been considered fairly satisfactory in the days of horse-drawn traffic. However, C. M. Osborn, the city manager, and the Board of City Commissioners considered the old system entirely inadequate under the present conditions. Another factor in favor of immediate decision to change the lighting system was that in East Cleveland, as in many other cities, the supply of natural gas had diminished to such an extent that during certain periods of the year the illumination from the gas lamps was seriously affected.

Possible adaptation of the old gas-lamp posts to the use of electricity was considered, but the decision was against it in view of experience elsewhere where this plan had been followed. A review of these made-over installations indicated that the saving in cost to be expected was relatively small, and it was recognized that material sacrifices in the ultimate lighting result would be involved because of the fact that as regards location, height and construction the old posts were not of the character best suited to a system of modern high-efficiency incandescent lamps.

After a careful survey of the city all the streets were grouped into two general classes—thoroughfares and residence streets. "White-way" lighting, for which recognized good practice in a city the size of East Cleveland would be ornamental standards spaced from 75 ft. to 100 ft. apart and equipped with 1,000-cp. gas-filled lamps at a mounting height of from 14 ft.

to 16 ft., was not considered necessary as yet, since East Cleveland does not have a closely built business district.

The streets classed as thoroughfares included not only the main highways through the city but also those streets which serve as principal feeders to residential sections. These latter differ from the typical residence streets only in that they are somewhat wider and carry greater traffic. The streets classed as residential are characterized by slower traffic, mostly of pedestrians and drivers familiar with the streets. In planning the lighting this distinction between thoroughfares and residence streets was necessary, since in East Cleveland, as in practically every other city, the area to be lighted was so great in proportion to the maximum available appropriation that a careful analysis of the minimum illumination requirements of the different streets was necessary in order to insure maximum effectiveness from the system as a whole.

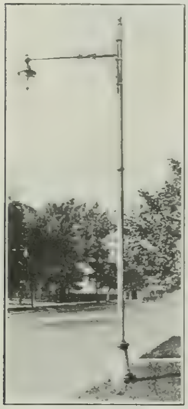


FIG. 2—TYPE OF LANTERN AND BRACKET STANDARD USING 1,000-CP. LAMPS

From this analysis the following deductions were assembled as representing fair minimum requirements which should be fulfilled by the new lighting system to be installed.

The illumination on the thoroughfares should be such that an automobile driver when moving at a standard rate of speed would be able to see a grown person or child in the street, or about to step from the curb into the street, in ample time to avoid accident; also that small obstructions or depressions would be clearly revealed. Passengers should be able to gage their footing quickly as they get on and off street cars, and it should be possible to read written addresses anywhere on the street.

The minimum requirements for reasonably satisfactory service on the residence streets should be such that obstructions or serious breaks in the pavement, or children playing in the street, will readily be seen by an automobile driver when going at a fair rate of speed, and that turns, dead ends and street intersections will be definitely marked. Any inequalities in sidewalks should be rendered visible, dense shadows from trees should be eliminated, and street signs and house numbers should be revealed. Enough light should be provided on front lawns and between houses to avoid dark hiding places; however, care should be exercised that equipment shall not appear unduly bright from the porches or upper-story windows.

Since only the minimum necessary quantity of light could be made available, it was considered imperative that the lamps should be carefully located and fitted with reflecting equipment which would most effectively control and redirect the light to the street surface. It was further considered essential that not only should the system be efficient but the lamp-post equipment and transmission system should be of a design which would not detract from the appearance of the streets. With this a system was required which would be flexible, reliable in operation and easily maintained.

The design which was developed and adopted as best meeting these requirements under the conditions in East Cleveland employs gas-filled incandescent lamps fitted with pendent refractor lantern fixtures of a new design, supported by ornamental bracket standards and supplied with energy from underground circuits. The new system totals approximately 900 lamps, of which about 600 are of the 115-volt multiple type and 300 of the series type.

Euclid Avenue, the most important thoroughfare, a 100-ft. street with a double-track street railway in the center, is lighted by ninety-three 10,000-lumen (1,000-cp.) lamps. The lamp posts are spaced at an average of 280 ft. apart on each side of the street and staggered. One lamp is provided, therefore, for every 140 ft. length of the street. On Euclid Avenue, as is the case to a considerable extent in other parts of the city, a large proportion of the side streets "dead-end" into the thoroughfares. In locating the lamps care was taken to place a lamp at the head of each of these side streets to provide an effective spread of light down the side street and to create an especially bright area clearly marking the intersection. The bright light at these points warns drivers approaching on the side street in ample time to slow down before turning into the thoroughfare. Previously, numerous serious accidents resulted from the failure on the part of drivers to realize that they were entering a thoroughfare in time to use their brakes and avoid collision.

On the wide thoroughfares carrying less traffic the lamp size was reduced to 4,000 lumens (400 cp.) and 2,500 lumens (250 cp.), at the same spacing as on Euclid Avenue. The equipment provided, however, is such that lamp sizes on these thoroughfares can be increased to 1,000 cp. whenever this becomes necessary without any alteration except adjustment of the socket position to focus the larger lamps. For the narrower thoroughfares the spacing was increased to a distance of approximately 200 ft. between lamps, instead of 140 ft. as on the wide thoroughfares. For the residential streets 150-watt (approximately 200-cp.) multiple lamps are employed, staggered and spaced approximately 200 ft. between units.

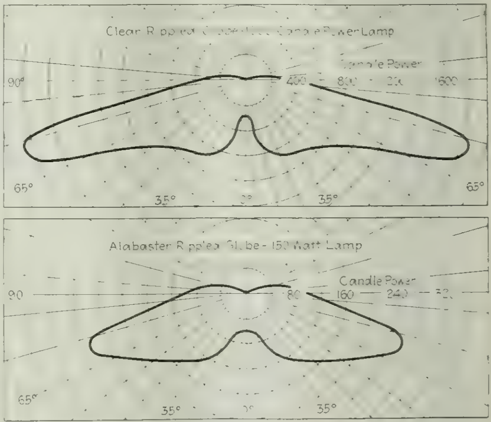


FIG. 3—DISTRIBUTION CURVES OF EAST CLEVELAND LANTERNS

The specifications developed for the equipment on the thoroughfares provided for a bracket-type lamp standard having a 6-ft. bracket and carrying the lamp at a height of 20 ft. above the surface of the street. Lower mounting heights have been found satisfactory with lamps of the same power as those used in the East Cleveland installation when employed at close spacings and with the light-colored surroundings characteristic of business district "white ways." However, under the conditions of thoroughfare lighting with wider spacings, where light backgrounds are absent and the general level of illumination is less, 20 ft. is considered the minimum desirable height.

The 6-ft. bracket length was adopted to bring the lamps out over the street and thereby to retain the advantages in lighting efficiency which have been conceded to the old-style mast-arm construction principle. A lamp position several feet beyond the curb increases the utilization of light on the street and greatly reduces the likelihood of interference with light distribution from overhanging tree foliage. Likewise, lamps placed over the street rather than behind the curb illuminate the vertical face of the adjacent curb as well as the one on the opposite side of the street. Particularly under adverse conditions, as when the street surface is wet, these illuminated curbstone faces are of material assistance to drivers by definitely outlining the boundaries of the pavement.

BRIGHT STREET SURFACE SILHOUETTES OBSTRUCTIONS

It has been pointed out a number of times that, except where there are levels of illumination of the order of those used in "white way" street lighting, considerable dependence must be placed upon seeing objects in the street at night by silhouette effect; that is, objects which are not in themselves lighted brightly enough to be easily seen are likely to be revealed as dark silhouettes against brightly lighted areas beyond, such as the spots of light beneath the street lamps. However, these bright spots of diffuse reflection are not found in the case of streets subjected to heavy, continuous traffic, where the pavement soon acquires a black polish from the action of the tires and the oil from engine exhausts. On streets in this condition, or on any paved street that is wet, the bright spots beneath the street lamps virtually disappear and the rays from the street lamps are specularly reflected by the surface, forming paths of brightness or glint from the pavement.

From the nature of this glint effect it is not possible to develop a sheen covering the entire pavement of a wide street from a single row of lamps. However, with a bracket system having lamps on each side of the street, spaced not too widely, these paths of light or glint merge into one broad strip giving a sheen of brightness covering practically the entire pavement and producing thereby a bright background against which objects may be seen in their true outline with such distinctness that an automobile driver is enabled to locate them and to estimate their rate of speed and direction of travel if they are moving.

The lamp standard which was adopted for the residence streets is similar in design to that used for the thoroughfares; however, the height of the lamp was made 16 ft. instead of 20 ft. and the bracket length was made 4½ ft. These dimensions were specified on account of the difference in the lighting problem presented by this class of streets.

The residence streets in East Cleveland are lined on both sides by shade trees in various stages of growth; hence the avoidance of foliage interference was a very important consideration. A common expedient in lighting streets of this character has been the adoption of a very low mounting height. However, in many instances, even though heights as low as 10 ft. have been adopted, interference from the low-hanging branches has not been entirely avoided. Furthermore, extremely low mounting positions greatly reduce the effective spread of light, necessitating extremely close spacings. At the same time, the light sources are brought directly within the line of vision of drivers, pedestrians and persons sitting on porches, with the result that serious interference with vision and trying glare effects have often resulted. The 16-ft. mounting removes the light sources sufficiently from the ordinary range of vision to avoid objectionable glare effects with lamps of the candlepower used. The tree-foliage clearance afforded by the bracket design at this height was, furthermore, found to be fully as effective as that which would have been obtained from a low upright post. Another advantage is that the bracket brings the light source out from the line of tree trunks in such a way as to avoid dense tree-trunk shadows parallel with the sidewalk. In working out the plan of location for the lamps, a staggered arrangement was adopted to give a further important insurance against dense shadows by providing light from different angles.

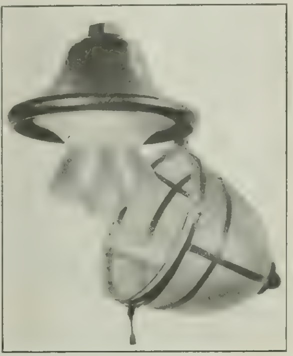


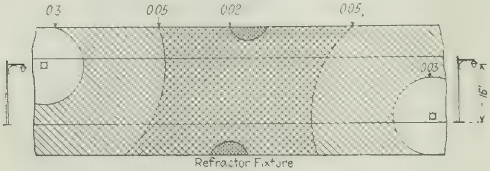
FIG. 4 — INTERIOR CONSTRUCTION OF NEW BRACKET-TYPE PENDENT REFRACTOR LANTERN

The clearance of overhead railway bridges, 15 ft., determines the maximum height in East Cleveland of moving vans and other trucks; hence, even though the lamp brackets extend over the street pavement, clearance of truck tops is assured.

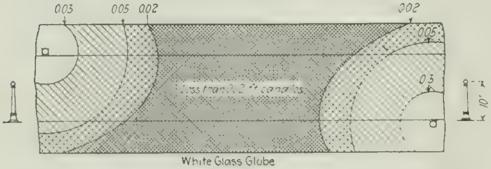
In developing the new lantern fixture used in the East Cleveland installation it was aimed to retain the efficiency in light distribution of the standard pendent street-lighting units of the refractor type and at the same time to realize a desirable ornamental appearance both by day and by night. Figs. 2 and 4 illustrate the appearance and construction of the new unit, made in two sizes—the larger being employed in East Cleveland on the thoroughfares and the smaller on the residence streets. To the casual observer the unit appears to be a sectional paneled lantern. However, the construction actually involves only a one-piece rippled-glass globe supported by a basket formed of copper bands. The top of the lighting unit is a single casting to which the basket is hinged. A fired porcelain-enameled reflector is bolted to the casting and serves the additional purpose of supporting the dome prismatic refractor.

In order to reduce the loss of light due to collection of dirt to the lowest possible amount a felt globe seat is provided, against which the globe is tightly held by a spring hinge and bolt. The dimensions of the lantern are such that even with the largest lamps used the heat is safely dissipated by radiation. Consequently, no ventilation whatever is provided and all the light-reflecting surfaces are inclosed in a bug-proof and virtually dust-tight chamber.

Candlepower distribution curves of the units are shown in Fig. 3. Nearly all of the light from the unit is directed downward toward the street surface, with the highest candlepower at the angles which cause the light to be incident on the street in the area midway between lighting units. This distribution of light is obtained with the aid of the dome prismatic refractor, which fits over the lamp and serves to redirect downward and outward the otherwise almost valueless upward rays from the lamp. Fully 50 per cent more light is made useful on the surface of the street with equipment of this character than with the ordinary opal globe. A practical comparison of foot-candles on the street surface delivered by the East Cleveland lanterns mounted on brackets 16 ft. above the street and by upright opal balls on 10-ft. posts at similar spacing distances and with lamps of the same power is afforded by Fig. 5.



Refractor Fixture



White Glass Globe

FIG. 5—STREET-SURFACE ILLUMINATION IN FOOT-CANDLES WITH REFRACTOR AND WHITE-GLASS GLOBES

An incidental advantage for residence street lighting in the case of a light distribution such as that of the East Cleveland lantern which avoids high candlepowers above the horizontal is that there is no excessive brightness directed toward upper porches and the windows of sleeping rooms.

The outer globe, which is of clear rippled crystal glass in the case of the thoroughfare-lighting units, and which is of rippled glass with a trace of opal giving somewhat increased diffusion for the lamps on residence streets, serves to break up the concentrated beams of light from the refractor sufficiently to spread and soften them, but does not materially reduce the directional effect obtained from the refractor. The function of the rippling on the globe may be likened to the nozzle on a hose which breaks up the solid stream of water in a softened yet well-directed spray. When lighted at night, the rippling gives the effect of innumerable minute prisms with a resulting life and sparkle to the lantern. The globe is not evenly luminous as in the case of the ordinary dense opal glass globe. Instead, there is a central brighter area which shades off somewhat, while the contrast between the metal bands and the lighted glass sharply defines the limits of the light source and gives a lantern effect.

The five-paneled basket was so designed that it would not materially reduce the useful light on the street. In practice, since one of the vertical bands is placed to face the lamp post, the open panels fall in such positions as to distribute the light on the street most effectively.

The lamp standards used in the installation have a drawn-steel shaft. This shaft extends directly into the ground, where it is embedded in a concrete base. The underground conduit is led out of the ground under the cast-iron base which surrounds the shaft of the lamp standard. The feed wires are carried up through the hollow shaft and inside the bracket to the lamp. Since the lighting unit is held rigidly in place by the bracket, the light is at all times steady and the objectionable variations introduced by the swinging of loosely hung pendent lighting units are avoided.

In certain locations it was desired to connect an overhead loop to supply the lamps, and this was easily arranged for by clamping an insulator bracket near the top of the pole and drilling a hole in the bottom of the bracket through which the leads were carried concealed in the bracket to the lamp.

No provision was made for lowering the lamps of the thoroughfare or residential systems, since it was calculated that the maintenance work could be carried on more efficiently and economically with the use of a tower wagon mounted on a light truck. This plan of maintenance entirely avoids the possibility of accident due to a lighting unit falling to the street and eliminates unnecessary breakage of lamps and glassware, which must be anticipated in installations where the lighting units are lowered for cleaning and renewals. A systematic schedule has been adopted which provides for thorough cleaning of the glassware by washing at intervals of approximately six weeks. At the same time, blackened or defective lamps which have lived beyond rated life but have not failed by burn-out will be renewed.

Cost conditions vary so greatly in different localities that installation cost figures are of questionable value. However, the average expenditure of the city for the multiple-lamp standards installed, including underground construction and time switches, was $131.53. The total annual operating cost of the complete new system, including payment for energy, lamp renewals, maintenance, interest on bonds, sinking fund provision, etc., is $45,000.

Features of the underground circuits feeding this lighting system will be discussed in a later issue.

Winnipeg Hydro-Electric System Ranks Sixty-sixth

THE hydro-electric system of Winnipeg, Manitoba, reports an output of 125,124,855 kw.-hr. in 1921. This report, just received, indicates that the system should have been included in the tabulation of North American generating and distributing companies having an output of more than 100,000,000 kw.-hr. in 1921, which was published in the April 29 issue of the *Electrical World*. The Winnipeg system would have ranked sixty-sixth in the tabulation. Of its total output, 60,494,902 kw.-hr. was sold to lighting customers, 36,978,097 kw.-hr. was sold to power customers, 23,000,000 kw.-hr. was used in intercompany business, line losses, etc., and 5,000,000 kw.-hr. was sold to customers for water heating and sign lighting at flat rates. The peak load was 34,264 kw., which was the record on Nov. 23, 1921. The system generates all its energy.

A Plan to Finance the Electrical Retailer Locally*

An Analysis of the Urgent Need That Exists for More Money in the Contractor-Dealer Business—Description of Method by Which It May Be Established as a Prosperous Local Business

By **HOWARD A. LEWIS**
Business Manager Electrical Merchandising

DUN and Bradstreet in their analysis of business failures say that inadequate working capital is one of the chief causes. Trying to do business without enough invested money and the wrong use of capital that is available are responsible, they say, for 29 per cent of all recorded business failures. Does this statement mean anything to the electrical retailing business? I think it does.

The merchandising business originally started in the electrical industry by the central-station companies selling appliances at cut prices. In some places they gave appliances away, because central stations saw this business in terms of current consumption. They financed their appliance business by charging it to "operating expense." Then contractors began to get calls for merchandise as the direct result of the central stations' activities, and the contractors financed this new business by ordering from their jobbers. They made use of their regular line of credit. This was before 1910.

Soon after we find the manufacturers starting national campaigns to sell appliances to the public, and contractors were systematically solicited to make retailing an organized part of their business activities. But the need for additional working capital was never suggested. This new business was to be financed by longer lines of credit from the jobber with a quick turnover of the merchandise. Yet "turnover" was and still is "Greek" to the average electrical contractor.

THE GREAT SPECIALTY BOOM

During the war period—from 1915 to July, 1920—came the great "specialty boom." Central-station companies retired as purveyors of merchandise. Electric specialty shops and house-to-house organizations came into existence. Curbstone contractors went to work in the shipyards. New manufacturers came into the industry with household specialties. The washing-machine business became the wonder of the industry. House-wiring work and general electrical contracting were paralyzed. There was a tremendous public demand for household labor-saving devices.

Contractors took their working capital that was invested in contracting and invested it in merchandise. Prices were rising, and the more merchandise they bought the better their balance sheet looked. Jobbers increased their lines of credit to contractors for merchandise purchases. New manufacturers gave lines of credit direct to contractors, and time-payment methods of financing came into popularity. This was a new use of credit, but not additional capital.

Three things happened to the profits made during this period—first, they were spent; second, they were invested in merchandise; third, they were invested in accounts receivable. Those profits invested in merchandise and accounts receivable became an addition to the working capital invested in the electrical retailing business—the first real addition that had been made. But when the boom broke in July, 1920, and prices began to fall and purchasers to default on time-payment contracts, this additional working capital depreciated and to a large extent disappeared.

THE VALLEY OF DESPAIR

During this period, from July, 1920, to 1922, contractor-dealers were in red ink, and of course these red-ink deficits represented a reduction in working capital. But the contractor-dealers had a tendency to blame the merchandising end of the business for their troubles, rather than the general economic conditions, and as a natural reaction there developed a desire on their part to get back into contracting. On Jan. 1, 1922, the actual available working capital invested in the business of the contractor-dealers was on a par with the amount invested on Jan. 1, 1917. Five years had passed and there was no increase in capital, and we must bear that fact in mind.

The first six months of 1922 shows a revival of building activity, based on permits let, that almost equals any record ever set for the same period. Furthermore, the average size of a wiring job has increased, for a greater number of outlets to give the present standard of service is required. As a result every wiring job today represents a larger financial transaction. Contractor-dealers will need all of their available working capital to finance needed contracting work, plus additional credit from jobbers, plus all the additional credit they can get based on the hypothecation of time-payment contracts covering wiring jobs. From a financial point of view, therefore, where does the retail end of the electrical business "get off"?

SOURCES OF CAPITAL

There are four sources of supply today for retail working capital in the electrical industry: First, the central stations have millions of dollars of new retail capital, appropriated by boards of directors of the larger syndicates, for men of this type see the advisability of aggressive retail merchandising now. "The more and better business campaign" initiated by the National Electric Light Association is an expression of this changed point of view. They want to sell merchandise to fill up the valleys in the load. I do not anticipate price cutting by central stations, but I do prognosticate that within two or three years much of this new capital will be withdrawn from the merchandising business and used for other purposes.

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*An address recently presented before the Westinghouse Agent-Jobbers' Association.

Second, there are the non-electric stores: Department and music stores particularly will put up additional working capital for financing radio sales, though not so much new capital for other electrical lines. But service work will slow up their activities, increase their general overhead and reduce the return on the capital invested in radio.

Third, there are the manufacturers, who will be opening up their own retail stores and financing their own house-to-house campaigns.

Fourth, there is the possibility of refinancing the contractor-dealer with additional working capital to be raised locally. And in this plan we will consider only the better-class contractor-dealer, say 10 per cent of the total number, established in smaller cities and larger towns, communities with 1,000 wired homes as the minimum.

TYPICAL SMALL CITY SET-UP

As a background let us get a picture of the financial situation in the average small American city or large town. Every town has its J. P. Morgan and its capitalistic group. Every town has its revolving pool of restless money-seeking local speculative investment. This money is not interested in outside speculative ventures. It is not used for general investment in stocks or bonds of large organizations. The money I am talking about wants to stay at home where its owners can watch it and have a voice in its management.

In the financial set-up of any town there is always this one richest man, who is interested directly or indirectly in one or more of the local banks. This man is the local J. P. Morgan. He has a circle of personal friends who are directors in the banks and in the other enterprises in which our richest man is usually the heaviest stockholder. This makes up the inner clique.

Usually there is another financial clique, headed by a local capitalist, interested in the second strongest bank in town. There is always more or less rivalry between these two cliques. If the town is strong financially, there may be a third clique. But the financial hierarchy of the town is made up of not more than fifty men. From two to five are listed as capitalists; two or more are lawyers; one or two are real estate men; one or more are local merchants, never over five; one or more are doctors with wealthy wives; one or more are manufacturers, if the town is in the East or Central West.

This financial hierarchy meets unofficially at some downtown club or at the country club. It has developed a class consciousness in terms of money as a result of the Liberty loan drives, Red Cross drives and other wartime civic activities which brought all the little cliques together as the moneyed group and unconsciously developed a local Wall Street spirit.

But these local financiers' only contact today with the electrical industry is through the manager or chief executive of the local central station. They know locally the money-making possibilities of the automobile business, but they do not know the local money-making possibilities of the electrical business.

Have you ever stopped to figure out how the local automobile business was financed? There is some valuable experience here for us. The local J. P. Morgan bought one of the first ten cars ever sold in his town. He then got interested in automobiling. From automobiling he got interested in the automobile industry. He saw the local possibilities for the investment of some of his money in this industry where he could watch it personally. So he helped finance some aggressive salesmen of the mechanical type, or else he financed his wife's nephew, who wanted to sell cars of the Stutz variety. He got the local bank, of which he was an officer or director, to give this new sales agency an adequate line of credit. And there you are.

For twenty years the civilized world has marveled at the supersized automobile factories with their quantity production, shipped on a C.O.D. basis. But the automobile business would not have grown as it did (despite the great latent consumer demand) if local capitalists and local banks had not financed local dealers. In 1920 we hear of Ford in financial trouble with short-time bank loans maturing and a syndicate of Wall Street bankers ready to take over the business. Next we hear of Ford making forced shipments to his dealers C.O.D., and in 1921 we see Ford making money as usual. It was the small-town financier who directly or indirectly was forced to come to Ford's rescue. Ten thousand little Wall Streets beat the big street, though they did it unconsciously.

OUR NEED FOR SUCH SUPPORT

Here is one precedent and it is well for electrical men to study it, for there are several reasons why our contractor-dealers must receive help through local refinancing. Millions of dollars are invested in our manufacturing plants and equipment, yet the central stations and non-electric stores cannot absorb the output, while additional new electrical devices are bidding today and will be bidding tomorrow for retail capital. Total possible electrical sales to the home already equal the price of a good automobile, but with a greater potential sales expense, because there are many cases where the idea of the use of the appliance must be sold first.

Our jobbers want and need more business, but they cannot afford to give more credit to contractor-dealers for merchandise—particularly in view of the immediate expansion in house wiring. But if manufacturers try to build their own local retail sales organization to take care of factory output, it will cost them more money than their present dealer spread, and retail prices will therefore be forced up rather than down, which will reduce volume. Furthermore, manufacturers and jobbers are better organized today to help get the good contractor-dealers refinanced locally than they are to organize their own local retail sales outlets. For helping the good contractor-dealer to get money locally is only a sales job, while operating a retail store is a sales, an organization and a financing job.

Clearly, therefore, the opportunity lies in the interest of local capital in the development of the electrical retail business, and I wish to submit a detailed plan by which, I believe, this local financing can be arranged. It is a job of promotion that can be carried out in these five steps:

First Step.—Through the existing jobbing sales organizations locate the contractor-dealer with sales and managerial ability. I know of one dealer who made in 1921 better than 33⅓ per cent on his investment of $8,500. The local capitalist that would put up $5,000 or $10,000 additional money in this man's business would have a speculative business investment that would satisfy the most exacting three-ball money lender.

Every jobbing organization has today an *informal* list of good accounts of this kind.

Second Step.—Have the jobbers' sales manager or a special representative (who may be a manufacturer's man) get in touch with the local central-station executives and do these things:

1. Get inside facts on the local financial hierarchy.
2. Sell the central station the plan and get its moral if not its actual support.
3. Get information from the central station regarding the number of houses wired and the various devices in use, so that you may get a true picture of the local merchandising situation.
4. Get central-station executives to introduce the special representative to the local J. P. Morgan and the other local financiers.
5. Have the special representative meet and get acquainted with the publishers of the local papers, for if the central-station executives cannot or will not give you the local financial information, the newspaper publishers will, if you tell them your plan.
6. Have the special representative talk with the contractor-dealer "prospect" and find out which of the local financiers he knows personally, which he knows by reputation, and which men in this group he particularly respects and admires.

Third Step.—Then invite the contractor-dealer prospect to the head office—invite him as a business guest. Let the principals of the jobbing organization talk frankly and fairly to the contractor-dealer about his business, the merchandising possibilities in his town, his present financial set-up and his need for more working capital. Suggest to him that he raise that capital locally and offer to co-operate and point out the definite men that the contractor-dealer can go to—particularly those men who have helped finance the local automobile dealers.

The success of this entire suggested plan depends primarily on this man-to-man interview, for the average contractor-dealer, in his own heart, does not see himself as a full-fledged business man on a par with the local dry-goods merchant and hardware-store proprietor. In his own mind he is a cross between a master artisan and some sort of a specialist. While he buys and sells and keeps some sort of books and receives credit, he does not see these things as fundamental business operations on a par with the work done by jobbers and other business men.

Work out in detail a possible refinancing plan, with maybe an alternative plan—one based on a partnership arrangement and the other predicated on the issuance of stock. The point is that you will have given the contractor-dealer something definite to take to the local capitalist. You will have put the contractor-dealer in a stronger trading position when he negotiates with the local moneyed men if he takes to them a businesslike proposition first and does not have to wait for them to make him an offer.

After the refinancing plan is worked out, let the jobber tell the contractor definitely what he will do for him in terms of an additional line of credit, sales helps, and advertising, predicated on the contractor raising this new capital locally.

I believe there are many good contractor-dealers already "sold" on the idea of getting more money in their business, but because they do not know how to work out a refinancing plan, they fail to take the first step for fear they will show their financial ignorance.

Fourth Step.—Next have the special representative see the local capitalists who the contractor-dealer would like to have invest money in his business. Usually one man, maybe two, can put up all the needed money. "Sell" these local financial men these seven things:

1. The electrical industry and its future.
2. The local possibilities and some definite ways in which money invested locally will make money.
3. The personal use of appliances, for if these local men are not using major electrical devices in their own homes you had better stop right there. There is still a job to be done.
4. The technical or specialized ability of the contractor-dealer prospect.
5. The contractor-dealer's money-making possibilities if he were properly financed.
6. The new money (approximately) that the contractor-dealer should have and why—in terms of lines to be pushed locally.
7. What the jobber's organization is prepared to do if the contractor-dealer obtains more money.

Fifth Step.—Then have the special representative bring the contractor-dealer and the moneyed man or men together, and he may or may not be present at the interview. Also, if possible, bring the central-station executives into the picture by getting them to express a willingness to co-operate with the enlarged organization. Then follow through and don't let the contractor-dealer become discouraged if the plan fails to strike fire on the first try. For time is a factor in all such negotiations.

A CONCRETE EXAMPLE

I have outlined this plan in detail in an effort to bring out all the variables in the problem, although there are simpler ways of accomplishing the same result. But I am sure of one thing—I know that contractor-dealers can be refinanced locally because I have the proof. There is a town in southern New Jersey which less than four years ago had five or six electrical contractors—the struggling kind, the unhappy kind, the kind we all try to uplift, the slow-pay kind.

This one had a different point of view. He had formerly worked for the local lighting company, but he had a little capital and started in business for himself. He instinctively resented being a slow-pay account—and he saw the possibilities in doing a real retail business.

This same town had its local J. P. Morgan and his financial cohorts. The local financial picture that I have painted was complete, and the contractor that I am telling you about analyzed himself and his business in this way and decided that what he needed was money—working capital. So he went to the local J. P. Morgan and he sold him. He sold him the electrical industry. He sold him electrical devices for his own home. He sold him the local electrical money-making possibilities.

He got the money he needed—and he has built up a real business that has paid dividends. And the local financier is satisfied because he gets a good return on his investment—also his money has helped build the town by establishing a real electrical business.

And what has been done there can be done in other towns, but to do this big merchandising job nationally there are 2,500 businesses that need on an average $10,000 each of additional capital. That totals $25,000,000. It is time that the electrical industry set to work to raise this kind of money locally.

179 Electric Appliances Under One Roof

A Survey of a Large New York Apartment-Hotel Shows a Greater Appliance Load Than That of Either Lighting or Power

By Mary Ormsbee Whitton
The New York Edison Company, New York

A SURVEY recently made by the New York Edison Company in one of New York City's large apartment-hotels develops the interesting fact that the appliance load there exceeds either the lighting or power load. It has been known, of course, for several years that in the modern home, well equipped with electric labor-saving apparatus, the appliance load would normally exceed that for lighting. The lighting load of an eight-room house, for instance, would probably come to about 1,000 watts, while the possession of an electric flatiron, a vacuum cleaner and a percolator would more than balance the entire lighting load. The noteworthy feature of this apartment house survey is that apparently every apartment in this large building is well furnished with enough household appliances to make the aggregate load heavier than that of either the passenger elevators or the lighting of the entire building.

Beginning first with the summary, it was learned that in this building the company's lighting load is 114.395 kw., the total power load is 138 kw. and the total load from electric appliances is 148.419 kw. Before proceeding, however, with an analysis of the report, it must be pointed out that the figures given by the survey probably underestimate the actual appliance load by at least 10 per cent, owing to practical difficulties encountered. For instance, when apartment owners were absent at the time the surveyors called, the management arranged for the admission of the company representative, who listed such appliances as he could see, but in one small apartment, besides those which were in plain view, we have learned that the owner had a vacuum cleaner, an electric flatiron and an electric fan.

Proportion of Convenience Outlets

In this building there are 3,363 lighting sockets and also 385 outlets in baseboards, walls and floors. On the face of it, this seems like one convenience outlet for every eight and one-half lighting sockets, not a very high proportion, but it should be remembered that this building is an apartment-hotel, with a large amount of restaurant, wall and stair lighting, quite aside from the lighting within the tenants' apartments. Taking one sizable apartment by itself, the list gives forty-three lighting sockets as against twenty-one wall and baseboard outlets. In the smallest apartments in the building the rate seems to be four lighting sockets for every baseboard outlet. It therefore appears conclusively that in the better grade apartment building the campaign for more convenience outlets has produced results.

A further analysis shows that with an appliance load of 148.41 kw., carried largely by 385 convenience outlets, the average load for each wall, baseboard or floor outlet is 385 watts. This is a fact worth consideration in estimating the size of feeders in buildings of this kind. The old figure of 50 watts for each lighting socket can no longer apply when convenience outlets enter into the calculation. Granting that some allowance must be made for diversity of use, the fact remains that probably in many cases insufficient allowance is made in estimating the probable load represented by convenience outlets in a building of this class.

As to the actual list of appliances found in this building, which operates its own hotel kitchen, the tenants had 123 electric cooking devices of various sorts, from large ranges requiring special wiring to electric toasters. The census shows seventy-four grills and small stoves, two egg boilers, three large stoves, two hot-plates, one waffle iron, twenty-three percolators and eighteen toasters. Electric flatirons form the next heavy item, some forty-two of these useful objects being located by the investigators. But one electric heating pad appears on the list, a figure which undoubtedly reports what was found, but is probably explained by the fact that owners of electric heating pads forget all about them until a toothache brings the subject to mind.

Similarly three hair curlers, two hair driers and one vibrator is a comparatively small showing for electric toilet articles, usually so popular in homes where expense is not the first consideration. Again it seems highly probable that many of these useful trifles remained securely reposing in their owners' toilet tables.

Smaller Appliances Predominate

The comparative scarcity of power appliances is explained by the general standard of living represented by the apartment hotel. For instance, one of the large apartments boasted a dishwasher, a knife sharpener and a buffer, thus indicating that the owner is accustomed to entertaining fairly lavishly within his own domains. For the most part, however, the hotel grill and restaurant offers a much easier method of providing formal dinners. Two electric washing machines and one electric ironer were found. It is assumed that the dwellers in the small apartments probably patronize the laundry. But one sewing machine appears on the list, a figure which is likely to be a little low.

The use of electric appliances reflects hotel rather than ordinary residence conditions. The living quarters range from a few one-room apartments, really hotel accommodations, through many apartments of three, four and five rooms, to a few apartments of nine and ten rooms, the equivalent high-grade residence conditions. It is found that in these larger apartments the electric equipment also is on a residence basis, one of these dwellings being provided with practically a complete equipment, including washing and ironing machines, electric refrigerator, vacuum cleaner and exhaust blower for the kitchen. The small apartments fairly blossom out with toasters, grills, percolators and other small table appliances. The various larger apartments throughout the building possess no less than sixteen electric stoves and ranges requiring heavier current than that obtainable through the ordinary lighting circuit. Of these, one was a range with a capacity of 6,500 watts, two were rated at 4,500 watts, one at 3,500, one at 2,860 and one at 2,500. The ten others were approximately of the same size, being counted at from 1,300 to 1,370 watts apiece. This display of the larger electric stoves is rather remarkable in a city such as New York, where there has never been any special cooking or heating rate available.

In all there were 179 appliances listed as in apparent habitual use under that one roof. And in spite of the high degree of service afforded by the hotel itself, these additional electric comforts provide the largest load in the building.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

A Question of Copper

To the Editors of the Electrical World:

Why do America's public utility undertakings use up copper four times as fast as is necessary? Is there any good reason why this must continue?

The electrical engineer from abroad comes to America to find advanced practice in things concerning his profession, and is not by any means disappointed on the whole, but right at the revenue-earning end of the business of electricity supply he finds an extremely low voltage of distribution and wants to know the reason for it.

Other countries, almost universally, deliver at 220 volts for domestic purposes, and the advantage over this country's practice may be seen at a glance in the equations: $V \times C = C^2 \times R =$ unit weight copper, 110 V; $2V \times \frac{1}{2}C = \frac{1}{2}C^2 \times R =$ one-quarter the former weight for the same power and area, at 220 volts.

Danger to users is not convincing, since the Old World has as many 220-volt consumers as America has 110. There they fix 250 volts as the point for caution, since that voltage will force a current of 1.25 milliamperes through the 200,000 ohms low average resistance of the human skin, and it needs quite twice that current to kill the human being.

Supplying at 220 volts leaves 30 volts within the safe limit of pressure for allowance to be made for "drop" and also for the artificial "ground" potential of the "middle" wire of a three-wire system.

Fixing the structural superiority of lower voltage lamps at 10 per cent in favor of 110-volt lamps over 220-volt, the user would hardly feel the difference, even if the public utility undertakings did not make it good in reduced rates, justified by, say, a 200 per cent saving in initial distribution outlay, while the 10 per cent extra demand would be most welcome to manufacturers.

Points of importance other than cables and lamps are that the smaller the current the smaller the switchgear, the panels to carry it, the rotaries and the secondary coils of transformers, all of which carry in their train less space and less money wasted in transit and handling, combining to lower the diversity factor of capital represented by the fraction resulting when cost installed is divided by cost at manufacturers' doors.

Manufacturers, who presumably trade on the fashioning of articles rather than retailing the raw material those articles contain, benefit exactly as above, requiring less space for raw material and finished goods, smaller works, less power to machine and manipulate the lighter articles, and would meet foreign demands without having to create and maintain a special section of their organizations for this purpose.

This case is put up for the electrical industry without apologies to the copper and transit people, for though the natural wealth of the country's copper would not be used wastefully, there is always export to fall back upon, and export markets usually bid higher than home ones.

There are probably thousands of prospects, public and private, that are held up for want of just sufficient funds, or perhaps because the outlay is just beyond the scope of anticipated revenue. What proportion of these will come within the range of feasibility if 220 volts, as against 110, brings a prospective figure of, say, $100,000 down to $75,000 if generating plant is included, or lower still if it should be a purely distributing scheme?

It might be that such developments alone would compensate the copper mines and railroads for the nation's more economical use of copper. The coming of the economical metal-filament lamp did not hurt the electricity supply companies; it brought more consumers and reduced that nasty eyesore, the "peak" load.

As with metal filaments, so with copper; so with everything, for that matter, from the historical introduction of penny postage right down to "5 and 10 cent" stores. The Woolworth Building of New York City should be nationalized as a monument to the proved fact that dollars pile up just as readily in nickels and dimes as they do in whole "bucks."

Consideration for copper gave birth to high-tension transmission and extra high tension. America is by no means backward in this direction, showing that the matter is fully appreciated. For every mile of transmission there might easily be 50 miles of distribution; why, then, is this not having more attention?

New York City. L. H. B. SANDWELL.

[What our correspondent says is all too true. Unfortunately, however, the United States has standardized on the lower voltage and some means must be found for amortizing the enormous investment in this low-voltage equipment before any change to a high voltage can be considered. If lamps only had to be changed the problem would be very simple. They are replaced after burning 1,000 hours. Not so, however, in the case of motors, transformers, generators, etc., the normal life of which is reckoned by years, not hours.—EDITORS.]

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Chinese Power Plant Burns Grass

To the Editors of the Electrical World:

Some installations of scientific and engineering equipment in China are curiosities indeed. The writer has recently seen a small electric light plant that is in a class by itself as a curiosity. The plant is in the village of Shui-kow, 150 miles inland from Foochow. It is an old 15-kw. direct-current outfit run by a steam engine, all being of German make of the vintage of the early nineties. The nominal voltage at the machine is 120, but it was actually 107, while at the far end of the village it must have been much less as the lights there were hardly red. They were fairly bright in the end of the village near the power plant.

The most interesting thing was the fuel. The operators of the plant had tried both wood and coal and had not been able to make ends meet. It cost them $16 a day for fuel. Then the "chief engineer" had an idea. The mountains all round were covered with sword grass about 8 ft. high, and it could be had for the cutting and carrying. So he rebuilt the furnace and now burns grass for fuel, saving $10 a day, and the company is accumulating dividends. PAUL P. WIANT.

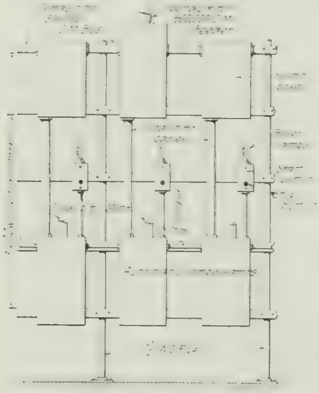
Fukien Construction Bureau,
Foochow, China.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Neatly Arranged Motor Compensators

An industrial manufacturing company planning an extension to its plant, which was to be equipped with a large number of individually motor-driven machines, found itself in difficulty properly to interlock the control devices to insure the proper sequence in starting and stopping the various motors. Each machine was to be equipped with a motor from 5 hp. to 40 hp. and each piece of apparatus usually depended upon some other piece of equipment. The questions involved were the starting and continuous running of certain conveyors upon upper floors before the elevators carrying the material from lower floors to the upper floors were started. Another question was the starting of elevators ahead of certain crushers and conveyors which discharged their product directly into the elevator boots. All the machines were motor driven and operated usually in groups of three situated possibly on different floors.


CONTROL PANEL THAT INSURES PROPER SEQUENCE OF MOTOR OPERATION

The design finally decided upon for the control of the motors was a remote push button control type of automatic compensator equipped with overload relay and low voltage release. The control circuits were interlocked so as to prevent the operation of certain motors driving apparatus in the groups which should not be operated until motors operating first had been started.

In supplying the power for the motors a 600,000-circ.mil three-conductor feeder was brought to the middle of a secondary bus that feed the bank of automatic compensators which were mounted in a row in a hallway on a pipe frame support. These compensators are fed from the 300,000-circ.mil secondary bus which extends through the twenty-one switch boxes for the motors as in the section shown in the accompanying illustration. These are connected by short sections of conduit and contain a three-pole switch which will cut out completely all equipment on that circuit when it is open.

Directly under the switch box within easy reach when the operator is standing on the floor are the master control "Start" and "Stop" push button boxes mounted in a row just above the automatic compensators. In addition to the "Stop" push button on each master control box there are a number of these buttons located conveniently near the motor and also near apparatus driven by each motor so the motor can be stopped in case of accident from several points. To start the motor up again there is only one button, which is located at the compensator. As a safety precaution the man in control of all operation is the only one allowed to restart the motor.

Motor Circuits Interlocked

As the type of automatic compensator used is inherently equipped to open in case of low voltage upon the power line, it is an easy matter to have certain of the compensators equipped with an auxiliary switch which will operate the push button control circuit for the next compensator. It is so arranged that the No. 1 compensator in each group must be in the running position before the "Start" button on No. 2 compensator in the same group will have any control upon its compensator, and so on for any number of compensators in one group. In a similar way when No. 1 "Stop" button in the group is pressed, the control circuit for No. 2 compensator is automatically opened, which in turn opens No. 3, and so on. Consequently if any "Stop" button is pressed, or if any control circuit is opened automatically or otherwise, all the other higher numbered control circuits will automatically open successively. This stops all of the motors in the cycle of operation beyond the point in which the open occurred, thus preventing conveyors and crushers from clogging up elevator boots and elevators from overfilling the conveyors.

A. L. Williams,
Consulting Engineer.
Niagara Falls, N. Y.

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Method of Comparing Value of Insulating Varnishes

Determination of which of several products is the best for the money must take into account both intrinsic merit and cost, and in cases where little is known of the materials experience must be allowed to weight the decision. A method* whereby these requirements can be applied to the selection of insulating varnishes was presented at the recent convention of the American Society for Testing Materials by John A. Findley, who spoke in part as follows:

> An arbitrary basis of comparing insulating varnishes can be established either from the average results of tests on a number of representative materials or by the individual investigator considering the best value in any given test as a basis with which the values given by the other products are to be compared numerically. For instance, if on the test of three varnishes we obtain an acid resistance of ten, eight and six hours respectively, ten is considered the base and the other relative values are eight and six. If in these same samples the respective disruptive strengths are 1,000, 1,400 and 1,500 volts per mil, 1,500 is the base with which the others are compared.
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> Suppose for brevity that these two qualities are the only ones of interest

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*Presented as an appendix to report of committee on electrical insulating materials, F. M. Farmer chairman.

TABLE I—COMPARISON OF DIELECTRIC STRENGTH AND ACID RESISTANCE OF VARNISHES

Qualities Considered	Actual Test Results Sample No. 1	Sample No. 2	Sample No. 3	Basis of Comparison	Ideal Relative Values	Translation of Test Results to Relative Values Sample No. 1	Sample No. 2	Sample No. 3
Dielectric strength	1,000	1,400	1,500	1,500	25	17	23	25
Acid resistance	10	8	6	10	75	75	60	45
Totals earned in test after valuation					100	92	83	70

in a given case, we must decide which of the three varnishes we are to choose as having the most merit for our work. We can set down beforehand two figures totaling an ideal 100 per cent which represent our idea of the relative importance to the whole of the qualities considered.

A manufacturer of small motors operating in places where acid is present might say that it was three times as important that his varnish shall possess acid resistance as that it show high dielectric strength. Expressing this thought in per cent would mean that he considered the acid value as forming 75 per cent of the ideal total and the disruptive strength value as 25 per cent. Putting down the test results originally found, the bases of comparison and the ideal percentage values as we judge them, we have Table I.

It would seem from this table that sample No. 1 was nearest to meeting our needs in the ratio of 92 to 83 or 92 to 70. But the purchasing agent states he can buy sample No. 1 for $1.10 per gallon, sample No. 2 for $1.05 and sample No. 3 for $0.95. How are we to correlate our test values with these prices?

It will have been noticed that in the test procedure all tests are based upon equal thicknesses of coat. This means that an equal volume of the solid content or varnish base has been considered and used irrespective of its concentration, which may be more or less according to its particular qualities or the type of solvent used in thinning. We must therefore determine the volume of solid content contained per gallon or other unit of varnish. This can readily be done by a distillation test.

Suppose that we find the three samples contain 45, 40 and 47 per cent of base by volume respectively, and that on account of their other qualities, to obtain equal specified thicknesses of coat, additions of 10, 4 and 15 per cent of solvent were necessary respectively. Let us resort to another table and combine all these figures so as to obtain the final relative values sought for. This is Table II.

It appears from the foregoing facts that, having reduced all our results to a numerical and comparative basis and taking into account all observations we have made together with the actual cost, we have obtained a relative value for the three samples. In this case the most expensive has shown the higher relative value. It will be seen, however, that any variation in any of the figures above will change the final value.

For instance, if sample No. 3 had earned a test total of say 80, its final value would have worked out as 38, or higher than sample No. 1. Of course, a minimum limit can also be set on the ideal values for any quantity and the samples which show tests below these limits should not be further considered. If in the future the testing of insulating materials should become entirely standardized, this system can still be applied, and at that time the value of goods tested in other laboratories can be translated on a percentage basis to one's own ideal and so the relative merits of different articles for one's particular need can be determined without going to the trouble of making further tests upon points for which there already exist test values.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

TABLE II—COST OF VARNISHES IN PREPARED STATE

	Sample No. 1	Sample No. 2	Sample No. 3
Totals earned in test, Table I	92	83	70
Percentage of base or solid content	45	40	47
Percentage of solvent added to get equal coat	10	4	15
Cost of varnish per gallon as supplied	$1.10	$1.05	$0.95
Cost of solvent as supplied	0.23	0.22	0.22
Total cost of thin varnish in state tested	1.125	1.06	0.983
Gallonage obtained in state tested	1.10	1.04	1.15
Cost per gallon in state tested	$1.02	$1.02	$0.86
Percentage of base in state tested	41	38	41
Actual relative value figure (this is the figure earned in test multiplied by the percentage of base of the thin product and divided by its cost)	37	31	34

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Thickness of Metal Welded Determines Current

IT HAS been common practice to do electric arc welding with the current too low, with the result that poor welds have been obtained. With a given arc length the quality of fusion is improved by increasing the arc current up to a certain maximum. If the current used is lower than this maximum value then the heat liberated at the crater is not great enough to fuse the parent metal properly, and the result is that the bead will show excessive overlap and poor penetration. If the arc current exceeds the maximum value, the heat at the crater is too great and the penetration is very deep. This factor must be considered in determining the current. The accompanying table gives the approximate current values for horizontal butt welds on steel plates made with bare electrodes using direct current. For lap welds multiply the current values by 1½, and for strap welds, by 1¼. D. N. LOUIS.
San José, Cal.

RELATION BETWEEN PLATE THICKNESS AND ARC CURRENT

Plate Thickness, in Inches	Arc Current, in Amperes	Electrode Diameter, in Inches
1/16	20– 50	1/16
1/8	50– 85	3/32
3/16	75–110	1/8
1/4	90–125	1/8
3/8	110–150	5/32
1/2	125–170	5/32
5/8	140–185	5/32
3/4	150–200	3/16
7/8	165–215	3/16
1	175–225	3/16

◆

Cable Get-Away Planned for Flexible Service

TO ENABLE cable assignments under varying load conditions to be changed conveniently without the crossing of conductor sheaths in manholes, a very careful study of the entire "get-away" problem was made in connection with the building of the South Meadow Station of the Hartford (Conn.) Electric Light Company. This plant will supply energy in large blocks by overhead connections to a 66,000-volt substation immediately adjoining the station, and the Hartford load will be supplied over 11,000-volt underground cables between substations in different parts of the city. Some of these cables require regulators.

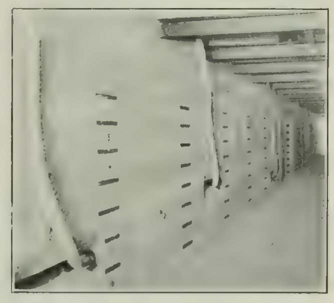


FIG. 1—CONTINUOUS DUCT RUNS OBVIATE MANHOLE CROSSINGS

To meet the above requirements and afford a systematic and clean-cut layout, the cable gallery shown in Fig. 2 was designed. Overhead feeders leave the building at the openings shown in the upper row of square panels, the lower row being reserved for lines brought back into the station after passing through feeder regulators located outside the building in cases where these are required. These panels were built in at the time of the construction of the generating station and can be easily knocked out when required. Either overhead or underground cables may be looped outside and back through the feeder regulators, or passed directly outward for aerial service or downward to the duct lines.

The arrangement of the ducts in the basement is shown in Fig. 1. Feeder switches are arranged in groups of eight. Then eight ducts are brought into the feeder gallery from a manhole just outside the station, and the line of ducts is built complete beyond the last switch. The method of bringing the cable out of the duct is clearly indicated in this illustration. It is to be noted that one cable in the section shown comes out of the bottom duct and the other two cables cross it in ducts above.

Two inches of concrete and a tile duct lie between these cables at the crossing. In case it is desired to change the location of the cable from one switch to another, it is only necessary to open up the wall at the new point and close the original opening with a split duct and a little concrete.

The duct lines leaving the station are built in sections of sixteen ducts, each section separated by two feet of earth. Eight cables only will be pulled into each section and these are carried straight through to the last manhole without any cables crossing another outside the station. This basement duct amounts to a set of cable selective buses into which taps may be connected from the feeder circuit-breakers in the station.

R. H. SOREN,
Vice-President.
Hartford Electric Light Company,
Hartford, Conn.

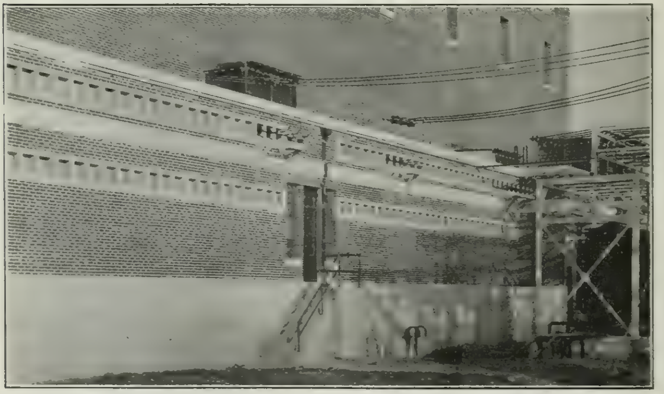


FIG. 2—GALLEY DESIGNED FOR FEEDER EXIT WITH OR WITHOUT REGULATORS

Easily Constructed Types of Current Transformers

SOLID-TYPE and split-type current transformers, used for taking current readings either in industrial plants or on lines, and which have been made in its own shops, have been used for some years by the Southern California Edison Company. The transformers are very light in weight and accordingly are easy to handle. However, the split-type transformers are not acceptable for laboratory or wattmeter tests. These transformers are made for use in test sets comprising the transformer, its leads, and a calibrated ammeter, as shown by A in the accompanying illustration, and are wound with two coils, for current readings of 50 amp. or less and for 200 amp. or less. Ammeters having a full-scale deflection on 1 amp. are connected to the transformers by 60 ft. of No. 12 cable.

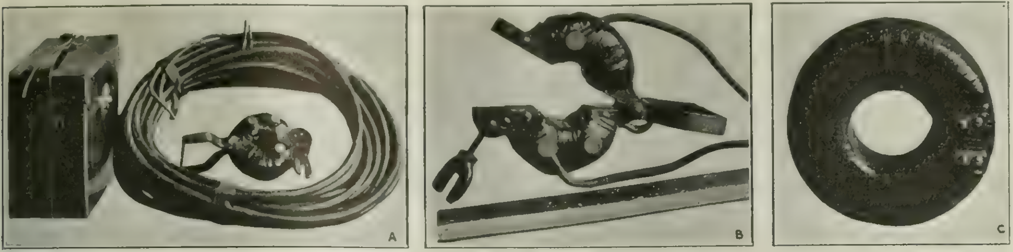
The dimensional details of the split-type transformers are shown in D of the illustration, and the best workmanship must be exercised in the construction if satisfactory results are to be obtained. The cores are made of 0.015-in. silicon steel punchings, although handwork may be substituted if necessary. After removing the sharp edges the core is insulated with two layers of ½-in. cotton tape and one of ¾-in. bias-cut oiled cambric, the latter being between the two cotton tapings. Each layer should be thoroughly shellacked. The 50-amp. winding consists of about twenty-eight turns of No. 16 double-cotton-covered magnet wire spaced around the core to obtain equal field distribution. As the characteristics of the iron and the type of ammeters used influence the ratio between the turns and the secondary amperes, the exact number of turns is subject to variation. The two sections of the winding are connected by a flexible jumper across the hinge. The completed winding is covered with one layer of the cotton tape and again shellacked. Because of the greater magnetic density the turn ratio of the 200-amp. winding approaches more nearly to unity. One hundred and ninety turns of No. 18 wire are used, requiring about 115 ft. of wire. These are placed in three layers on each half of the core and are connected by jumpers as before. The method and direction of winding the coils on the core are shown in F. The windings are protected on the outside by heavy tape held in place by a layer of the cotton tape. The binding posts are then placed on pads and held by strong machine thread, and the terminals are soldered to them, as shown in B. Three more layers of cotton tape are put on, shellacked and finally varnished. It is best to obtain ammeters with blank scales calibrated with the transformers and leads.

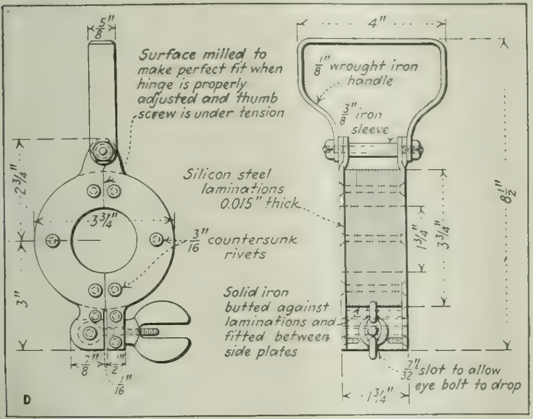
A solid-core type of current transformer, shown in C, has also been made by this company for use in making wattmeter tests. The ratio and phase angle are well suited for this, as is shown by the curves in E. Design data for these transformers are given in the above table.

The core is made of 125 rings of 0.013-in. silicon steel. The outside diameter is 6⅞ in. and the inside $3\frac{23}{32}$ in. The core is approximately 1⅝ in. thick and has a cross-section of 2.6 sq.in. The laminations are

DESIGN DATA FOR SOLID-CORE CURRENT TRANSFORMERS

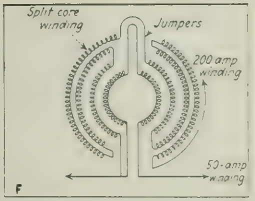
	Amperes		
	1,200	2,000	4,000
Number of laminations	125	125	125
Thickness of laminations, in	0.015	0.015	0.015
Area of magnetic circuit, sq. in	2.470	2.440	2.33
Weight of core, lb	10.75	11.15	14.6
Secondary turns	240	400	800
Number of layers (secondary)	2	3	5
Turns per layer	130–110	145–135–120	180–176–168–161–115
Size of wire, No.	13	13	10
Length of turn (average), in	7.15	9.25	13.3

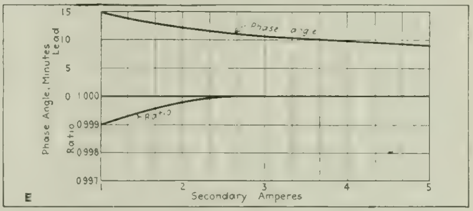



5/8"
Surface milled to make perfect fit when hinge is properly adjusted and thumb screw is under tension
4"
1/8" wrought iron handle
3/8" iron sleeve
Silicon steel laminations 0.015" thick
2 3/4"
3 3/4"
3/16" countersunk rivets
Solid iron butted against laminations and fitted between side plates
3"
1 3/4"
3 3/4"
8 1/2"
7/8"
1/2"
1/16"
7/32" slot to allow eye bolt to drop
1 3/4"
D

CONVENIENT TESTING TRANSFORMERS

A—Complete test set, consisting of current transformer, calibrated leads and meter. B—Split-type current transformer shown in A. C—Rugged construction feature of solid-core transformer. D — Construction details of split core. E—Characteristic curves of 1,200-amp. transformer with solid core. F—Method of winding coils on split core.





tightly clamped, bound with ½-in. cotton tape and shellacked. Over this is placed a layer of 0.015-in. varnished pressboard bound with ¾-in. tape and again shellacked. The terminal blocks are riveted to brass plates which can be bound to the side of the finished coil.

The winding consists of 240 turns of No. 13 double-cotton-covered magnet wire wound in two layers, of 130 and 110 turns respectively. Between the two layers varnished pressboard is held in place by 1½-in. stay binding. W. R. FRAMPTON,

Superintendent Test and Meter Department
Southern California Edison Company,
Los Angeles, Cal.

◆

Turbine Economy and Reserve Capacity

FACTORS which bear upon the amount of reserve capacity needed in the modern steam-driven central station equipped with large and economical turbine units were briefly discussed by L. L. Elden, electrical engineer with the Edison Electric Illuminating Company of Boston, during a hearing on rates before the Massachusetts Department of Public Utilities. Mr. Elden said that the installed generating capacity of the company attained a maximum of 173,000 kw. during the past winter. The peak load was 128,200 kw. The Boston system has always been operated on the theory that a reserve equipment to the largest unit should be constantly maintained. Up to the time that the first eight units, aggregating 96,000 kw., were installed at the company's L Street station, this meant 15,000 kw. in spare capacity. In the first-built section at L Street the company maintains six engine-driven units aggregating 9,000 kw. rating, and these have been of value in emergencies.

With the installation of 30,000-kw. units, of which two are now in use at L Street, the percentage of reserve was greatly changed. The company has striven to maintain 30,000 kw. in spare capacity, and the performance of the 30,000-kw. units has been such as to prove this a sufficient reserve under the conditions. New loads have been taken on, however, the total added in 1921 being 25,000 kw., and the increase of the load by steps of 3,000, 5,000 or 7,000 kw. in short periods of time, coupled with the fact that at times the company has had 60,000 kw. in horizontal turbines out of commission without any notice, because of hot bearings and failure of windings, has brought it face to face with the proposition of having at least two units of 30,000 kw. each available without regard to the service other units are performing.

A third 30,000-kw. unit is to be installed at L Street to meet the above conditions.

The efficiency of the new 30,000-kw. units in fuel consumption is about 1.4 lb. per kilowatt-hour, compared with about 1.6 lb. with all the L Street turbines in service. With the two 30,000-kw. units out, the fuel consumption is about 1.9 lb. Since 1919 the company has been unable to get the full benefit of these larger units by continuous use of them at high load factors. Operating difficulties, due perhaps to the rapid development of the art of turbine design and manufacture in very large units, have appeared in virtually all makes placed on the market. The service of such units is improving, however, Mr. Elden said, and the operating results in 1921 were better than those of 1920. Before the war the Boston company reached a manufacturing cost at the station of about 4.8 mills per kilowatt-hour. High fuel, labor and supplies cost, the witness added, have increased this manufacturing cost. For the last half of 1921 this cost was just under 1 cent.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Keeping Stocks at Proper Level Shows Good Profit

Perpetual Inventory Holds Down Stock Investment, Increases Turnover and Eliminates Dead Stock

By M. J. Kane
Contract Agent Harrisburg Light & Power Company,
Harrisburg, Pa.

During the year 1921 the Harrisburg Light & Power Company sold slightly over $100,000 worth of electrical appliances in its office salesroom, realizing a profit of approximately 18 per cent on the gross sales. This business was transacted almost entirely on the sales floor by a floor salesman with his assistant. There were no outside salesmen or solicitors working in the company's territory.

In order to make this volume of sales with its accompanying profit two important factors have been carefully watched. One has been to see that an ample and well-diversified stock was properly displayed in the salesroom at all times, and the other factor, which was probably of first importance in showing a profit on sales, has been the use of a system for keeping the stock inventory up to date so that it would show at any time the quantity of appliances and material on hand. A card-index form of inventory was adopted, from which it is possible to ascertain the quantity of any particular article in stock. This card index amounts to a perpetual inventory, and the form of card used is reproduced in Fig. 1. A study of this form will show that it not only gives the quantity balance of the item but shows the daily sales as well.

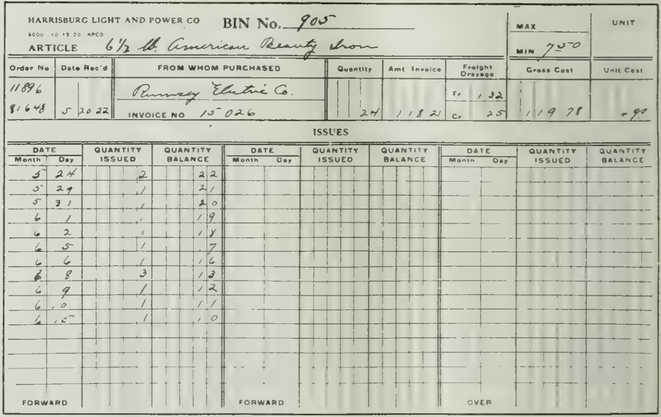
When a shipment of material has been received and billed, a card is filled out with a description of the article, quantity received, the amount of the invoice, to which are added freight and drayage charges, which give the total gross cost. The unit cost is then obtained and the selling price entered as shown in the upper right-hand corner. At the close of business every day the duplicate sales slips for appliances sold are sorted and the quantity of each is entered under the quantity issued. This is subtracted and the quantity balance shows the number of that particular item remaining in stock. As these entries are made every day it is possible to tell exactly what stocks are getting low and when the reorder should be placed.

This card is a part of a system of keeping stock records which the Harrisburg Light & Power Company has used for the past three years and has found to be a comparatively simple and extremely reliable method of handling its stock.

The other forms used are shown on the opposite page. Fig 2 is the form of order to the stockkeeper for material, Fig. 3 is the stockkeeper's record of material issued and Fig. 4 shows the form used for the monthly recapitulation of all material taken from stock. Material coming into stock is entered first on the form shown in Fig. 5 and a temporary inventory card like Fig. 1 but of different color is made out and held until the bill is received, when the cost plus freight and drayage are added and the permanent inventory card, Fig. 1, is made out. A record of all invoices for material received is kept on the form shown in Fig. 6.

By the use of this form of card inventory it has been possible to maintain stocks at the proper levels without overordering or permitting stocks to become too badly depleted. It is possible to tell by looking over past sales how rapidly an article has been moving and thus keep the amount of money invested in stock at the lowest possible figure. Items which prove to be slow movers can be quickly spotted and a special price made in order to move them more rapidly. The rate of turnover has been increased and dead stock has been practically eliminated. It is a very easy matter at the end of each month to ascertain what profit has been made and to determine what class of merchandise to push.

We believe that this system of keeping a perpetual inventory has been the principal means of our having been able to show a fair profit on merchandise sales. Our sales force has been small and virtually all sales are made directly from the office floor. A fair amount of advertising



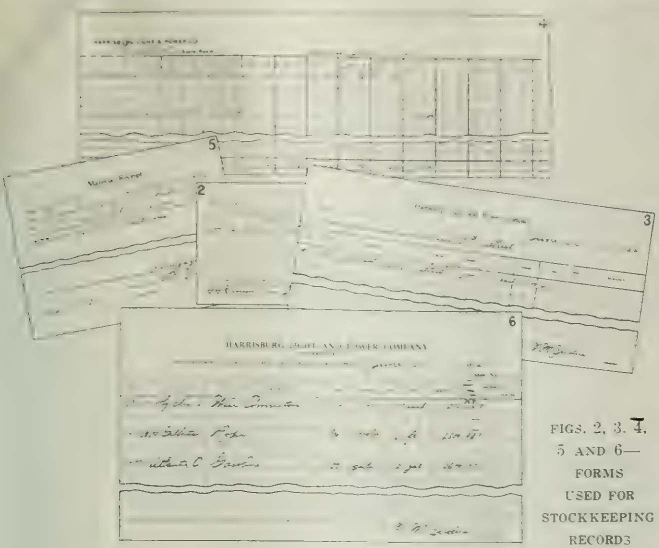
HARRISBURG LIGHT AND POWER CO BIN No. 905
6000 10 15 20 APCO
ARTICLE 6½ lb. American Beauty Iron
MAX
MIN 7.50
UNIT

Order No	Date Rec'd	From Whom Purchased	Quantity	Amt Invoice	Freight Drayage	Gross Cost	Unit Cost
11896		Rumsey Electric Co.			Fr 1 32		
81648	5 20 22	INVOICE NO 15026	24	118 21	Cr 25	119 78	4 99

ISSUES

DATE Month	Day	QUANTITY ISSUED	QUANTITY BALANCE	DATE Month	Day	QUANTITY ISSUED	QUANTITY BALANCE	DATE Month	Day	QUANTITY ISSUED	QUANTITY BALANCE
5	24	2	22								
5	29	1	21								
5	31	1	20								
6	1	1	19								
6	2	1	18								
6	5	1	17								
6	6	1	16								
6	8	3	13								
6	9	1	12								
6	10	1	11								
6	15	1	10								
FORWARD				FORWARD				OVER			

FIG. 1—INVENTORY CARD SHOWS EXACT STOCK ON HAND


5
2
3
6
HARRISBURG LIGHT AND POWER COMPANY

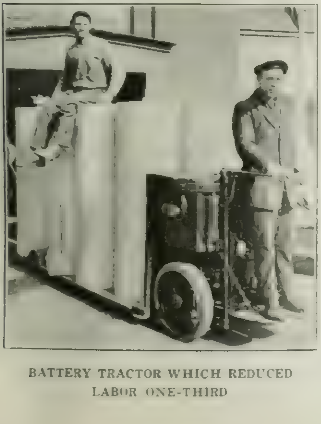
FIGS. 2, 3, 4, 5 AND 6—FORMS USED FOR STOCKKEEPING RECORDS

is carried in the local papers, and windows have been changed weekly. In addition to this there is the advantage, of course, that customers come into the office to pay their bills, and as there are approximately 18,000 residential customers connected to our lines at this time we have a very good opportunity to show them the appliances in the salesroom.

◆

Electric Tractor Effects Saving in Labor

THAT marked economies can be realized by the use of electric tractors in industrial plants is demonstrated by the experience of the Hamersley Manufacturing Company, Garfield, N. J. The drop-frame electric truck shown here has been in constant operation in the company's paper mill since 1916, and in the department where it was used the labor required for handling paper rolls was cut down from eighteen hand-truck men to twelve.



BATTERY TRACTOR WHICH REDUCED LABOR ONE-THIRD

◆

Utility Association Adopts Code of Ethics

IN ORDER that the executives of public utilities in Oklahoma may have a common aim and purpose in giving out information regarding their companies and the industry in general, a code of ethics has recently been adopted by the Oklahoma Utility Association as a standard to govern its activities. The code is as follows:

Public utilities are natural monopolies and as such should be subject to public regulation as to all matters touching public interest. If public regulation is to be successful, it must be intelligently administered, but it cannot be so administered by an uninformed public; therefore:

1. It is the duty of all members of this association to avail themselves of every opportunity, and to seek opportunities, fully and honestly to acquaint the public with all matters relating to the operation of public utilities.
2. Public utility managers are trustees, whose duties are to safeguard and protect the interests of the public, the employee and the investor, and the acts of such managers should be influenced by a full realization of these responsibilities.
3. It is the duty of every member of this association to strive in every way to promote peace and harmony among its members, and to uphold and support every honest policy or aim of all public utilities, and to discourage and condemn such policies or aims as are unjust or unworthy.
4. No business transaction is, in the final analysis, satisfactory or profitable to either party to the transaction, unless it is satisfactory or profitable to both, and every transaction should be carefully analyzed with this principle clearly in mind.
5. It is the duty of every public utility to take an active part in public affairs, in the interest of honest, efficient government, and to enable such utilities correctly to learn the needs of the community and to build intelligently to keep pace with its growth.
6. Public utility enterprises are honorable and worthy, and they afford distinct opportunities for individuals to serve society effectively.

◆

What Other Companies Are Doing

Worcester, Mass. — Appliance sales by the Worcester Electric Light Company during the past few months reflect a decided improvement in business conditions. During April and May the company sold 235 vacuum cleaners, a prize of one cleaner being awarded to every salesman disposing of twenty outfits within the time limit set. To stimulate sales during the last three days of the drive a boudoir lamp was given to each man selling six cleaners. During June an electric flatiron was given as a prize to each salesman disposing of eleven cleaners in fourteen days. House-to-house solicitation, supplemented by a nominal amount of newspaper advertising, was used. Gross appliance sales ran about $2,000 a week until a recent short period of bad weather, which reduced this by about $300. O. R. Underhill is appliance department manager.

Louisville, Ky.—H. M. Byllesby & Company are issuing a twelve-page booklet giving the latest information and statistics regarding the Louisville Gas & Electric Company. The development of this company from 1838 to the present day is described by various charts and photographs. The kilowatt-hour output for 1921 has increased 126 per cent since 1914.

Akron, Ohio.—Employees of the Northern Ohio Traction & Light Company sold $675,000 worth of 7 per cent preferred stock in the past nine months during an energetic sales campaign which has just come to a close.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

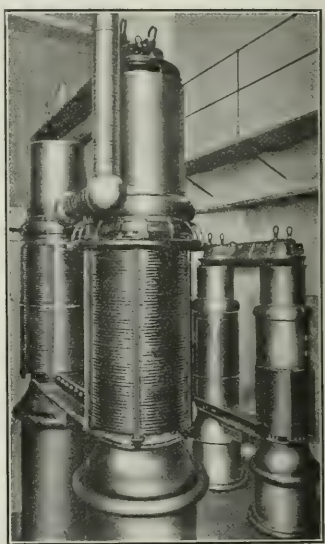
The Power Supply of Bavaria, Germany.—A. MENGE.—A project for a uniform power supply is under way in this part of Germany, utilizing the water resources near Munich and including four existing steam plants. One company is building a plant on the Walchensee which will have a total output of 126,000 kva. and four small generating plants along the Isar which will have a total capacity of about 55,000 kva. These smaller plants, with the necessary transmission lines, are expected to be completed by 1924, while the Walchensee station will be able to deliver about 100,000,000 kw.-hr. per year by the fall of 1923. Three-phase current at 50 cycles and 110,000 volts has been chosen for the trunk lines. Four standard types of steel towers, two for double lines and two for single lines, are used for the entire transmission system. The Walchensee station contains four single-phase, 16⅔-cycle generators for railway supply and four three-phase, 50-cycle generators for general power supply. The latter consist of 24,000-hp. single-runner Francis turbines connected to 20,000-kva., 500-r.p.m., 6,600-volt generators. The three-phase generators are connected in Y, the neutral grounded over a resistance of 0.8 ohm, which will carry 4,500 amp. for ten seconds. Thirteen indoor-type substations are located along the transmission lines. In every substation are installed, according to its size, two to four rotary condensers of 8,000 kva. or 16,000 kva. to compensate the power factor in the lines.—*Elektrotechnische Zeitschrift,* May 28, 1922.

Power Development in the Southeast.—CHARLES G. ADSIT.—The author emphasizes the dependability of the water power of the South and states that the resources available can make ample provision of power for the growing industries of that section. A table giving the developed water power and the steam power of Alabama, Tennessee, Georgia and North and South Carolina is given. This table shows that the developed water power equals 492,500 kw., while the steam power is 181,000 kw. The present state of the Muscle Shoals development and future possibilities are described.—*Mechanical Engineering,* May, 1922.

Generation, Control and Switching

The Behavior of a Plunger-Type Protective Relay.—Y. TORIYAMA.—The manner in which the magnitude of the pull on the plunger varies with the initial position of the plunger is experimentally determined. The velocity and the dynamic pull at every point of the travel during the upward motion of the plunger is also determined and the results are given in curves and tables.—*Journal of the Institute of Electrical Engineers of Japan,* May, 1922.

Generators for Water Turbines.—R. BUCHTA.—The designer of large generators for medium and high speeds will find in this paper, with its thirty-seven illustrations, a great deal of information on the mechanical details of such machines. On account of the overspeed guarantee now usually required, special attention has to be paid to insure a very rugged rotor construction that will withstand the centrifugal forces exerted by the pole pieces. The different constructions are shown on generators of from 500-kva. to 15,000-kva. capacity.—*Siemens Zeitschrift,* May and June, 1922.



DRY, AIR-INSULATED 500,000-VOLT TESTING TRANSFORMER (H. DE RAEMY)

Considerations Relating to the Design of Oil Circuit Breakers.—D. R. DAVIES.—The author first discusses the methods usually adopted for reducing the losses in oil circuit breakers. Information is then given which can be used for estimating the maximum temperature rise of small conductors during short circuits. This information is also applicable to potential transformer connections or the like.—*Electrician,* June 16, 1922.

Transmission, Substations and Distribution

Modern High-Voltage Transmission Lines.—E. SPLITTSTÖSSER.—Mechanical and electrical data are given in this article on the newly installed 100,000-volt trunk lines in Germany, with particular emphasis on the safety of the suspension system. Steel-aluminum cables are receiving the preference over copper. While the older lines had three grounded steel cables for lightning protection, the use of one of these has now been found sufficient. Joints in the bimetallic cables are made separately for the steel and the aluminum with a notched sleeve connector. Cap-and-pin type insulators are used more frequently than Hewlett chains, because they are held to be cheaper, shorter in over-all length and better from the voltage distribution standpoint.—*Siemens Zeitschrift,* May and June, 1922.

New High-Tension Insulator.—L. PERRIN and E. PIERNET.—The authors try to overcome the difficulty of unequal voltage distribution along an insulator chain by simply avoiding any metal parts. A number of specially formed porcelain insulators are held together by short studs made of oil-treated wood and cemented into the individual porcelain disks. In this way a solid porcelain insulator column may be built up. Another method is where the individual porcelain parts and studs are made hollow, so as to form a wall or a roof bushing. It is also possible to give the intermediate studs a ball-shaped upper part and to hold this ball within the hollow, spherically shaped head of each porcelain by a retaining collar of cement. This will result in a flexible chain, swinging with the ball heads as fulcrums. Tests made with these insulators at the French testing laboratories showed great mechanical strength and an almost perfectly proportional voltage distribution along a chain of four of these units with 110,000 volts.—*Revue Générale de l'Electricité,* May 13, 1922.

Units, Measurements and Instruments

500,000-Volt Testing Transformers.—H. DE RAEMY. — High-voltage electric testing equipment, in keeping step with the increasing transmission voltages, has to cope today with potentials of 500,000 volts to 750,000 volts. In Europe, where oil is difficult to obtain and consequently high in price, successful attempts had been made recently to design such transformers as a dry, air-insulated type. One firm has lately installed several such sets, two of which, each for 500,000 volts, are described in these two papers. In both cases the high voltage is obtained by series connection of two transformer units. The machines are very bulky and in both the described laboratories extend through two stories (9 m.). To keep dangerous corona discharges down to a minimum, a number of well-designed and properly placed metallic shields have to be used as equalizers around the ends of the windings.—*Bulletin Schweizer Elektrotechnischer Verein*, June 22, 1922, and *Revue Générale de l'Electricité*, June 10, 1922.

Illumination

Better Signs.—C. A. ATHERTON.—The development of electric signs has progressed to a point where there is need for a more exact engineering basis of design and a more artistic treatment in general. Because of the adoption of lamps of higher wattage it has become necessary to determine the relative size of the spot of light obtained from lamps of different wattages, in order to predetermine the exact pattern of the appearance of the sign. An equation has been developed for this. A modification of this equation is given which may be used for the determination of the maximum distance at which Gothic letters may be read under normal conditions. Through another adaptation of the equation, lamp spacing for various wattages is determined by various types of signs. An example of the proper spacing is given in the accompanying table. Proper illumination of inclosed lamp signs is discussed and a simple rule formulated for obtaining satisfactory results. — *Transactions of the Illuminating Engineering Society*, May, 1922.

LAMP SPACING FOR EXPOSED LAMP SIGNS TO OBTAIN THE APPEARANCE OF A CONTINUOUS LINE OF LIGHT USING CLEAR-GLASS LAMPS

	Distances to Observer in Feet When the Surrounding Illumination Is									
	Comparatively Bright					Comparatively Dark				
Lamp Spacing, Inches	10 Watt Lamps	25 Watt Lamps	50 Watt Lamps	75 Watt Lamps	100 Watt Lamps	10 Watt Lamps	25 Watt Lamps	50 Watt Lamps	75 Watt Lamps	100 Watt Lamps
	*	*	*	*	*	*	*	*	*	*
3	480	420	*	*	*	290	*	*	*	*
4	630	560	500	*	*	390	330	*	*	*
5	790	700	620	570	*	490	410	*	*	*
6	950	840	740	680	610	590	500	420	*	*
7		990	870	800	720	690	580	490	440	*
8			990	910	820	790	660	560	500	*
9					920	880	740	630	570	500
10						980	830	700	630	550
11							910	770	690	610
12							990	840	750	660
13								900	810	720
14								970	870	770
15									940	830
16									1,000	990

*For distances less than the lowest given in the table, it is impossible to obtain the appearance of a continuous line of light.

Motors and Control

The Control of Blower Motors. — HENRY G. ISSERTELL.—The author has devoted his article to showing how to select the right motor and the right form of control for paddlewheel, centrifugal and multivane types of blowers for the ventilation of several types of buildings.—*General Electric Review*, May, 1922.

Application of Motors and Controls to Printing Plants.— Control of the presses is the most important consideration from the standpoints of economical operation and safety, and it must be 100 per cent efficient. Electric motors and their controllers meet these requirements in every respect, and it is on account of this that nearly all printing plants are motor-driven. — *Electrical Record*, July, 1922.

Heat Applications and Material Handling

Welding a High-Pressure Underground Steam Line.—E. L. HOPPING.—The Philadelphia Electric Company has recently constructed a 12-in. steam and a 3-in. water-return line, about 2,200 ft. in length, in which welded joints were used wherever possible. Methods used and the difficulties encountered are discussed. Oxy-acetylene and metal electric arcs were both employed in the construction work.—*Journal of American Welding Society*, April, 1922.

An Adaptable Electric Steel Company.—S. G. KOON.—By the merging of two forging plants of different characteristics it is expected that the operating schedules of both will fit well together and provide an outlet for certain products which can be made more readily at one plant than at the other and which in some cases will be made from a byproduct of the larger company. A well-illustrated description is given of the furnace and forge installations of each plant.—*Iron Age*, May 4, 1922.

Electrophysics, Electrochemistry and Batteries

The Throwing Power and Current Efficiency of Zinc-Plating Solutions.—W. G. HORSCH and T. FUWA.—The results of a comparison of four distinct types of zinc-plating solutions are given. The effect of modifications in the composition of each type was studied. Using a three-section cathode, the throwing power, cathodic current efficiency and cell voltage were determined for each bath and modification.—*Paper presented before American Electrochemical Society*, Baltimore, April 27, 1922.

Insulating Materials.—Directions for the study of hard composite dielectrics based on the specifications issued by the British Electrical and Allied Industries Research Association in which methods of tests are defined intended for use in the investigation of the mechanical and electrical properties. Materials were included having bases of vulcanized rubber, vulcanized bitumen, shellac and synthetic rosin. The tests include specific insulation resistance, surface leakage and puncture strength, toughness, plastic yield with temperature aging, density and water absorption.—*Beama*, May 1922.

Electrodeposition of Iron.—In view of the extended use of this method for many industrial purposes the Department of Scientific and Industrial Research (England) has issued a report which embodies the results of research carried out by W. E. Hughes. The report gives a description of the deposits, with the effects of temperature, current density and mechanical movement. A theoretical discussion is also given.—*Bulletin No. 6 of the Department of Scientific and Industrial Research (England).*

Traction

Mercury Rectifier for Railroad.—H. IDELBERGER.—A 210-kw. rectifier has been installed in the power house of Siemensstadt (Germany), to work in parallel with two existing 150-kw. motor-generators. The current demand on this station is exceedingly fluctuating, varying frequently within a few seconds from zero to 900 amp. Including the auxiliary pumps, an over-all efficiency of 90 per cent has been attained, as compared with 61 per cent for the motor-generator sets. The operation of the rectifier is completely automatic, requiring no attendance.—*Siemens Zeitschrift*, May and June, 1922.

Telegraphy, Telephony, Radio and Signals

Fire Alarm and Police Patrol Systems.—A report just issued of the twenty-sixth annual convention of the International Association of Municipal Electricians held last September in Colorado. Among the major papers that were read and discussed were: "The Relation of the National Electrical Code to the Electrical Industry," "Ornamental Street Lighting," "The Value of Modern Fire-Alarm Systems with All-Underground Service," "Comparison of Paper and Rubber Insulation for Fire and Police Underground Cables," "Educating the Public to the Greater Use of the Fire-Alarm System," "Radio Telephone and Telegraph as Used in Fire and Police Signal Systems," and "Modern Electrical Apparatus for Street Traffic Signaling."—*Report of the 1921 Convention of International Association of Municipal Electricians.*

The Importance of Higher Voltages for Amateur Spark Communication.—S. KRUSE AND D. W. RICHARDSON.—It has been demonstrated in practice that higher voltages and lower spark pitches are better for spark radio communication using 60-cycle supply. The reason for this is explained, and the conclusion is reached that if proper insulation precautions are taken the most effective spark transmitter for low-wave work will be one using a 60-cycle synchronous spark gap and a transformer with a 28,300-volt secondary whose peak value is 40,000 volts.—*QST*, May, 1922.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Depreciation Provisions of Water-Power Act

Secretary of Power Commission Suggests Amending the Act in Line with Views of N.E.L.A.

IT WILL be necessary to amend the federal water-power act before the depreciation regulation can be altered materially from its present form. This conclusion was reached by the Federal Power Commission at a meeting on July 26. The commission decided that the changes requested by the electrical industries involve a matter of law and are not a matter of policy. It was stated that if the electrical industries continue to believe that relief is necessary they will have to obtain legislation to that end.

As a result of the dissatisfaction with the depreciation regulation, the commission ordered a careful study made of the water-power act, of similar state statutes and of decisions of state courts and commissions which had a bearing on the matter in question. Both the National Electric Light Association and the National Association of Railway and Utilities Commissioners submitted briefs which were considered in connection with the whole subject matter by the chief counsel of the Federal Power Commission and by the law officers of the Departments of War, the Interior and Agriculture.

These law officers agree that, in view of the use of the word "depreciation" in the federal statutes and its definition in decisions of federal courts and of federal and state commissions, the primary purpose of accounting for depreciation under the water-power act is that reserves may be established and maintained sufficient for offsetting the reduction in service value due to accruing depreciation from whatever cause and for maintaining the original investment, unimpaired and adequate for renewing and replacing so far as respects their original costs, units of equipment or structures when their useful lives expire. The chief counsel of the commission holds, and the law officers of the three departments agree with him, that the act as now worded requires an accounting for depreciation substantially as set forth in the existing regulations. It also is held that the definition of "depreciation" proposed by the representatives of the National Electric Light Association and the amendment of the regulation proposed by them with respect to accounting for depreciation are not in conformity with the act. Consequently the commission voted that it is without authority to amend regulation.

O. C. Merrill, the executive secretary of the Federal Power Commission, told the commissioners at the July 26 meeting that he is not convinced that the provisions of the act with respect to depreciation are in conformity with the wisest public policy or that they are in the best interests of the ratepayers in the long run. He expressed the belief that the question should be approached primarily from that standpoint. He suggested to the commission that if upon further consideration it should appear unwise to require the fully accrued depreciation to be taken up on the licensee's accounts, steps should be taken to amend the act.

Mr. Merrill suggested and the commission agreed that it should be optional with licensees whether they account for depreciation on the straight-line or on the sinking-fund basis until the act be amended. A further suggestion by Mr. Merrill also was approved by the commission that he be authorized to confer with the water-power development committee of the N. E. L. A. and others interested, with the view of presenting to the commission proposals for such a degree of flexibility in the annual charges of accruing depreciation as will give due consideration to the maintenance both of the financial credit and of the capital assets of the licensee.

Exemption from Water-Power Act Sought

A systematic attempt to remove the St. Lawrence River project from the conditions imposed by the water-power act is under way, according to Washington reports. The plan is said to be to have the proposed treaty provide that the project is to be conducted under the exclusive jurisdiction of the International Joint Commission. The Swing-Johnson bill proposes to place the Colorado River under the jurisdiction of the Secretary of the Interior, and a well-defined effort to exempt the Columbia River development from Federal Power Commission control is also said to exist. If these efforts should be successful, some contend, the effect will be to repeal the water-power act piecemeal. It is believed that the lack of opposition in both the Senate and the House to the Ford proposal to make Muscle Shoals an exception to the act has encouraged greatly those who would remove from its jurisdiction other conspicuous water powers.

Government Will Direct Distribution of Coal

The President Puts Secretary Hoover in Charge—I. C. C. Issues Priority Orders

THE combination of railroad and coal strikes is bringing matters to a focus at Washington. Stocks of coal are rapidly diminishing, and such coal as is being mined is moved with difficulty if at all. The situation has assumed such a menacing and serious aspect that President Harding has appointed a governmental commission with Herbert Hoover as its chairman to direct the transportation and distribution of the available coal supply.

The Interstate Commerce Commission has issued priority and routing orders effective July 26. Public utilities are listed second in class 2 of preferred consumers of coal. The priority order for public utilities specifies "for public utilities which directly serve the general public under a franchise therefor, with street and interurban railways, electric power and light, gas, water and sewer works; ice plants which directly serve the public generally with ice or supply refrigeration for human food stuffs."

John W. Lieb, vice-president of the New York Edison Company and official fuel representative of the gas, electric light and railway industries, was in conference with Secretary Hoover and other officials in Washington on Tuesday. He says the federal authorities intend to protect the public interests in every possible way by preventing profiteering and undue competition among buyers and by priority for the railroads, other public utilities, etc. M. H. Aylesworth, executive manager of the National Electric Light Association, was in Washington the latter part of the week to watch the interests of electric public utilities.

From all parts of the Middle West reports are coming in of pending shutdowns of small plants due to coal shortage. Every effort is being made to get coal to these stations, and it may be that interruption of service may be avoided. None of the large electric light and power companies of the country is in any immediate danger of coal shortage.

Orders have been placed for hundreds of thousands of tons of British-mined coal for early delivery along the Atlantic seaboard. The Shipping Board is lending its active co-operation in the movement of this fuel.

Sales Managers Confer

Men from Many Cities Discuss the Commercial Problems of the Central Station

THE Sales Managers' Association held its eleventh annual convention on Monday, Tuesday and Wednesday at Association Island, Henderson Harbor, N. Y. Representatives of the sales department of the central-station companies of Baltimore, Boston, Brooklyn, Chicago, Cincinnati, Cleveland, Detroit, Keokuk, Newark, New York, Long Island City, Philadelphia and Washington were in attendance. R. R. Young, Newark, N. J., was chairman. An exceedingly well-balanced program of commercial subjects was provided.

R. S. Hall, Boston, read a paper on merchandising and wiring by central stations in which he emphasized the importance of the central station avoiding unfair competition; F. D. Pembleton, Newark, discussed the opportunities for co-operation between central stations, contractors and dealers and the great work waiting to be done by constructive publicity; J. F. Gaskill, Philadelphia, presented an analysis of the competitive costs of energy in ice plants, showing by graphs the good influence of this class of load on the power company's annual business cycle; C. K. Nichols, New York, submitted a report on the comparative performance of different types of domestic refrigeration; A. A. Pope, New York, read a paper on commercial department relationships which described in detail the operation of the organization of the New York Edison Company, and Miss F. M. Sheridan, Detroit, reported progress in her study of the comparative expense of sales departments, the situation being still incapable of accurate analysis because of the lack of comparable standards.

The ten most important opportunities for business development at present, according to a paper by R. H. Tillman, Baltimore, are offered by pumps and compressors, ventilating equipment, steam boilers, color display lighting, construction equipment, material handling, electric trucks, railway electrification, electrochemical applications and refrigeration.

H. B. Brown, Philadelphia, described the success of the mail-order type of advertising which has been employed by the Philadelphia Electric Company, and O. R. Hogue, Chicago, outlined the recent experience of the Commonwealth Edison Company in industrial and commercial lighting.

Service to Outlying Communities

An interesting new plan for supplying electric service to outlying communities was covered in a paper by G. E. Miller, Cleveland, which described a system now in force and serving several towns from the lines of the Cleveland Electric Illuminating Company. Under this plan the community constructs its own distribution line for connection to the power supply, the company providing transformers and meters and having the right to extend to other towns lying beyond.

E. W. Lloyd, Chicago, outlined the new-business program of the Commonwealth Edison Company and described the present plans of the joint committee for business development, of which he is chairman.

A further report of the recent activities of the greater service department of the Southern California Edison Company was submitted by S. M. Kennedy, Los Angeles, who was unable to be present.

Three topics were presented for general discussion, the problem of the minimum bill to the residence consumer, the question whether utility companies should take the public into fuller confidence regarding company problems, accomplishments and development, and the value of sales manuals for instructing employees in company policies and methods.

The following executive committee was elected for the ensuing year: L. R. Wallis, Boston; H. K. Mohr, Philadelphia; J. D. Noyes, Detroit.

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Georgia Senate Rejects State Water-Power Plan

The Georgia State Senate's committee on constitutional amendments has discarded by a vote of ten to one the water-power bills proposed by the Municipal League of Georgia. In substance these bills provided for the appointment of a commission to investigate the water powers of the state with a view to state-wide development.

N. E. L. A. Executive Meeting

Encouraged by its success in obtaining revisions downward of the fire insurance premiums paid by electric light and power companies, the insurance committee of the N. E. L. A. will turn its attention during the present administrative year to the question of securing reductions in the casualty insurance premiums paid by electric light and power companies, according to the report made at the first meeting of the newly elected national executive committee of the association, held at headquarters in New York last week. S. E. Wolff, former chairman of the committee, reporting on behalf of the present chairman, Charles B. Scott, said that the reductions in fire insurance premiums secured would total more than $400,000 a year, and that at least that amount will be saved to member companies if the committee is successful in obtaining similar revisions in casualty insurance premiums.

John W. Lieb reported for the joint fuel committee of the electric, gas and street railway utilities, as noted on another page.

President Smith stated that in all probability N. E. L. A. representation upon the joint committee on inductive co-ordination, which last year was the joint general committee on inductive interference, will be the same as last year, with the addition of himself as an ex-officio member.

The executive committee decided that the *Proceedings* of the 1922 convention at Atlantic City shall be published in four volumes.

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Do Terms of Water-Power Permit Govern?

Counsel of Federal Commission Holds That Compliance with Them Makes Issue of License Obligatory—Judge Advocate General Says Commission May Alter Them

IN AN opinion rendered to the executive secretary of the Federal Power Commission, Col. Lewis Call, chief counsel of the commission, has ruled that the holder of a preliminary permit is entitled to a license under the conditions set forth directly or indirectly in the preliminary permit. As the preliminary permit is issued in accordance with the provisions of the federal water power act and the regulations of the commission issued thereunder, he holds that these constitute a part of the permit, and whatever conditions are prescribed in the statute or in the regulations, though not specifically set forth in the preliminary permit, nevertheless are included by inference. He also holds that if the permittee complies with the conditions directly or indirectly expressed in his permit and is willing to accept a license on the conditions set forth in the permit, he is legally entitled to the license.

The opinion was rendered in response to a request from Executive Secretary Merrill for answers to the following questions:

1. "If a preliminary permit is first issued and such permit is to be followed by license, can conditions be inserted in the license which were not expressed directly or indirectly in the preliminary permit?

2. "If a preliminary permittee has complied with all the provisions directly or indirectly expressed in his permit, which are conditions precedent to issuance of license, and if he also is willing to accept a license containing all the provisions directly or indirectly expressed in his permit, which are to be conditions of such license when issued, has the commission authority to refuse to issue a license or to make its approval conditional upon the acceptance of other or additional provisions?"

In his opinion Colonel Call points out that the act provides for the issuance of preliminary permits for the purpose of enabling applicants for license to secure the data and perform the acts that are required by the law as conditions precedent to the issuance of a license to the permittee.

Section 5 of the act states that each preliminary permit is "for the sole purpose of maintaining priority of application for a license," and that it shall be issued "for such period or periods not exceeding a total of three years as in the discretion of the commission may be necessary for making examinations and surveys, for preparing maps, plans, specifications and estimates and for making financial arrangements," and that "each such permit shall set forth the conditions under which priority shall be maintained and a license issued."

Colonel Call contends that the provision of the act which allows a permit to be canceled upon the failure of the permittee to comply with the conditions of the permit implies that it may not be canceled for any other reason. He holds that the requirements as to written notice of application and of advertising is to insure that all objections to the issuance of a preliminary permit may be brought before the commission and considered before the permit is issued.

He also points out that the permit must set forth the conditions under which priority shall be maintained and the conditions under which a license shall be issued. The former provision, he believes, is for the express purpose of requiring the permittee to make examinations and surveys and take the other necessary steps so that he shall be in a position to proceed with his project when the license is issued. The evident purpose is to protect the permittee in the investment, frequently aggregating many thousands of dollars, necessary to the making of preliminary investigation. The provision also assures him that he may safely proceed with his investigations and his financial arrangements in the certainty that if he complies with the conditions expressed in his permit he will in due course receive a license.

JUDGE ADVOCATE GENERAL DISSENTS

The Judge Advocate General of the War Department, however, holds that the preliminary permit is issued for the sole purpose of maintaining priority of application for license, and that the commission has the power, in order to secure the project best adapted to develop, conserve and utilize in the public interest the navigation and water resources of the region in question, to impose conditions in the license not expressly appearing in the permit.

The Judge Advocate General also holds that, even though a preliminary permittee has complied with all of the conditions of his permit and is willing to accept a license upon the terms contained in the permit, the commission may make its approval conditional upon acceptance of other or additional provisions, provided such conditions are for the purpose of securing the fullest development of the public resources under the terms of the act.

The commission at its meeting on July 26 decided to refer the conflicting opinions to the Attorney-General.

Burlington Company Offers to Lease Municipal Plant

Closer co-ordination of the electrical generating and distribution facilities at Burlington, Vt., is forecast in an offer by the Burlington Light & Power Company to lease the municipal electric lighting plant of the city for a period of twenty years and operate it in conjunction with its existing steam and hydro-electric stations. D. W. Jardine, local manager of the Burlington company, informed a representative of the *Electrical World* this week that the company offers to pay $40,000 per year rental for the plant and also to extinguish $200,000 in bonds on the installation at the end of the lease.

The municipal plant has a present peak load of about 750 kw. and, besides furnishing energy for the street lighting and city pumping, supplies commercial customers from an overhead distribution system of moderate size. The Burlington company is completing important underground work in the heart of the city and operates 10,000 kw. in steam and hydro-electric stations, with an interconnection into the Montpelier-Barre district. During the past two years the municipal plant has been purchasing energy at 1 cent per kilowatt-hour from the Fairfax plant of the Public Electric Light Company of St. Albans, on the Lamoille River, this being transmitted to Burlington at 33,000 volts. About 2,000 kw. is available from this source under the present agreement.

European Power-Plant Engineering Shows Influence of Manufacturers

Recently Returned American Engineer Gives Impressions Regarding Practice in Great Britain and France—Ejector Draft and Economizer Employed Extensively—Air Preheaters Coming Into Use

SOME interesting observations regarding the development of electric light and power companies abroad were made by C. W. E. Clarke, power engineer for Dwight P. Robinson & Company, Inc., who recently returned from a brief tour of England and France.

"One not acquainted with the conditions surrounding the electric light and power industry in England and on the Continent," said Mr. Clark, "is apt to meet with a succession of surprises because of the lack of similarity in methods and also because central-station development in those countries is at a decidedly earlier stage than ours. Greater London, for example, instead of having a few large central stations, is supplied with light and power from more than forty separate plants. The majority of these are operated by means of cooling towers. The largest plant in the London district and one of the largest in England is the Lots Road station of the London Electric Railway Company, with a total capacity of 83,000 kw., consisting of six 8,000-kw., one 15,000-kw. and one 20,000-kw. machine, the two last named just recently installed.

"Another plant, of interest because of its stoker installation, is the Wolverhampton Corporation Electric Supply plant at Wolverhampton. The design is somewhat different from the usual type of chain grate, inasmuch as it has its own fans mounted on the stoker frame with fans and grate operated by one motor. This makes a very attractive and self-contained unit.

"The Birmingham Corporation Electric Supply Company is completing a new plant called 'Nechells,' which is to have an ultimate capacity of 105,000 kw., the first installation consisting of two 15,000-kw. units. The plant is to be operated with cooling towers. The steam pressure will be 325 lb. with

COOLING TOWERS ARE USED EXTENSIVELY IN EUROPEAN POWER STATIONS (NECHELLS PLANT) superheat at 272 deg. F. In accordance with the usual practice abroad, the boilers are fitted with economizers. Draft is produced by discharging a fairly high-pressure blast of air through ejector nozzles in the center of the stack. This plant is also equipped with so-called 'ironclad' switch gear. Buses and all connections to switches are run in steel, box-shaped conduits, which are filled with insulating material after the buses are installed.

"The Manchester Electric Supply Corporation is building a new station at Barton, which should prove to be an interesting development since it is one of the newer designs and contains, among other up-to-date features, a very complete heat reclamation system. The station is designed to contain three 25,000-kw. turbo-generators at present.

"I had the pleasure of going through the works of the Metropolitan Vickers Company, a large turbine-manufacturing concern at Birmingham. In my opinion the products of this company, especially the turbo-generator units, are the finest in Europe, and I question if they are not better in some features of design and construction than the turbines in this country. One novel feature is the provision for steam extraction for feed-water heating by installing the heater as an integral part of the turbine base.

"The Dalmarnock station at Glasgow is a relatively new development, with an ultimate capacity of 200,000 kw. The present plant operates under 275 lb. steam pressure and 300 deg. F. superheat. In my opinion this is the best plant I saw in England. It is operated under commercial load at a heat consumption of 18,500 to 19,000 B.t.u. per kilowatt-hour, with coal containing about 12,000 B.t.u., a very good record, especially when it is considered that the yearly load factor is less than 30 per cent.

"In France I inspected four stations, all in the environs of Paris, namely, the Saint-Denis, Saint-Ouens, Issy les Moulx and Gennevilliers stations. The main interest in the first three stations lies in the use of the Belleville type of boiler, a rather remarkable piece of equipment and so unlike a boiler as we know it as to cause remark from Americans. The tubes are threaded into the tube header and further held in place by lock nuts. The most interesting station in Paris is the new Gennevilliers station,* designed to contain 200,000 kw. ultimately. Three 40,000-kw. units are now installed. This station is more American than any other on the Continent and shows the earmarks of the designer's visit to this country about three years ago. Unless trouble is encountered with the condensing equipment, which looks rather small, I expect this station to prove to be one of the best in Europe. It is especially noteworthy because of the large size of units and the air preheaters with which the boiler plant is equipped. This is the largest installation ever attempted along these lines, and the results should prove interesting. The boiler plant is arranged with three parallel lines of boilers, two rows of Babcock & Wilcox with chain grates and one line of large Stirlings, double-fired by Riley stokers. The Babcock & Wilcox boilers are set rather low, but the Stirling units have very fine combustion space provided for them.

"Both in England and on the Continent, in central-station work especially, one sees the mark of the manufacturer rather than of the engineer, the latter apparently accepting without very much question the opinion of the manufacturer as to how apparatus should be installed and utilized. This is particularly apparent in the setting of boilers, which are still set very low with small combustion spaces. It is not uncommon to see a 1,500-hp. boiler set with the front header 8 ft. or 9 ft. from the floor, whereas today 15 ft. to 20 ft. would be considered good American practice.

C. W. E. CLARKE

"The almost universal use of economizers is another noticeable point of departure from our practice, for their installation is apparently in no way controlled by load conditions, cost of fuel, etc. The use of air heaters is becoming more general, although I saw no good representative installations of heaters in operation. Several are under construction, however.

"The European method of rating boilers is another point of departure from our custom, inasmuch as they base ratings on evaporative capacity, a logical method except where a boiler is designed for a certain number of square feet of heating surface. In this case, owing to variant ideas of builders as to what constitutes good practice in terms of evaporation (in pounds of water) per square foot of heating surface, the relative evaporation rates might be radically different.

"Some of the structural steel designs used abroad are worthy of comment. Apparently there is a very general tendency to use heavy rolled shapes in designing columns and beams, while from our point of view the use of plates and angles would be better practice. In the construction of large steel-skeleton buildings the sides are covered for the full height with temporary scaffolding. Apparently the present-day hanging scaffoldings widely employed in this country are not used. However, the builders in England are in the hands of the Board of Trade, a rather arbitrary governmental organization, which sometimes does not permit the use of methods or devices which we consider good practice."

Mr. Clarke states that every courtesy was extended to him by the engineers of France and England. However, he was not allowed to see the North Tees power station at Newcastle. Merz & McLellan, the engineers, declared that the station, although it had been in commercial operation for some time, was not yet fully in commission. Furthermore, the Newcastle-on-Tyne Electric Supply Company has made it a rule to admit no visitors to the station until the whole of the plant shall have satisfactorily passed the specified tests.

J. W. Lieb Reports to N. E. L. A. on Fuel Situation

One of the most important matters to come before last week's meeting of the new executive committee of the National Electric Light Association was a summary by John W. Lieb, chairman of the joint fuel committee of the N. E. L. A., the American Gas Association and the American Electric Railway Association, of the activities of that committee, which took over the coal situation when the National Committee on Gas and Electric Service was discharged more than a year ago. Mr. Lieb stated that as a result of a warning notice sent out from the three associations in January, followed by additional letters containing information on the coal situation, the public utilities of the country undoubtedly were in better shape so far as coal reserves are concerned than any other class of industry. Questionnaires sent out by the three associations a month ago resulted in replies showing that the utilities as a whole had between thirty and forty days' supply of coal on an average, the electric light and power companies at that time having fifty days' supply.

Mr. Lieb said that virtually all companies are now in the spot coal market purchasing at increased prices in order to maintain existing reserves, although every effort is being made to get coal as cheaply as possible.

Of particular interest to members present who operate steam properties at or near tidewater was Mr. Lieb's statement that several hundred thousand tons of British coal had been ordered by utilities and industries of this country for delivery within the next two months. This coal is now available at from $7.25 to $7.75 per ton f.o.b. American ports.

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*See frontispiece in July 15, 1922, issue of the *Electrical World*.

Pulverized Fuel for St. Louis Plant

Splendid Location Near Low-Grade Fuel Source —No Stack Trouble—Fuel Equipment Part of Boiler Setting—Plan Held Cheapest and Best

The decision to use pulverized fuel in a large central station, after careful analysis of costs, shows that engineering of power plants is still in the process of evolution. As mentioned in last week's issue of the *Electrical World*, the new Cahokia plant of the Union Electric Light & Power Company in St. Louis will have its initial installation of eight boilers equipped with pulverized-fuel apparatus, which will be supplied by the Combustion Engineering Corporation.

The reasons given by McClellan & Junkersfeld, the consulting electrical engineers, for the use of this fuel are:

1. An annual coal consumption lower than with the best of a number of stokers tested and investigated is assured.
2. A net saving is made in operating cost by reason of the relative cost of maintenance, banking and pick-up losses, ash disposal and pay-roll.
3. Increased operating convenience is gained both for normal load and for quickly added loads.
4. The fixed charges on pulverized-fuel equipment and building are no greater than those on stoker equipment and building.
5. Owing to the location of the plant, there is no question of trouble from stack ash.
6. Operating reliability of the equipment is unquestioned, while low-grade fuel can be burned and oil can be quickly substituted for coal if desired.

The increased efficiency of combustion with the use of pulverized fuel was the biggest of several factors. Moreover, this plant is about 20 miles from a mining region where low-grade fuel can be obtained at about $2.50 per ton. In the opinion of Peter Junkersfeld, slagging and troubles with pulverized fuel are as preventable as with stokers and have have been eliminated to a large extent by careful design.

The decision on the plant fuel equipment was reached only after exhaustive tests and investigations had been made throughout the country. One of the most important installations studied was that of the Milwaukee Electric Railway & Light Company.

The new plant will cost about $6,000,000 and will be built on the Illinois side of the Mississippi at St. Louis.. This location was chosen because it is the load center, because it eliminates all bridge or switching charges for fuel transportation, and because service can be obtained from several railroads. In addition, no possible trouble can result from chimney discharge.

At present there are being installed two 30,000-kw. turbo-generators—one General Electric and one Westinghouse —but the ultimate development will consist of eight units. The two units are supplied with steam from eight boilers of about 18,000 sq.ft. heating surface with steam at the throttle having a pressure of 300 lb. at a temperature of 690 deg. F.

The condensers for the units will be placed in pits because of a 45-ft. variation in high and low water in the river. Each pit will contain two condensers, with a twin intake tunnel and a single discharge tunnel. The boilers will be without economizers and will be eighteen or twenty tubes high, with a very deep combustion chamber specially designed as to setting and arrangement to burn pulverized fuel having about 17 per cent ash content. The pulverized-fuel equipment is part of the boiler, takes the same space and is arranged like a stoker installation, as part of the boiler room.

All auxiliaries will be electrically driven. Feed water will be heated by bleeding from main units with exhaust from a house turbine for maintaining a heat balance.

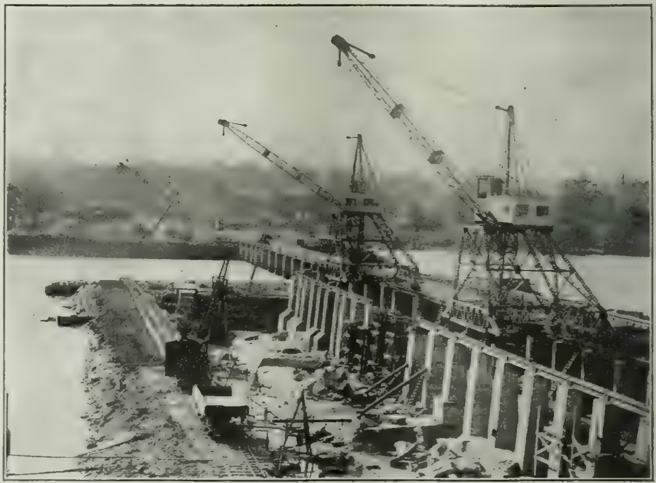
Another feature of the plant is that uture units can with equal convenience be equipped either for pulverized fuel or for stokers. This arrangement arose from the fact that the original design of the station was predicated on using either type of equipment. Improvements may be expected in the development of stokers as well as in pulverized-fuel equipment, but stokers have been under development for a long period of years and the burning of coal in pulverized form in large quantities by central stations has been done only in the last few years. Without attempting to estimate future developments in the two classes of equipment for burning coal, the consulting engineers state that at least the present relative position, so far as the Cahokia station is concerned, will probably be maintained.

Powdered Coal in Arkansas

Following a successful experiment in operating a power plant with powdered coal as fuel, the Arkansas Light & Power Company plans to install a large plant of this type at Russellville, Ark., connecting it by high-tension lines with the company's plants at Pine Bluff and Picron. The Russellville plant of the power company has been closed down for several days, energy for Russellville, Dardanelle, Atkins, Morrillton and Plumerville being supplied from the powdered-coal plant at the mines of the Southern Anthracite Company, south of Russellville. According to B. C. Fowles, manager of the power company, the powdered-coal plant will furnish power during the summer months, except on Saturday nights, when the Russellville plant will be operated.

The powdered-coal plant, which was installed as an experiment, is declared to be a complete success. The Pine Bluff plant supplies the rice fields in the Grand Prairie district, its peak load for pumping purposes being from June to September. Cotton gins in other sections demand a peak load during the fall and winter months. With the three plants connected, it is said they will equalize the demand for power throughout the year.

Army Engineers Resume Work on the Wilson Dam



Immediate work in continuation of the construction of the Wilson Dam at Muscle Shoals, Ala., by army engineers will be possible by the use of unexpended appropriations of $230,000. This sum will be supplemented Oct. 1 by the $7,500,000 recently authorized by Congress.

Hydro-Electric Plans for Central Chile

British Engineers Report Favorably on the Development of the Colorado and Maipo Rivers —A Total Development of 100,000 Hp. Projected

CHILE has a Colorado River of her own. This stream and another, the Maipo, have lately been explored with respect to their hydro-electric potentialities by two British engineers, F. S. Badger, who represents J. G. White & Company, and Norman Rowe. Plans based on the favorable report of these engineers are, according to the Trade Supplement of the London *Times*, being made for the exploitation of these water powers by a new enterprise, which also purposes the purchase and amalgamation of a number of existing undertakings such as the Chilean Electric Tramways & Light Company and the Compañia de Fuerza Electrica de Santiago. From the *Times'* report these details of the projected hydro-electric development are taken:

The first plant to be erected will consist of three, and subsequently of four, generating units of 10,000 hp. each. The available head is 590 ft., and the main canal will be about 25,000 ft. in length. On account of the large amount of silt brought down by the Colorado and Maipo Rivers, the expedient of storing water by means of a dam was not thought suitable, and instead it has been decided to construct a reservoir in a natural depression in the hillside.

Electrical energy will be generated at 6,600 volts, 50 cycles, three-phase, and transformed to 110,000 volts for transmission. The transformers and 110,000-volt switchgear will be of the open-air type and will be installed outside the power station, but the controls for the 110,000-volt oil switches will be mounted on the main switchboard inside the power house, in conjunction with the controls of the 6,600-volt switches, all switches being worked electrically by remote control. For additional security and ease of operation, both the 110,000-volt and the 6,600-volt busbars will be in duplicate, and the transmission lines will also be in duplicate.

Carried on double-circuit steel towers, the line to Santiago will at first consist of two circuits of copper conductors, the insulators used being of the suspension type and the normal spans 61 ft. From Santiago the line will be continued on one set of double-circuit towers and pass through Polpaico, over the Pass of Domida, to Limache and Valparaiso. It is intended to construct a substation at Santiago in order to supply the Electric Tramways & Light Company, as well as other local consumers, while a further substation will be erected at Tiltil to supply the demand in that locality, including the necessary power for the operation of the State Railways over a heavy grade.

These works are merely intended to serve as a nucleus of a much wider and more comprehensive scheme of hydro-electric installations. Rights have been acquired to utilize other natural water resources, such as a portion of the Maipo River which runs through a deep and narrow gorge and affords an almost ideal site. At Puente de Cristo there is to be constructed a hydro-electric station capable of producing 65,000 hp., and when these works, together with others in contemplation, have been completed, the central region of Chile will have command of more than 100,000 hp. supplied from hydro-electric sources.

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Newspaper Men Visit Pit River

More than sixty California newspaper men spent three days inspecting the Pit River developments of the Pacific Gas & Electric Company recently. The writers were guests of the company and reported an enjoyable time. A year ago the plant was started and now the power house, costing upward of $6,000,000, is nearing completion. The plant will develop 93,000 hp. when completed and will be ready for operation about Sept. 15. A 220,000-volt transmission line 210 miles long will connect the plant with the Vacaville substation, and 70 miles must still be covered by another line before San José Mission is reached and the power is delivered at San Francisco.

The whole Pit River development is expected to reach completion in 1935, at a cost of more than $100,000,000, or an annual expenditure of about $8,000,000. The power developments mapped out are: Pit No. 2, 23,500 hp.; Pit No. 3, 90,500 hp.; Pit No. 4, 107,200 hp.; Pit No. 5, 250,000 hp.

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Southern California to Save 1 per Cent in Financing

Stockholders of the Southern California Edison Company are to vote on Aug. 1 on a plan for rearranging the capitalization of the corporation which will make junior financing cheaper and thus bring about a saving of 1 per cent or more in the cost of money raised by the company. In announcing the new plan to the stockholders President John B. Miller says:

"The company's general policy is to provide the major part of its new construction needs through the sale of bonds and the remainder by capital stock. Heretofore common stock paying 8 per cent dividends has been sold. It is now proposed to substitute a stock limited to 7 per cent dividends for future sales, thus resulting in the company securing funds at 1 per cent less than formerly, with resultant benefit to present stockholders. This plan will make additional funds available for dividends on the stock outstanding.

"Through the unprecedented distribution of common stock among the people of southern and central California the company is now in a most enviable position. In 1917 it adopted the policy of having a large number of partner stockholders with the result that between 1917 and the present date there has been sold about $35,000,000 common stock and the number of stockholders has been increased from less than 2,000 to over 47,000. This splendid result makes possible a rearrangement of the company's capitalization to provide for future financing at less cost, which should provide a greater surplus available for dividends on common stock."

Brief News Notes

American Public Service Extends Lines.—The American Public Service Company has completed arrangements for building high-tension lines into McCauley, Sylvester, Plastico and other towns along the Kansas City, Mexico & Orient Railway in west Texas, according to announcement by P. P. Sheppard, its representative. Electric energy for lighting and power will be made available to these towns.

Oshkosh Has "White Way."—On July 4 the Mayor of Oshkosh, Wis., threw the lever that supplied energy to 230 new ornamental street lamps in the business section. The official opening was in the power house of the Oshkosh Gas Light Company and was attended by officials of that company, of the Monroe Electric Company of Chicago, which installed the lights, and of the Oshkosh Association of Commerce. The Association of Commerce was instrumental in getting the new system for the city.

No Conflict Over Ohio River Development.—The Louisville Gas & Electric Company will not enter into any controversy with the city of Louisville regarding the power site at the falls of the Ohio River, according to a report from the Kentucky city. The company, it is announced, will lay its claims before the Federal Power Commission's examiners at the same time that the city's claims are presented. The commission has issued a statement that the examiners will soon hold hearings in Louisville. "The city of Louisville," the commission reports, "has made application for power development at the proposed reconstructed dam in the Ohio River at the Falls of the Ohio, near Louisville. The city proposes to use the power for municipal purposes and to sell it for public utility purposes in Louisville and adjacent municipalities. The application is in conflict with Project No. 1,289, an application for a preliminary permit from the Louisville Hydro-Electric Company." The latter company is a subsidiary of the Louisville Gas & Electric Company. The power will not be available, it is said, for ten years, as the construction of a plant and dam at an expenditure of about $12,000,000 is necessary. A steam plant will also be required to assure a continuous supply of power.

New Station at Merrimack, Ala.—The Alabama Power Company has erected a new primary substation at Merrimack, near Huntsville, tripling its power output at that point. It is reported that another large cotton mill is to be erected at Merrimack, and the power facilities now provided are declared to be ample to care for the needs of any new industries which may be established.

Camden-Atlantic City Line Buys Philadelphia Power.—Electricity bought from the Philadelphia Electric Company will be used to furnish the power of the West Jersey & Seashore Railroad's third-rail line from Camden to Atlantic City. An agreement has been reached between the Pennsylvania Railroad, which controls the West Jersey, and the electric company by which the Pennsylvania Railroad will run a transmission line across its Delaware River Bridge and connect with the West Jersey in Westville.

Central Maine Purchases Freeport Company.—A decision has been given by the Public Utilities Commission of Maine approving the petition of the Central Maine Power Company and the Androscoggin & Kennebec Railway Company for the sale of the former properties of the Freeport Electric Light, Heat & Power Company by the Androscoggin & Kennebec Railway Company to the Central Maine Power Company and authorizing the Central Maine Power Company to furnish its service in the town of Freeport. The price paid was $20,000.

New England Bureau of Public Service Information Plans Expansion of Service.—A New England "Primer of Public Utilities" has been prepared for distribution this fall by the New England Bureau of Public Service Information, according to the first annual report of Joseph B. Groce, director of the bureau. The New England bureau covers six states. Thirty-seven bulletins have been issued since the inauguration of bulletin service to the press, to executives of subscribing companies, to chambers of commerce, banking houses and public libraries in October, 1921.

The Scottish Highland Electricity Supply Scheme.—Under the Grampian hydro-electric project now before the British Parliament the development company would tap the water power available within an area covering 417 square miles in the northern part of Perthshire. About 56,000 continuous horsepower would thus be made available for the whole of central Scotland. There would be four power houses—one on the Tummel River, rated at 17,400 hp.; one at the western end of Loch Rannoch, rated at 26,900 hp.; one on the Garry River, rated at 7,500 hp., and one on the Bruar, rated at 4,200 hp. Electrification of the Highland Railway is contemplated. The total cost of carrying out the scheme, says the London *Engineer*, is put at £4,500,000.

Water Power on the Spanish-Portuguese Border.—Utilization of the power resources on the rivers forming the boundary between Spain and Portugal has been brought nearer, says the American Consul at Oporto in a report to the Department of Commerce, by the beginning of operation of the plant of the Compañia Electro del Lima at the falls of the Lima River, on the frontier. The development of the important power resources of the Douro River, an international stream, has been prevented by the inability of the two countries to agree on the distribution of the power. The Lima project is being handled by a company owned jointly by Spanish and Portuguese interests. The Spanish interest is held by the Hidroelectrica Hispañola, which is one of the two large hydro-electric companies operating in Spain. The Portuguese interest is held by the banking firms of Pinto and Setto Maior. The success which apparently is accompanying the Lima development is expected to pave the way for more important developments on the Douro.

British Scheme to Consolidate Power Supply Is Making Progress.—Fourteen districts have been mapped out by the electricity commissioners under the electricity supply bill, which is intended to reorganize the entire system of distribution for Great Britain, according to the American Consulate at London. The districts already defined are Lower Severn, West Lancashire, West Riding of Yorkshire, Mid-Lancashire, Southeast Lancashire, North Lancashire, North Wales, London and home counties, Northwest Midlands, Northeast Midlands, South Wales, Southwest Midlands, East Midlands and West Scotland. Prior to 1919 the supply of electricity in England was in the hands of more than 500 concerns, located in various parts of the country and each having its own area. Conditions have been especially bad in and about some of the larger English cities where numbers of these smaller plants endeavor to operate as central stations, each supplying a small area, at different voltages and frequencies. The city of London is at present supplied with electricity by about seventy different stations. In most of the new districts modern large-capacity stations will have to be built. The first of these is to be erected by the County of London Electricity Company, at Parking, Essex, and will be used to reinforce the supply for Greater London. Each of the new capital stations will cost upward of £3,000,000 and will be so designed as to allow enlargement to meet increasing demand. It is probable that the next ten years will see the number of central stations in England reduced to about a score.

Associations and Societies

National Radio Chamber of Commerce.—This organization held its first annual meeting at Washington on Wednesday, Thursday and Friday of this week. Among the speakers announced were Secretaries Hoover and Weeks, Gen. G. O. Squier, Dr. S. W. Stratton and M. C. Rypinski.

Chicago Section, A. I. and S. E. E.—The final meeting of the Chicago Section of the Association of Iron and Steel Electrical Engineers was held on June 20 during a boat trip down the Sanitary Canal en route for an inspection trip through the power plant at Lockport, Ill. The following officers were chosen for the coming year: President, Charles Donovan, American Sheet & Tin Plate Company, Gary, Ind.; vice-president, Henry E. Davis, Interstate Iron & Steel Company, South Chicago, Ill.

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Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

A. I. E. E., Pacific Coast Convention—Vancouver, B. C., Aug. 8-11. F. L. Hutchinson, 33 West 39th Street, New York, N. Y.
Michigan Electric Light Association—Ottawa Beach, Aug. 21-23. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.
International Association of Municipal Electricians—New Bedford, Mass., Aug. 22-25. C. R. George, Houston, Tex.
New York Electrical League—Association Island, Sept. 5-7.
N. E. L. A. Geographic Divisions — New England, New London, Conn., Sept. 5-8; Southeastern, Atlanta, Sept. 12-15; Rocky Mountain, Glenwood Springs, Col., Sept. 18; Great Lakes, French Lick Springs, Ind., Sept. 28-30. M. H. Aylesworth, 29 West 39th Street, New York.
Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 6-9. H. M. Stine, 212 Locust St., Harrisburg, Pa.
Association of Iron and Steel Electrical Engineers—Cleveland, Sept. 11-15. J. F. Kelly, Empire Bldg., Pittsburgh, Pa.
American Electrochemical Society — Montreal, Sept. 21-23. A. D. Spillman, Columbia University, New York City.
Illuminating Engineering Society—Swampscott, Mass., Sept. 25-28. Samuel G. Hibben, 29 West 39th Street, New York.
American Institute of Mining and Metallurgical Engineers—San Francisco, Sept. 25-28. F. F. Sharpless, 29 West 39th Street, New York.
National Association of Railway and Utilities Commissioners — Detroit, Sept. 26. J. B. Walker, New York Transit Commission, New York.
Illinois State Electric Association—French Lick Springs, Ind., Sept. 28-30. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.
Indiana Electric Light Association—French Lick Springs, Ind., Sept. 28-30. Thomas Donohue, Lafayette, Ind.
American Electric Railway Association — Chicago, Oct. 2-6. J. W. Welsh, 8 West 40th Street, New York.
Empire State Gas and Electric Association —Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.
Association of Edison Illuminating Companies—New York City, Oct. 11-14. Preston S. Millar, 80th St. and East End Ave., New York.
National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St.
Electric Power Club—Asheville, N. C., Oct. 30. S. N. Clarkson, 506 Laclede Gas Bldg., St. Louis.

Commission Rulings

Service Charge Substituted for Meter Rental.—Declaring a rental charge for meters illegal, the Wisconsin Railroad Commission has ordered the Princeton municipal electric light department to repurchase at present values meters sold to consumers and to impose a service charge of 15 cents a month per meter in place of the rental charge.

Taxes on Bonds.—Taxes on bonds paid by a public utility company must not, the Pennsylvania Public Service Commission declared in a complaint against the Lewiston-Reedsville Water Company, be charged to operating costs. Assuming such taxes is in effect paying an increased interest rate on borrowed capital, and such a payment cannot be passed on to the public.

Basis of Energy Sales by Municipality to Utility.—A municipal electric plant supplying electricity at wholesale to a public utility should, the Wisconsin Railroad Commission decided in passing on an application from the village of Embarrass, bill the company on the basis of the reading of a master meter rather than the readings of individual meters. In view of transformer losses, however, the commission reduced the rate from 8 cents per kilowatt-hour to 5 cents, the regular power rate of the village.

Commission Has No Duty to Protect Company Against Loss from Unfortunate Contract.—Declaring that the province of the commission is to "safeguard the interests of the public," the New Hampshire Public Service Commission refused to change an unprofitable contract rate made by the Antrim-Bennington Electric Light & Power Company with a manufacturing company, saying: "Where the utility enters into a contract to furnish service at a rate lower than is provided by its regular schedule and it is found that the performance of this contract will necessarily work a hardship on the other consumers by either increasing their rates or impairing the service, then the commission should terminate the special contract, even though it was approved by the commission when entered into. But where the enforcement of the contract results simply in a decrease of the net return to the owners of the property and has no injurious effect on the general public, the contract should not be set aside. It is not the duty of the Public Service Commission to protect the owners of the public utility property against the consequences of an unfortunate contract voluntarily entered into by them. There is no reason why they should not abide by the consequences of their acts so long as the public is not adversely affected."

Grouping Communities for Rate Making.—The Wisconsin Railroad Commission, approving the division of the territory of the Wisconsin Gas & Electric Company into sections according to the character of territory served, said: "That the rates charged should vary with the density of the territory served must be expected if these rates are to be in keeping with the costs of serving the various communities. With a very large number of communities to supply with energy, it is not practicable to serve each under a different set of rates. Divisions are, therefore, resorted to which include all territory whose energy consumptions are similar and to which the same schedule of rates can logically be applied. The differentials between the rates of the various groups are designed to represent as closely as possible the average differences in the costs of service."

Attaching Transformers to Commission Lines Condemned.—Maintaining that the practice of attaching a transformer directly to an 11,500-volt transmission line to serve patrons with 110 volts or 220 volts is not good engineering practice, the Pennsylvania Public Service Commission, in adjusting a complaint brought by the Brownstown Electric Light & Power Company against the Edison Electric Company of Lancaster, said: "Connections with high-power lines should be made only by substations equipped with transformers, switching equipment, lightning arresters and voltage regulators. If made in any other way—especially in the manner desired by the complainant company—the entire territory served by the transmission line of high voltage would be subject to frequent interruptions, since the voltage regulation would not be properly controlled."

Depreciation Charges and Maintenance. — The distribution between charges to depreciation reserve and to current maintenance was discussed by the Arizona Corporation Commission in deducting accrued depreciation in rate proceedings *re* the Tucson Gas, Electric Light & Power Company. "The accumulation of a reserve to meet replacements of property having a life of more than one year has been found expedient," the commission said. "It is clear that a company might charge the cost of replacements of every nature, including trivial repairs, to the depreciation reserve, thereby relieving the expense of maintenance very considerably, or it might charge the cost of all replacements to operating expense as the replacements occurred, thereby eliminating the necessity for any depreciation reserve. Modern accounting, as exemplified by the recommendations made by the N.E.L.A., dictates a middle course in which minor repairs are charged to maintenance and replacements 'incident to important retirements of buildings or large sections of continuous structures, like electric lines, or of definitely identifiable units of plant or equipment,' are charged to depreciation reserve."

Recent Court Decisions

The Indiana Consolidation Case.—The Indiana Supreme Court has set Oct. 4 as the date for hearing argument in the appeal of the Indiana Public Service Commission against the injunction granted to the cities of Indianapolis and Kokomo by the Superior Court which forbade the execution of the order of the commission authorizing the consolidation of seven Indiana electric traction and gas utilities into the Indiana Electric Corporation. The Superior Court, in granting the injunction, declared the action of the commission to be without force and void.

Public Utilities Commission Statute Does Not Deprive Courts of Equity Jurisdiction.—Denying to the plaintiff (State ex rel. City of Cleveland vs. Court of Appeals) a writ of prohibition against the issuance of an interlocutory order by the Court of Appeals, to which the East Ohio Gas Company had carried a rate ordinance passed by the City Council of Cleveland, the Supreme Court of Ohio declared that the act creating the Public Utilities Commission of the state in no way withdrew from the courts any of the jurisdiction in equity which they theretofore had, and that when a case is stated which if true involves confiscation the court will have jurisdiction and issue such orders as may be necessary to preserve the rights of the parties to the controversy (135 N. E. 377).*

Federal Court in Colorado Reverses Itself on Confiscatory Rates.—A decision by the United States District Court in Colorado, in Pueblo Gas & Fuel Company vs. City of Pueblo, reversing a former decision of the same court and following the ruling of the Circuit Court of Appeals in the case of the Denver Tramway Company, permits the plaintiff company to obtain relief despite the existence of a contract previously held by the court to be inescapable in its terms. The finding reads: "The court feels compelled to the belief that the views it has heretofore expressed are erroneous, and that under the ruling in the Tramway case the plaintiff must be granted the relief which it seeks. The writ prayed for should not, however, be without conditions. A rate that is confiscatory today may become highly remunerative within a few years or even months. The order for the writ of injunction may be entered, reserving to the defendant the right to petition that the case be again opened on the facts for the purpose of showing, if it can, that the rates named in the ordinance are no longer confiscatory; and for that purpose the court will retain jurisdiction over the case."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Chubb Elected President of Iowa Section, N. E. L. A.

C. N. Chubb, recently elected president of the Iowa Section of the National Electric Light Association, is the vice-president and general manager of the People's Light Company, Davenport, Iowa. Mr. Chubb was graduated from the Massachusetts Institute of Technology as a civil engineer, and after about two years in steam-railway work he entered the employ of the United Gas Improvement Company of Philadelphia, serving on various properties in positions ranging up to vice-president and general manager. He went from the United Gas Improvement properties to his present work at Davenport. During the past year Mr. Chubb was president of the Iowa District Gas Association, and he is now chairman of the Technical Section of the American Gas Association.

C. N. CHUBB

President McClellan to Make Western Trip

President William McClellan of the American Institute of Electrical Engineers, whose term of office expires next month, when he will be succeeded by Frank B. Jewett, is starting on a Western trip, in the course of which he will meet and address a number of local Institute sections. His itinerary follows:

July 31—St. Paul and Minneapolis. Here he will address the local section at luncheon in St. Paul and at dinner in Minneapolis. Engineers and business men of the Twin Cities will be present.

Aug. 3—Spokane. Luncheon address to engineers and business men.

Aug. 4—Seattle. Luncheon address.

Aug. 5—Portland. Luncheon address. From here he will return to Seattle and be the guest of the local section on a motor trip to the Pacific Coast convention at Vancouver, B. C.

Aug. 8—Vancouver. Presidential address at the convention, his last official function.

Aug. 12—Salt Lake City. Luncheon address.

Aug. 14—Denver. Luncheon address.

Aug. 15—Kansas City. Evening address.

International Tour Planned by Electrical Societies

Kenneth A. McIntyre of the Society for Electrical Development and Lawrence W. Davis of the National Association of Electrical Contractors and Dealers will shortly make a tour through western Canada and the Western States as representatives of their respective societies. The trip has been planned together in order to insure economy of time and effort in covering the twenty-five cities which have been selected for meetings. Mr. Davis will devote his time to advancing the interests of the contractor-dealers by visiting in person every one so far as time permits. Mr. McIntyre will concentrate on co-operative league work.

F. J. Macleod Nominated Justice of Massachusetts Superior Court

Governor Cox recently nominated Frederick J. Macleod, who was formerly chairman of the Massachusetts Public Service Commission, as justice of the Massachusetts Superior Court. Mr. Macleod is well known in the New England public utility field for his able direction of the regulation of transportation and communication companies prior to the consolidation of all regulatory functions in the Department of Public Utilities.

W. L. Frost has been appointed manager of the consumers' department which was recently created in the Southern California Edison Company and will now have general supervision of the activities of that company directly affecting its customers. He will have charge of the personnel and in addition he will supervise the credit and collections departments, the advertising department, the library department and the complaints department. Mr. Frost has been in the employ of the Southern California Edison Company since 1900 and has successively held positions as meter reader, groundman, lineman, bookkeeper, collector, cashier, power salesman, foreman, assistant purchasing agent, manager of three different districts and assistant to vice-president. He has long been active in the work of the N. E. L. A.

General Electric Company Appoints New Manager

Walter S. Goll, who has been the assistant general manager of the Fort Wayne works of the General Electric Company since October, 1918, was selected as manager of the works to fill the vacancy left by the recent resignation of F. S. Hunting. Mr. Goll is fifty years of age and assumes his new executive responsibilities after about twenty-five years of activity in the manufacture of electrical apparatus and machinery. He was born in St. Louis Oct. 30, 1872, and was graduated from Cornell University with the degree of M. E. in 1896. Immediately after his graduation he entered the service of the St. Louis & Suburban Electric Railway Company and in April, 1897, became connected with the railway engineering department of the General Electric Company at Schenectady, N. Y.

About twelve months after this Mr. Goll resigned to become engineering correspondent with the Siemens-Halske Electric Company of Chicago. The Fates, however, decreed otherwise, for this company was subsequently purchased by General Electric interests, and on April 1, 1901, Mr. Goll became manager of the Chicago office of the Fort Wayne Electric Works of the General Electric Company. Early in 1909 the Northern Electrical Manufacturing Company, a subsidiary of the General Electric, was absorbed by the Fort Wayne Electric Works, and Mr. Goll was transferred to Madison, Wis., to become manager of that plant. In 1915 the Madison plant was sold, and in February, 1916, Mr. Goll was sent to Fort Wayne, where he took charge of certain special engineering and commercial work. About two years later Mr. Goll was appointed assistant general manager.

W. S. GOLL

Col. Arthur S. Dwight, president of the American Institute of Mining and Metallurgical Engineers, has been made a Chevalier of the Legion of Honor by the French government. Colonel Dwight served conspicuously with the Eleventh Engineers and received the "D. S. O." from the British government.

Charles F. Rand, treasurer of the American Institute of Mining and Metallurgical Engineers, has been designated for the cross of the Legion of Honor by the French government in recognition of his services during the war. Mr. Rand has been a leader in engineering movements for many years.

W. P. Little a Vice-Chairman Accounting Section, N. E. L. A.

W. Paxton Little was elected a vice-chairman of the Accounting Section of the National Electric Light Association at its recent convention held in Atlantic City. Mr. Little comes to this executive position with the association after many years of relation with public accounting, having been a member of the New York State Society of Certified Public Accountants since 1904 and being chairman of the committee on the classification of accounts of the Canadian Electrical Association at the present time. Mr. Little entered the service of the Cataract Construction Company as auditor in 1893, when this company was engaged in constructing the works of the Niagara Falls (N. Y.) Power Company. At the same time he had charge of the accounts of the Niagara Falls Power Company, and in 1895 he was appointed assistant treasurer of that company. In 1905 he was elected treasurer of the Niagara Falls Power Company and the Canadian Niagara Power Company, and he has continued as chief accounting officer of these companies since that date. He was also treasurer of the Tonawanda Power Company from 1905 to 1917. Mr. Little is a member of the American Institute of Accountants and of the National Association of Cost Accountants, as well as the New York State Society of Certified Public Accountants.

W. P. LITTLE

Roger B. Stevens, formerly electrical engineer on the consulting board of the American Sugar Refining Company, has opened a consulting engineering office in the Vanderbilt Avenue Building, 51 East Forty-second Street, New York City. Mr. Stevens' office is prepared to do engineering and construction work for all classes of industry, including complete industrial plants, industrial power plants, electrical construction of all kinds, and special investigation work on power, illumination and production problems. In his recently acquired capacity of consulting engineer he has been retained by the A. R. Burnette Corporation and the George Comfort Company of New York City as adviser on electrical and power problems and has retained the A. R. Burnette Corporation as consultants on structural and special industrial work. Mr. Stevens spent a number of years in the contracting business in Michigan and Ohio and was connected with the Montana Power Company of Butte, Mont., on the electrification of the Chicago, Milwaukee & St. Paul Railroad through Montana and Idaho. During the war he was a member of the Signal Corps and Air Service of the United States Army and after leaving the service became associated with the American Sugar Refining Company.

John P. Lucas, the director of public relations for the Southern Public Utilities Company, was temporarily released a short time ago, in order that he might devote his time to a "Live-at-home" campaign then being conducted in North Carolina to bring before the farmers of the state the deplorable results of failure on their part to grow at home the food and feed needed by their families and livestock. Mr. Lucas was so successful in handling the publicity for the campaign that the joint committee for agricultural work passed a resolution thanking him for his efforts.

George McQuaid, well-known Texas newspaper man, has been employed by the public utility organizations of Texas, and is in charge of the Texas Public Service Information Bureau, recently established in Dallas, Tex., with offices at 1004 Magnolia Building. The bureau is issuing a weekly news bulletin giving current news and interesting information regarding the utilities operating in Texas, and about public utilities in general. This bulletin is supplied to the weekly and daily newspapers of Texas and to others interested in utilities. Mr. McQuaid is one of the best-known newspaper men of Texas and Oklahoma, having been connected with various newspapers in those states for the last thirty years, serving in various capacities from reporter to managing editor and editor. Mr. McQuaid was born in Virginia and was educated at Georgetown University.

Dr. Raymond Elected President Armour Institute of Technology

Dr. Howard M. Raymond has been elected president of the Armour Institute of Technology. Dr. Raymond comes to this high position in the field of technical education after twenty-seven continuous years as instructor and professor in the institution of which he is to be the head. He was graduated from the University of Michigan as electrical engineer in 1893 and immediately upon graduation became connected with the Rockford Electrical Manufacturing Company for a period of one year, after which he returned to the University of Michigan to take post-graduate work in physics and electrical engineering for two years. In 1895 he was appointed director of the Manual Training School, Ishpeming, Mich., resigning during the same year to accept a position as instructor in physics in the Armour Institute of Technology. In 1898 he was appointed associate professor of physics in that institution, and he filled that post for the following five years, for three of which he acted as principal of the Armour Scientific Academy. In 1903 he was appointed professor of experimental physics in the Armour Institute of Technology and also dean of engineering studies.

H. M. RAYMOND

E. S. Roberts, formerly sales agent of the Savannah (Ga.) Electric & Power Company, has been transferred to the Blackstone Valley Gas & Electric Company at Pawtucket, R. I., where he is sales manager.

L. H. B. Sandwell, English electrical and mechanical engineer, has come to establish himself permanently in America, after a successful career in India covering exactly twenty years. During his stay in the Orient Mr. Sandwell was connected with the Calcutta Electric Supply Corporation, Barrackpore Electric Supply Company, United Provinces Electric Supply Company and Bombay Electric Supply & Tramways Company.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

The True Function of Distribution

What the Jobber Really Is Paid For—The Potentiality of a Territory—What the Manufacturer Should Contribute*

By George P. Baldwin
General Merchandise Manager, General Electric Company

THE day is approaching when electrical merchandise will become a shopping line. But the conditions of the growth of the electrical industry have tended to make us a race of engineers. And this is the reason perhaps why some of us have not realized the importance of the marketing and shopping features of our industry.

We can liken our process of distribution to the voyage of a trading ship that goes to the South Seas in search of the products of the islands there—products which are in demand in the country from which she sails. She purchases goods, gathers them together, makes up a cargo, sails home, and on reaching there sells the goods. The ship has not manufactured anything in the accepted interpretation of the word, nevertheless work has been performed, and the evidence is expressed in expenditures covering the purchase of the goods and the payment of expenses, expenses which in a great many ways parallel those of the present-day jobber.

Margin for Work Done

The ship has made for her owners a profit or a loss, not necessarily because they own the ship, but because the ship has made a voyage—a successful or an unsuccessful trading expedition—all depending on whether or not there was a gain or loss. And, incidentally, while the ship could not have sailed without the services of a navigator or a crew, the operation of the ship itself was but one of the contributing factors of the transaction as a whole and a necessary item of expense.

G. P. BALDWIN

In a word, the ship was but the vehicle by which the goods are transported, and the organization were the buyers, warehousemen and sellers of the goods. The goods were purchased in the South Sea Islands; expense was added, increasing their value by virtue of work that was performed and service that was rendered, and consequently the goods themselves were also vehicles conveying a transaction by which a profit or a loss was made.

We speak of expense in terms of selling price. We speak of percentage of selling expense. We speak of percentage of gross or net profit in terms of volume of sales. Some day we are going to speak more of the ratio of gross profit and expense, and after we get that idea firmly fixed in our minds we are going to change somewhat our attitude and some of our methods. For, after all, the important point is that the jobber receives a certain margin for work to be performed for the benefit of the community which he serves—a margin regulated to a large extent by competition—and it is what he saves by his superior methods, as against those of others likewise engaged, that is his net profit.

We must learn more of the potentiality of a given territory also—what is the total demand of a given territory and what is a fair share. To get this information we must know very thoroughly what we are selling, where and to whom; and if the study of potential demand did nothing else, it would at least make us learn more of our customers—what and from whom they are buying.

With these facts as a start, then we can begin the study of logical territory. To what radius can a jobber in a given geographical center of distribution afford to go, beyond which he cannot serve with profit to himself or the community? For any concern can only handle volume to the limit of its capital and within a radius that will net a fair return. Or, as our economist friend might say, What are the possibilities before the law of diminishing returns begins to indicate that an operation from a given center is not truly in the public interest? This may seem academic, but it has been very forcibly brought to the attention of our mail-order houses.

The Share of Each

A jobber may say that he is doing a nice business in a certain territory. But the jobber alone cannot be the sole judge. This is a feature in which the manufacturer and consumer both have a deep interest. The measure of the jobber's effectiveness must be his realization of the available potential demand. I think it is modern to consider the transaction closed only when the goods are in the hands of the ultimate consumer and satisfactorily performing the service for which they are intended and when all concerned—manufacturer, wholesaler and retailer—have contributed their full, fair share and each has received his just compensation.

When the manufacturer, the jobber, and the retailer for that matter, each participates in the whole operation as a unit, and each contributes his full, fair share, and each fairly considers the problem as a whole and all work together in sequence and harmony as a team, then goods are bound to flow smoothly and evenly from the gathering and fabricating of the raw material through to the ultimate consumer. Our ship will have made a successful voyage, each contributor will have received his just compensation, the public interest will have been economically served and the service fairly rewarded. If we work on any other basis, we are liable to be "opportunists" rather than intelligent American business men.

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*Part of an address recently presented before the General Electric Distributing Jobbers' Association.

CUSTOMER BENEFIT SUCCEEDS

This may seem to be an ideal condition, but it seems to me if we are going to progress in the future, we must approach the problem in some such manner. If we are all thinking along these lines, all thinking of others concerned as well as ourselves, we are bound to produce sound ideas and establish advanced practice; and not only will we profit, but the consumer will as well. No scheme of distribution or of manufacture or combination of both can, in my judgment, go ahead and disregard the consumer. It is the history of all successful merchants and manufacturers engaged in commodity lines that they have succeeded best on the basis of lowering costs, sharing the savings with the consumer, and necessarily they have increased their own profits by so doing. Any plan that is evolved whereby the manufacturer has all the profit or the jobber has all the profit will not be satisfactory, but if both have a satisfactory profit, then the arrangement will be sound and we can enjoy happiness and prosperity.

You may say this has been tried for years. Perhaps it has. I have my doubts. If it has, then the trouble has been in our approach. We have said this was wrong, that was wrong, or the other thing was wrong; we have not said this was right, that was right, or the other thing was right. Let us see if we cannot get together on a platform of rights rather than wrongs—then we shall surely have a secure foundation. The future will be built on rights rather than wrongs.

TRUE CO-ORDINATION

I would say that the problem of the manufacturers is:

First, to have our factories make goods in a class by themselves as to quality, at a price commensurate with this quality.

Second, to establish a contributing commercial service that will respond quickly to the demands placed upon it.

Third, to have every one in the field and in the factory appreciate the distributor's and consumer's viewpoint as well as our own, so that we may approach the problems with sympathy.

Fourth, to make a thorough survey of demand with a view toward determining territorial potentiality and limitations and to have this information available so that the best use can be made of it, to assist the distributor, if he requires it, in obtaining his full share of the potential.

Fifth, to create by personal contact on the one hand and advertising and publicity on the other, a popular demand, and to do this on the basis of inviting the attention of the consuming public to the fact that the manufacturers' names on the goods is evidence of quality and the distributor's name is evidence that the service and the accommodation is all that it should be. Then the entire transaction has back of it the guarantee of quality and excellence of service.

Solving the Radio Distribution Puzzle

Some of the Effects of Random Distribution—The Trend Toward Electrical Trade and Specialty Shops

BY E. PADELFORD COCHRANE

AS IT is conservatively estimated that the American people will have spent in 1922 between $30,000,000 and $50,000,000 on radio equipment, and as the distribution situation in radio is a stew of uncertainty and experimentation, it is easy to see that for the business man the "romance" in radio lies not in the magic ether waves, but in the adventure of solving the distribution puzzle. Radio is a youngster that has grown too fast. Consequently it has outgrown all existing radio facilities almost before it has started.

With businesss dull in other lines there came a stampede of dealers from half a dozen lines to "cash in" on the one buying hobby in which the public seemed still keen.

In less than six months time the radio industry raced along the merchandising highway from a starting point of a small, rather unnoticed accessory in a limited number of electrical supply stores to a multiplex distribution machinery including radio jobbers, radio specialty stores, cut-price stores, mail-order supply houses, radio chain stores, radio co-operative buying associations, radio chambers of commerce, general and dealer publications, directories and at least 25,000 distributive outlets which included everything from 5 and 10 cent stores to handsome, specially built-in departments in department stores with clerks trained in radio technique. For an Aladdin's lamp marvel the distributive situation in radio rivals in a measure the marvel of the audion tube itself.

As it stands at present, the highly technical nature of radio, and the general public lack of knowledge concerning it, makes the service factor extremely important, especially in the higher priced makes. Therefore, the most decided tendency is toward making either the radio specialty shop or the electrical goods dealer the medium for distribution. Hardware stores, drug stores and department stores as a class are not well equipped to supply service, nor are they, as a rule, anxious to do so.

Ultimately, it is the consensus of opinon that the ideal distributor of radio apparatus will be the radio specialty shop, where full stocks of all types of radio goods will be carried and studied; where exact knowledge, professional responsibility and care can be provided, as well as adequate service.

Unless newer inventions, doing away with certain troublesome technical features, appear on the market, service will increase rather than decrease in importance, and the radio specialty shop will be more and more necessary. If service becomes of less importance through radio progress in simplification, it is possible that the business will continue in the hands of other types of distributors.

The eventual number and types of retailers will be largely determined by the complexity or simplicity of the more expensive sets. The history of analogous products indicates that cheap sets are used for experimental purposes mainly, and that as soon as the consumer masters the technical intricacies, he buys a more expensive machine, whereby he can get much more satisfactory results.

For this reason, the merchandising of the larger sets, together with the necessary service, are bound to be increasingly important factors in the trade. At this time, the distribution of such sets is getting largely into the hands of the electrical dealers, where it is most easily handled, and department stores and miscellaneous retailers are confining themselves principally to selling the smaller sets, which are more easily sold and on which less service is expected.

The jobbing situation also may undergo changes before long. Radio is sold both through jobbers and direct to retailers, although as in most other lines of a complicated technical nature, it is regarded as more satisfactory to sell direct.

The large number of cheap sets sold—a ratio of about five to one—also has its influence on the division of trade between jobber and dealer, as the cheap set, being in large demand and requiring little technical demonstration, is an article easily handled by jobbers. The estimated 5,000 jobbers' salesmen handling this type of goods unquestionably constitute an efficient and excellent medium for wide distribution at minimum cost, particularly when demand is in excess of supply.

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Strikes Cause Conduit Price Advance

Another increase in the price of conduit is reported by manufacturers. This is a decrease of three points in the discount list or an advance of about 6 per cent. Most manufacturers issued the new price card on July 24. The preceding advance was on July 6, when a 4 per cent increase went into effect. The coal and railroad strikes are directly responsible for this advance. Stocks are low in New York City, and curtailments at Pittsburgh mills make the general situation more serious, manufacturers point out.

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New Business Barometer to Be Inaugurated

A new barometer of business, which is expected to touch the industrial pulse of the nation, is to be inaugurated next month by the Post Office Department, it is announced by Third Assistant Postmaster-General Glover. Since 1900 the department has issued monthly comparative figures on postal receipts for the fifty largest cities in the country. Mr. Glover is compiling a second list of fifty cities which are to be essentially industrial cities. Postal receipts, always considered a significant indication of the trend of business, are being watched more closely now than ever before for the expected clue to the prospective business boom and the recovery from the recent depression.

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Two Electric Locomotives Exported in May

Only two electric locomotives were exported from the United States during the month of May, a recent report by the Bureau of Foreign and Domestic Commerce states. These were sent to Chile and were valued at $10,900.

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Platinum Market Continues Steady

Demand for platinum continues steady with only small quantities of the crude and manufactured metal entering the port of New York. Recent advices from Colombia are that floods on the Condoto and upper Atrato rivers have receded and larger shipments can be expected within the next month. It is noted that "contact point" manufacturers have placed orders to replenish depleted stocks. Prices remain unchanged in the market.

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Fewer Freight Cars Reported Idle

Freight cars idle on American railroads because of business conditions totaled 405,185 on July 1, compared with 429,074 on June 23, or a reduction of 23,889 cars, according to reports just received from the railroads of the United States by the American Railway Association.

Loading of revenue freight totals 718,319 cars during the week which ended on July 8, compared with 876,896 cars during the preceding week, or a reduction of 158,577 cars, according to reports just filed by the same association. This reduction under the previous week was due to the observance of Fourth of July as a holiday throughout the country. Despite the coal strike, however, there was an increase of 77,784 cars over the corresponding week last year, but a decrease of 77,872 cars compared with the corresponding week in 1920.

Further Gain in Building Permits Reported

The spring and summer months this year as was expected, have been marked by noteworthy expansion in the value of building permits issued throughout the country. Complete statistics for July, of course, are not yet available, but the June exhibit discloses an even heavier total than was recorded in May. At more than $224,000,000, permits granted at 104 cities last month represent a rise of 8.7 per cent over those of May, when the number of centers reporting was 102, and are 64.8 per cent in excess of the amount involved at 104 cities in June, 1921. Outside of New York City, with gains largely predominating, the June permits surpass those of that month of last year by 81.2 per cent, while there is an increase at the metropolis of 21.1 per cent. With an average of 104 cities making monthly returns, permits issued from January 1 last to the end of June had an estimated value of fully $1,081,700,000, or about 72 per cent more than the aggregate for the same six months of 1921.

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Says 610,000 Miners Are Out, 185,000 Are at Work

Approximately 610,000 coal miners are on strike in bituminous and anthracite coal fields and 185,000 are at work, the Department of Labor announces upon completion of a survey of the coal mining industry.

The effect of the strike as revealed by the survey is set forth by the department in a table which by states gives the approximate number of men employed in the mines when the general suspension of work was declared and the number now on strike as follows:

States	Employed Before Strike	On Strike
Alabama	30,000	None
Arkansas	5,000	4,000
Colorado	15,000	4,000
Illinois	90,000	90,000
Indiana	30,000	30,000
Iowa	15,000	15,000
Kansas	13,000	12,000
Kentucky	40,000	5,000
Maryland	7,000	5,000
Michigan	3,000	3,000
Missouri	12,000	11,000
Montana	5,000	5,000
New Mexico	4,500	1,900
Ohio	50,000	50,000
Oklahoma	10,000	9,000
Pennsylvania (bitum.)	175,000	155,000
Pennsylvania (anthracite)	155,000	155,000
Texas	4,500	4,000
Utah	4,000	2,000
Virginia	12,000	None
Washington	5,000	2,000
West Virginia	90,000	40,000
Wyoming	8,000	7,000
Total	895,000	6 0,000

Now at work, 185,000

Non-Metallic Tubing Marking Specifications Issued

The Underwriters' Laboratories of the National Board of Fire Underwriters, Chicago, have issued a new page relative to the marketing of flexible non-metallic tubing, as follows:

"The product designed to meet the foregoing specifications must have a distinctive marker for its entire length so that it may be readily identified as to actual manufacturer.

"Flexible tubing which does not contain a distinctive registered marker for its entire length will not be accepted as standard.

"Each coil of flexible tubing must be plainly tagged or marked, as follows: Name of manufacturing company, or, if desired, trade name of the tubing. The manufacturer's listed marker for the product. This marking may be placed on the outside of individual cartons, instead of on tags, when such cartons are employed to ship coils of tubing.

"Observations will be made with regard to tags attached to coils of the product to note that both of the items enumerated in paragraph 282 are properly given on the tags or cartons."

Smaller Sizes of Magnet Wire Scarce

Deliveries are uncertain, according to Boston jobbers, upon magnet wire of the finer sizes, definite shipment promises being difficult to secure on Nos. 38 and 40. Lower down in the scale conditions are much easier, and in the twenties deliveries out of stock are quite general. The demand is largely from manufacturers of radio apparatus. Prices are reasonably steady at present. In 100-lb. lots No. 18 silk-enameled wire is moving at $51.98 per 100 lb. As the size decreases the cost of the silk insulation grows by leaps.

England Will Bar Foreign Radio Sets for Two Years

Foreign radio receiving sets will be barred under the British broadcasting scheme, Postmaster-General F. G. Kellaway of England has announced in answering questions in the House of Commons. He has informed British manufacturers that, in the event of their providing efficient broadcasting apparatus, permission under post office license will be restricted for two years to sets manufactured in Great Britain.

This concession, it is stated, is due to the representations of British firms that they will have to use capital in creating a demand for radio sets and that they cannot employ it if they have to meet the competition of American and French sets, of which some thousands have been sold.

Bank Clearings Continue to Show Substantial Gains

Substantial gains in bank clearings over last year's totals continue, an aggregate of $6,771,075,749 at twenty cities in the United States this week as reported to *Dun's Review*, representing an increase of 18.8 per cent over the $5,696,065,882 of a year ago. Decreases still appear, however, in comparison with the clearings of 1920, the reduction from the $7,614,659,959 of the corresponding week of that year being 11.1 per cent. Aside from Kansas City and Minneapolis, where losses of 5.5 per cent are disclosed in each instance, this week's clearings exceeded those of last year at all centers reporting, and the $2,450,675,749 at the outside cities which is included in the statement marks an expansion of 13.9 per cent over the total of a year ago. At New York City, which reports clearings of $4,320,400,000 this week, there is a gain of 21.9 per cent.

Labor Shortage Affects Copper Production

Production of copper has been affected more by labor shortages than by either the coal or the rail strike, according to New York City representatives of Western and Michigan Mines.

The higher wages and steadier employment offered by Montana oil companies and Detroit automobile manufacturers have attracted both unskilled and skilled workers in those regions from the mines. Some of the Western companies have not only paid transportation of families back to copper regions but have assured skilled workers that they will be retained for repair and improvement work around mines when a slump occurs. The labor shortage prevented overproduction of copper threatened in May and has, therefore, aided in maintaining present prices of the metal.

Short Asbestos Fiber Demand Is Improved

Decided improvement in the demand and consumption of the shorter grade of asbestos fiber is noted, says a recent report from the Asbestos & Mineral Corporation, New York City. "While the demand for longer grade of asbestos fiber is not quite so brisk, there is a perceptible improvement. All of the Canadian mines, with but a few exceptions, have resumed or are about to resume operations, and prospects for the asbestos industry are much brighter for the last half of the current year. We venture to predict that by the end of the year the depression cloud in this industry will disappear entirely. We believe that the recent downward revision of prices has about reached the lowest point commensurate with present costs of labor and supplies."

Metal Market Situation

Buying of copper is in small volume both here and abroad. Domestic producers are unwilling to make further commitments until the situation clears. The impression of one producer who has been feeling out the market is that large buying is to be expected as soon as the strike situation clears. In the meantime the market will be very quiet, he says.

Most producers are unwilling to sell under 14 cents, delivered. The demand aside ship is meager, in sympathy with the slow European demand. France and Germany are the only countries buying directly from producers, as England is temporarily out of the market.

Figures for the fiscal year ended June 30 show that approximately $90,000,000 has been realized in sales of copper to foreign consumers. The Copper Export Association handled the bulk of this metal.

NEW YORK METAL MARKET PRICES

Copper	July 20, 1922	July 27, 1922
London, standard spot	£ s d. 63 2 6	£ s. d. 63 2 6
	Cents per Pound	Cents per Pound
Prime Lake	14 00	14 00
Electrolytic	14 00	13 87½
Casting	13 35	13 35
Lead, Am. S. & R. price	5 55	5 75
Antimony	5 05	5 25
Nickel, ingot	36 00	36 00
Zinc, spot	5 50	6 25
Tin, Straits.	31 62½	32 25
Aluminum, 98 to 99 per cent	19 10	19 10

OLD METALS

Heavy copper and wire	10 50–11 00	10 50–11 00
Brass, heavy	5 50– 5.75	5 50– 6 00
Brass, light	5 00– 5 12½	5 00– 5 12
Lead, heavy	4 62½ 4 65	4 62½ -4 65
Zinc, old scrap	2 87½ 3 12½	2 87½ 3 00

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

STRIKES hindering movement of electrical apparatus are causing lower stocks and advanced prices. Prices are strong, the feature of this week's market being a decrease of three points in the list of conduit by manufacturers. This means an increase of approximately 6 per cent in quotations. Wire sales are in good volume. Pole-line hardware in the Chicago district has advanced 5 per cent. Keen competition prevails and stocks are moving steadily.

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New York

Conduit Advances Again — Rubber Covered Wire Prices Unchanged—Better Grade Fixtures Active

Demand for all kinds of electrical materials remains steady, and prices are reported stronger. The feature of this week's market is the advance of approximately 6 per cent in the price of conduit. This is the second advance in the month of July. Flexible armored conductor continues in active demand and plentiful stocks are reported. Cleaners and washers are gaining more attention than for some months past. Jobbers report that their sales to industrial and manufacturing plants are steadily increasing.

Rubber-Covered Wire.—Prices remain unchanged. Demand is fair, and jobbers are inclined to hold their stocks in expectation of a better market.

Outlet Boxes.—Demand for outlet boxes continues strong following the recent price advances. Stocks are noted to be ample.

Lighting Fixtures.—These are selling well; the better grades seem to be in greatest demand.

Fans.—Demand for fans continues to fall off. Jobbers are of the opinion that the market is quite thoroughly sold.

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Chicago

Depleted Conduit Stocks—Pole-Line Hardware Advances 5 Per Cent—Loom Reported Sluggish

Movement of electrical supplies has been satisfactory this week, although prices on conduit and rubber-covered wire are stronger. The building activities are increasing the call for all items used in wiring. Slow deliveries from conduit manufacturers are not assisting the forward stride of the electrical jobbers. Plans for manufacturing expansion, necessitated because of the volume of high-tension business, were reported by one company during the week. Pole-line hardware has been increased 5 per cent and competition is keen.

Conduit.—An active demand with slow deliveries from manufacturers is causing a scarcity of the ½-in. conduit. The other sizes are available. Prices vary from $45 to $47 per 1,000 ft.

Wire.—House wiring is holding a consistant demand for wire and the market has strengthened slightly. Stocks are ample. Few changes were noted on the call for bare or weatherproof wire, but prices are firm.

Flexible Armored Conductor.—This material is moving at a quiet but steady rate. In lots of 5,000-ft. the No. 14 two-wire, single-strip, sells for $42.50 per 1,000 ft. Dealers' stocks are normal.

Pole-Line Hardware.—An advance of 5 per cent went into effect the middle of this month. Dealers state that competition is keen and that they are moving their stocks steadily.

Loom.—Demand for loom is spotted, but in general the call has been sluggish.

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Boston

Railroad Buying 25 Per Cent Better—Building Operations Gain—Wire Sales Good

Active business continues despite the railroad and coal strikes. Railroad buying from jobbers is about 25 per cent better than a year ago. Building operations are gaining, New England contracts totaling $5,949,300 for the latest week reported. Deliveries are still good in most lines, but some uncertainty as to rigid-conduit shipments is reported. Labor conditions in the textile field are improving.

Fixtures.—Stocks are being built up in anticipation of active local demand in the late summer and fall. Mercantile and residential sales predominate and inquiries are very vigorous.

Wire.—Sales are in good volume, especially for interior uses. Rubber-covered No. 14 sells at $6.25 per 1,000 ft. in 5,000-ft. lots, and weatherproof is moving moderately well on a 16-cent base. Little bare is changing hands. Deliveries are long on the smaller sizes of silk-covered magnet wire.

Flexible Armored Conductor.—This material continues to display strength in sales, with ample stocks and firm prices. No. 14 single-strip moved on Monday at $43.20 per 1,000 ft. in 1,000-ft. lots.

Rigid Conduit.—Prices on ½-in. pipe have been announced as follows on less than 500 lb. and on 500 lb. to 5,000 lb.: $64.19 and $58.35, galvanized, per 1,000 ft. Elbows are quoted at $13.09 and $11.90 per 100, and couplings, $6.14 and $5.58 per 100. Corresponding prices for black conduit are $58.58 and $53.25; elbows, $11.84 and $10.75; couplings, $5.68 and $5.16. Deliveries are causing some uneasiness, though immediate necessities are being well cared for.

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Atlanta

Better Radio Business—Financial Conditions Improved—Safety Switches Continue Active

Electrical interests report that business has shown improvement, especially in the lines of radio equipment, fans and seasonal specialties, while they are in receipt of many inquiries from large industrial interests which will undertake expansions as soon as conditions become more stable. Bankers report financial conditions throughout the state as better than for many months past, with money easier and in plentiful demand.

Lighting Fixtures.—Both commercial and residential types are in very satisfactory demand, the medium-priced residential type being the most popular. Agitation by central stations for better industrial lighting will doubtless tend to stimulate the movement in this line. Stocks and shipments are good.

Distributing Transformers. — The volume of sales in this line is reported as only fair. The large number of transformers thrown on the market by the salvage from army camps is holding down the sales of new apparatus. Stocks are in good condition, but shipments are reported from good to slow.

Wire.—This line is very active in both weatherproof and rubber-covered, the brisker movement being in the popular sizes, though there is considerable sale of and inquiry for the heavy cable.

Fans.—The season on fans finally opened with a rush, and sales have been most satisfactory. As a result stocks have reached a low ebb, with shipments from factory slow and inadequate. Should the hot weather continue—and the prospects are that it will—it appears there will be a shortage in certain lines. No recent price changes are reported.

Vacuum Cleaners. — Advertising coupled with vigorous sales efforts are bringing in only a fair volume of business in this line. Jobbers' stocks are good and shipments satisfactory.

Safety Switches.—This line continues as active as usual with the demand showing a satisfactory and steady increase. Jobbers' stocks in the popular sizes are in fair shape with shipments satisfactory.

Bell-Ringing Transformers. — This item is increasing in popularity, but sales have not come up to the volume that was anticipated, though it is very probable that they will go stronger in the latter part of the summer as homes near completion. Jobbers' and dealers' stocks are in good condition.

San Francisco

Railroad Strike Conditions Easier—Insulating Material Stocks Well Assorted

Railroad strike conditions are easier and fruit shipments are again moving. The threat of an Eastern tie-up has prevented much use of the 10 per cent lower rail freight rates effective July 1. Building contractors are very busy, but dealers report stagnant summer business. Non-employment is limited to strikers and drifters.

Firms selling marine materials and specializing in wiring and fittings for ships report a quiet market. Their business has greatly declined since the war and will continue dull if the present bitter rate war between companies, operating coast to coast lines, results in forcing several of them out of business.

Insulating Material. — Local stocks are good and well assorted. Demand is better than for a year past.

Pole-Line Hardware.—This line has been in excellent demand this year. All the power companies are building rapidly and much fututre business is in sight. Several jobbers maintain complete stocks and the increasing competition has produced special prices.

Schedule Material. — Bigger shipments than ever before are made regularly to the Coast.

Household Appliances.—Washers, despite the vacation season, are showing better sales than earlier in the year. The number of makes marketed has noticeably decreased. Vacuum-cleaner sales have rather sharply dropped. Sewing-machine sales have largely passed out of the hands of electrical dealers, and for a time at least the old door-to-door methods of sewing-machine dealers are again getting the bulk of the business.

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St. Louis

Increased Demand from Industrials Reported—Transformer Business Active—Used Motors Sought

Notwithstanding seasonal slackening in certain lines, increased demand from industrials and from construction is resulting in increased business each week. Some jobbers report business from 100 per cent to 150 per cent better than at this time last year. Appliances, especially flatirons, fans, washing machines and vacuum cleaners, are contributing to the increased business. The power companies are closing more and larger power contracts, and the power companies in and around Kansas City are reported to be expanding at an exceptionally rapid rate. Recent price changes have tended to unsettle the market, but stocks on the average are so low that very little undue competition is experienced.

Farm-Lighting Plants. — Improved agricultural conditions this year and lower prices are resulting in numerous inquiries, and the indications are that fall will see a good business in this line. At present the demand is comparatively dull.

Protective Equipment.—One jobber reports the sale of lightning arresters for use on distribution circuits better than in 1920. Demand is occasioned by new distribution and transmission extensions and by the increasing desire of the power companies to protect their equipment.

Transformers.—The demand is especially good for single-phase units for lighting purposes, and both single-phase and three-phase power units are showing improvement. More activity is found in high-voltage transformers than at any time since 1920.

Portable Drills. — Industrial plants and garages are buying more liberally, but the demand continues comparatively dull.

Meters.—Little change in demand is found in eastern Missouri and southern Illinois, though sales are in satisfactory volume. In western Missouri and Kansas exceptionally active conditions are reported.

Motors.—Used motors are being more generally sought, but their supply is limited, especially as the purchaser usually wants quick delivery. Plans are being announced for the construction of new industrial plants, and as a consequence motor business is expected to strengthen materially in the near future.

Portland–Seattle

Good Business in All Lines—Appliances Moving Slowly—Ranges in Greater Demand

The unusually long dry spell, which has lasted for more than two months and a half, continues to be a serious menace to the forests of the Northwest. Fires which rain alone can stop are daily destroying much valuable timber. Wheat and other grain crops will be greatly reduced. The port business of both Portland and Seattle has been very good so far this year. Building throughout the Northwest continues very active.

Electrical jobbers report business good in almost all lines. Jobbers, however, are becoming somewhat alarmed over the rail strike situation and fear a shortage of material. Some delay is now being experienced in getting shipments from the East. Reduction of transcontinental freight rates will not affect prices to any great extent.

Contractor-dealers are busy with contracting work, but store sales are somewhat below normal. Appliances, with the exception of ranges, are moving very slowly. Ranges are in greater demand than ever before in the history of the business in this section. All of the better class of apartment houses which are being built are installing electric ranges. Dealers who have been handling radio equipment report that this line is now very dull.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including **Important Orders** and Contracts for Apparatus and Equipment

Fireside Radio Set Moves to Permanent Location

The Fireside Radio Set Company has moved to its permanent location at 6332 Cottage Grove Avenue, Chicago. This company, which has been capitalized at $25,000 for the purpose of dealing with wholesale and limited retail business in radio equipment, was located for organization purposes at 6459 South Green Street, Chicago. A. C. Spencer is president and B. H. Ehringer is vice-president.

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Organized for Radio Research and Wholesale Distribution

The General Radio Laboratories, Inc., 1730 Tribune Building, Chicago, has been organized for research and wholesale distribution of radio equipment with a capitalization of 250 shares of no par value.

R. L. Steffey, vice-president, declared to a representative of the *Electrical World* that the main purpose of the company was to serve as a distributor of high-grade radio apparatus ranging from complete sets to spare parts.

The officers of the company are R. H. O'Connor, president and treasurer; R. L. Steffey, vice-president, and F. G. Steffey, secretary. The establishment of its laboratories is being planned, although no definite details are available at present.

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Study Sales System for Crediting Business from Appliances

The Charles H. Tenney Company of Boston, public utility engineer, has appointed a research committee to investigate and make recommendations relative to a point or credit system to be used in connection with crediting its various companies' sales departments with the sale of appliances which consume a large amount of gas or electricity.

It is pointed out by this company that the sale of electric flat irons is highly desirable from a central company standpoint, owing to the amount of electricity consumed. However, the cost attached to merchandising this appliance in quantities is so great that the sales department oftentimes cannot show even a slight profit at the end of a campaign.

"But with a point or credit system,"

the announcement states, "the sales department would be credited with so many points per electric iron, each point having a monetary value.

"At a stipulated period these points would be totaled, and an equivalent sum derived from general expense or such other source as might be determined would be credited to the sales department."

Electrical Engineering Company Moves to Larger Quarters

The Electrical Engineering Company is now established at 2014 Wabansia Avenue, Chicago, having moved from 922 East Forty-first Street. This removal has increased its manufacturing floor space 200 per cent. An active transformer business created the demand for larger facilities. There were no changes in personnel with this expansion.

Form Consulting Engineering Service in Chicago

C. H. Shepherd and S. S. Hovey have formed the firm of Shepherd & Hovey, consulting engineers, 53 West Jackson Boulevard, Chicago. This firm has established an electrical quantity service consisting of the preparation of electrical estimates showing required materials, the production of drawings, etc., with the actual costs to be added by the client. The service is designed to be of assistance to electrical engineers and contractors.

Indiana Service Corporation Is Making Improvements and Additions

Improvements and additions costing $250,000 are being made by the Indiana Service Corporation on the company's power plant in Fort Wayne.

A new switch house is to be built. This unit, which will cost $10,000, will be an auxiliary to the main plant and an addition to the present building housing the distribution system. The first unit of the new building was begun last November. It will be finished, together with a second unit, by the middle of August. Work on the second unit was started recently. The company is doing the construction work itself.

The improvement made by this new building will permit a better distribution of power. It will tend to eliminate interruptions to service, assuring a more uniform flow of current. Current, as the result of this new arrangement, will be furnished more uniformly and with less chance of temporary cessation for lighting, for street and interurban systems and for industrial plants.

Another change of importance is the addition to the company's equipment of a new turbine which, it is said, will be larger than either of the two now in use. This change has necessitated the installation of new machinery at the various substations of the corporation and this work is now in progress.

To Develop Standard of Public Utility Advertising

Michigan public utilities have been invited to align their advertising managers with a national advertising association for developing standards of advertising copy and ideas for telling the public utility story.

The movement, which is only just under way, was recently inaugurated at Milwaukee. It is planned to form the Public Utility Advertising Association and to make it a unit of the Associated Advertising Clubs of the World. A code of standards has been suggested which contains the following points to be observed in the preparation of copy.

First consideration must be given to the public interest; no erroneous or ambiguous or misleading claims shall be made; every consistent effort is to be put forth to sustain public confidence in statements contained in advertising copy; no unfair demands must be made upon those who sell advertising copy, and co-operation must be extended to publishers in the interest of keeping their columns free from erroneous and false matter.

To Hold Second Radio Exposition Jan. 13 to 20, 1923

The second National Radio Exposition will be held in Chicago, Jan. 13 to 20, 1923, according to a recent announcement made by Milo E. Westbrooke, manager of the exposition, and president of the International Trade Exposition Company, Chicago. The announcement says:

"In our plans of advertising the exposition and our exhibitors nationally we are preparing a directory telling where to buy radio sets, parts and supplies, the same to be mailed to a list of nearly 20,000 radio dealers throughout the United States. Each of our exhibitors will be given a half page 'ad' in this directory without charge."

Cable Company's St. Louis Plant Nearly Complete

The Standard Underground Cable Company, St. Louis, Mo., expects to have its new plant in operation within a few weeks. Under the original plans it would have been opened last spring, but labor troubles, which involved the builders alone, occasioned delay.

The factory buildings are virtually completed. There are three of these, in the form of wings westward from a single front that extends 320 ft. along Kings Highway, each 560 ft. long. The site embraces 15 acres. These wings are to be filled with machines, installation of which is the main work yet to be done. Some of these already are on the floor, others are arriving in large numbers daily.

The local plant production is to supply the trade in the South, Southwest and Middle West as far as Denver, which calls for heavy output. Other plants of the company are at Pittsburgh, which is headquarters; Perth Amboy, N. J.; Oakland, Cal., and Hamilton, Ont. E. J. Pietzcker is manager of the sales offices in St. Louis and Chicago.

International Trade Body to Sail Aug. 19

An international trade commission, directed by the Southern Commercial Congress, will sail from New York on the "George Washington" Aug. 19 for a tour of the principal cities of Europe. It is reported that more than ten electrical manufacturers will be in the commission. The object of the commission is to investigate the possibilities of the development of trade in Europe. The commission will be the fifth foreign mission that the Southern Commercial Congress has sent in the last fourteen years, including trade commissions to Europe, South America and the Orient. The commission will have the indorsement of the United States government.

Although the commissioners will be limited in number, being appointed by governors of the various states, by mayors of the larger cities and by a few of the great commercial organizations, the congress has arranged to let a few New York business men who desire to investigate trade conditions in Europe accompany the commission unofficially.

"Home Beautiful" Exposition to Be Held in Philadelphia, Oct. 9

A "home beautiful" exposition will be held in Philadelphia at the Commercial Museum Oct. 9 to 14 inclusive, officials in charge have announced. The announcement says:

"Every labor-saving and pleasure-giving device that is of interest in the modern home, as well as every furnishing that adds to its artistic and esthetic betterment, will be seen at the coming show," according to its officials. "More than a million complimentary tickets will be distributed to the housewives of Philadelphia and vicinity, and practically the entire space on the spacious exposition floor has been contracted for by leading dealers in household appliances.

"In keeping with the artistic quality of the show, the booth arrangements and general scheme of decoration will represent the utmost in beauty and fitness.

"The established place of musical instruments as an integral part of every home today will offer a wide scope for dealers in player pianos, talking machines and other instruments.

"The almost indispensable place that electricity and electrical appliances have in the home, covering practically every field of household activity, will offer opportunities for the most interesting displays by electrical dealers. Every convenience and pleasure-giving device that the mind can conceive will be on exhibition. It is proposed with the assistance of the Electric Club of Philadelphia to show a complete model home, thoroughly equipped with everything that makes the home delightful through the medium of electricity and proper wiring. Cooking and housecleaning devices, machines for electric sewing and appliances for personal use will be among the exhibits.

"The importance of a warm, cozy house, with its appeal to menfolk who have to arise at an early hour, will be shown in improved weather stripping and in the latest stove and furnace appliances, such as that which automatically shuts the top door and opens the draft just before the rising hour.

"Everything imaginable in sewing machines, washing machines, vacuum cleaners and other appurtenances for laundering and house-cleaning will be on hand. The Philadelphia Laundry Owners' Exchange, which is an exhibitor, will during the week invite visitors to the show."

Menominee & Marinette Company Purchased by Wisconsin Interests

Purchase of the property of the Menominee & Marinette Light & Traction Company by the Wisconsin Securities Company was consummated and possession of the property was taken on July 1, 1922. The company serves the cities of Marinette, Wis., and Menominee, Mich., with electricity for light and power and also supplies the gas and street railway service. The electric distribution lines of the company likewise serve the towns of Stephenson and Wallace in Michigan.

The transmission lines of this company will be connected with those of the Wisconsin Public Service Company by a new line approximately 20 miles long, and it is hoped that this connection can be completed this fall.

Extensive repairs and additions to the company's gas plants and distribution mains, as well as to its hydraulic station and transmission facilities, are under consideration. The major portion of the planned improvements can be completed for service within the present year, it is said.

Northern States Power Company Visited by 4,000 People

More than 4,000 people visited the new offices and appliance display room of the Northern States Power Company at Sioux Falls, S. D., when the formal reception for customers was held July 7 and 8. The "open house" was arranged to give citizens of the city a chance to visit the new quarters, which were built especially for the company, and to view the large showing of the newest electrical appliances.

Specialists in demonstrating the various electrical appliances were brought in from the company's headquarters at Minneapolis, and several manufacturers' representatives also assisted. Labor-saving appliances attracting the most interest were the electric range, washing machine, vacuum sweeper and automatic electric refrigerator.

Visitors were asked to register their names and addresses, and on both days of the reception drawings were made and prizes were awarded to the lucky participants. An electric washer, vacuum cleaner, flatiron, toaster and curling iron were among the prizes given away.

Standard Gas & Electric Company Announces Sale of Shares

Customer-ownership sales of preferred shares at the operated public utility properties of the Standard Gas & Electric Company for the first six months of 1922 resulted in 8,400 transactions, having a total par value of $4,813,250, that company announces. This is an increase of 23.2 per cent over the corresponding period of 1921, when there were 7,500 sales, with a par value of $3,906,200. Sales for the calendar year 1921 amounted to $8,001,000, and the present rate of increase applied to that figure will bring the total for 1922 close to $10,000,000. The companies which are placing their securities as investments among their customers are the Louisville Gas & Electric Company, Mountain States Power Company, Northern States Power Company, Oklahoma Gas & Electric Company, San Diego Consolidated Gas & Electric Company, Southern Colorado Power Company and Western States Gas & Electric Company.

Another Chicago Jobber Is Selling Directly by Mail

The Electrical Merchandising Corporation, 106 South Jefferson Street, Chicago, is one of the latest electrical supply jobbers to enter the field of selling direct by mail. A. E. Novey, the president of the company, speaking to a representative of the *Electrical World*, stated that he had started business on March 1 with a capitalization of $40,000 and a floor space of 5,000 sq.ft. Mr. Novey had been the president of the Co-operative Electrical Supply Company of Chicago. The new company is carrying standard lines of fixtures and wiring materials. Alfred Bernstein is vice-president and I. Becker secretary.

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The Board of Selectmen of Thompsonville (Conn.) plans to install a "white way" system of lighting on Main Street in the near future. The cost of installation is not to exceed $15,000.

The Milford (Conn.) Electrolytic Iron Company, recently incorporated, has leased the factory of Page & Nettleton and expects to start production in about two months.

The Coppus Engineering Corporation, of Worcester, Mass., manufacturer of steam turbines, turbine blowers, pumps, etc., has recently incorporated under the laws of Massachusetts with a capital stock of $500,000. The concern will operate the plant of the Coppus Engineering and Equipment Company, on Park Avenue, Worcester. The incorporators include Frans H. C. Coppus, Linwood M. Erskine, and Otto Wachsberg, all of Worcester.

The F. W. Wakefield Brass Company, Vermilion, Ohio, manufacturers of "Red Spot" lighting specialties, has recently received notification to the effect that Holophane Glass Company of New York has standardized on "Red Spot" hangers for both ceiling and suspension units.

The American Wireless Company of Hartford, Conn., has been incorporated under the laws of Connecticut to buy, sell, maintain and operate instruments, apparatus and all appurtenances to aerial communication. The capital stock is $30,000, and the incorporators are Jonathan Starr, Groton, Conn., Frank H. Foss and M. H. Foss, both of Windham, Conn.

The Johns-Pratt Company of Hartford, Conn., whose selling arrangements through the Johns-Manville Company were recently dissolved by mutual consent, has established a New York office in the Liggett Building. It is intended to have a complete representation at this office for the three departments of the company—"Noark" fuses and protective devices, "Vulcabeston" packing and Johns-Pratt molded products.

The Electric Specialty Company of Port Arthur, Texas, has just been organized to conduct an electrical goods retail business. The company is capitalized at $6,000, and the incorporators are J. M. Axwell, G. A. Jernigan and C. S. Powell.

The Canadian General Electric Company will absorb the Canadian Electric Appliance Company, Ltd., on Aug. 1, an announcement from Montreal states.

The Westinghouse Electric & Manufacturing Company recently shipped another trainload of electric railway apparatus from its East Pittsburgh plant. This shipment consisted of equipment for the French Midi Railways as part of an order which totaled over $1,000,000. The apparatus shipped weighed approximately 800 tons.

The Johns-Manville Company, operating plants at Wankegan, Ill., and Manville, N. J., will soon erect a plant at Asbestos, Quebec, for the manufacture of asbestos. This new plant will cost more than $1,000,000, employ upward of 300 people, and will take care of all Canadian manufactured asbestos requirements. The company announces that it has taken over the Bennett Martin Mine at Thetford Mines, Quebec. Heretofore 80 per cent of the world's asbestos output has been mined in Canada but manufactured elsewhere and much of it reimported into the Dominion. The new plant will be completed in six months, work beginning immediately. T. F. Manville, president of the company, and a large party of executives have just completed an inspection of the site and the mine. American capital is responsible for the development, although a large Canadian interest in the scheme also exists.

Foreign Trade Notes

GREAT INCREASE IN THE USE OF ELECTRICITY IN SHANGHAI, CHINA—Unprecedented sales and profits during the past year, *Commerce Reports* states, are reported by the electrical department of the Shanghai Municipal Administration. The capital outlay for the year amounted to 20,771,489 taels ($15,786,332 at the 1921 average of 76 cents for the tael), with gross profits of 1,863,610 taels ($1,416,343) The net return for 1921 was 1,048,525 taels ($796,879), and the estimated profit for the current year was 1,152,000 taels ($875,520), both setting new high marks. In its output the Shanghai municipal electric plant almost equaled that of Manchester, England, which has the largest municipally owned station in Great Britain. The Shanghai plant now supplies 33,334 premises. Of the 185,364,746 units of electricity sold, 10 per cent was for private and 17 per cent for public lighting; heating and cooking took 5 per cent, power 32 per cent, and traction 6 per cent. At the end of 1921 its foreign staff numbered 135 and Chinese employees 2,797, increases over the previous year of 30 and 590 respectively.

THE LATVIA GOVERNMENT CONSIDERING HYDRO-ELECTRIC DEVELOPMENTS.—The construction of five hydro-electric plants on the Dvina, at a total cost of 53,600,000 Russian rubles, according to the *Electrical Review*, is under consideration by the government of Latvia. The two proposed for early erection are those at Kokenhusen (80,000 kw.), for railway electrification purposes, and at Dahlen (24,000 kw.), which will supply the Riga district. The other three will be at Stockmannshof (36,000 kw.), Keggum (36,000 kw.) and Ascheraden (16,000 kw.).

ELECTRIFICATION WORK AT BOMBAY.—Surveys, *Commerce Reports* states, are being made for the purpose of making accurate maps in connection with the proposed electrification work at the city of Bombay, India. An unofficial map has been received from the vice-consul at Bombay on which the lines proposed for electrification are indicated. This map is available from the electrical equipment division or the district and co-operative offices of the Bureau of Foreign and Domestic Commerce by requesting exhibit No. 60,695.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A commercial agent in Australia (No. 2,954) desires to secure the representation of firms for the sale of electrical fittings, galvanized wire, etc.

Electrical goods dealers in Italy (No. 2,966) desire to purchase and secure an agency for electric cooking and heating apparatus, lamps and machines for electric installations, and electrical appliances and supplies in general.

A mercantile firm in Spain (No. 2,974) desires to purchase electrical supplies, etc.

New Apparatus and Publications

ELECTRIC CLEANER.—The Apex Electrical Distributing Company, Cleveland, has issued "The Apex Salesman's Manual," which is a treatise on house to house selling methods as applied to the "Apex" electric suction cleaner.

ELECTRIC HEATING DATA. — The Electrical Alloy Company, Morristown, N. J., has issued a bulletin entitled "Electrical Heating Reference Data," which gives instructions and suggestions on electrical heating. It also contains charts showing the current-carrying capacity of resistance ribbon and strip.

WIRELESS EQUIPMENT.—"Radio Enters the Home" is the title of a 128-page booklet published by the Radio Corporation of America, Woolworth Building, New York. It gives complete instructions for radio broadcasting and description of apparatus.

SYNCHRONOUS MOTORS.—Bulletin No. 1124, distributed by the Allis-Chalmers Manufacturing Company, Milwaukee, describes and illustrates its various types of synchronous motors.

ELECTRIC FIXTURES. — The O. C. White Company, 15 Hermon Street, Worcester, Mass., is distributing a folder covering its new line of "White" adjustable portable electric fixtures for plant and shop use.

SUCTION SWEEPER. — The Hoover Suction Sweeper Company, North Canton, Ohio, announces the development of a new heavy-duty "Hoover" suction sweeper, model 961, designed for clubs, hotels, offices.

RADIO RECEIVING SET.—The Main Radio Company, Marion Building, Cleveland, is distributing a leaflet describing the "Main" radiophone receiving set.

PANELBOARDS AND SWITCHBOARDS.—The Electric Motor & Engineering Company, Canton, Ohio, has issued catalog No. 3 (sections 2 and 3) covering its panelboards, switchboards, steel cabinets and power equipment specialties.

RECORDING INSTRUMENTS. — The Thwing Instrument Company, 3339 Lancaster Avenue, Philadelphia, is distributing bulletin No. 11, describing the "Thwing" radiation pyrometers, indicating and multiple-recording types.

ELECTROLYSIS. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a pamphlet (Reprint 118) embracing an article by Prof. Charles F. Scott on the subject of "The Question of Inductive Interference and Electrolysis as Related to Railroad Electrification," which gives the causes and the remedial measures that have been applied.

VENTILATING SYSTEM.—The Spray Engineering Company, 60 High Street, Boston, Mass., is distributing a folder containing a recent reprint of an article entitled "Closed-Circuit Ventilating System for Cooling Turbo-Generator," which describes an installation of an air-cooling apparatus built by the Spray company.

COPPER CABLE.—The June 15, 1922, issue of the *Bulletin* of the Copper and Brass Research Association contains an article entitled "Ten Million Pounds of Copper Cable for Highest Voltage Transmission Line," which gives details of the order for the copper cable for the 220,000-volt transmission line of the Pacific Gas & Electric Company, San Francisco.

RESISTANCE THERMOMETER. — The Brown Instrument Company, Philadelphia, announces the publication of a new resistance thermometer catalog, covering various types of instruments made, etc.

FARM LIGHTING PLANT.—The Stearns Motor Manufacturing Company, Ludington, Mich., has recently developed a new "Stearns" farm lighting plant of 1,500 watts capacity.

DRIVE SCREWS.—The Parker Supply Company, 785 East 135th Street, New York City, is manufacturing the "Parker" hardened drive screws in sizes corresponding with machine screw diameters up to No. 14. A bulletin is available.

SMALL MOTORS.—The H. B. Sherman Manufacturing Company, Battle Creek, Mich., is distributing a small booklet describing the "Sherman" small motors recently placed on the market by the company. At present the motors are made in ⅛, ⅙ and ¼ horsepower, for both alternating and direct current.

AMMETERS AND VOLTMETERS. — Ammeters and voltmeters for use with radio transmitting and receiving sets are being made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

ELECTRIC FURNACE.—"Hawley Electric Oscillating Brass Melting Furnaces" is the title of a small pamphlet issued by F. H. Niles & Company, Inc., 421 Claremont, Jersey City, N. J., describing the "Hawley" electric furnace manufactured by the Hawley Down Draft Furnace Company and sold by the Niles company.

New Incorporations

THE CHAMBLEE-CAMP GORDON WATER, LIGHT & POWER COMPANY, Atlanta, Ga., has been incorporated with a capital stock of $17,500 by Ammen M. Pierce, Fred A. Gates and R. E. Deans.

THE WOOD-REINECKE ELECTRIC COMPANY, Louisville, Ky., has been chartered with a capital stock of $30,000 by Biscoe Hindman, Chicago; Harry I. Wood and William Reinecke, both of Louisville.

THE MONTVALE-THAXTON TRANSMISSION COMPANY, Montvale, Va., has been incorporated with a capital stock of $25,000. The officers are: W. O. McCabe, Thaxton, president, and S. H. Price, secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BURLINGTON, VT. — The Burlington Light & Power Company has submitted a proposal to the Board of Aldermen offering to lease the municipal electric light plant and distribution system for a period of twenty years.

WORCESTER, VT.—The Selectmen have been authorized to enter into a contract with the Montpelier & Barre Light & Power Company to install an electric lighting system in the village.

CHELSEA, MASS.—The installation of an ornamental lighting system on Broadway, Washington and Everett Avenues is under consideration by the Board of Aldermen.

FRAMINGHAM, MASS.—Plans have been submitted to the Selectmen by the Edison Electric Illuminating Company for the installation of a new ornamental lighting system in the business district to be maintained by underground wires.

NORTH ATTLEBORO, MASS.—The New England Power Company, Worcester, has petitioned the Commission of Public Utilities for permission to extend its Milbury-Pawtucket transmission line through North Attleboro, Attleboro and Seekonk.

SOMERVILLE, MASS. — Plans for the proposed new junior high school, to cost about $800,000, provide for a vocational department.

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North Atlantic States

HILTON, N. Y.—Application has been made to the Public Service Commission by the Cooper Electric Corporation and the Hilton Electric Light, Power & Heat Corporation, both of Hilton, asking authority for the transfer of the property and franchise of the Hilton company to the Cooper company, and for authority for the latter company to operate an electric lighting system in Parma, Monroe County. The Cooper company also asks for permission to issue $50,000 in capital stock, the proceeds to be used for the installation of an electric system to furnish service in Parma.

MARCY, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until August 2 for furnishing three electric elevators as follows: Buildings for chronic patients, storehouse and cold-storage building at the Utica State Hospital, Marcy Division, Marcy.

NEW ROCHELLE, N. Y. — Work has begun on the foundation of the proposed new high-tension distribution substation of the Westchester Lighting Company to be erected at its plant on Echo Avenue, to cost about $75,000.

ROCHESTER, N. Y.—The Rochester Gas & Electric Company contemplates installing new electrical and steam equipment in its power plant. The construction of a new substation in the Twelfth Ward is under consideration by the company. This will involve the installation of an underground conduit to carry the transmission cables from Kodak Park to the lake.

SYRACUSE, N. Y.—Under the terms of the new contract with the Syracuse Lighting Company for street lighting, all arc lamps in the center of the city will be replaced with modern lamps.

TROY, N. Y.—Steps have been taken by the Kiwanis Club for the installation of an improved lighting system on the highway between Watervliet and Albany.

LAKEHURST, N. J. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 1 for two electric furnaces, for use at the local aircraft plant.

LAKEWOOD, N. J.—The Lakewood & Coast Electric Company has been granted permission to issue $83,000 in bonds and $21,000 in capital stock, part of the proceeds to be used for extensions and improvements.

SUMMIT, N. J. — The Commonwealth Electric Company has secured permission to issue $73,000 in bonds and $19,000 in capital stock, part of the proceeds to be used for extensions and improvements.

BERWYN, PA.—The Hester Price Canning Company contemplates rebuilding its factory and power plant, to cost about $40,000.

BETHLEHEM, PA.—Plans for the proposed local meat-packing plant to be erected by the Confederated Home Abattoirs Company, Portland, Me., include a power plant. The total cost is estimated at $1,000,000 Local offices have been established in the Odd Fellows' Building.

CORRY, PA.—The City Commission has authorized the installation of an ornamental lighting system in the business section. The plans call for forty-six lamps of 250 cp.

EAST PROSPECT, PA.—The East Prospect Borough Light, Heat & Power Company has petitioned the Public Service Commission for permission to distribute electricity in the borough of East Prospect. Hause, Evans & Baker, Harrisburg, are attorneys for the company.

GREENSBURG, PA.—Work will begin at once on the construction of a power house at the Westmoreland Hospital, to cost about $40,000.

GREENVILLE, PA.—The Public Service Commission has granted the Mercer County Light, Heat & Power Company permission to acquire the franchises and property of the following companies: Findley, Sugar Grove, Springfield, Pine, Liberty, Wold Creek, East Lackawanna, Worth, Jackson and Jackson Center Electric Companies.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company has filed plans for a one-story addition to its substation at Frankford Avenue and Arrott Street.

PITTSBURGH, PA.—The Public Service Commission has given its approval for the erection of an electric transmission line by the West Penn Power Company to furnish electricity for lighting and power purposes in Greensburg and Unity Township, South Strabane Township and Redstone Township.

SCRANTON, PA.—Work will soon begin on the installation of new equipment at the power house at Adams Avenue and Gibson Street, to cost about $60,000. J. H. Williams, 425 Washington Avenue, is president of State Board of Control.

WINDSOR, PA. — Application has been made to the Public Service Commission by the Lower Windsor Township Public Service Company for permission to supply electricity in the township of Lower Windsor. Hause, Evans & Baker, Harrisburg, are attorneys for the company.

WOMELSDORF, PA. — Application has been filed with the Commission for Incorporation by the Womelsdorf Electric Company for a charter and also for permission to acquire the borough lighting plant in Womelsdorf.

WYOMISSING, PA.—Plans for the proposed group of buildings to be erected in Wyomissing for the Reading (Pa.) Hospital include a power house. The total cost is estimated at about $1,500,000. Richer & Eller, 147 North Fifth Street, Reading, are architects.

BALTIMORE, MD. — The United Railways & Electric Company has issued $2,500,000 in notes, part of the proceeds to be used for extensions and improvements.

CUMBERLAND, MD.—Plans are being prepared by the N. & G. Taylor Company, 300 Chestnut Street, Philadelphia, for a power plant at its local tin mills.

EASTON, MD.—The Public Service Commission has granted permission for extensions to the municipal power plant, including the installation of turbo-generators, etc.

PORT DEPOSIT, MD. — The Northern Maryland Electric Company has applied to the Public Service Commission for permission to purchase the property of the Port Deposit Electric Company and to issue $85,000 in bonds and $5,000 in capital stock, the proceeds to be used to finance the deal.

ALEXANDRIA, VA. — The Alexandria Light & Power Company has been incorporated with a capital stock of $650,000 to take over the properties of the Alexander County Lighting Company and the Arlington Electric Company.

RICHMOND, VA.—The new printing plant to be erected by the News-Leader Publishing Company, to cost about $300,000, will be equipped with electrically driven machinery, conveying machinery, etc. Baskerville & Lambert, Travelers' Building, are architects.

North Central States

DETROIT, MICH.—Plans have been prepared by the Ford Motor Company, Highland Park, for the construction of a new laboratory and mechanical research building, to cost, including equipment, about $500,000.

MICHIGAMME, MICH — Preliminary surveys are being made by the Michigan, Iron, Land & Lumber Company for the construction of an electric power plant on Lake Michigamme. The proposed plant will supply electricity to the Imperial mine and to the village of Michigamme.

SAGINAW, MICH.—Plans for the proposed high school to be erected on the East Side, at a cost of about $250,000, call for a detached power house.

BELLEFONTAINE, OHIO.—Bids will be received by the Director of Public Service, Bellefontaine, until Aug. 3 for constructing an addition to the municipal water and electric plant.

CUYAHOGA FALLS, OHIO.—The installation of street lamps on Center Street has been authorized by Edward H. Hoppenstedt, service director.

LANCASTER, OHIO.—The Ohio Power Company will build a transmission line from Logan to Lancaster. The construction of a line from Logan to Nelsonville is also under consideration.

LORAIN, OHIO.—The Ohio Public Service Company contemplates an addition to its local power plant, including the installation of a 35,000-hp. turbo-generator, etc. A transmission line will be erected from Lorain to Mansfield. The cost of the entire project is estimated at $1,500,000.

NEVADA, OHIO.—The Village Council has granted the Ohio Power Company, Newark, a franchise to install an electric system here. The company will extend its transmission line from Bucyrus to Nevada to furnish the service.

TOLEDO, OHIO.—Work will begin at once on the construction of an addition to the Detroit Avenue substation of the Toledo Edison Company. This station will be the connecting link between the Acme power house, through the present underground transmission system or the new aërial high-tension belt line, and West End manufacturing district. The cost is estimated at about $200,000.

GEORGETOWN, KY.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system on Main Street and Broadway.

CAMPBELLSBURG, IND. — The Interstate Public Service Company will erect a transmission line from Salem to Campbellsburg. When completed, the municipal power plant will be discontinued.

CONNERSVILLE, IND.—Work will soon be started by the Hydro-Electric Light & Power Company on extensive additions to its system, to cost between $150,000 and $200,000. The plans call for the dredging of the hydraulic canal, extending from the feeder dam 7 miles from Connersville, and the erection of five new power plants. The five stations will have a total output of 1,380 kw. Contract for construction work has been awarded to the Boyer Construction Company, Newcastle.

FORT WAYNE, IND.—Extensions and improvements are to be made to the system of the Indiana Service Corporation, to cost about $250,000, during the summer. The work will include the construction of a new switchhouse and the installation of a second generating unit. The company is now changing the power supply of all its lines, including interurban.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company will build a substation of about 5,000 kw. capacity, to cost about $100,000.

CHICAGO, ILL. — The Commonwealth Edison Company will soon call for bids for an addition to its substation, 35 x ft. 75 ft., at 19 East Twenty-first Street, and also an extension to substation at 305 West Ohio Street.

CHICAGO, ILL.—The Star & Crescent Milling Company, 108 South La Salle Street, will build a one-story power plant at its factory in South Chicago.

CHICAGO, ILL. — The Commonwealth Edison Company has awarded a general contract to Thomas G. Gage, 64 West Randolph Street, for the construction of a one-story substation, 50 ft. x 190 ft., at 750-752 West Adams Street.

DAYTON, ILL.—The State Engineering Department has received permission from the Federal Power Commission to construct a hydro-electric power plant on the Fox River, near Dayton, with initial capacity of 1,500 hp.

MARINETTE, WIS.—The Republic Box Company, Chicago, contemplates building a new box and crating factory in Marinette to replace the plant damaged by fire last fall. The plans call for a one-story building, 100 ft. by 250 ft., with several wings and a separate power plant and boiler house.

MENOMINIE, WIS. — Plans are being prepared by the Wisconsin Public Service Corporation, 559 Marshall Street, Milwaukee, for the installation of an electric generating unit in Menominie and the erection of a transmission line, here. Mead & Seastone, Madison, are engineers.

PORT WING, WIS.—Arrangements have been made by the North Wisconsin Hydro-Electric Power Company for an issue of $125,000 in bonds for the completion of its power plant at Orienta Falls on Iron River, east of Port Wing. The plans provide for the construction of a dam 125 ft. long with a head of 80 ft., capable of developing 2,500 hp. The cost of the entire project is estimated at about $200,000. T. N. Okerstrom is president.

MAQUOKETA, IA.—A power house will be erected at the proposed high school, to cost about $150,000. Arthur Ebeling, Kahl Building, Davenport, is architect.

PLEASANT HILL, MO. — The Public Service Commission has granted the Green Hill Light & Power Company, Pleasant Hill, permission to purchase and operate the following properties: The electric power plant and distribution systems at Warrensburg and vicinity; distribution systems at Knobnoster, Montserrat, Lamonte, Concordia and surrounding territory; electric power plant and distribution system in Brookfield and vicinity; transmission line from Laclede to Linneus, and the portion of the transmission lines from Laclede to Sumner now owned by the Brookfield Electric Light Company and the North Missouri Power Company.

ST. JOSEPH, MO.—Extension and improvements to the municipal electric light and power plant, to cost about $300,000; are under consideration.

ST. LOUIS, MO. — The Department of Public Utilities has approved the resolution providing for the installation of 285 street lamps, to cost $53,000, on Kingshighway.

SIKESTON, MO.—Plans are being prepared for a municipal electric light and power plant. Fuller & Beard, Chemical Building, St. Louis, are engineers.

SPENCER, S. D.—The property of the Spencer Light & Power Company has been purchased by the Minnesota Electric Distributing Company, Minn. Electricity will be supplied from the Sioux Falls plant. The Minnesota company plans to extend the main transmission line from Salem to Spencer and eventually north to Canova.

PLATTSMOUTH, NEB.—The installation of an ornamental lighting system in the business district is under consideration.

WICHITA, KAN.—The Kansas Gas & Electric Company contemplates the construction of a new transmission system, from Eldorado to southeastern Kansas, to furnish service in that section.

Southern States

DURHAM, N. C.—The Durham Public Service Company is planning to install an ornamental lighting system on East Chapel Street.

LAKELAND, FLA.—The City Commission is considering the installation of additional equipment in the municipal electric plant.

VERO, FLA.—Extensions to the municipal electric light plant, to cost about $40,000, are under consideration.

JACKSON, ALA.—At an election to be held Aug. 8 the proposal to issue $36,000 in bonds for the installation of an electric light plant and waterworks system will be submitted to the voters.

MONTGOMERY, ALA. — The Atlantic Coast Line Railway Company, Wilmington, N. C., is planning to rebuild the portion of its car and locomotive shops recently destroyed by fire, at a loss of about $200,000.

OSYKA, MISS. — The Central Light & Power Company, Amite, La., contemplates erecting a transmission line from Ponchatoula to Osyka to furnish electricity here.

ASHDOWN, ARK.—The installation of a municipal lighting plant is under consideration by the Council.

BLYTHEVILLE, ARK.—The Arkansas-Missouri Power Company has been granted permission by the Arkansas Railroad Commission to issue $625,000 in bonds for extensions and developments. The company will acquire the properties of the Missouri-Southeastern Utilities Company and the Caruthersville-Kennet Light & Power Company, Caruthersville.

STAMPS, ARK.—Bids will be received by C. G. Lunday, vice-president of the Louisiana & Arkansas Railway Company, Stamps, until July 31 for construction of locomotive repair shops at Stamps, including power house and equipment. Harrington, Howard & Ash, Kansas City, Mo., are consulting engineers.

MELVILLE, LA.—Extensions and improvements will be made in the municipal electric plant and water works system, to cost about $40,000. Swanson & McGraw, Inc., United Fruit Building, New Orleans, are engineers.

ARDMORE, OKLA.—The City Commission has contracted with the Ardmore Power Company for the construction of a transmission line to the municipal pumping plant at City Lake.

VINITA, OKLA.—Steps have been taken by the Chamber of Commerce to secure the installation of an ornamental lighting system.

CORSICANA, TEX. — Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system on Beaton Street. It is proposed to use ornamental standards mounted with cluster of lamps. George F. Baum is chairman of committee.

LUBBOCK, TEX. — The Texas Utility Company is preparing plans for the installation of additional units at its local power plant. A transmission line will be erected to Idalou, Lorenzo, Ralls and Crosbyton. The cost is estimated at $250,000.

LUFKIN, TEX.—The city officials have been authorized to enter into a contract with the Lufkin Light & Power Company for the installation of a new street-lighting system. Ornamental lamps are to be used in the business district and 100-cp. lamps in the residential section.

ROBSTOWN, TEX.—The Robstown Gin & Ice Company will make extensions in its power plant, including the installation of new equipment.

SEQUIN, TEX.—Plans have been completed for the installation of an ornamental lighting system from the Southern Pacific depot to the court house, covering a distance of 1 mile.

Pacific and Mountain States

CLE ELUM, WASH.—The Chicago, Milwaukee & St. Paul Railroad Company is planning to rebuild the portion of its local substation recently destroyed by fire. The loss is estimated at about $20,000.

BANKS, ORE. — The Murphy Timber Company, Portland, is planning to rebuild its lumber mill, recently destroyed by fire, causing a loss of about $200,000. All machinery will be electrically driven.

BAGBY, CAL. — The Mariposa Mining Company plans to rebuild its power house at its properties near here, recently destroyed by fire.

BANNING, CAL.—The City Trustees are negotiating for the purchase of the local electric plant to be owned and operated by the municipality. If taken over by the city, extensions and improvements will be made. If not purchased, a new plant and system will be built.

CHICO, CAL.—The Butte Meadows Company has been granted permission by the State Water Commission to construct a hydro-electric plant on Butte Creek.

LONG BEACH, CAL. — The Southern California Edison Company has applied for permission to construct a substation on West Third Street.

LOS ANGELES, CAL.—Bids will be received by Thomas Oughton, city purchasing agent, City Hall Annex, until Aug. 2 for 61,000 ft. of fire-alarm cable, as per Specification 498.

MONTEREY, CAL.—The Del Monte Light & Power Company is reported to be contemplating the erection of a transmission line from Monterey to Gastroville, via Del Monte, Seaside and Marina.

TURLOCK, CAL.—Bids will be received by the Turlock Irrigation District until Aug. 3 for the erection of 28 miles of 66,000-volt transmission line as follows: (1) For line complete (contractor to furnish all material); (2) for labor only, the district to furnish materials; (3) for material, including about 200 steel towers, 170 miles of copper or steel reinforced aluminum wire, about 6,000 suspension-type insulators with fittings, switchboard panel, lightning arresters and oil circuit breakers. R. V. Meikle is chief engineer.

UKIAH, CAL. — The Snow Mountain Water & Power Company, 216 Pine Street, has applied to the State Water Commission for permission to construct hydro-electric plants on the Middle Eel River, Thatcher and Elk Creeks. It is estimated that 12,000 hp. can be developed at a cost of about $10,000,000.

MURTAUGH, IDAHO.—The Public Utilities Commission has granted the Murtaugh Light & Power Company, recently incorporated, permission to erect transmission lines and distribute electricity in certain territory in Twin Falls and Cassia Counties. Electricity will be purchased from the Idaho Power Company.

DENVER, COL. — The Denver & Salt Lake Railroad Company is planning to rebuild its shops at Utah Junction, recently destroyed by fire, causing a loss of about $700,000.

Canada

ENDERBY, B. C.—The installation of a municipal electric light plant, to cost about $23,000, is under consideration.

BELLE RIVER, ONT.—A bylaw providing for obtaining electricity from the system of the Hydro-Electric Power Commission of Ontario has been approved by the ratepayers.

LONDON, ONT.—Work will soon begin on the erection of a transmission line to serve London Township. In connection with this it is proposed to extend the service in both Broughdale and Oxford Park. Work also will soon be started on the erection of a new transmission line from Delaware to Melbourne, a distance of 10 miles. J. M. Wilson, engineer, of the Hydro-Electric Power Commission of Ontario, is in charge of the work.

QUEBEC, QUE.—Notice has been served on the Quebec Railway, Light, Heat & Power Company by the city of Quebec that if work is not started on the proposed extensions on Dorchester Street and on the Charlesbourg Road before Aug. 1 steps will be taken by the city to nullify the contract.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 11, 1922)

1,422,110. Interlock Circuit Protector; J. Lebovici, Oakley, Ohio. App. filed April 26, 1919. Trouble in one phase opens all phases.

1,422,120. Regulating and Control Apparatus and System; F. W. Meyer, Milwaukee, Wis. App. filed March 24, 1920. Electroionic rectifier for charging storage batteries.

1,422,130. Electrical Heater Resistance Element; R. W. Reynolds, Darlinghurst, New South Wales, Australia. App. filed Feb. 18, 1921. Film composed powdered graphite and aluminum silicate.

1,422,134. Motor Controller; T. H. Rodman, New York, N. Y. App. filed Aug. 27, 1920. Controller for printing-press motors.

1,422,135. Method of Manufacturing Calcium Carbide; W. B. Rogatz, Plattsburg, N. Y. App. filed May 5, 1921. By electric arc.

1,422,170. Electrical Connector Device; R. B. Benjamin, Chicago, Ill. App. filed Dec. 19, 1917. Pull-switch lamp receptacle.

1,422,188. Brush Holder for Electric Machines; E. Dorffel, Bernburg, Germany. App. filed March 10, 1921. Holder pivoted and held against commutator by spring.

1,422,207. Indicating and Recording Apparatus; A. C. Johnson, Chicago, Ill. App. filed Dec. 6, 1918. Records actual operating period of a machine.

1,422,224. Speed Indicator for Aëroplanes; A. F. Poole, Kenilworth, Ill. App. filed May 31, 1918. Operated by earth's magnetic field.

1,422,239. Flashlight; C. W. Swingle, Chicago, Ill. App. filed May 7, 1920. Hand-operated, self-contained generator.

1,422,241. Electric Multiple Connection Plug; C. H. Tomlinson, Mansfield, Ohio. App. filed April 17, 1912. For multiple-control system for electric cars.

1,422,243. Electromagnetic Power Transmission Apparatus; R. W. Van Norden, San Francisco, Cal. App. filed Oct. 30, 1918. Electromagnetic speed-reduction gear.

1,422,257. Circuit Connector; Harry A. Douglas, Bronson, Mich. App. filed Aug. 15, 1918. Plug and socket.

1,422,312. Electric Condenser; Franklin S. Smith, Philadelphia, Pa. App. filed Feb. 12, 1919. Gas used as dielectric.

1,422,317. Electromagnetic Measuring Apparatus; J. C. Stangier, Chicago, Ill. App. filed March 16, 1918. Indicates momentary flow of current.

1,422,331. Adapter; F. T. Baird, Blue Island, Ill. App. filed Jan. 13, 1921. Portable electric lantern.

1,422,348. Electric Steam-Pressure Cooker; W. A. Duncan, Chicago, Ill. App. filed March 14, 1922. Heating element placed in receptacle similar to fireless cooker.

1,422,374. Conduit Coupling; J. F. Rambo, Pomona, Cal. App. filed April 29, 1920. For supporting conduit from other pipes.

1,422,395. Multi-Disk Electric Machine; R. H. Wappler, Yonkers, N. Y. App. filed Dec. 12, 1919. Supplies current to X-ray machine.

1,422,396. Clamp Mounting for Electrodes; R. H. Wappler, Yonkers, N. Y. App. filed Feb. 14, 1921. Body contacts for medical apparatus.

1,422,414. Rotor Spider; James Burke, Erie, Pa. App. filed Nov. 6, 1919. Wheel with welded spokes holds field coils.

1,422,415. Automatic Electrical Controlling Device; C. F. P. Carrier, Philadelphia, Pa. App. filed Oct. 9, 1919. For cutting machines in and out of operation.

1,422,427. Electric Apparatus for Propelling Projectiles; A. L. O. Fauchon-Villeplee, Paris, France. App. filed April 1, 1919. Electric gun with energizing bars the length of gun.

1,422,429. Connection for Electrical Apparatus; C. D. Filkins, Schenectady, N. Y. App. filed April 21, 1919. Connectors for radio variometers.

1,422,439. Anode for Luminous-Arc Lamps; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed Sept. 26, 1919. Made of iron shell with copper core.

1,422,443. Leading-in Wires for Incandescent Electric Lamps; F. Hoge, Zoug, Switzerland. App. filed Feb. 26, 1919. Composed of tungsten and fused glass.

1,422,447. Switching Key; Le Roy W. Kelsay, New York, N. Y. App. filed Feb. 8, 1921. Used with oscillating connector blocks.

1,422,470. Inductive-Interference-Suppression Device; H. S. Osborne, New York, N. Y. App. filed Aug. 3, 1920. Auxiliary winding in transformers.

1,422,481. Electric Vacuum Apparatus; M. Schenkel and J. Jüst, Charlottenburg, Germany. App. filed Aug. 12, 1916. Metallic vapor rectifiers.

1,422,484. Means for Controlling and Measuring a Current Flowing in an Alternating-Current Circuit; E. C. Schweitzer, Chicago, Ill. App. filed Feb. 13, 1919. By electrolytic means.

1,422,487. Telephone Attachment; T. W. Small, Cleveland, Ohio. App. filed May 19, 1919. Attachment holds receiver to user's ear.

1,422,523. Signaling Mechanism; C. E. Beach, Binghamton, N. Y. App. filed June 18, 1917. Municipal police signaling system.

1,422,553. Inclosed Arc Lamp and Method of Starting the Same; E. Friederich, Berlin, Germany. App. filed Jan. 28, 1916. Mercury-vapor lamp.

1,422,590. Clock; P. Mansel, Siemensstadt, Germany. App. filed Feb. 6, 1917. Striking mechanism actuated by electricity.

1,422,592. Compensating Starting Switch; Van N. Marker, Chicago, Ill. App. filed Oct. 23, 1919. Compensator completely cut out of circuit.

1,422,625. Electrical Control Apparatus; C. Schwartz, New Rochelle, N. Y. App filed Feb. 27, 1918. Relay closing switch.

1,422,653. Electrical Transformer for Regulating or Varying the Voltage of the Current Supplied Therefrom; F. E. Berry, Hayes, England. App. filed Dec. 27, 1918.

1,422,672. Thermocouple; T. G. Coghlan, Wellsburg, W. Va. App. filed March 9, 1921. Indicates temperature in combustion-engine cylinders.

1,422,686. Fare-Recording Apparatus; P. R. Forman, Rahway, N. J. App. filed July 22, 1919. Indicates number of fares collected but not the amount.

1,422,721. Electrically Heated Utensil; J. F. Lamb, New Britain, Conn. App. filed Aug. 18, 1919. Soldering iron.

1,422,733. Method of Producing Iron and Steel; W. E. F. Bradley, New York, N. Y. App. filed July 17, 1918. By passing a hydrocarbon gas through a molten mass of metal or ore in an electric furnace.

1,422,735. Automatic Means for Controlling Electrically Heated Devices; A. F. Brown, Los Angeles, Cal. App. filed Jan. 16, 1918. Thermostatic cutout.

1,422,747. Renewal of the Filaments in Metal-Filament Electric Lamps; S. Coxon, Liverpool, England. App. filed Sept. 2, 1920. Apparatus for winding new filament on to supports.

1,422,765. Battery Grip; C. E. Johnson, Chanute, Kan. App. filed June 1, 1921. For connecting lead wires to terminals.

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The Spirit of Interconnection

INTERCONNECTION is a long word. It has been a big word in recent electrical history. Speak it and there come to mind pictures of great central-station systems linked together by physical connection so that each may draw upon the other for electrical energy.

We have published maps of whole states and groups of states whose power resources are shared, and printed many stories of how this new method of give and take between utilities has helped out in emergencies.

But interconnection is more than this if you have sensed the fundamental meaning of the word. It is just another application of the *e pluribus unum* idea. The spirit of interconnection is a principle as practical, as profitable and as logical applied between the executive offices of central stations as it has been proved where it has tied two generating stations together.

NO BETTER example of the advantages of interconnection exists than in the railroads. You buy a ticket in New York for San Francisco. You board your car, make yourself comfortable, and the train starts. Day and night it hurries on along the rails. With but one change you arrive at the appointed hour. You say, "The railroad brought me here." You are not conscious of the fact that it has taken maybe seven, maybe ten railroad companies to carry you across the continent. The only evidence that you have seen has been the appearance of a new conductor or trainman from time to time.

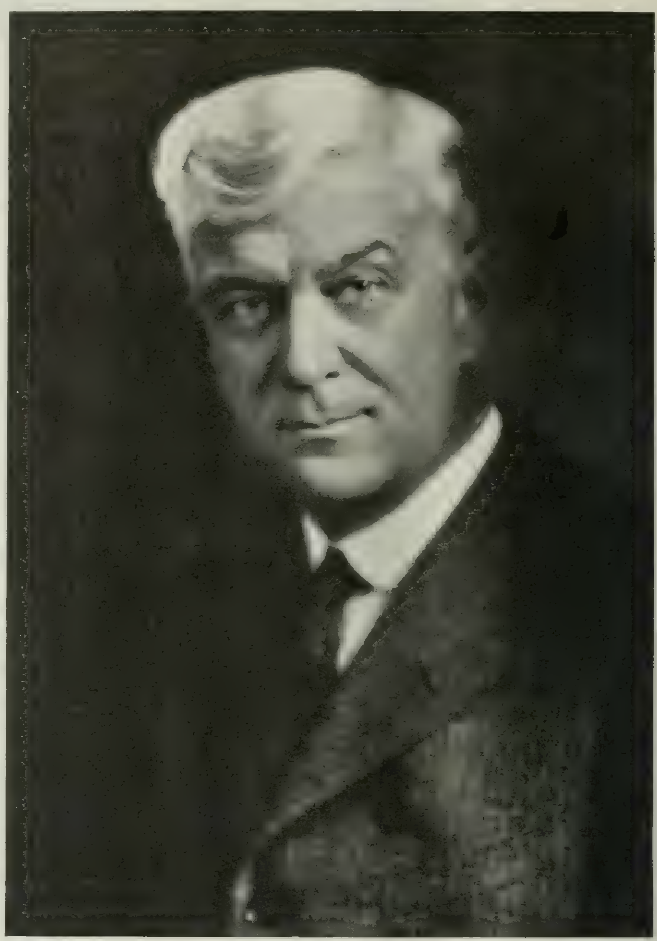
Interconnection has made this possible. But it is more than a simple interconnection of steel rails, important as that may be to your long journey. Interconnection of purpose, interconnection of personnel, interconnection of train schedules, interconnection of many other elements of personal and impersonal service, interconnection of ideals—all these have been organized into what we lightly call our railroad systems. The spirit of interconnection pervades and dominates it all, and this is what has made the safety, speed and comfort of our railroads possible.

THE electrical industry has taken but the first step in applying this spirit of interconnection for the benefit of the American public that the railroad systems have united to serve so well. Some of the more progressive power companies have already joined together their transmission lines. Some day this will be universal practice. But what of policies and the character of the service?

The principle of interconnection will guide us to great opportunity if we will follow it. For when people can use their motors and flatirons in any town, and find the rules and regulations of different companies alike, and feel the friendly educational influence of all central stations working together, then they will understand us better. And out of understanding will come pride, dependence—and traffic, as with the railroads. And the industry will profit much.

Elmer E. Woodward

Pioneer inventor, designing engineer and manufacturer of waterwheel governors.



TO HAVE achieved success in a unique field, one in which not a few have failed, is the distinction attained by E. E. Woodward, president and general manager of the Woodward Governor Company of Rockford, Ill. The waterwheel governor is an indispensable accessory to the modern hydro-electric plant. During the development and progress of turbine waterwheels and their installation there has also been remarkable improvement in waterwheel governors. For nearly four decades manufacturers of waterwheels and concerns using them have been greatly indebted to Mr. Woodward for his untiring efforts and close application to this business, in which he has attained so enviable a position.

Mr. Woodward's success has been achieved in his native city, for he was born in Rockford in 1862. His taste for mechanics took him, when he was twenty years old, into the plant of his father, the late A. W. Woodward, a manufacturer who had built a few of the simple governors of that day applicable to waterwheels driving mills through mechanical transmission devices. At that time the present hydro-electric unit, serving high-voltage transmission lines of what would then have seemed incredible length, had not been conceived.

One of Mr. Woodward's early inventions was the compensating-type mechanical governor, which was greatly needed and met with much favor, as many of the small and medium-size plants of that day required far better regulation than could possibly be obtained with a simple mechanical type. It is of interest to note that the compensating type is the only successful quick-acting mechanical governor in the world today. Recognizing, however, that this type has its limitations, Mr. Woodward a number of years ago developed and perfected the Woodward oil-pressure governor. This also was very favorably received.

The trend of the times continuously demands better and more accurate regulation as well as many other refinements in design, and Mr. Woodward's genius has been quick to respond to these needs as well as to anticipate what is now essential in the most modern hydro-electric plants. He has been concerned with thousands of waterwheel installations under all kinds of conditions. Latest of Mr. Woodward's achievements is the invention, development and perfection of the apparatus required on governors for automatic non-attended hydro-electric plants. It is thought that this improvement will permit many water powers to be developed that otherwise would not pay on account of the operating expense. It is also expected that this automatic apparatus will be sought by many plants because of its convenience and simplicity of operation.

As a youth Mr. Woodward was of a studious turn of mind, and this trait has been pre-eminent in his career. Nothing apparently gives him more pleasure than to set himself to a difficult engineering problem, especially if it pertains to the regulation of waterwheels, and invariably he will solve it. Not only is he a persistent student in engineering and a master of the mechanical end of his business, but he is also a man of good executive ability. The growth of the business of which he is the head is indicative of his genius and his industry in the promotion of the hydro-electric industry through the development of hydraulic equipment.

Editorial Comment

Electrical World, August 5, 1922

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Number 6

Coal and Rail Strikes Will Soon End

LET no man deceive himself regarding the coal and railroad strikes. Both will soon be over. However, the vexed question of coal supply will remain, for it is not possible to make up over night a shortage of coal caused by a strike of three months' duration. Coal will have to be rationed, and the federal government has shown commendable wisdom in intrusting the problem to state authorities and state utility commissions. The latter are more familiar with local conditions, and it is probable that the states have more power to cope with the situation than the federal authorities. The railroad strike must be settled first, however, since priorities are of little use if the railroads are not in a position to move the coal.

Out of all the disturbances two facts thrust themselves forward—one the excellent service maintained by the electric public utilities, and the other the recognition accorded by the Interstate Commerce Commission to public utilities, based, no doubt, upon a realization of the value of continuity of service in public utility work. The public utilities may therefore rest content, knowing that if there is any coal to be had at all, those in authority will see that the utilities are supplied. There is no immediate cause for alarm. The general public has refused to be stampeded by either the coal or the railroad strike, and lacking public interest and public support both strikes must soon terminate.

Of What Use Is Electricity on the Farm?

THE careless assertion is frequently made by central-station men that the farmer has little use for electricity on the farm. Yet in a recent commission hearing on the subject of rural service one of the witnesses laid emphasis on the large part that a proper water supply plays in the fattening of stock for the market. When it is available at the right time and, in the winter, at the right temperature, it is possible, he held, materially to shorten the time of preparing stock for market. Ground feed also plays an important part in some phases of this sort of farm work. In both situations electric power may give control of water and feed conditions to an extent that is not possible in any other way. Again, another opportunity lies in the use of irrigation for some forms of farm produce. Berries and many vegetables are frequently short crops because of lack of rain at the crucial period of their development. A general-utility motor of one to three horsepower or less can often be utilized for such purposes with improvement to the present poor load factor of farm-line demands.

There are no data available now to show the exact part that electric service can play in increasing farm efficiency. There are many data available on the effect of such things as proper feed and water for stock. The problem that needs study is how electricity can be used to produce the conditions that our agricultural schools have determined to be necessary for efficiency in the agricultural industry.

Twenty years in the development of industrial plant equipment has increased the inherent advantage of electric power through the development of machines designed for use with the electric motor. The same process will be gone through in the farm equipment field, and it is becoming evident that this is recognized by some of the leading men in that field. The next few years may bring forth surprising developments, and it will be well for central-station operators to give attention to these phases of the farmer's problem. They will be one of the agencies called on to help in this development.

Shaping Policy on Wired Wireless

THE rapid development of radio has brought with it new problems to electric light and power companies, so much so that the National Electric Light Association has a sub-committee of its public policy committee at work on the entire question of radio, particular attention being directed to "wired wireless." There is a very general feeling that broadcasting in all cities and communities of any size will be brought about by this new development of "wired wireless" because of the elimination of antennas and batteries. Naturally this will raise important legal and public-policy questions, and before adopting any definite policy it might be well for electric light and power companies to await the report of the sub-committee of the N. E. L. A. on the subject. The committee is made up of men of high caliber who may be counted on to go exhaustively into the matter, and in view of the wide interest manifested an early report may be looked for.

Are Power Reports Going Out of Fashion?

UNDER the pressure of installing electric service for power or industrial heating applications, central-station engineers often overlook the preservation of the comprehensive analytical data upon which such contracts were based. The result is a painful shortage of complete information in many localities when attempts are made to compare notes and study the economics of industrial central-station service.

It would be foolish to assert that thoroughgoing studies of power situations are no longer made in the vast majority of central-station sales departments. Without such analyses new business could not be obtained at anything like the present rate. But the point is what becomes of the data after the contract is signed? In altogether too many cases they are thrown into a folder and filed in a rough form which makes them of dubious value for future reference. Over and over again the "prospect" is furnished with little more than an extended memorandum of the salient points on which his decision as to taking service is to be made. The bound report of earlier days is apparently less and less necessary to secure the business.

Anything which facilitates getting new business at lower cost is welcome to the modern central-station manager, provided that nothing is omitted the loss of which is injurious to future development. Whether a bound report similar to that which a first-class consulting engineer would render is needed in a particular case depends, of course, on circumstances. Some companies doubtless overdid the report idea a few years ago and actually aroused suspicion by the *édition de luxe* appearance of their propositions. Now, however, the pendulum has swung too far the other way, and as a result the files of many power sales departments are fragmentary in the extreme. We do not plead for a return to the gilt-edged, red-bound limited editions of power reports (embellished with the prospective customer's name in gold on the outside) which were quite the rage in certain utility circles in pre-war days, but too much emphasis cannot be laid upon the importance of establishing and maintaining a complete record of essential information, tests, layouts proposed, cost computations and economic conclusions in such form that for years to come it will answer the questions of the engineer charged with the responsibility of providing service at the minimum cost to the customer and to the company. Utilities which gladly and intelligently meet the moderate cost of compiling and maintaining such data are thereby laying foundations for future prosperity which are well-nigh invaluable.

Importance of Research in Cable Manufacture

ACTIVITY in research on the problems of cable manufacture continues apace, as indicated by the papers presented in a session devoted entirely to this subject at the recent convention of the American Institute of Electrical Engineers. A change in viewpoint and method of attack is suggested by one or two of the papers. In the past, work in this field has been characterized by a study of the materials entering into cable construction and their improvement on one hand and by effort to determine a satisfactory method of rating cables as based on their losses, heat conductivity and the outside temperature. These are the usual and natural methods of most engineering experiment; that is, to determine and improve the constants of the available materials and to design the equipment by a proper relation of these constants to the conditions of operation. For work of the latter character in the field of cables the paper by Atkinson of a year or so ago and now that by Roper on the selection of cables for specific duty are conspicuous examples.

The recent convention papers, however, are generally notable for a new departure in that they devote more attention to the scientific study of the underlying theory of cable operation. Insulation in general is one of the most serious problems of electrical engineering and the factor of all equipment of which we probably know least. Particularly in the case of cables there is much evidence that the usual simple ideas of electric stress, as computed from the dimensions, in its relation to the dielectric strength of the insulation, are not sufficient to account for all the conditions surrounding the failures of cables. Manufacturers therefore are looking deeper into the theory of insulation. Thus the Del Mar-Hanson paper introduces a study of the motion of ions in liquid dielectrics as affecting their electric strength, and the Middleton-Dawes-Davis paper, investigating the existing gradients in cables, finds, as long suspected, that the inner layers of insulation may be stressed to abnormal values without evidence of failure.

The realization that further improvement in American cables must come through a better understanding of the ultimate nature of the processes involved in insulation, and that this can result only from scientific investigation of the highest type, was indicated in the discussion. Moreover, it was suggested that further knowledge will probably lead to a radical readjustment of our present ideas as to the simple nature of electric displacement, electric stress distribution in concentric fields and their relation to dielectric strength as usually understood.

More Light on the Specific Injury from Electric Shock

THE whole matter of death from electric shock has become much complicated, not to say muddled, by the diverse effects produced by shocks of various sorts and intensities. Judging from experiments running many years back, there is a material difference between the phenomena produced by shock from direct current and that produced by alternating current as such, although the two sets of phenomena merge when the current is of high intensity. When this condition exists the conspicuous observed phenomena are those due to heating and destructive action on the cells of the blood and the circulatory system. Hence, as G. M. Ogle notes in his enlightening article this week on the subject of effects of electric shock, there has been a good deal of misunderstanding regarding the possibility of remedial measures.

Death may result from alternating-current shock insufficient in itself to produce the effects mentioned above by interrupting the ordinary working of heart and lungs. In these cases, which are not uncommon, the victim virtually dies of suffocation unless he is quickly removed from the circuit and subjected to the ordinary means of revival after suffocation. From shocks acting in this manner one passes by degrees to shocks involving an expenditure of electrical energy sufficient to produce the effects frequently noted in electrocutions. When these conditions, which Mr. Ogle very well describes, have supervened no amount of artificial respiration or other remedial efforts appropriate for suffocation can possibly produce any results. However, it should be remembered that the energy spent upon the victim in the case of electrocution is many times that which may be sufficient to produce a fatal shock.

We do not agree with Mr. Ogle that a shock fatal to a normally healthy person at 110 volts alternating current or thereabouts is entirely impossible. There have been divers reports of death from this voltage in which there was no sound reason for suspecting a connection with high-voltage conductors. However, a fatal accident at 110 volts is extremely unlikely, for the reason that it would require an extraordinarily good contact across the victim's body to pass a current large enough to produce fatal results—a contact out of the question except under unusual circumstances. Even in the case of direct current, which produces small nervous shock and is believed to cause death by its permanently destructive action on the blood, tissue and circulatory system, there is at least one recorded death from 220 volts, the victim of which had been in normal health according to the autopsy. He had been standing in water and made good contact with a bare conductor while the other side of the circuit was accidentally and thoroughly grounded.

With either alternating current or direct current, whether a person is killed or only shocked is merely a question of how good a contact is established and what path the current takes through the body. Prevention of fatal accidents should be greatly aided by broadcast dissemination of the information presented in Mr. Ogle's article.

Now Is the Time to Rehabilitate Street Lighting

CONDITIONS with respect to street lighting have changed very materially in the last decade. Perhaps the one thing that more than anything else has affected the situation is the enormous increase in motor traffic which has converted comparatively unimportant highways into through streets of large significance with respect to their requirements. Motor headlighting is not enough to remove the combined difficulties of dense traffic and fast driving at night. The blinding glare and intense shadows which are still all too common increase the troubles of the driver, and the street lamp has become a matter of grave necessity in making highways safe under modern conditions.

The old spotted lighting given by wide-spaced arc lamps, generally hung too low, has become a nuisance. The small incandescent lamps at the curbstone serve to cast malevolent shadows to make driving still more difficult, and there is and has been a great incentive toward a change for the better, which now that wartime days are past becomes at least feasible.

In the first place, the large incandescent lamps, even up to 1,000 cp., have demonstrated their usefulness, when placed fairly high, in lighting the first-class thoroughfare quite uniformly and steadily. So, too, with the arc lamp; but the latter lends itself somewhat less readily to redistribution of its light by means of refractors. For streets requiring less intense lighting, the medium-power "incandescents," if properly spaced and placed with reference to their use, enable almost any requisite intensity to be furnished in well-distributed illumination. The account which we gave last week of the lighting system of East Cleveland, Ohio, portrays an excellent example of the present drift of enlightened practice.

Practical requirements certainly frown upon straggling arcs fed from overhead wires and the little incandescent lamps which used to replace the flickering gas lamps of a generation ago. In city lighting at least the overhead wire must go. It is particularly obnoxious when lighting units are distributed, as for the best illuminating results they should be, on both sides of the street. Again, if underground distribution is utilized, it is undesirable and expensive to space the lights as closely as in the old gas-lighting days, and considerably bigger sources separated somewhat widely and made effective by suitable redistribution of their light meet technical requirements and financial ones with equal success. This solution of the difficulty, too, makes it desirable to place the lamps higher than has been usual, with facilities, as in the bracket lantern used at East Cleveland, for getting the light far enough out over the street to avoid trouble with trees.

With all these modifications of practice in mind, the question will inevitably arise whether street lighting thus skillfully planned for efficient illumination cannot in many instances be carried out to advantage on multiple-series distribution instead of by the high-tension circuits more generally used. It should be remembered that in foreign practice series distribution is a very unusual method of street lighting. It involves undesirable plant characteristics and greatly increased difficulty of insulation, easily avoidable in a district of fairly dense service by adopting the multiple arrangement. There are many ways in which current American practice is behind the precedents long familiar across the water, and it is well to give attention to these differences in practice, as probably not due altogether to the recklessness and incapacity of foreign innovators.

Let us take heed of the best examples of American practice and not be afraid to unite them with the experience of others. Now is the time to undertake the rehabilitation of street-lighting systems if they are to be in readiness for the fall and winter months with their longer dark periods.

Objectors to New Pole Specification Should Give a Reason for Opposition

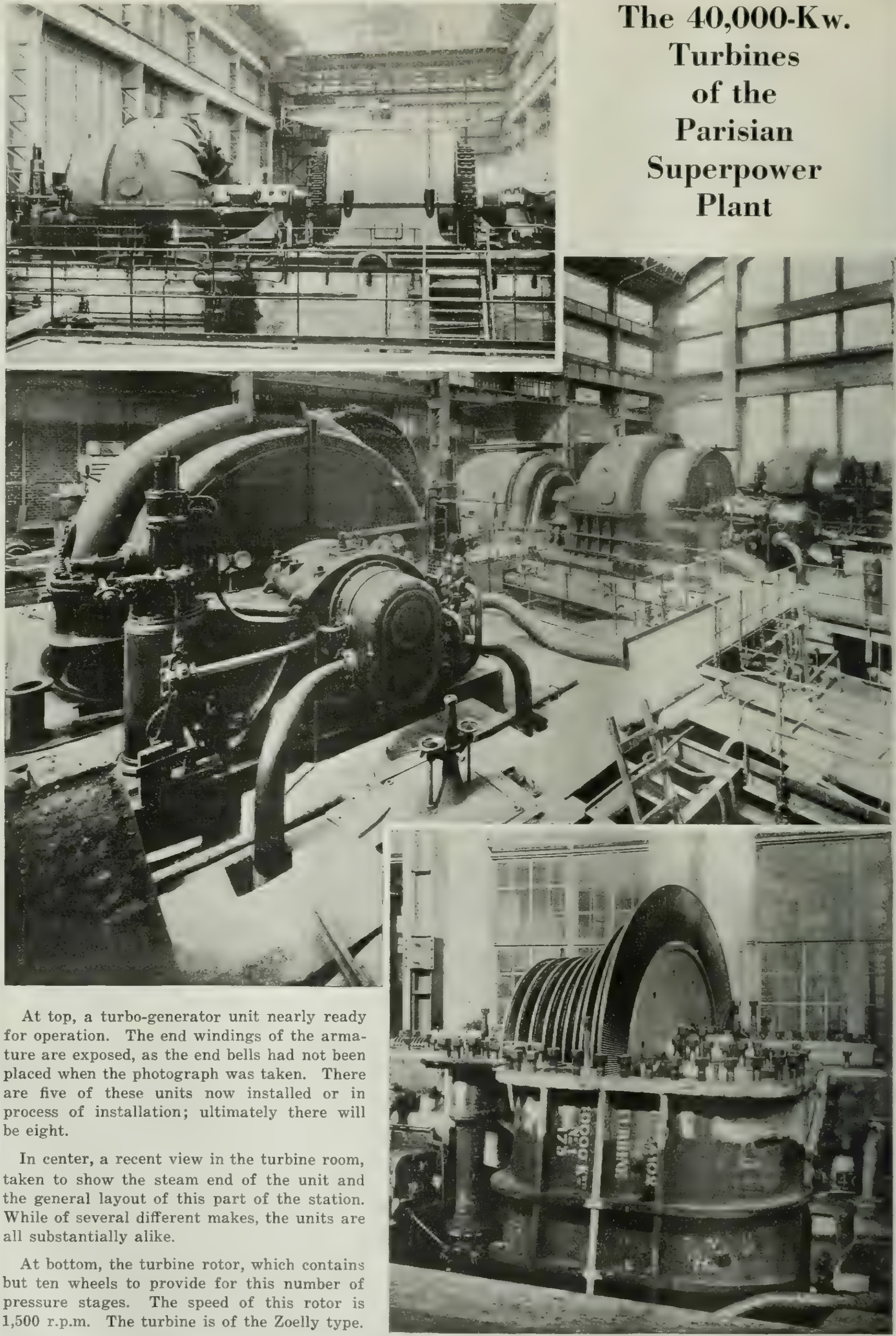
IT HAS been evident for some years that the old pole specifications no longer fit the product that is available. No matter how desirable the older requirements may have been from a theoretical engineering standpoint, it is time that they were superseded if the requirements cannot be met.

A new specification and classification of wooden poles, which will better represent the materials grown in the United States, was presented and adopted as a recommended tentative uniform practice for the coming year by members of the National Electric Light Association at the recent meeting in Atlantic City. This specification was prepared by a sub-committee working with various pole producing and handling firms, and therefore it is reasonable to suppose that the interests of all concerned were considered.

The argument for the new specification is that it will permit better use of available timber and thereby help in the conservation of the supply. The change in the classification will also permit the ready shifting of a pole from one class to another by the simple expedient of cutting off the top, thus making the pole a shorter one of the next higher class. What the practical effect of the change will be remains to be seen.

The specification is not yet a definite standard; it is still on trial and is to be kept under observation until the effect of practical use is observed. Users should make a record of the advantages or disadvantages of its application so that they can be brought before the N. E. L. A. committee for later consideration. This should be done before long-continued use has made the specification hard to change. The next year or two is the time to present objections, if any are found.

The 40,000-Kw. Turbines of the Parisian Superpower Plant



At top, a turbo-generator unit nearly ready for operation. The end windings of the armature are exposed, as the end bells had not been placed when the photograph was taken. There are five of these units now installed or in process of installation; ultimately there will be eight.

In center, a recent view in the turbine room, taken to show the steam end of the unit and the general layout of this part of the station. While of several different makes, the units are all substantially alike.

At bottom, the turbine rotor, which contains but ten wheels to provide for this number of pressure stages. The speed of this rotor is 1,500 r.p.m. The turbine is of the Zoelly type.

The New Superpower Plant Near Paris Approaching Completion

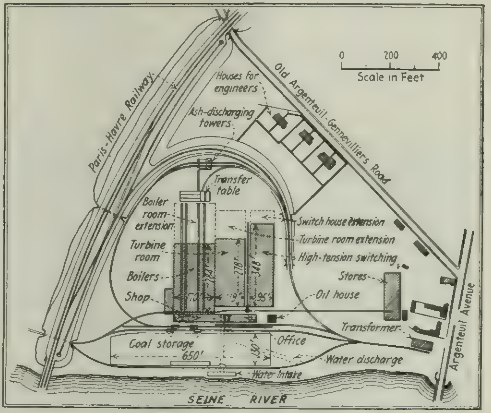
By Use of Highest Boiler Pressure Thought Economical, Recovery of Wastes and Adoption of Large Units, the Designers of This Station, Ultimately to Be Rated at 320,000 Kw., Have Made a Notable Achievement

FOUR miles east of Paris, on the bank of the Seine River, the great Gennevilliers power plant rapidly assumes its finished form. This plant promises to be one of the most economical in the world, the designs having been prepared with these four fundamental considerations in mind: (1) that the highest practicable steam pressure and temperature should be employed in order to obtain high thermodynamic efficiency; (2) that boilers in the largest practicable sizes should be used, with all auxiliaries which would tend to minimize the outflow of heat through the stack; (3) that the largest practicable size of steam turbine should be used, with provision for heating the feed water from the low-pressure stages; (4) that every feasible means of gathering up stray heat should be adopted.

While, of course, the fundamental principles employed here are those which control the design of every power plant, they are applied in some unusual ways in this case. Attention will be directed particularly to the features in which Gennevilliers differs from many other plants.

In this examination it must be borne in mind that the high cost of fuel in the region of the plant was a ruling consideration in the design, pointing to the desirability of concentrating the local power supply to permit the use of large units. This necessitated the amalgamation of practically all of the power-producing companies in the vicinity of Paris. The first step was the formation of the Union Française d'Electricité in 1919, followed by the absorption of other utility companies to form the present Union d'Electricité.

The initial capacity of the Gennevilliers plant is 200,000 kw., produced by five similar turbine units, supplied with steam by fifteen boilers, five being double-end boilers each of twice the capacity of the others. The turbines operate at a throttle pressure of 313 lb. gage and at about 280 deg. F. superheat. Some general information regarding the plant is given in Table I.



GENERAL PLAN OF GENNEVILLIERS POWER PLANT LAYOUT

TABLE I—GENERAL FACTS REGARDING THE GENNEVILLIER PLANT

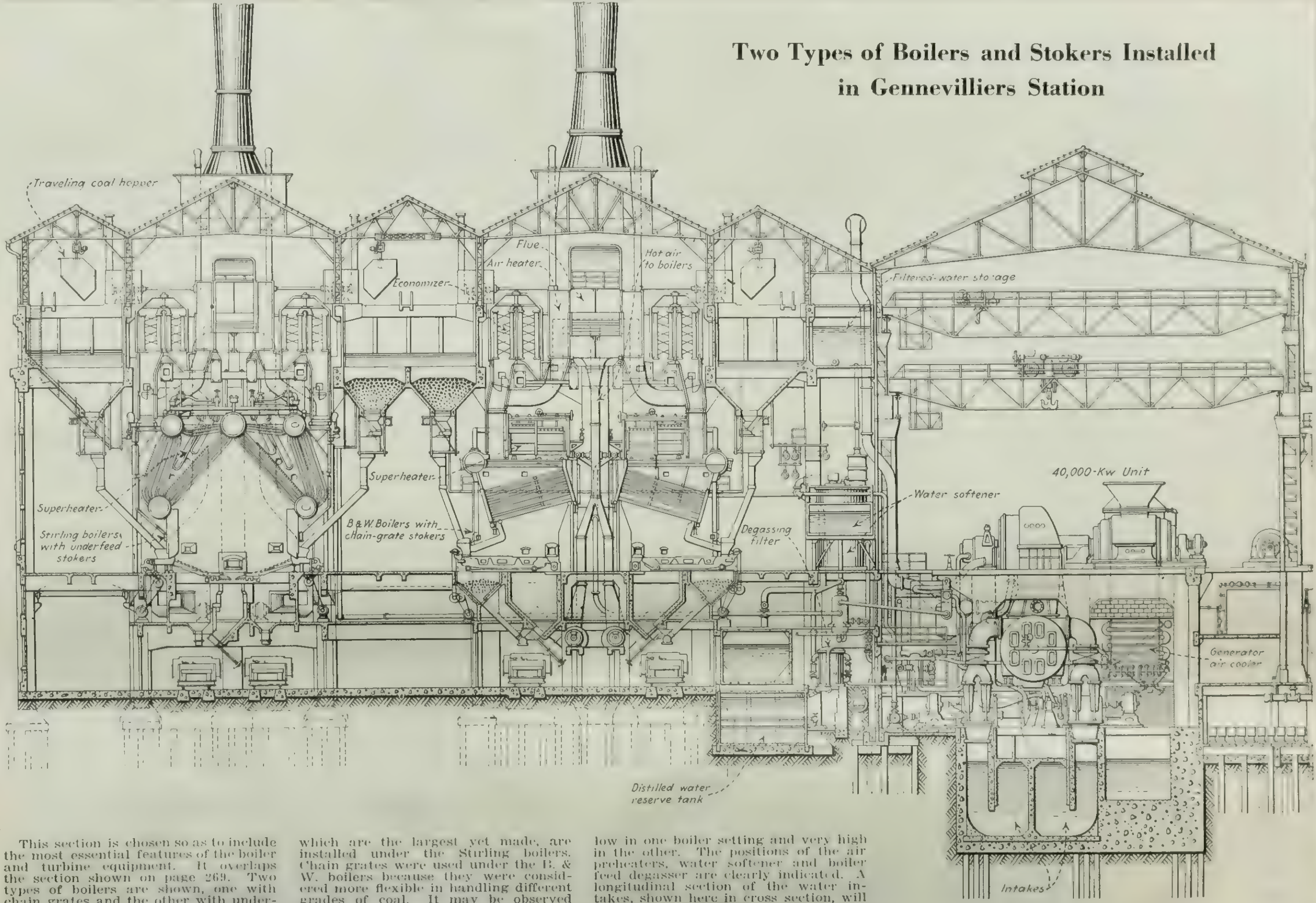
	Double-End Stirling	Single-End B & W
Number of boilers	5	10
Heating surface per boiler, sq ft	22,600	14,300
Superheater surface, sq ft	10,764	8,190
Economizer surface, sq ft	12,915	8,617
Ratio of volume of water to volume of steam	4.05	2.21
Volume of water per square foot of heating surface cu ft	0.127	0.09
Steam guarantees:		
Normal steaming rate, lb. per hour	132,000	88,000
Pounds per hour per square foot of heating surface, normal rate	5.85	6.15
Pounds per hour per square foot of heating surface, maximum rate	7.79	8.12
Total grate surface per boiler, sq.ft.	660	394
Number of generating units		5
Maximum continuous load, kw		40,000
Speed, r.p m.		1,500
Frequency, cycles		50
Terminal voltage		6,000
Guaranteed steam consumption of turbine without bleeding, lb. per hour:		
At 40,000 kw.		9.62
At 30,000 kw		9.46
At 20,000 kw.		9.9
At 10,000 kw.		11.0

A summary of the design constants for the plant is given in Table II, page 270.

As shown in the accompanying plan, the power house lies in an angle between the Seine River and the Paris-Havre Railway. It is in the usual three sections—the boiler house, the turbine house and the high-tension switch house—the dimensions of all of which are given in the plan. Between the buildings and the river is a coal-storage yard, with capacity for 60,000 tons. The intake and discharge tunnels for condensing water pass under this yard.

The first feature of interest in the boiler house is the use of two types of boilers, double-end Stirling and single-end marine-type Babcock & Wilcox. Two types were used rather than one because the plant had to be built to handle a considerable variety of fuel and at the same time it was desired to have a high degree of flexibility in operation. Part of the plant was therefore equipped with Stirling boilers fitted with Riley underfeed stokers, and the remainder with B. & W. boilers and chain grates. Two B. & W. units set back to back have approximately the same over-all length as one Stirling unit. In extending the boiler plant, therefore, either type may be installed without changing the structural features. The use of the large boiler units results in a floor space of only 0.24 sq. ft. per kilowatt installed. The arrangement of three rows of boilers, grouped in

Two Types of Boilers and Stokers Installed in Gennevilliers Station



This section is chosen so as to include the most essential features of the boiler and turbine equipment. It overlaps the section shown on page 269. Two types of boilers are shown, one with chain grates and the other with underfeed stokers. The underfeed stokers, which are the largest yet made, are installed under the Stirling boilers. Chain grates were used under the B. & W. boilers because they were considered more flexible in handling different grades of coal. It may be observed that the combustion chamber is very low in one boiler setting and very high in the other. The positions of the air preheaters, water softener and boiler feed degasser are clearly indicated. A longitudinal section of the water intakes, shown here in cross section, will be found on page 270.

two blocks, with three firing aisles, also conduces to floor-space economy.

The flue gases, after leaving the boilers, pass first through steel-tube economizers, of the form of an inverted U. Under normal load these lower the flue-gas temperature from about 620 deg. F. to about 430 deg. They then pass through an air preheater, losing about 130 deg. more. The air for the furnaces enters the preheater at about 85 deg. and leaves at 195 deg. From the heater the air goes, by way of a hot-air box over the boiler and suction ducts, to the forced-draft fans.

The preheater is composed of channel-iron frames and No. 7 gage steel plates, forming passages through which the air and the flue gases travel in alternate layers only 1$\frac{3}{16}$ in. thick. The air is taken from the top of the boiler room, where it has become heated to a certain extent, and travels downward through the heater, while the hot gases travel upward.

The heater plates are in standard commercial sizes and may be replaced without drilling, punching or machining of any kind, the whole structure being clamped together by means of long tension bolts.

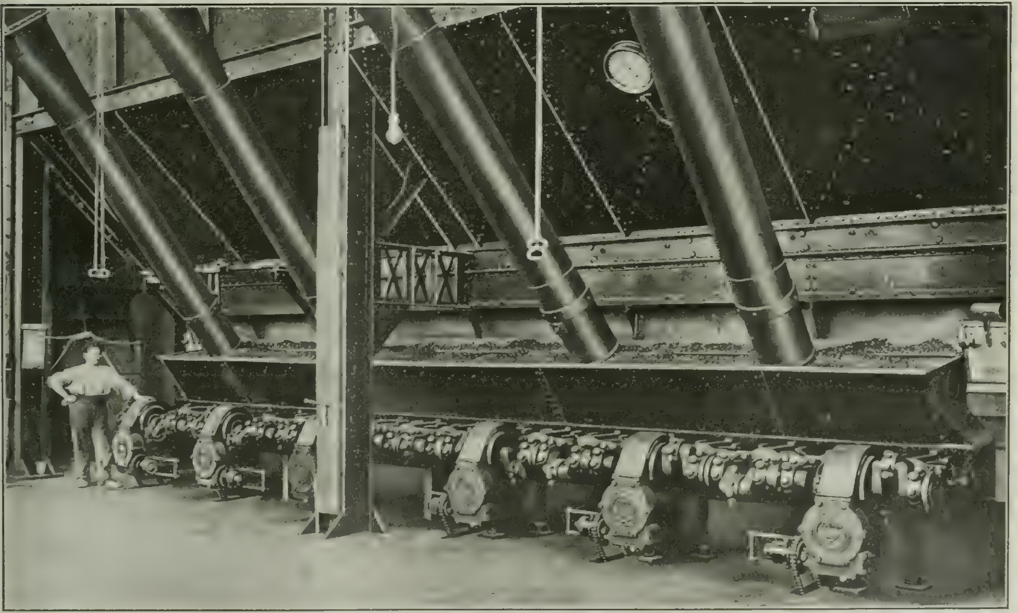
The stacks in the Gennevilliers boiler plant are of the convergent-divergent type, which was selected on account of economy in construction. They operate on the ejector principle, a jet of high-velocity gas being driven upward from a point just below the waist of the stack.

There will be six of these stacks for the present, three each for the Stirling and B. & W. boiler sections. For each stack there will be two induced-draft fans, and for the boilers forced-draft fans, four for each Stirling and two for each B. & W. All fans have adjustable-speed motors.

The feed-water heating has received special attention in this plant as a means of saving fuel. The condensate is used in part for cooling the generator ventilating air, circulating in a closed air circuit, and also for cooling the generator bearings; the economizers transfer heat to it from the flue gases; steam bled from the turbines adds its quota of heat, and the exhaust from the steam-driven boiler-feed pumps finishes the heating process in the condensate tanks.

The make-up water is softened by the Kestner method, involving the Cochrane hot-soda process. After the water has been treated, it goes to one of two distilling boilers reserved especially for make-up water, the other boilers receiving condensate. One distilling boiler is a reserve. To prevent concentration of salts in the distilling boilers a certain amount of water is drawn continuously from their mud drums, returned to the purifier and mixed with the make-up water.

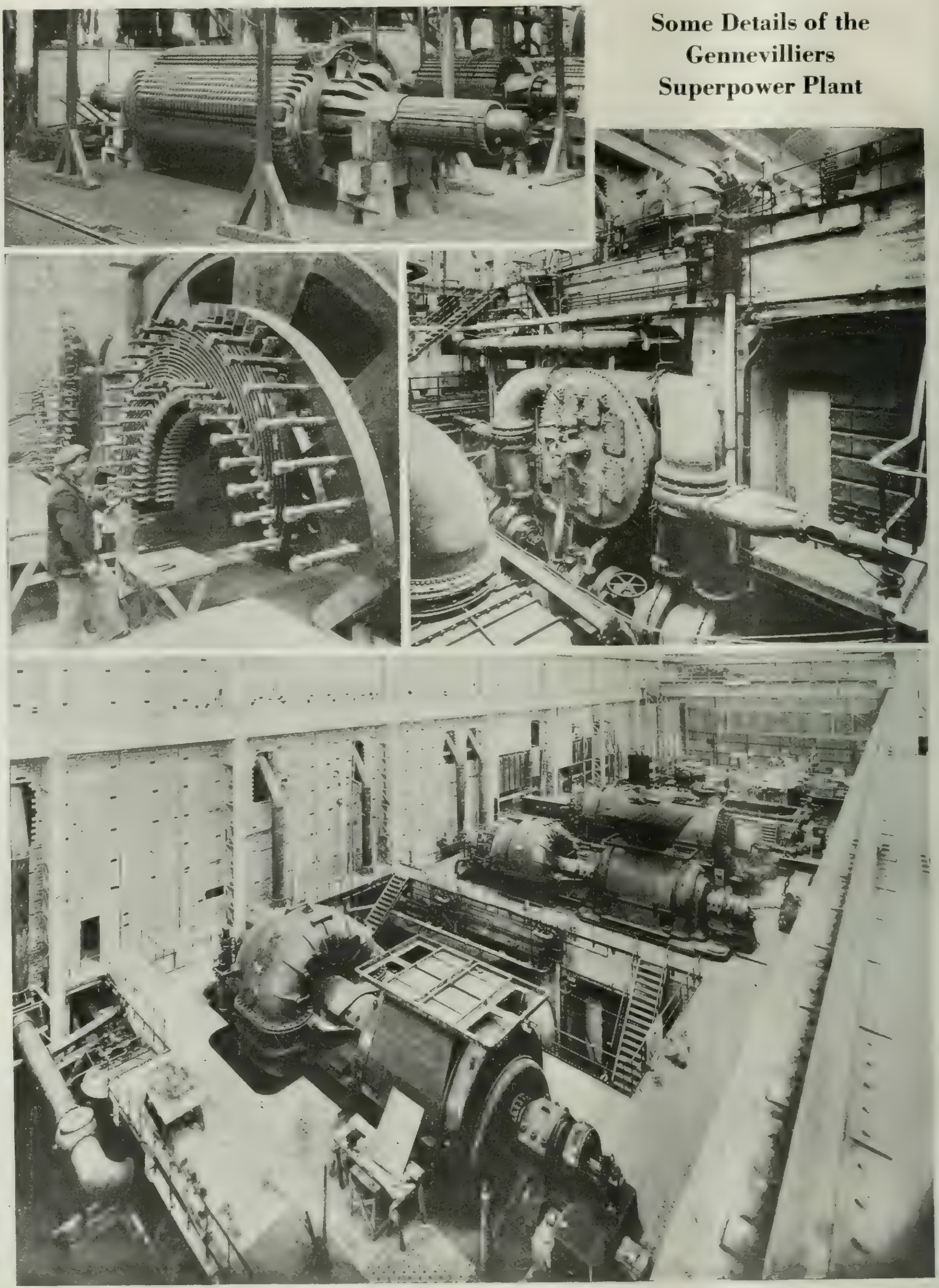
Before going to the boiler-feed pumps, both the boiler make-up and the condensate from the turbine condensers pass through special de-gassing filters, filled with finely divided iron. This metal removes the last traces of oxygen.



THIS STOKER AND ITS MATE CONTAIN THIRTY-SIX RETORTS AND PROVIDE A GRATE AREA OF 660 SQ.FT. UNDER A DOUBLE-END STIRLING-TYPE BOILER

As was suggested earlier, the Gennevilliers plant is ideally located with respect to coal supply. The storage yard, which lies along the water front, is depressed 10 ft., permitting flooding of the lower portion of the pile. Two traveling cranes bridge the yard, and provision is made for unloading either barges or railroad cars. The coal is either stored in the yard or dumped into 20-ton cars, which run on a standard-gage track. For loading these cars a belt conveyor, running through the center of each crane, is provided. The cars transport the coal to pits opposite the boiler plant, from the bottom of which it is lifted by duplicate bucket conveyors to the crusher, whence it is raised to the top of the boiler house.

Some Details of the Gennevilliers Superpower Plant



At top, the generator rotor in process of winding. In center, left, unfinished stator winding, showing details of end connections. In center, right, end of the steam condenser which has less than one square foot of condensing surface per kilowatt of turbine capacity. At bottom, turbine units in several stages of completion.

An elaborate monorail overhead system is used to distribute the coal to the bunkers, employing 6-ton motor-driven traveling hoppers. The rail is so laid out with switches that any bunker can be reached by way of four routes. The rail is sectionalized and provided with an interlocking block signal system to prevent collisions.

Each car carries two 500-volt motors and draws its current from a trolley wire.

TURBINES HAVE ONLY TEN PRESSURE STAGES

The five turbines in the plant are of the Zoelly impulse type, single-cylinder and single-flow. There are but ten pressures stages, each consisting of one velocity stage. The speed of the machines is 1,500 r.p.m. They are controlled by two automatic admission valves and two by-pass valves, the latter admitting high pressure into the second stage above 30,000 kw. These valves are oil-operated and controlled by the governor, and their action is throttling.

Provision is made for bleeding steam from the seventh and eighth stages for feed-water heating, and important element in maintaining heat balance in the plant.

Although three different builders are represented in the five turbines, they are practically identical.

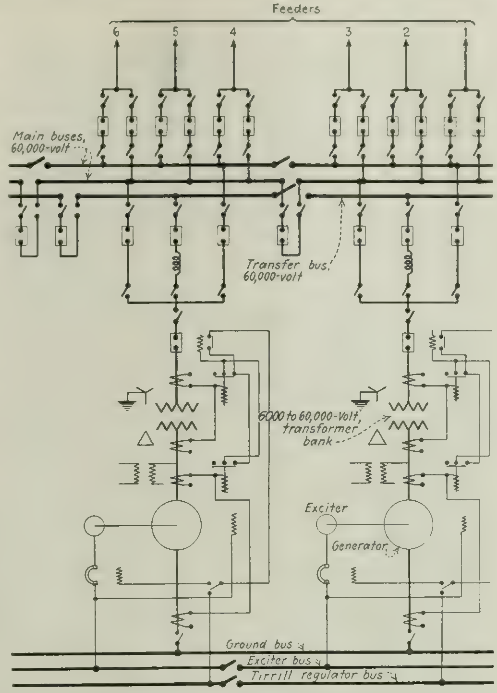
The surface condensers into which the turbines exhaust have but 37,650 sq.ft. of condensing surface, or 0.94 sq.ft. per kilowatt. The tubes are only 0.866 in. outside diameter. Each condenser is equipped with two motor-driven condensate pumps (one a spare), three air ejectors (one a spare), a motor-driven circulating pump (for normal operation) and a duplex motor and turbine-driven circulating pump (for emergency use).

The steam piping in the plant is designed to utilize the high-velocity possibilities of the high-pressure steam to the limit. The velocity in the 10-in. turbine mains at full load approaches 12,000 ft. per minute.

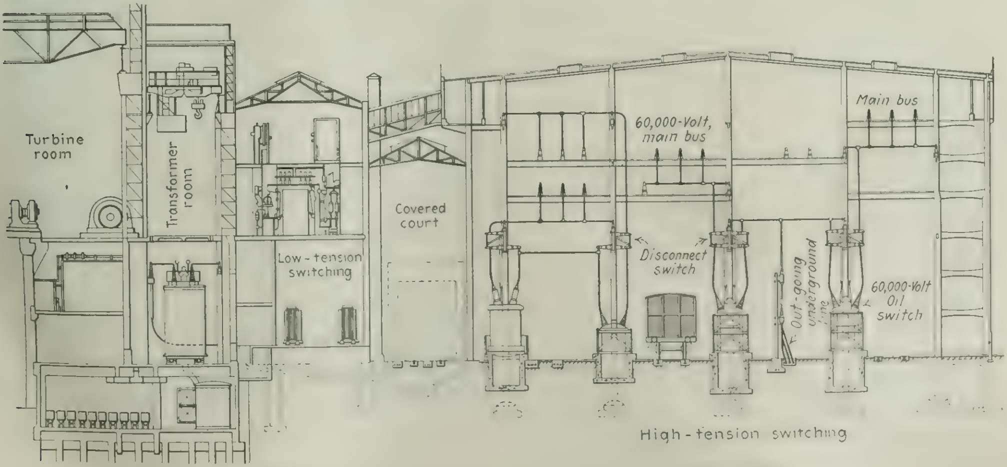
CLOSED-CIRCUIT COOLING SYSTEM FOR GENERATORS

Electrically the three-phase, 50-cycle, 40,000-kw. generators follow standard designs. Although the product of two manufacturers, they, like the turbines, are similar in detail and their rotors are interchangeable.

The generators are cooled by means of a closed air circuit, using the same air repeatedly, thus avoiding the necessity of washing a continuous supply of air and largely eliminating the fire risk. This air is cooled in surface coolers, arranged somewhat like a condenser, in the foundation of the generator. The condensate from the condenser is the main source of cooling, thus restoring a large part of the generator losses to the steam system. Raw water added later to the boiler make-up is used to supplement the condensate, the cooler being so arranged in sections as to make this possible.



SINGLE-LINE DIAGRAM OF PART OF HIGH-TENSION SWITCHING CIRCUITS



CROSS-SECTION THROUGH TRANSFORMER AND SWITCHING SECTIONS OF PLANT

As the amount of condensate available for cooling decreases with the load more rapidly than the generator losses, an automatic valve is provided to return to the condenser part of the condensate leaving the cooler. The rapid circulation of this water results in the absorption of the necessary heat in the cooler.

It is understood that the designers of this plant are contemplating a further development of the generator cooling system by substituting nitrogen for air, thus entirely eliminating the fire risk.

Each generator is connected direct to a bank of three single-phase transformers, which raise the voltage from 6,000 to 60,000. There is not even a disconnecting switch between the generators and the transformers.

TABLE II—STATION DESIGN CONSTANTS, GENNEVILLIERS PLANT

	Stirling	B. & W.
Steam conditions at throttle:		
Pressure, lb. gage		313
Total temperature, deg. F.		705
Degree of superheat, deg. F.		280
Boiler room:		
Square feet of boiler heating surface per kw. station capacity		1.28
Square feet of heating surface per square foot of grate	34.3	36.3
Cubic feet of combustion space per square foot of grate	2.08	7.8
Square foot of superheater surface per square foot of heating surface	0.476	0.573
Square foot of economizer surface per square foot of heating surface	0.572	0.602
Square foot of air preheating surface per square foot of heating surface	0.857	0.844
Cubic feet of water per cubic foot of steam in boilers	3.24	2.21
Cubic feet of water in boilers per square foot of heating surface	0.127	0.090
Forced-draft fan motor output per square foot of grate; hp., normal rate of firing	0.261	0.294
Same, two-hour overload	0.364	0.406
Induced-draft fan motor output per square foot of grate; hp.; normal rate of firing	0.033	0.035
Same, two-hour overload	0.133	0.140
Turbine Room:		
Square feet of condensing surface per kw. capacity		0.941
Ratio of circulating pump capacity to condensate pump capacity		42

Each transformer is installed in a reinforced-concrete cell covered with a heavy slab which must be lifted to permit removal of the transformer. The usual precautions for the removal of oil and fumes in emergency are taken, and the water piping, gages, etc., are in an operating passage running the length of the transformer cells.

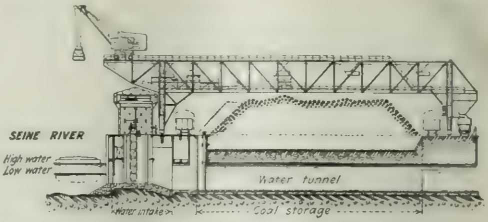
The high-tension switch house has been described as an American outdoor switchboard inclosed in a light reinforced-concrete structure. There are two main buses and one transfer bus. Each generator occupies one bus section with three feeders. The switching equipment, as well as the main transformers, are of General Electric make.

The generator oil switches are controlled by two sets of differential relays, one protecting the generator windings, the other the transformers and cables up to the oil switches. The outgoing underground feeders are also protected by differential relays. Each oil switch is set over a concrete pit, the object of which is to receive the oil in case of rupture of the tank and extinguish it if it is burning.

All the feeders are underground cables, three single-conductor cables, laid together in a concrete trough, being the arrangement adopted.

The supply of power for the auxiliaries is, in general, three-phase, although for the forced and induced-draft fans, the stokers and the coal-handling equipment 500-volt direct current is used. The three-phase voltage for the smaller motors is 220, and that for the larger motors 3,000. The regular main source of supply for these auxiliaries is the 60,000-volt bus, but provision for reserve is made by the installation of a storage battery and two 3,000-kw. house turbines. The latter will also be used at times of very light load.

In the above account of some of the important features of the Gennevilliers power plant the mechanical features have been emphasized as being less familiar to *Electrical World* readers than the electrical features. If more details are desired, particularly of the electrical equipment, they can be found in a booklet issued by the Union d'Electricité which will be available at a nominal price at the office of the *Revue Industrielle*, Paris.



CROSS-SECTION THROUGH COAL YARD AND LONGITUDINAL SECTION THROUGH INTAKE TUNNEL

The thanks of the editors of the *Electrical World* are due Col. E. Mercier, director of the Union d'Electricité for information regarding the design of the plant, for which he is responsible, and to R. Gasquet, editor-in-chief of the *Revue Industrielle*, for photographs and other illustrative materials.

HIGH-TENSION AND LOW-TENSION SWITCHING PANELS. SEE DIAGRAM, PAGE 269, FOR RELATION TO OTHER PARTS OF PLANT

Advertising—Its Value to Central Stations*

Why Some Advertising Falls Short—Logical Planning Essential—Getting the Public Viewpoint—Copy Preparation—Budgeting Expenditures—Amount of Advertising Appropriation

By W. J. REAGAN
Commercial Manager Utica Gas & Electric Company, Utica, N. Y.

ADVERTISING is playing an increasingly important part in the commercial activities of public utilities. A greater interest in public relations work is noticeable in every section of the country and the utilities are slowly coming out of the dark and turning the light on themselves. The electric light and power and gas companies are doing far more advertising than has ever been done by them before and a serious and intelligent bid is being made for public interest and good will. Advertising or publicity is an organized effort for creating or correcting the opinions or habits of the people. What we really buy when we buy advertising is mental impressions. This conception repeated is the power that builds good will.

Good will is gained primarily by good service. But hundreds of business men have proved that the growth of good will can be greatly accelerated by advertising. Moreover, your mental property—like your physical property—tends to depreciate. The average American is quick to notice poor service, prone to forget good service. You must keep him constantly reminded of the good service which he is enjoying and will continue to enjoy. Advertising is the most effectve way of doing this. In other words, advertising builds, maintains and increases the value of your mental property—property more important today than ever before in industrial history.

However, a great deal of effort and valuable space are being wasted because it misses the mark. Too many central-station men appear to believe that advertising consists of filling a given amount of white space with type and they judge the volume and the value of their advertising by the size of the bills that come in at the end of the month. Preparation of good "ad copy" is given too little attention; frequently there is no definite plan mapped out beforehand and the results are disappointing.

Making Advertising Pay

One way to make advertising pay the most is to employ a trained advertising or publicity man to take charge of the advertising and public relations work. Provided your company cannot afford to employ a man for his full time, get a part-time man. Frequently it is possible to employ some one connected with a local newspaper—an editor or reporter—to do the work on a part-time basis.

And when you get an advertising man, make him more than a mere explainer of policies long after they are formulated, or actually put into effect. Advise with him as to public relations. Tell him in advance what you have in mind and ask him how the newspapers and the public will take it. Copy should be written by some one who understands the people who are to be influenced. It is no handicap for the copy writer to learn our business thoroughly, but to understand people is much more important. Consequently, it is quite possible for advertising agencies to write better copy than anyone in the utility's organization, unless a special copy department is maintained.

When the agency's services are available, the plants are visited by their representative and the functions of the meterman, lineman, test man, trouble shooter, service department, ledger department, treasurer's system, the hydraulic plant, the watershed, the carrier current system are investigated and visualized. After several weeks of searching, talking to and questioning employees, the agency man returns to his own organization, relates his impressions and, after many conferences, the angle to be exploited is decided on. Thereafter, the copy man, space man, the illustrator and the type man are charged with their respective assignments, and something worth while is produced.

Incidental to the agency man's tour of inspection, he discovers something wrong, a glaring inconsistency, opposing his ideal of the service which he intended to broadcast. The utility organization, through the proper channels, will receive his constructive criticism, as coming from the "man in the street." His point of view should be valuable. Many times suggestions of this nature when followed are productive of much good to the organization and service alike.

Value of the Outside Publicity Man

Similar service is sadly lacking in most instances where the publicity man is an established part of the organization. His constant association with various department heads establishes a familiarity which tends to tolerate some breaches of discipline and departures from the formulated policies. This state of affairs is detrimental to the utility's well being. In other words, the publicity man gets into a rut. Opportunities to receive, on short notice, the approval of the executive, or his company council, in order that some explanatory write-up may be published on a mooted point which has come to his attention, or to discuss innovations for future development of service, are fewer, after the officers of the company begin to think that they cannot be bothered further with these matters. He is absorbed in the company's routine. He loses his initiative, his critical viewpoint, and his value is unconsciously curtailed.

On the other hand, it is not an ideal condition for the management of the advertising to be in the hands of an outside organization. Every one knows there is much more to advertising than the printed advertisement, and a person should be in command who knows both the public and the business. Such a manager uses the outside experts merely as assistants and counselors.

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*From a paper presented at the commercial section meeting of the Empire State Gas & Electric Association at Lake George, N. Y.

The initial step for any company to take before attempting publicity is to analyze its service and determine whether it is giving the best service that it can under existing conditions. This does not mean service equal to that of any other company regardless of financial conditions. It means the best possible service under the circumstances. If the facts in the situation prove that the company's condition permits no improvement in the existing service, the company need not fear to begin advertising. The general public seldom will demand better service than that to which it is entitled if it knows the facts.

BACKING UP A CAMPAIGN

Having disposed of the question of service, the management should subject itself and the entire company personnel to close scrutiny in regard to its attitude toward the public. Concretely, the central-station manager who advertises one policy in the newspapers and permits his employees to carry it out half-heartedly is wasting money solely because they have not had the plan explained. His employees come in closer contact with his customers than the newspapers. If they tell the same story as the advertising, the chain is complete and the advertising in the papers and the advertising by employees supplement and strengthen each other.

Copy should not be written until the company's service—as previously described—has been fully attained, and it should be an expression of that service. It won't do for advertisements to be simply strung together without thought of their bearing on one another, or their suitability to the purpose of the campaign. A so-called "clever" idea is adopted as one advertisement. Next another idea is submitted by someone without knowing what the advertiser is trying to accomplish and it is purchased. Such advertising is like trying to kill a deer by shooting into a thicket in any direction, upon the theory that game may be hidden there, or like trying to build a house by throwing a brick here and another there, instead of placing one upon another with mortar between.

It is not necessary that advertisements be made into an obvious series and labeled "1," "2," "3," etc. Indeed, that might be done and still the real vital connection be absent. What is desirable is that the manager shall see the connection himself, that he shall have a distinct purpose in his campaign, and that he shall build his advertisements with a clear idea as to how each one is going to push the campaign a little nearer to the goal.

The utility problem is intricate and involved and is difficult for the layman to understand. The objective to be attained should be a clear, concise explanation of the functions of the various departments of our organization, service and corporate being, couched in the newsy style of the newspaper reporter, in accordance with the angle of the "man in the street." In following this suggestion down, I will mention some of the subjects which our company has exploited in its various campaigns.

We began with a clear statement of what we proposed to publish—about our physical properties; distribution system, wires, poles, transformers, meters, large coal piles, the yearly cost of the coal we burn; our service men, meter readers, test men, linemen, stokers, switchboard tenders; the training these men receive; the risk they assume to insure uninterrupted service; our policy in extending gas mains and the electric distribution system.

NEWSPAPERS MOST DIRECT ROUTE

The newspaper is used by more advertisers, reaches more people, and reaches them more often, than any other advertising medium. It produces the maximum results. Many times the subject matter will be of the moment, necessitating publication the same day or thereabouts. It is a logical conclusion, therefore, that in the interest of sustained attention, quick service and widespread clientele the newspaper can almost be relied upon as the sole medium of contact.

Probably the most wasteful expenditure of money in the advertising field is that for space in programs, souvenir booklets, special editions and publications, without bona-fide subscription lists. Beware of all of them.

The recognition of the principle of correct budgeting has taken advertising out of the field of sporadic or uncertain expenditures. The utility can know accurately from clear and scientific analysis just what it is investing in advertising and why and that the total amount so invested is absolutely based on a definite program.

Under the old idea of advertising as mere paid publicity, it was entirely natural that it should be regarded as something that could be carried on intermittently, but advertising for the education of the public mind, the kind of advertising that must be done today to drive the public through the door of understanding and co-operation, needs to be carefully planned and unfailingly carried out.

AMOUNT OF APPROPRIATION FOR ADVERTISING

Department stores of recognized standing do not plan to spend more than 2 per cent of their gross receipts per year for advertising. Businesses that are building up must spend as high as 5 per cent. Merchandisers of class and distinction spend 7 per cent. Dealers in new electrical appliances are in the latter class. However, they are favored through the manufacturers' advertising and the ratio is consequently less. Appropriations for the national advertising of well-known articles are shown by the following percentages of gross sales:

	Per Cent		Per Cent
Arrow collars	3½	Kodaks	3
Cadillac automobiles	1	Northern Pacific Railroad	1 9
Colgate's	2	Dutch cleanser	10
Fatima cigarettes	5	Rund heater	2½ 3½
Sears-Roebuck	10	Union Pacific Railroad	2½

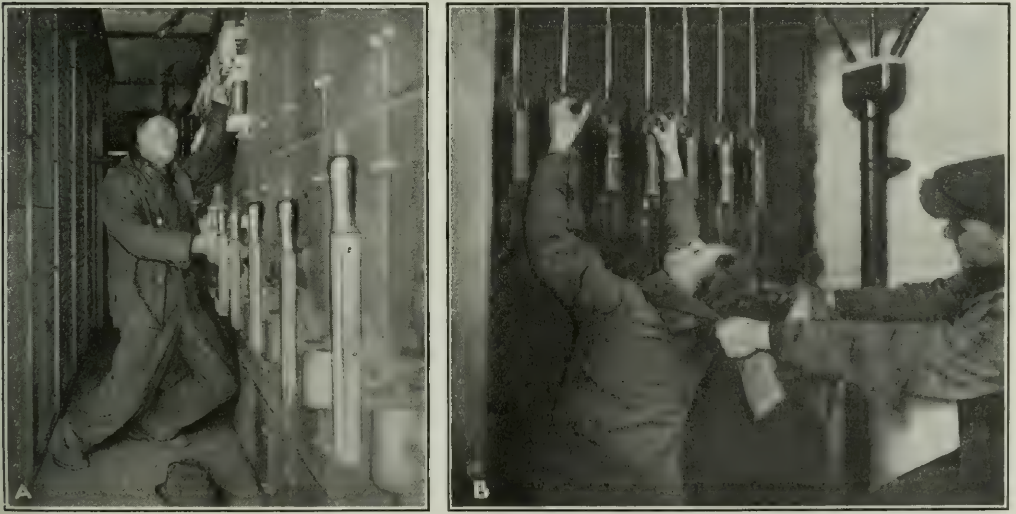
In the utility business it is conservatively estimated that one-third of the total new business appropriation can be budgeted for an advertising fund. Experience has shown that the newspapers should receive better than one-half of the advertising appropriation. A good formula which closely checks the foregoing states that if central stations will intelligently apply only 1 to 1.5 per cent to their annual gross receipts to advertising, assigning one-half to good will and one-half to merchandising, they can take advantage of every form of co-operative help to the fullest extent and put themselves in the strongest possible position.

What Determines the Deadliness of a Shock

Physiological and Chemical Effects of Electric Current on Human Body Discussed—Observations Based on Actual and Extensive Tests—Suggestions on Rescuing Shocked Person

By **GEORGE M. OGLE***
Power representative, Public Service Electric Company, Newark, N. J.

DEATH by electricity is caused from paralysis of all muscles, including the involuntary muscles of the heart, lungs, etc., as well as destruction to the mental and nervous systems of the body. It has been found by exhaustive research† work that a current of 1 amp. passing through the brain or other vital organs of the body will in most cases produce death if allowed to act for only a short period of time, and it is therefore evident that it is the amperage, together with the energy dissipated in the body that actually destroys life. On the other hand, the element of voltage enters, inasmuch as the resisting power of the human body is very high and it requires a voltage comparatively large or small, depending entirely upon the resistance and contacts, to force this amount of current through a circuit in which the body and its contacts constitute the resistance.



GOOD CLEARANCES AND INCLOSED PANELS WILL ELIMINATE MANY HAZARDS

A.—A person is held paralyzed and speechless on a 440-volt circuit, making his chance of recovery very remote.

B.—Dry clothing can be used as an insulator in an emergency when rescuing a person; in no case should the bare hands be used.

The resistance of the human body is a variable factor and depends largely upon the applied voltage, inasmuch as the resistance measured from hand to hand with precision instruments on potentials not in excess of 10 volts will show approximately 40,000 ohms, while if this potential is increased to 110 volts the resistance breaks down to some extent and becomes nearly 10,000 ohms.

The question naturally arises as to the reason for this difference of resistance in the same body under different potentials. This is explained by the high resistance of the epidermis. If the skin is removed from the human body and thoroughly dried, it becomes a very good insulator of high resistance, and under low voltage with dry contact the pressure is not strong enough to break down the skin's resisting power, while, in the cases of higher voltages through low resistance contacts, the epidermis generally breaks down, allowing the current to enter into the blood and muscular tissues of the body. Due to the normal animal salts contained in the blood and muscular tissues of the average healthy person, which are, by virtue of their liquid and physical form, of very low ohmic resistance, excellent paths are available for the flow of heavy currents when the body is acted upon by medium voltages. To illustrate that the skin is our chief protection from death when placed in an electrical circuit, it is only necessary to consider the human body being severely cut, or the skin opened up in such a way that direct electrical contact could be made to the main blood arteries, in which case the extremely low voltage of 50 would prove to be a death-dealing potential. Furthermore, the resistance breaks down very rapidly with even higher voltages, as may be seen in the fact that the resistance instruments will show the body to have about 200 ohms resistance under a potential of 2,000 volts with moistened contacts.

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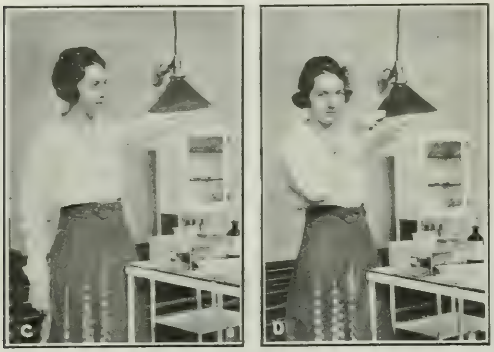
*Formerly electrical engineer, Vulcan Iron Works.

†Based on observations in the field and during electrocution of criminals at Sing Sing.

It is most interesting to note that the resistance of the average woman's body is considerably less than that of a man's, for the reason that her hands are very rarely calloused, her skin softer and her general physical condition more delicate than that of the male sex, which allows a stipulated voltage to send a greater quantity of current through her body, due to the low breakdown resistance of her skin.



SAFETY RULES SHOULD PREVAIL IN THE HOME
C.—One hand rule should be enforced even on 110-volt circuits.
D.—Proper installation will eliminate this hazard.

The resistance of a given person varies largely, from time to time, in accordance with their blood and skin conditions, as well as the percentage of moisture or perspiration emanated through the epidermis, which means, if taken technically, that a man whose body is thoroughly dry may stand a considerably higher voltage than he could otherwise withstand on a hot summer day when wet with perspiration, which forms an excellent conductor, due to its contents of salt matter. For this reason, a person may be electrocuted from a certain electrical circuit, while the next one to come in contact with it would only be slightly hurt, showing conclusively that the voltage is only one of the three important functions when studying the danger of any electrical circuit.

As the general public understands the voltage of an electrical circuit more clearly than that of the other two important factors, below will be found a table of commercial line voltages, for both direct and alternating current, which shows the general result on the average person, where the amperage flow through the body is restricted only by the ordinary accidental dry contact.

Electrical currents on the human body produce one or more of the following conditions, depending upon the source of energy, voltage applied and resistance of the body through points of contact:

1. Painful shocks to nervous system.
2. Unconsciousness.
3. Paralysis of the brain.
4. Paralysis of all voluntary and involuntary organs.
5. Hemolysis, or blood disintegration.
6. Creating of excessive heat in the body.
7. Burning of body at points of contact.
8. Painful muscular contractions.
9. Mental and nervous deficiency.
10. Total inability.
11. Death.
12. Cremation.

When a person is subjected to an electrical current under a potential of 2,000 volts with good contacts the feeling may be described as that of an extremely superpowerful blow at all points of the body and the vanishing to complete unconsciousness, all of which takes place in an infinitely small fraction of time. Other characteristics are that all muscles in the body instantly contract, causing severe contortions of all limbs, fingers, toes, mouth, face and eyes and, if it is applied for any length of time, burning rapidly develops at the points of contact. Under a pressure of 2,000 volts with excellent contact the average body would receive about 10 amp., and if this amount of current is allowed to act on the body for thirty seconds there would be severe burning of the flesh, even to the extent that the skin could well be classified as in a "charcoal state."

If temperatures are taken during and immediately after such an application of electricity, it will be found that the electrodes making contact may reach a temperature high enough to melt copper (1,940 deg. F.) and that the average body temperature will be in the neighborhood of 140 deg. F., which, if this temperature rise alone were only considered, would show that it would practically be impossible to restore life or reinstigate blood circulation under such abnormally high body temperature.

A more practical and probably better understood illustration of the death-dealing blow a person receives when a current of 10 amp. under a pressure of 2,000 volts is passed through the body may be seen in the fact that when this amount of electricity is transferred into mechanical power it would be at the rate of 884,400 ft.lb. per minute, or enough electrical energy to light 800 electric lights in the average home. Death and some of the above hazardous results may be incurred on circuits of considerably lower voltage if the contact with the body is such that its ohmic resistance is low, such as is the case when internal contact is made with the blood, etc.

High-powered circuits of 33,000 volts and above will

Volts	Classification	Remarks
110	Not usually dangerous	Will produce shocks to the nervous system, causing muscular reactions.
220	Not usually dangerous	A voltage not to be experimented with in determining its effects or feelings upon the body. May produce slight burning of body at points of contact. Will produce severe shocks to the nervous and muscular systems.
440	Semi-dangerous	May cause death where moist, accidental contacts are made. Produces severe shocks to the nervous system. May cause paralysis of muscles, holding victim speechless in circuit. Often produces bad electrical burns.
550	Semi-dangerous	About the same as the 440-volt system.
1,100	Dangerous	Produces unconsciousness and total paralysis of all muscular and nervous systems and in most cases will cause death or very severe burns upon very slight contact.
2,200 and over	Dangerous	Will destroy life. Produces unconsciousness and total paralysis of the muscular system, blood disintegration and the cremating of body, if left in circuit. Extreme care should be exercised in the handling of such currents.

practically destroy the body past recognition by cremation within a fraction of a second. However, cases are known where currents have passed through the body in amounts great enough to burn the entire limbs off, or to the extent that they would have to be amputated, and yet the subject has regained consciousness and revived. Other cases have shown that even though consciousness and life are restored, which can only be done provided the current is instantaneously removed or has not passed through the brain or other vital organs, the person has been left a total imbecile or mentally deficient, due to the tremendous shock to their mental system.

There are other cases where contact is made with low potentials of approximately 550 volts which cause muscular contractions of the hands or even greater gripping on the conductors, and while this voltage and contact may not send a deadly current through the body at the instant of making contact, the person, in most cases, would be held in circuit until life was extinct, unless seen and freed by a bystander. Even though these low voltages under favorable contact do not produce instantaneous unconsciousness, care should be taken for reason that they often prove fatal, inasmuch as a person subjected to this low potential becomes muscularly paralyzed and consequently speechless, thus cutting him off from helping himself or summoning assistance.

It is not uncommon to hear of a person being killed on 110-volt lighting circuits, but in most cases, if the real truth is known, it will be developed that there was an electrical defect in the wiring whereby the high voltage current was allowed to enter into the supposed 110-volt circuit, or that the person actually died of some physical defect, such as heart failure, etc., which may or may not have been actuated by the low voltage electrical shock.

The exact line of demarkation as to just what current passing through the body will prove fatal has been a question that has outlasted many controversies, and up to the present time no satisfactory solution of this problem has evidenced itself for reason of variable physical conditions and that such exacting data could only be collected upon the sacrifice of human life in a most painful and inhumane way. We do know, however, that a current of 1 amp. passing through the brain or other vital organs will in most cases prove fatal.

Electricity, in some ways, may be well compared with most poisonous drugs. A certain dose of a given poison may kill a particular person, while in the next case an equal dose to another person, with the immediate aid of medical treatment and quickly freeing the stomach of its poisonous contents, may not prove fatal but only place the victim in a critical condition for a short time, leaving him with no after effects. Electricity differs from the above in that if the proper amount of current is passed through the vital organs there is no salvation.

TESTS FOR CAUSE OF DEATH

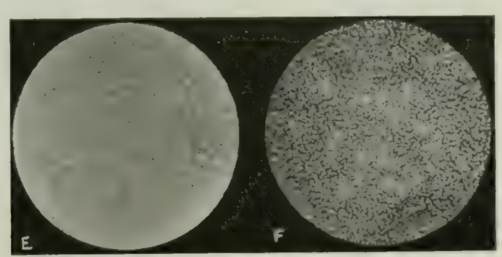
Serious legal debates often exist over whether a person was electrocuted or died of other natural causes. A superficial way to determine if death was caused by electrical currents is to examine the body for burns at points where the victim came in contact with the live wires, together with the fact that the teeth very rapidly lose their luster and that rigidness of the body after death first sets in at the joints closest to points of contact. For greater technical detail and more paramount characteristics of an electrical death the body should be examined in one of the three following ways:

1. The temperature rise in the body, which can easily be determined by immediately taking the victim's temperature.

2. For heamolysis or disintegration of the blood corpuscles, which are clearly shown upon microscopic examination.

3. By the peculiar foggy eye condition with a star fracture of the eye lens.

Research work and literature on the subject of electrical currents on the human body is limited, chiefly due to the fact that such data can only be compiled as the result of casualties or at the expense of human life. Two semi-technical points that will be of interest to those familiar with electrical currents are, first, the fact that a normal, healthy person cannot withstand the voltage that can be applied to one affected with tuberculosis or other chronic diseases, in which case the blood does not contain as much salt matter as is found in the normal healthy person, resulting in higher ohmic resistance of the body and consequently higher voltages to send a fatal current through the diseased person, and, second, when a human body is placed in an alternating electrical circuit it has capacity and will tend to produce a leading phase displacement between the impressed voltage and the resulting current, causing a leading power factor.



BLOOD TESTS WILL OFTEN SHOW CAUSE OF DEATH

E.—Normal human blood corpuscles magnified 460 diameters.
F.—Disintegrated human blood corpuscles after electrocution magnified 460 diameter.

High frequency currents are chiefly used in electrotherapeutics and radio work. Medical science has used to great advantage high frequency currents under different conditions for treatment of various diseases, while the high voltage and high frequency apparatus has also become very prominent in the use of wireless telegraphy. These currents are not to be feared or classified as dangerous, due to their extremely high frequency and the pre-eminent characteristic of the body to resist or restrict the flow of a current having such a high number of cycles per second.

Another peculiar phenomenon is that certain currents passing through different parts of the body after death will produce various muscular movements, giving most pronounced indication of life. In sending such currents through the body after death it is most interesting to note the higher resistance of the body, which continually becomes greater with the gradual loss of blood heat. Medical science at various times has given serious consideration to the peculiar action of the heart after death by the application of even small 1-volt battery currents, which will cause it to pump periodically as the current is applied. Such action, however, is only muscular contraction and relaxation upon the closing and opening of the electrical circuit and this action of the heart will completely cease upon the removal of the current, showing that such heart actions are neither accelerating, self-supporting nor lifelike.

Prominent medical men often maintain that they can revive a person after a most severe and fatal current has passed through the body, provided they are given the victim immediately upon removal from the circuit. Such statements are carelessly made and are generally relative to other conditions, for if the proper amount of electrical energy has been dissipated in the human body we encounter blood disintegration and temperatures that in themselves make the restoring of life impossible.

The average death caused from electrical current is usually traceable to the neglect on the part of the one involved. Some accidents are caused, however, by people carelessly coming in contact with fallen wires or tampering ignorantly with high-power electrical circuits. Whenever or however such an accident may happen, the best and most logical thing for the bystander to do is to make immediate efforts to have the current cut off by means of the closest switch, but if this is not possible within a very short time element, other means should be resorted to immediately. Never make an attempt to free the victom with bare hands, as it may cause severe burns or electrocution by receiving a portion of the current. Where it is necessary to free a victim from a live electrical circuit, it can best and most safely be done by using a piece of dry wood or rubber gloves, provided the high-powered circuit is less than 10,000 volts. If neither of these two articles can immediately be found, it is comparatively safe to remove dry clothing from your own body, throwing it around the neck or other part of the victin and freeing him from the circuit in this manner.

In any event, it is most essential to remember that the very essence of saving the victim's life lies in the rapidity of time in which he is freed from the line circuit, and if unconscious or burned when removed, medical advice should be sought immediately, using artificial respiration until such time as the doctor arrives.

Material Increase in Central-Station Output During May

CENTRAL-STATION operations experienced a remarkable expansion during May. Reports received by the *Electrical World* for that month from central generating and distributing companies representing 83 per cent of the installed rating of the country indicate that the average daily output of such companies was more than 4,000,000 kw.-hr. in excess of that reported for April.

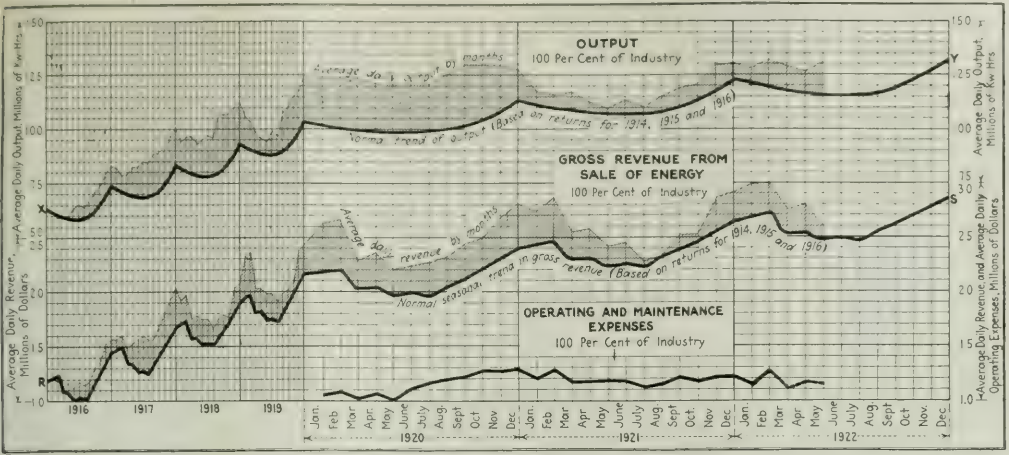
Three conditions probably contributed to this unusual increase in operations at this season of the year. First, the government reports indicate that, with the exception of leather, every primary industry in the country increased operations over those of April, with a resulting increase in the industrial load of the central stations of the country. Second, thousands of new residential lighting customers were added to the central-station lines during May owing to the housing construction going on throughout the country. The energy consumption by these new customers was, in all probability almost sufficient to overcome the usual decrease in lighting requirements caused by the advancing season and by the operation of the daylight-saving law in many towns and cities. The irrigation load of the Western distributing companies probably nearly reached its peak during May, and a largely increased consumption of electrical energy by this class of consumers was the third cause for the upward trend in energy consumption by the country as a whole.

The class of central-station customers which increased its energy requirements during May is also discernible on a close study of the figures for gross revenue. While the total of kilowatt-hours sold by the central stations was materially above that sold during April, yet the average daily gross revenue was 6.8 per cent less than that reported for April. The increased output was, therefore, apparently distributed in large part among the low-revenue customers, which fully bears out the government reports of increased industrial activity throughout the country.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to gross revenue from sale of energy, gives further evidence of the material increase in the low-revenue load and probable decrease in the high-revenue or lighting load during the first five months of the year. In May the operating ratio of companies having steam-electric generating plants only, taken in the aggregate, was 53.7 per cent, as against 45.7 per cent in January of this year. Evidence of the tendency toward financial prosperity in the electric light and power industry.

TABLE I—CENTRAL STATION RETURNS FOR THREE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)				Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase			1922 Thousands of Dollars	1921 Thousands of Dollars	Per Cent Increase	Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
														1922	1921	1922	1921	1922	1921
Mar.	78	3,154,993	2,781,731	13.4	72	$61,148	$56,047	9.1	Mar.	55	19,199	19,897	−3.5	48.3	54.6	27.1	21.0	40.7	42.8
Apr	82	3,121,167	2,769,089	12 7	75	62,784	58,483	7 4	Apr.	61	21,403	21,666	−1 2	48 3	53 9	25.3	27.6	34.8	47.7
May	83	3,367,998	2,800,374	20 1	76	61,134	56,603	8.0	May	62	22,060	21,669	1 8	53.7	58 1	25 1	22 4	43.3	46.0



however, is shown by the fact that the operating ratio decreased from 58.1 per cent in May of 1921 to 53.7 per cent in May of this year.

The accompanying diagram of central-station operations may also be considered as a barometer of business conditions in the electric light and power industry. The line *X-Y* shows the normal trend of output based on returns of central-station operations during the years 1914, 1915 and 1916 received by the *Electrical World*, which are assumed to represent years of normal operations in the industry. The curves indicate that the central-station industry is operating at several points above the normal trend of output and gross revenue as established in 1914, 1915 and 1916. The energy output of the industry during the present year appears to be tending toward a larger monthly increase than would be indicated by the curve of normal seasonal trend. The gross revenue appears to be following the normal seasonal trend curve very closely.

Apparently every section of the country experienced an acceleration in industrial activity during May and a consequent increase in industrial energy requirements. To this was added a materially increased irrigation load throughout the West.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States			Percentage of Installed Ratings Represented	Atlantic States			Percentage of Installed Ratings Represented	North Central States			Percentage of Installed Ratings Represented	South Central States			Percentage of Installed Ratings Represented	Pacific and Mountain States		
		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase
KW.-HR. OUTPUT:																				
Mar.....	82	258,142	210,107	22.9	81	1,177,876	1,024,161	15 0	70	968,229	86 2,240	12 2	60	160,656	145,320	10 6	94	590,090	539,903	9.3
Apr....	81	231,874	205,089	13 0	82	1,129,200	979,666	15 3	80	1,019,170	910,482	11 9	63	158,524	137,240	15.5	94	582,400	536,612	8.5
May.	82	242,154	198,888	21 8	83	1,204,529	982,362	22 6	82	1,109,374	934,895	18 7	62	163,924	138,089	18 7	95	648,017	546,140	18.6
REVENUE:																				
Mar......	82	$6,366	$5,947	7 0	75	$23,798	$21,617	10 1	57	$17,411	$15,726	11 0	60	$4,214	$4,048	4 1	94	$9,359	$8,709	7.5
Apr....	81	6,130	5,807	5.6	76	23,809	21,847	9 0	67	19,536	18,017	8 4	62	4,123	3,928	5 0	94	9,186	8,880	3.5
May...	82	5,799	5,508	5.2	76	22,557	21,129	6 8	69	18,960	17,048	11.2	62	4,174	3,795	9 9	95	9,644	9,123	5.7
OPERATING EXPENSES:																				
Mar.....	53	$1,800	$1,741	3.4	56	$7,140	$7,345	-2.8	38	$4,884	$5,188	-5.9	59	$2,097	$2,313	-9 3	93	$3,278	$3,310	-0.9
Apr..	53	1,621	1,655	-2.1	56	7,322	7,295	0.3	53	7,148	7,259	-5.3	61	2,063	2,075	-0 5	93	3,249	3,382	-3.9
May.	53	1,608	1,682	-4 4	57	7,518	7,363	2 1	55	7,675	7,202	6 6	61	1,863	2,018	-7 7	93	3,396	3,404	0 2

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months	
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
Steam Plants:																				
March	54.6	62 1	58.9	66.6	48.0	52.0	50.9	56.8	47.8	57.5	52 8	62.4	47 2	52.7	50.3	55.8	47 3	56.3	49.0	55 0
April......	49.5	62 5	57 5	66.5	47.3	51.5	50 7	56.7	48 7	55 2	52 3	61 9	50 6	54 7	50 0	56 0	47.4	54.5	48 4	55 0
May	58 8	62 4	57 1	66 0	54 4	58 0	50 6	56 6	50 6	58 8	61 5	52 0	54 1	56 1	50 1	55 1	54.7	56 3	48 8	55 3
Hydro Plants:																				
March...	36.3	34 1	31 3	45 0	23.9	27 8	18.2	22.4	26 0	25.6	22 7	21.8	37.0	37.3	35 6	34.2	28 6	36 0	27.0	25.5
April	38 4	37 0	33 1	44 1	21 0	24 5	18 5	22 8	23 6	24 3	22 6	22 1	37 2	22 4	36 0	34 2	27 5	31.7	26.9	26 4
May	32 0	28 7	33 2	42 1	16.2	18.0	18 5	22 7	22 1	22.7	22.3	22 6	33 0	28 0	36 4	34 4	35 2	32 8	27.2	26 8
Combined Systems of Steam and Hydro Plants:																				
March.....................	46.7	46.0	52.8	52.7	49.3	52.4	44.5	49 0	43 3	49.3	46.7	55.8	41 6	38 4	43 8	45 4	32 6	34.1	37.2	40.8
April	43.7	45.9	52 6	52.4	47 7	50.6	45.1	49.7	47 8	52 7	46.9	55 8	39 8	43 7	43 5	45 1	33.7	38.2	36.8	41.0
May	46 2	49 4	52 4	52 5	44 8	45.3	45 4	49 5	50 6	55 1	47.7	55 8	38 5	44 5	43 1	45 3	31 3	34.4	36.6	40.7

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Should Impress Public with Value of Decorative Lighting

To the Editors of the Electrical World:

Referring to the frontispiece on page 1160 of the June 10 issue of the *Electrical World,* showing electrical decorations in connection with the recent Knights Templars conclave in New Orleans, it is my opinion that the central station, contractor-dealer and jobber should co-operate generally in bringing about the lavish use of electric service in civic events of this kind, thereby impressing upon the public unconsciously the tremendous importance of the industry. Aside from this, such decorative accomplishments create considerable business for the electrical industry as a whole.

There were approximately 26,000 lamps used in the Knights Templars decorations. All of the material (streamers, etc.) has been acquired by the American Legion and will be reinstalled for the convention which it will hold in New Orleans in October, 1922. During the great war, with its shortage of power and decorative material of this kind, there was naturally a tendency to curtail the installation of large electrical displays. As business again becomes normal the industry as a whole should turn its attention toward developing them.

W. E. CLEMENT,
Commercial Agent.

New Orleans Railway & Light Company,
New Orleans, La.

Evolution Will Eliminate Excess Varieties

To the Editors of the Electrical World:

I have just read Mr. Sargent's article which appeared in the *Electrical World* of June 10. There are undoubtedly unnecessary duplications in wiring-device lines. Some of these could well be made obsolete, and in fact I believe that manufacturers will continue to drop from their lists articles for which they have small sales.

We have from time to time dropped many catalog numbers. In fact, it is our policy to do this whenever sales on any device show a permanent reduction to a point where further production makes them unprofitable. Sometime, however, although the very small sale of such an article makes it unprofitable, at the same time the small existing demand is one that manufacturers rather like to fill, believing that there is considerable advantage in accommodating the user, because of the expectation that he will also buy other material if he finds that all of his requirements are satisfied by any one manufacturer.

My personal opinion is that a proper balance will naturally be maintained not only by manufacturers but by jobbers as well, and that when any particular article becomes to them an unprofitable one they will drop it. I should be inclined to doubt the success of any proposed concerted management on the part of manufacturers to eliminate certain lines having a comparatively small sale. If there was a demand large enough to make it interesting to any one manufacturer, there would always be some one ready to produce it.

Production of any article in small quantities naturally leads to high cost, and, of course, to high selling price. Therefore it seems to me that the tendency of manufacturers to concentrate on lines which afford a volume for production is naturally going to produce some articles which are manufactured in volume at a lower cost, and that these articles will compete with and eventually supplant any article for which there is a decreasing demand and which can be replaced with whatever happens to be the popular device of the period.

During any such evolution there are bound to remain some imperative demands for peculiar devices for which the user will be entirely willing to pay comparatively high prices. Manufacturers will continue to supply these demands so long as the user is unable to correct his requirements and satisfy them by use of some article which the manufacturer is already producing in volume and selling at lower prices.

My reasoning may seem a little bit hazy, but what I am getting at is that the laws of evolution and survival of the fittest will take care of most of our problems.

BY A MANUFACTURER.

The Jobber and His Profit

To the Editors of the Electrical World:

I have read with considerable interest the article published in a recent number of the *Electrical World* entitled "A Study of Jobbers' Sales and Costs," and I think we are all under obligations to you for advocating our case so ably.

The outstanding question might be summed up in the words "Why do they do it?" I think we jobbers are largely to blame for our own predicament, because it is an old saying of the manufacturers that the more profit they give us the more cheaply we sell our goods to our customers. In other words, the jobbers will not keep the profit the manufacturers are willing to allow them. A partial, though not complete, answer to this is that if the manufacturers would quit creating so many new jobbers and would quit encouraging non-electrical jobbers to handle electrical material as a side line, it would be easier for us to keep some of the profit which they are willing to give us.

I could name, for instance, a prominent manufacturer of dry batteries whose products we used to order in carload lots. He began making distributors out of hardware stores, mill-supply houses, and what-nots, and the result is that in our unalterable determination to retain our profit on his line and not to cut his prices, we have seen the business pass away from us, until now it is barely a third of what it was ten years ago.

Frankly, I do not know the end, unless it be that the margin of profit on electrical supplies will ultimately go so low that the great surplus of jobbers now existing will be forced out of business and the line will no longer be sufficiently attractive to non-electrical jobbers to encourage them to handle electrical goods even as a side line. Perhaps the industry will resolve itself into different classes of specialists, some of whom will handle house-wiring material only, some household devices only, others catering to industrial plants only, and so on, so that their respective costs of doing business may be properly apportioned to the several lines of goods and the gross margin of profit applying to these different lines.

W. R. HERSTEIN,
Vice-President and General Manager.

Electric Supply Company,
Memphis, Tenn.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Coal Purchase Specifications Placed on Rational Basis*

Cost of Handling, Storage and Other Factors Influence Characteristics of Coal Used—Curves and Formulas Given for Determining Coal Values

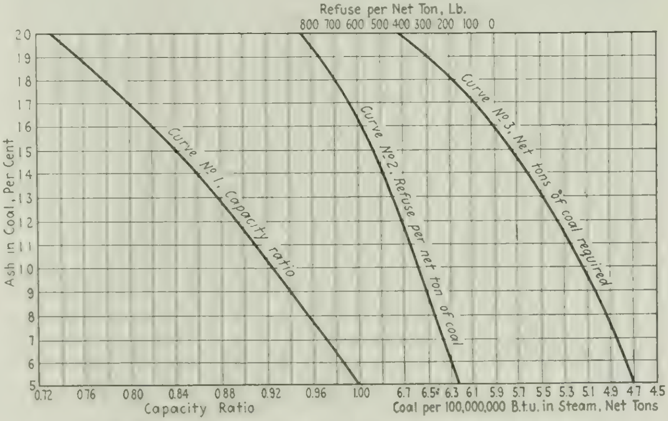
IN PURCHASING coal the object should not be to get the most coal or the largest number of B.t.u. for a dollar, but to get coal which, when used in the plant for which it is bought, will enable that plant to deliver the required amount of its products for the lowest cost when both operating and investment costs are considered. The factors that determine the value of a certain coal in any given plant are as follows:

1. The cost in the bunkers of the coal required to produce a given number of B.t.u. in the steam.
2. The relative investment in boiler plant, including coal-handling and ash-handling machinery, land, buildings, etc.
3. The cost of handling and disposal of refuse.
4. The relative cost of fireroom labor with coals different in quality.
5. The cost of carrying banked boilers varying with quality of coal.
6. The clinkering tendencies of the coal.

The application of these factors is shown by the accompanying curves and formulas, examples being worked out to illustrate specific cases. The formulas are applicable to all types of coal-burning equipment. The curves, however, are based only on operating results with underfeed stokers.

After deciding upon the supply from which the coal is to be drawn, as, for instance, the semi-bituminous field, the selection of the coal possessing the characteristics most desired remains. Experience in the operation of the plants under consideration has shown that the most satisfactory results can be obtained from coals having the following characteristics: (1) A volatile content less than 20 per cent; (2) as little ash as possible; (3) an ash fusion temperature not less than 2,450 deg. F.; (4) at least 25 per cent of the coal should be capable of being stored for nine months without serious trouble from spontaneous combustion.

Having selected from the coals offered those which, from consideration of price, quality, etc., seem to be most suitable, sample cargoes of these coals are obtained and subjected to a boiler test which weeds out a number of coals that laboratory tests may have indicated would be satisfactory.



RELATION OF COST FACTORS AND PERCENTAGE OF ASH IN COAL

We now have before us a number of coals offered at various prices, all of which our tests indicate will give satisfactory results. It still remains to determine their relative values.

All the six factors first enumerated, with the exception of the last one, bear a very definite relation to the percentage of ash in the coal, and an attempt has been made in the accompanying curves and formulas to give a method by means of which a comparison can be made of the value of a coal of any given analysis and that of a coal containing 5 per cent of ash. The ratio of the maximum capacity of the boiler plant with 20 per cent ash coal to the maximum capacity of the boiler plant with 5 per cent ash is called the capacity ratio and is shown by curve No. 1. The pounds of refuse per ton from x per cent ash coal is given by curve No. 2. Curve No. 3 shows the tons of coal with x per cent ash to produce 100,000,000 B.t.u. in steam.

In these curves no account has been taken of the effect on coal value of extra fireroom labor (other than that involved in handling and disposal of ashes), extra cost of operating banked boilers, or clinkering tendencies of the ash. The reason for this is that the first two of these items in most plants are a very small proportion of the total effect on coal value of changes in ash percentage, and in the case of the third item there is a lack of definite data applicable to other than a very restricted type of coal-burning equipment.

All of the curves are based on experimental data obtained at the plants of the New York Edison Company and the Union Electric Light & Power Company at Cincinnati. Each of these plants is equipped with an underfeed type of stoker, the first being equipped with low-set boilers and the second having a modern type of setting. These curves are the average of the experimental data of the two plants and represent the conditions to be expected in the average underfeed stoker plant.

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*Suggestions made at recent convention of American Society for Testing Materials.

Two sets of formulas are given for applying these curves to all conditions. The first set takes into account the relative coal cost of a given number of B.t.u. in the steam plus the cost of ash handling and removal, and the second set, in addition to the items considered in the first set, takes into account the cost of extra investment necessary in boiler plants to burn the higher-ash coal.

FORMULAS FOR USE IN CALCULATING COAL VALUES

Three thousand boiler-horsepower maximum rating will produce 100,000,000 B.t.u. in steam per hour. If the boiler plant, including land, buildings, etc., cost $100 per maximum horsepower when using 5 per cent ash coal, then such a plant would cost $300,000, which at 15 per cent (interest 7 per cent, depreciation 6 per cent, taxes and insurance, 2 per cent) equals $45,000 per year, or $5.13 per hour. Let

X = cost in dollars per net ton of 5 per cent ash coal in bunkers (exclusive of ash handling);

Y = value in dollars per net ton of x per cent ash coal in bunkers (exclusive of ash handling);

A = load factor;[1]

B = cost of boiler plant per maximum horsepower divided by 100;

Z = value in dollars per net ton of x per cent ash coal in bunkers;

C = tons of 5 per cent ash coal to produce 100,000,000 B.t.u. in steam (4.67) (curve No. 3);

D = tons of x per cent ash coal to produce 100,000,000 B.t.u. in steam (curve No. 3);

R = capacity ratio[2] (curve No. 1);

S = pounds of refuse per ton from x per cent ash coal (curve No. 2);

T = pounds of refuse per ton from 5 per cent ash coal (160 lb.) (curve No. 2);

U = cost of ash handling and removal in dollars per pound.

Formulas, relative value neglecting investment:

$$Y = CX \div D \qquad (1)$$

$$Z = Y - (S - T)U \qquad (2)$$

Formulas, relative value including investment:

$$Y = \frac{CX + (5.13B \div A) - (5.13B \div AR)}{D} \qquad (3)$$

$$Z = Y - (S - T)U \qquad (4)$$

Example 1, where investment cost is not considered: When 5 per cent ash coal costs $3 per net ton in bunkers, and ash handling and removal costs 20 cents per ton, to determine the economic limit of cost for coal having 20 per cent ash:

We have $X = 3$, $C = 4.67$, $D = 6.75$ (curve No. 3), $S = 840$, $T = 160$ (curve No. 2), and $U = 0.0001$.

Substituting in equations 1 and 2,

$$Y = 4.67 \times 3 \div 6.75 = 14.01 \div 6.75 = 2.08$$

$$Z = 2.08 - (840 - 160) \times 0.0001 = 2.01.$$

Example 2, where investment cost is considered: When 5 per cent ash coal costs $3 per ton in the bunkers, ash handling and removal costs 20 cents per ton, the load factor is 50 per cent and additional boiler plant would cost $90 per maximum horsepower with 5 per cent ash coal, to determine the economic limit of cost for 20 per cent ash coal:

We have $X = \$3$, $A = 0.50$, $B = 0.90$, $C = 4.67$, $D = 6.75$ (from curve No. 3), $R = 0.736$ (from curve No. 1), $S = 840$, $T = 160$ (from curve No. 2), $U = 0.0001$.

Substituting in equations 3 and 4,

$$Y = \frac{4.67 \times 3 + \frac{5.13 \times 0.90}{0.50} - \frac{5.13 \times 0.90}{0.50 \times 0.736}}{6.75}$$

$$= \frac{10.71}{6.75} = \$1.59$$

$$Z = 1.59 - [(840 - 160) \times 0.0001] = \$1.52.$$

In building a new plant, careful consideration should always be given to the coal available at the locality where the plant is to be built. Fuel-burning equipment should be installed which would enable the plant in question to deliver desired output for the lowest cost when fixed and operating charges are considered.

Having determined the relative value of the coals under consideration, contracts should be placed with those producers whose prices, quality considered, are the cheapest. In distributing the tonnage, consideration should be given to the general reputation and responsbility of the producer and his facilities for carrying out his contract, also to the advantage of having the coal come from a number of districts so separated that a local interruption to production is not likely to cut off the whole supply.

E. B. RICKETTS.

Ass't to Chief Operating Engr.
New York Edison Company,
New York, N. Y.

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[1] Load factor equals total steam generated in pounds per year divided by pounds of steam generated in maximum hours multiplied by 8,760.

[2] Capacity ratio equals maximum capacity of boiler plant with 20 per cent ash coal divided by maximum capacity of boiler plant with 5 per cent ash coal.

Estimated Cost of 20,000-Kw. Plant Addition

Subdivided costs estimated in connection with the addition of a 20,000-kw. turbo-generator and four 1,608-hp. water-tube boilers to an Eastern central station are given in the accompanying table, work now being in progress. The installation includes a two-bay extension of the turbine room and electrical galleries and a four-bay extension of the boiler house, the ends being constructed of hollow tile permitting future extensions to the building. Floors and roof are of concrete on a structural-steel frame, the walls being of brick with steel sash.

ESTIMATED COST OF CENTRAL STATION EXTENSION

Engineering, including office at works	$149,835
Insurance	8,000
Temporary construction	15,000
Shrinkage on construction equipment	7,000
Station yard	1,700
Building	158,780
Equipment foundations	14,240
Boiler plant	275,500
Draft system	59,800
Feed-water system	8,150
Condenser system	121,350
Piping and covering	100,000
Coal and ash-handling system in building	31,580
Exciters	37,415
Switchboard and wiring	92,655
Auxiliary equipment	11,100
Machine-shop building	20,560
Machine-shop equipment	5,130
Testing and preliminary operation	7,000
Coal-handling equipment and structures	205,265
Light and power for coal-handling plant	10,000
Main generating unit	310,000
Contingencies	49,940
Total	$1,700,000

Multiple-retort mechanical stokers with steam dumps will be installed, the present forced-draft system being extended to meet the needs of the new boilers. One new forced-draft fan equipment will be installed. Two reinforced-concrete stacks, 230 ft. high above fires and 15 ft. in diameter with brick lining, will be erected. The new generating unit will be of 20,000-kw. maximum rating, delivering three-phase, 60-cycle, 13,200-volt energy.

Circulating-water piping for the condenser of the new unit will be connected into the present intake and discharge water tunnels and water wells. The track runway for the present coal larries over the firing aisle will be extended and provision made for ash hauling conforming to the existing system. Coal-handling equipment will be provided in the yard for stocking and reclaiming fuel and elevating it to the coal bunker. This equipment will include a gantry bridge of 210-ft. span with its reclaiming tower, belt conveyors for stocking and reclaiming fuel, with other related equipment. The coal-storage pile will have a capacity of about 42,000 tons.

Switching and control equipment for the new unit and for four additional 13,200-volt feeders will be installed. Reactors will be provided in the main bus and in four 13,200-volt feeders. Two 300-kw., 250-volt exciters will be installed. Five units will be changed over to 250-volt excitation, and a 45-ft. x 65-ft. machine shop built and equipped.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Fish versus Mineral Oil for Meters

THE problem of what brand of oil to use in meter bearings has always been an important one. Before taking up the qualities of the various oils, it would be well to outline a few of the desirable characteristics which an oil for electric meters should possess. Some of these are: (1) It should not become acid or deteriorate when exposed to atmosphere at ordinary temperatures. (2) It should stand the action of small quantities of gas such as are found in the atmosphere. (3) It should have sufficient viscosity to keep the oil in bearings such as are found in electric meters. Its viscosity should not change rapidly with changes in temperature. (4) It should not freeze at temperatures down to 15 deg. Fahr. (5) It should have fair lubricating qualities. (6) It should not evaporate.

In order to determine these characteristics, tests have been conducted on fish oils covering a period of six months. The oil as obtained is allowed to remain in contact with metallic lead for about two years, in order to neutralize all the acid after which it is chilled, pressed and bottled. From the results of the tests it was found that the acid content of animal oils could never be entirely eliminated and that the very best that we can hope to accomplish with such oils is to keep the acid content at a certain minimum. As the temperature rises the acid content rapidly increases.

Tests conducted on three most universally used fish oils showed that when hermetically sealed and in contact with clean brass chips none of these oils showed any tendency to decompose, even when exposed to heat and sunlight. However, within eight hours after being in contact with air and brass chips at normal temperature and average humidity, decomposition rapidly set in. Very complex organic acids are formed which attack brass and nickel, forming compounds of nickel and copper. Examined in the light of requirements given above, fish oils do not satisfy the first requirement completely. Physical tests show that the remaining requirements are very well satisfied. It must be remembered also that if they can be used where low temperatures predominate the chemical reactions will be greatly retarded.

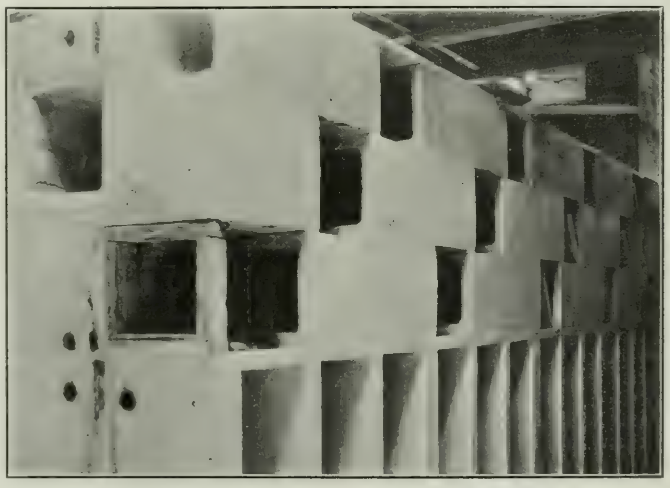
Considering the petroleum-base oils, it was found that they have no acid-forming tendencies. They do not readily evaporate since they are a product of fractional distillation and can be obtained very uniform in quality. It is also possible to obtain oils of this kind that have a viscosity equal to that of fish oils. They have also withstood in their natural state the action of centuries in contact with many chemical elements. Finally, they have very excellent lubricating qualities.

If oils are to be used in places where the temperature is not below zero and where it often rises to 100 deg. Fahr., there can be no argument against a highly refined petroleum oil. However, if the temperatures are extremely low, then there is a field for the fish oil, since there is less tendency to decompose and less change in viscosity with temperature. If fish oils are used it is desirable to use as much as the sapphire cup will comfortably hold. The larger body decomposes much more slowly and its life as a lubricating body is greatly extended.

F. C. HOLTZ,
Chief Engineer.
Sangamo Electric Company,
Springfield, Ill.

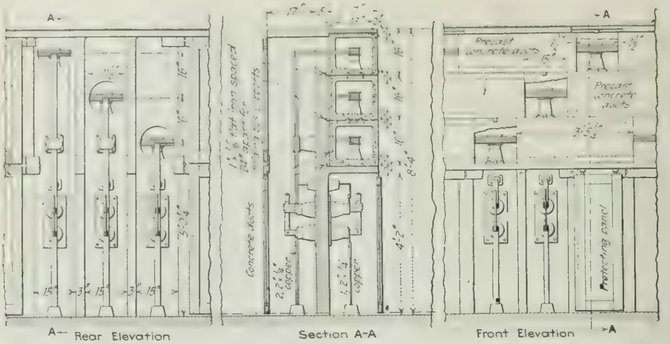
Rigid Bus Structure Made from Pre-cast Ducts

IN THE construction of masonry bus structures the building of the horizontal bus compartments has always been the most difficult part of the work. Where the structures are built of brick, horizontal barriers of Alberene stone or pre-cast concrete are used and the vertical barriers are usually of brick. Where concrete is used for the structure, it is necessary to pre-cast slabs both for the vertical and horizontal barriers or to restort to complicated forming and pouring in slow stages. The cost of construction in either case is high, and it is difficult to build a structure which is sufficiently rigid to withstand the short-circuit stresses met in present-day practice.



PRE-CAST DUCT STRUCTURE WHICH IS VERY RIGID ERECTED AT LOW COST

To overcome these objections the New York & Queens Electric Light & Power Company has adopted a form of bus construction which is illustrated in the accompanying photograph and drawing. Rectangular ducts are pre-cast and erected in three horizontal rows, one above the other, the units being staggered so that the openings for bus taps occur at the proper place in each row. The



THIS DUCT CONSTRUCTION PROVIDES AMPLE CLEARANCE FOR THE BUS INSULATOR SUPPORTS

duct walls are 2 in. thick, and for a 2,300/4,000-volt bus the inside dimensions are 12 in. x 13 in. The length is 3 ft. 5¼ in., which is equal to the width of two single-phase compartments. The units were cast in steel forms and are reinforced with wire mesh, which is open on one side to prevent possible eddy currents. Each unit weighs approximately 400 lb. Inserts are provided on the top of each unit for the insulator on the bus above. It will be noted from the photograph that this form of construction provides additional clearance at the supporting insulators where it is needed on account of clamps and bolts. This is accomplished without increasing the size of the structure, as would be necessary if the increased clearance were carried throughout.

The cost of this type of construction is considerably less than that of others, and it results in a much more rigid structure.

W. C. Blackwood,
Electrical Engineer.
New York & Queens Electric &
Power Company,
New York, N. Y.

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Pneumatic Equipment for Line Trucks

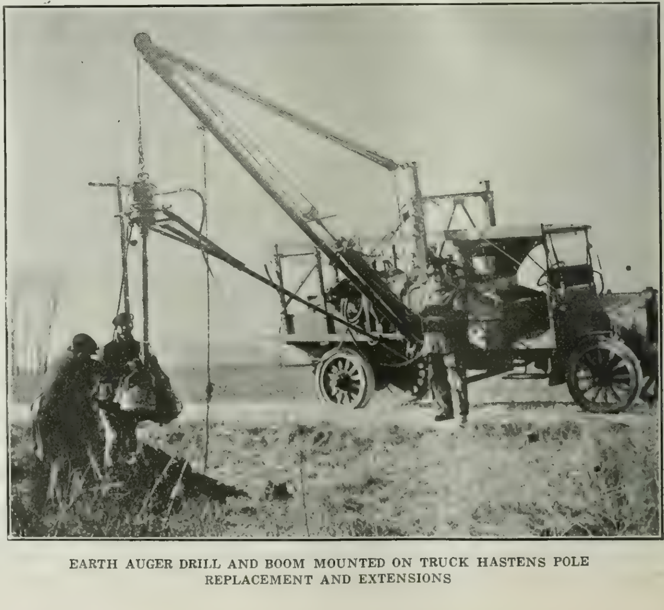
A TRUCK equipped with a derrick, mast and boom, rotary air drill, earth auger with a telescoping stem and a pneumatic cylinder hoist mounted on the boom is shown in the accompanying illustration. This truck has been used successfully by several power companies in their line departments for doing such work as digging pole holes, anchor holes or manholes, lifting poles into place, drilling rock for blasting or for setting anchors, cutting concrete or asphalt pavement, and for rotating and installing pipes horizontally beneath pavement, tracks or walls or other embankments.

The rotary air drill with the auger is suspended from the piston of the hoist by a rope passing over a sheave in the end of the boom. There is also mounted on the truck a reciprocating pneumatic drill with bits and a pneumatic grinder, together with the tackle and adapters for forcing the pipe through an embankment.

In digging holes the truck stays on the hard road and the boom swings over to where the pole is to be placed. The valves are manipulated and the auger guided by a workman. When the auger is filled with earth it is stopped by a turn of the valve. The hoist is then operated, the auger with its material lifted, and when the boom has been turned so that the auger is over the point where the excavated material is to be emptied, the auger is opened. The boom is then moved back so that the auger hangs over the hole, where it is lowered by operating the hoist valves and again rotated until filled with earth. This operation is repeated until the hole is the proper depth. If a boulder is encountered, the boom is moved so that the auger is out of the way and the boulder broken by means of the reciprocating drill. After the hole is dug the pole is lifted into place by the pneumatic hoist. It is necessary, of course, to uncouple the drill and auger from the tackle to do this.

This device with a crew of three men has excavated approximately 1,500 pole holes, under a wide variety of conditions, sometimes drilling six holes 6 ft. deep and 22 in. in diameter in an hour, and then again only twelve a day. In the latter case the digging was through about 2 ft. of stone macadam on top of a stiff blue clay and the holes were 6 ft. 6 in. deep. This was on a transmission line for the Public Service Company of Northern Illinois. In one case where the holes were bored before the poles were distributed sixty 30-ft. poles were set in two hours.

Field Editor Electrical World.
Chicago, Ill.



EARTH AUGER DRILL AND BOOM MOUNTED ON TRUCK HASTENS POLE REPLACEMENT AND EXTENSIONS

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Seven Steps in Making a Customer a Shareholder in the Utility

A Condensed Sales Manual for the Guidance of Employee Salesmen in a Customer-Ownership Campaign

AS AN aid to its employees in selling the company's stock to customers the Northern Ohio Traction & Light Company of Akron has analyzed the making of a sale, dividing the process into seven parts in a manner which gives the employee-salesman a clear and logical plan upon which to work. The seven steps are outlined and explained as follows:

1. *To Get Prospects.* — Every friend, acquaintance, person you meet or person mentioned is a possible prospect. Get names and addresses. If he is hard up now, he will be working later, or may know of some one with means.

2. *To Get in Touch with Prospects.*— Prospects are seldom sold on the first or second call. Having received a name or thought of some one who might be a prospect, a cordial letter is a good introduction, to be followed by a visit in a day or so.

Whenever you meet such persons a question such as "What do you think of our savings plan?" "Have you heard about our 7 per cent savings plan?" "There's a bit of property a person doesn't have to pay taxes on," or some such remark will tell how they are going to line up and about when to see them or send a special man.

If favorable, get them to set a time when you can see them to explain the plan in detail. If a prospect is working, pay day is sometimes a good day to see him. It is sometimes desirable to lead up to the subject by talking of some topic in which your prospect may take especial interest.

3. *To Interest Prospects.* — A large part of the world's business is transacted through friends. In order to make friends for yourself, your company or your proposition, you should be friendly by (1) renewal of acquaintance; (2) help or offer to help in the way of information, special service, sale of Liberty bonds, etc.; (3) following up on a service rendered or a special accommodation; (4) suiting your time to that of your prospect in personal calls or telephone calls; (5) getting names and addresses of other friends; (6) investigating complaints and reporting to prospect.

4. *Force of Suggestion.*—(1) Avoid the word "stock"; it puts many prospects on the defensive. Talk savings plan, partnership in our business, customer ownership, earnings kept at home in our own community, etc. (2) Be optimistic. Our business is good, is improving rapidly and so is business in general. (3) Mention your ownership or savings plan on 7.37. (4) Mention others who have invested. (5) Show sample savings plan receipt to illustrate method of making payments, drawing out if necessary, transfer of certificate, etc. (6) The contest idea appeals to many and the idea that you are working for the credit of your department in a contest. (7) Savings plan for children's education, etc., is sometimes effective. (8) Don't forget the tax-free feature.

5. *Closing Prospects.* — Close prospects immediately if possible by getting payment down or a date when payment can be made. Some prospects have been closed by setting a date when the payment should be in to get credit in a contest. It is well to see them a little in advance of the date set to remind them and to be sure no outside salesman gets there as has happened several times by delay.

Several difficult prospects have been closed by offering as a last resort to lend them the first payment. Suggest more shares in closing and pave the way for repeated sales. Assure prospect of your appreciation and offer assistance in your particular department at any time.

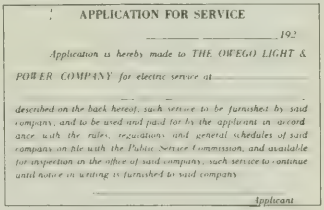
6. *Keep Your Own Prospect Lists and Follow Up.* — You may be able to get a sale that no one else can. It is worth trying for. Hundreds of prospects have turned down the specialty man and afterward been sold by an employee. Persistent and repeated effort will win. Records of sales closed on the fifteenth trip are not uncommon.

7. *High Lights for Results.* — Every customer and every child should start a savings plan, 7 per cent, tax free. Liberty bonds exchanged for 7.37, free of charge, free of tax and paying a bonus. A cash business in necessities of life. Investment in home industry in property you can see. Have never missed a dividend. Pay yourself dividends when you pay your electric bill.

If you don't sell your prospect, make a friend for yourself and your company. By so doing you pave the way for future sales and good will.

A Short Form of Meter Contract

IN THE application for service shown in the accompanying cut the Owego (N. Y.) Light & Power Company has eliminated as far as possible all involved, legal phraseology which is found so often in the "meter contracts" used by public utility companies. On the reverse side of this card, which is 3 in. by 5 in., blank space is provided for recording such information as the class of service, whether light or power, connected load, the business of occupation of the customer and where he was formerly served.



APPLICATION FOR SERVICE

________ ____________ 192

Application is hereby made to THE OWEGO LIGHT & POWER COMPANY for electric service at ____________

____

described on the back hereof, such service to be furnished by said company, and to be used and paid for by the applicant in accordance with the rules, regulations and general schedules of said company on file with the Public Service Commission, and available for inspection in the office of said company, such service to continue until notice in writing is furnished to said company

____
Applicant

A BRIEF BUT COMPLETE APPLICATION FOR SERVICE

There are many obvious advantages to the utility in adopting such a form of service application. It makes for a most favorable impression upon the customer as he is not offered a dozen or more paragraphs of fine print setting forth in cold, uninteresting language the rules regulations and penalties which he is liable to incur if he uses the company's service. The customer expects to pay for the energy he uses or he would not ask for it and the company is fully protected by the rulings of the public service commission and by the state laws. Accordingly he is asked simply to sign an application for service, pay for that service as he uses it and to notify the company when he wants it discontinued.

This kind of service contract seems to meet all the legal requirements and it supplies the necessary information for the accounting department to make a record of the customer's account. Such a form of application could be profitably adopted by the utility companies, if not for all customers, at least for those in the residential class, which are in the large majority and, in the last analysis, it is these customers upon whom the utilities must depend for public good will.

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Customer Density Shows Popularity of Electric Service

QUINCY, MASS., has the largest number of electric services per 100 population among sixteen leading Massachusetts central stations, according to Henry M. Faxon, president of the Quincy Electric Light & Power Company. At a recent hearing before the Massachusetts Department of Public Utilities Mr. Faxon submitted the accompanying comparative tabulation, showing the average annual revenue per electric lighting service, the number of services and the population for this group of companies.

SERVICE DENSITY AND REVENUE PER SERVICE

	Population	No. of Commercial Lighting Services	Average Yearly Receipts per Electric Lighting Service	No. of Services per 100 of Population
Quincy....	40,674	8,715	$30 28	21 43
Attleboro..	18,840	3,103	35 11	16.79
Beverly....	27,079	3,372	50 97	12.45
Cambridge	108,822	9,785	54.82	8.99
Boston...	1,165,012	111,326	89.02	9 56
Brockton...	102,942	11,950	35.75	11 61
Fall River..	133,988	11,361	40.79	8 48
Gloucester.	30,506	4,060	37.71	13.31
Haverhill....	49,450	6,444	50 47	13 03
Lowell ..	129,503	9,260	50 89	7.15
Malden	134,014	18,763	32.97	14 00
Northampton	21,652	3,068	38.62	14 17
Pittsfield...	50,856	5,737	48 58	11 28
Salem....	37,200	6,144	40 96	16 52
Springfield..	116,092	21,837	52 50	18 81
Worcester..	166,019	31,912	35 69	19 22

The population was recorded as of the 1915 state census for each company. Mr. Faxon did not discuss the local differences in distribution systems among the several companies, but declared that the maintenance of 21.43 services per 100 residents of his company's territory is good evidence that this utility is meeting the requirements of the local public. The comparisons presented illustrate the interest of unit analysis applied to the commercial activities of the modern central station.

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A Service Automobile for Appliance Repairs

TO MAINTAIN customer good will and keep appliances in active use John H. Mitchell, new-business manager of the East St. Louis (Ill.) Light & Power Company, recently placed an appliance service automobile in operation. The car has been especially equipped to carry all the necessary parts in order that most repairs can be made on the customer's premises.

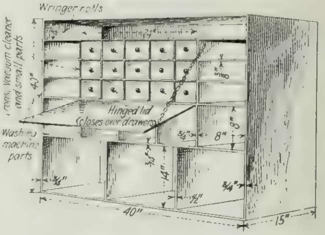
Wringer rolls
Vacuum cleaner and small parts
40"
24"
Hinged lid (closes over drawers)
Washing machine parts
¾"
8"
14"
¾"
½"
¾"
40"
15"

FIG. 1—SERVICE CABINET FOR APPLIANCE REPAIR PARTS

Directly behind the driver's seat a cabinet measuring 40x40x15 in. was built of ¾-in. poplar. This cabinet, Fig. 1, which faced the rear of the car, was divided into compartments, with a center section of twenty drawers for holding small parts such as heating elements, fuses and attachment plugs. This section of drawers was kept in place by a hinged lid, which fastened at the top when closed. The other compartments were designed to contain washing machine parts and spare appliance parts. From the top of the cabinet to the roof of the car ⅜-in. iron rods were spaced 4 in. apart in order to prevent unauthorized persons entering the car. The rear doors were closed by means of a padlock.

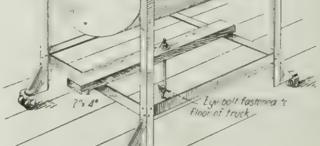

FIG. 2—ADJUSTABLE EYEBOLT HOLDS LARGE APPLIANCES SECURELY

The remaining space in the car was used for the delivery of washing machines and other appliances. A suitable clamping device shown in Fig. 2 was installed on the bottom of the car which would hold a washing machine securely in position while in transport. Necessary repair parts for appliances on which the guarantee has expired or which were not originally delivered by the company are sold at list price, with an addition of labor charges at $1 per hour of time actually spent on the premises.

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What Other Companies Are Doing

Lancaster, Pa.—Plans have been completed by the Lancaster Electrical Contractors' Association and the Edison Electric Company to stage an electrical show this fall during four days, Oct. 18, 19, 20 and 21. It is expected that this will be the largest and most complete show of its kind ever held in a city of similar size in Pennsylvania. A number of contracts have already been closed for exhibit space. H. J. Von Nieda, commercial manager of the Edison Electric Company, is chairman in charge of preliminary arrangements.

Nebraska City, Neb.—The Nebraska City Utilities Company during the week ending June 24 sold merchandise to the amount of $774.87, including four washing machines, five fans, two gas ranges and one two-horsepower motor. Two fifteen-year old boys were hired by the company to sell lamps in Nebraska City at five cents for each lamp sold without regard to size of lamps. In seven days, the boys sold $116 worth of lamps. The lamp sales had been running about $37 a week.

Hartford, Conn.—In the face of severe business depression among the metal-working industries of its territory in 1921, the Hartford Electric Light Company added 3,384 hp. in motors and 393 kw. in industrial electric heating equipment to its system. That is, for every six kilowatts in motor load one kilowatt in industrial heating apparatus went upon the lines. Concentrated attention upon the opportunities for electric heating in diversified industries, combined with sustained engineering interest in performance, have been important factors in the above result. H. W. Derry is power engineer of the Hartford company.

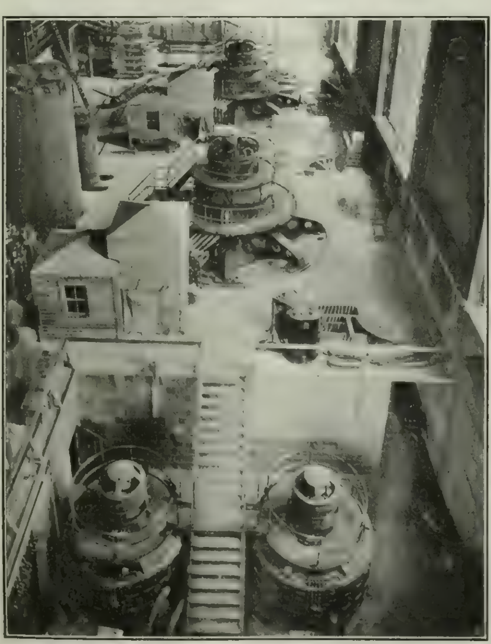
Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Energy Regulation on Electric Steam Boilers. — E. Zeulmann. — The constantly rising prices of fuels of all kinds give more and more emphasis to the use of cheap electric power for the generation of steam. The article describes some of the best known types of electric boilers, in which the water itself serves as the electric resistance. Particular attention is paid to the different methods of the regulation of the electric input, discussing their respective advantages and disadvantages. A number of existing plants are described in detail. The paper contains twenty-seven illustrations, most of them sectional drawings. — *Elektrotechnische Zeitschrift*, June 1 and 8, 1922.

Queenston-Chippewa Development of the Hydro-Electric Power Commission of Ontario.—F. A. Gaby.—This paper gives a general description which is quite complete of the entire Queenston-Chippewa development on the Canadian side of the Niagara River, which will have an ultimate capacity approximating 650,000 hp. Important features of the waterway are described covering the special design of intake works to avoid ice troubles, the control gate in the canal, the concrete-lined canal channel and consideration given the design of canal, forebay, screen house, penstocks and draft tubes. Of special interest are the 55,000-hp. turbines operating under a head of 305 ft. and connected to 45,000-kva., 12,000-volt, three-phase, 25-cycle, 187.5-r.p.m. generators; the 15 000 kva., 12,000/63,500/76,200-volt transformers, and the design and arrangement of relay systems and of switching equipment to take care of the extremely heavy short-circuit conditions.—*Journal of the A. I. E. E.*, July, 1922.



Generator Room of the Queenston-Chippewa Development, Showing Top Frame of Two 45,000-Kva. Generators with House Generators in Foreground

Generation, Control and Switching

Truck-Mounted Circuit Breakers.—E. K. Read.—A well-illustrated description of the truck-type circuit breakers installed at the Ninety-seventh Street substation of the United Electric Light & Power Company, New York. Breakers placed on the incoming feeders are rated at 600 amp., 25,000 volts, with a rupturing capacity of 26,000 amp. at 13,200 volts, and weigh approximately 4,700 lb. with oil. On the outgoing feeder the breakers installed are rated at 600 amp., 13,200 volts, with a rupturing capacity of 3,500 amp. These weigh approximately 1,980 lb. For the distribution system feeders the breakers are rated at 600 amp., 2,700 volts, with a rupturing capacity of 7,800 amp. The total weight of this truck with oil is approximately 2,000 lb. *Electric Journal*, May, 1922.

Power Systems and the Steel Industry.—E. C. Stone.—The author brings out the most important points which must be observed in the development of high-power generating and transmission systems in the steel industry and shows the means by which these systems are made to deliver a thoroughly reliable supply of power. These means are: Ample factors of safety throughout, adequate emergency equipment properly separated from the running equipment, suitable devices to prevent high voltage and high current, large-capacity circuit breakers selectively controlled by automatic relays, and a complete system of inspection and maintenance. The author considers particularly the question of switchgear and its protection, which he covers very thoroughly.—*Paper presented before Association of Iron and Steel Electrical Engineers*, June, 1922.

Transmission, Substations and Distribution

12,000-*kva. Substation Using Truck-Type Switchboard Throughout.*—A. H. Kehoe.—A very good application of the extensive use of the truck type of switchboard is the West Ninety-seventh Street substation of the United Electric Light & Power Company, New York. In this station are four incoming cables at 13,200 volts, three-phase, 60-cycle. The station transforms the energy for distribution at 2,750 volts, three-phase. This is the first time that this company has used three-phase in its distribution system. The substation is a three-story-and-basement structure. Incoming and outgoing cables, cooling blowers, reactors and miscellaneous station equipment are placed in the basement. The first floor with mezzanine gallery contains six air-blast 2,000-kva. transformers. The 13,200-volt switching equipment, together with the 2,750-volt switches from the transformers and the switchboard for substation service, is placed on this floor. The second floor contains 2,750-volt switch galleries, together with the main and auxiliary 2,750-volt buses. On the top floor are the operator's desk, the 60-kva 10 per cent air-blast induction regulators and the control board for all oil switches.—*Electric Journal.* May, 1922.

Units, Measurements and Instruments

Testing Transformer Rated at 350,000 Volts.—R. MASSOT and P. BUNET.—A 300-kva. oil-insulated testing transformer is described with one of the ends of the 350-kv. winding permanently grounded. A series-parallel arrangement of the 5,000-volt low-voltage winding gives one-quarter, one-half or the full voltage. An oil-filled condenser bushing is used to carry the insulated end of the winding through the cast-iron cover, and its oil content acts at the same time as an oil conservator. The winding is of the circular-disk design and is placed in one stack on a three-legged iron core. The transformer weighs complete with oil 15 metric tons and has an over-all height of 4.65 m. Tests with this machine at full rated voltage gave a silent operation without visible corona discharges.—*Revue Générale de l'Electricité,* May 20, 1922.

Illumination

Value of Improved Street Lighting to Municipalities and Property Owners.—C. H. SHEPHARD.—There are so many considerations involved in the selection, construction, operation, maintenance and financing of a street-lighting system that are complicated and interrelated that it is almost impossible to lay down any definite rules except in the most general form. However, the municipalities contemplating the installation of a street-lighting system should first obtain a comprehensive engineering analysis of all the factors involved. This analysis covers the intensity of illumination desired and unit or units proposed to give such illumination, the type of standard required to support the unit, type of electrical system necessary to supply power most economically, specifications covering labor and material, and estimate of cost of construction, operation and maintenance, with a method of financing.—*Electrical Journal,* May, 1922.

Motors and Control

The Application of Electricity in the Manufacturing Industry.—The first of a series of articles that will deal with the varied uses of electricity in different industries. This article applies to the manufacture of rubber tires. The Goodyear Tire & Rubber Company is taken as an example.—*Electrical News,* June 1, 1922.

Motor-Service Panels with Standardized Equipment.—C. H. MATTHEWS.—Details are outlined of the methods used in building switchboard panels with interchangeable equipment that facilitate quick changes, new requirements and repairs. Drawings and photographs show various panels for 2,200-volt motors, including lines and feeder circuits. For each panel there is an assembly drawing and a wiring diagram. A master list of material is made up, including all of the parts used on all of the standard types of panels adopted. This list describes each part in detail, and to each item listed has been given a designated letter. Then for each panel a table is made giving the number of each one of the parts required for a particular job. Five types of panels described in the article are for an incoming line, a slip-ring motor, a feeder circuit, a synchronous motor and a squirrel-cage motor respectively.—*Electrical Review and Industrial Engineer,* June, 1922.

Heat Applications and Material Handling

Electric Ovens for Baking or Heat Treating.—WIRT S. SCOTT.—The author points out the many advantages of electric ovens and discusses the cost of electric heat compared with gas and oil fuels. He explains the flexibility and ease of heat control, the freedom from gases and the low maintenance, and shows why automatic conveyors for dipping parts in enamel and for carrying them through ovens are particularly effective with electric heating. He points out six advantages of electric ovens, namely, (1) reduction in amount of rejected work and the necessity of refinishing parts; (2) improved quality of products due to definite temperature control; (3) reduced fire risks; (4) economy of continuous-conveyor-type oven made possible by the use of electric heaters; (5) greater speed of production; (6) low production costs. The article is well illustrated and contains tables comparing energy cost of gas and electric ovens and energy required by electric furnaces to raise the temperature of a cold furnace and to hold it at a definite temperature.—*Electrical Review and Industrial Engineer,* June, 1922.

Electrophysics, Electrochemistry and Batteries

Electricity and Matter. — ERNEST RUTHERFORD.—A résumé is given of the great advances made in recent years in knowledge of the relations between electricity and matter. This leads to a consideration of the fundamental problem of physics, the constitution of the atoms of the elements.—*Electrician,* June 23, 1922.

Electrical Engineering Features of the Electrical Precipitation Process.—G. H. HORNE.—The handicaps first met with in the Cottrell process and the means by which these were overcome are reviewed. The source of power, methods of rectification, relation between precipitation and impressed voltage and power consumption are discussed. It is shown that Peek's formulas for corona loss may be used as a means of interpreting electrical precipitation power date.—*Journal of the A. I. E. E.,* July, 1922.

Maintaining Batteries on the Long Island Railroad.—Complete facilities are provided at the Morris Park shops for overhauling batteries. The yard is wired with convenient outlets for charging batteries without removing them from cars. A description is given of the assembling and charging department, separating room, method of washing battery boxes and elements, means of testing car-lighting generators and other car-lighting equipment, as well as of the distilled water plant.—*Electric Railway Journal,* June 17, 1922.

Traction

How Resistance is Used in Railway Automatic Substations. — Views of several electrical engineers of long experience with automatic substations are presented on the question of using resistance in the machine circuits or in the feeder circuits, or both. The discussion covers city and suburban and interurban substations and complete automatic substations.—*Electric Railway Journal,* June 24, 1922.

Electrification of the Chichibu Railway of Japan.—CORLISS A. BERCAW.—Extensive hydro-electric power development has made possible the electrification of the Chichibu Railway, with resulting increase in capacity and conservation of fuel resources. Passenger and express service will be accommodated by multiple-unit cars, while mixed freight and passenger trains will be operated by five 41-ton electric locomotives.—*Railway Review,* June, 1922.

Telegraphy, Telephony, Radio and Signals

Construction and Operation of a Simple Home-Made Radio-Receiving Outfit.—The method of constructing a very simple and inexpensive receiving outfit (600 m. to 200 m.) from materials which can be easily obtained is described. The cost of the materials need not exceed $10. Satisfactory results have been obtained from sets constructed according to these instructions by persons having no previous experience with radio. The equipment uses a crystal detector.—*Circular No.* 120 *of the Bureau of Standards.*

The Field Radiated from Two Horizontal Coils.—GREGORY BREIT.—The landing of airplanes can be facilitated by emitting from the landing field a vertical beam of electromagnetic radiation of a radio frequency. A type of transmitting-coil antenna has been devised for this purpose the behavior of which is calculated, and formulas are worked out for the current received in a coil aërial and in an antenna oriented in a known manner at a sufficient distace from the transmitter.—*Scientific Paper No.* 431 *of the Bureau of Standards.*

Printing Telegraph. — S. SUZUKI. — Various kinds of machine printers are described and compared from the standpoint of line economy. Among these are the Western Electric multiplex printer, "Star Stop" printer, Kleinschmidt printer and "teletype."—*Journal of the Institute of Electrical Engineers of Japan,* May, 1922.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

Frank W. Frueauff Dies

Junior Member of H. L. Doherty & Company Carried Off by Sudden Illness

FRANK W. FRUEAUFF, junior member of the firm of Henry L. Doherty & Company, vice-president of the Cities Service Company and an outstanding figure in electric light and power circles, died suddenly on Monday afternoon, July 31, at his home in Fifth Avenue, New York City, from an attack of acute indigestion. He had attended conferences at his office in the morning, although suffering severely, and had made an engagement for the evening. He was only forty-eight years of age. Plans for the burial had not been completed when the *Electrical World* closed its forms.

Mr. Frueauff was born on March 29, 1874, in Columbia, Pa. He moved with his parents to Leadville, Col., in 1881 and to Denver in 1887, and as a boy sold newspapers in the latter city. He was graduated from high school in 1891 and entered the employ of the Denver Consolidated Electric Company, remaining with it until Henry L. Doherty in 1899 brought about its consolidation with the Denver Consolidated Gas Company as the Denver Gas & Electric Light Company. Beginning as a meter reader, Mr. Frueauff rose rapidly in these companies, becoming secretary of the last-named in 1899, vice-president and general manager in 1907 and president in 1913.

Mr. Doherty preceded Mr. Frueauff as the president of the Denver Gas & Electric Light Company, and in 1905 the two men formed a partnership as Henry L. Doherty & Company, Mr. Doherty contributing engineering and mechanical genius and Mr. Frueauff extraordinary skill in the promotion of friendly public relations. At the subsequently established New York headquarters of the company, which rapidly became among the foremost controllers of public utilities in the country, Mr. Frueauff acquired the reputation of being one of the busiest executives in America, becoming a director in 141 corporations and the head of all the Doherty interests, directing the affairs of public utility companies in all parts of the country, serving more than two hundred communities. The Cities Service Company, a Doherty holding corporation, increased its business under Mr. Frueauff's guidance in a few years from a million dollars a year to one hundred million or more. Despite the tremendous load of work which he shouldered, his associates have always described him as a just and cool man who under no circumstances would let the most trying situation turn him from an even, careful consideration of facts. He was a pioneer in the promotion of the sale of securities to customers, and to this policy he attributed no small part of his success.

Mr. Frueauff was elected president of the National Electric Light Association for 1909-1910. He had also been president of the National Commercial Gas Association and the Colorado Light, Power and Railway Association. He was an associate member of the American Institute of Electrical Engineers and a member of the Illuminating Engineering Society. He was married in March, 1909, to Miss Antoinette Perry of Denver, who, with two daughters, survives him.

F. W. FRUEAUFF

Philadelphia Plans Engineering Congress for 1926

Preliminary steps have been taken to organize an international engineering congress to be held in Philadelphia in 1926 in connection with the sesquicentennial celebration of the signing of the Declaration of Independence. The four major national engineering societies—civil, mechanical, electrical, and mining and metallurgical—are to participate with the Engineers' Club of Philadelphia in making the plans, which provides for a board of management consisting of two representatives of each of the five organizations mentioned and two from the Federated American Engineering Societies.

Rail Strike Affects Utilities

Fuel Situation of Electric Light and Power Companies Still Causes No Alarm

ALTHOUGH officials in Washington are being deluged with requests for coal, most of which are being returned promptly to the governments of the respective states from which they came, the fuel situation as it affects the electric public utilities is not serious. Thus far only two urgent cases have come before the National Electric Light Association, and steps have been taken to relieve the companies involved. When it is recalled that almost 40 per cent of the electrical output in the country is generated by water power and that coal-burning electric public utilities in large cities have ample supplies of coal on hand which are being constantly added to, the complacency with which the privately owned public utilities look upon the fuel crisis is explained. Right now complaint has been lodged in Washington against seizure of coal en route to a public utility in Michigan by an Ohio steel company.

The rail strike has also affected construction work on a large hydro-electric plant in Alabama. Because of car shortage this public utility is unable to obtain supplies of cement with which to carry on its construction work. Solicitude is being expressed by a few large electric public utilities operating in the Eastern Provinces of Canada about their coal supply. These companies operate hydro-electric plants and steam stations. Until American industries are supplied it is questionable whether a large amount of coal will be shipped across the border. The indications are that fuel will have to be rationed until next spring. Coal production is increasing gradually, and belief is expressed in Washington that if this product is properly allocated no great hardship will result even though the coal strike continue for some time. Every effort is being made to settle the railroad strike first.

STATE FUEL AGENCIES OPENED

Henry B. Spencer, the fuel distributor of the government, has opened offices in Washington and made appointments of state fuel agencies in Alabama, Connecticut, Florida, Illinois, Indiana, Iowa, Kansas, Kentucky, Massachusetts, Michigan, Nebraska, New York, North Carolina, North Dakota, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia and Wisconsin. In most of the states the public utility commissions are acting as the state fuel agency. The price of coal, despite the government mandate, is constantly increasing, some utilities paying as high as $10 a ton, an increase of approximately 90 per cent over contract price. These utilities, however, are determined to maintain service and are buying coal whenever and wherever it is procurable.

South Carolina Property Sold at Auction

George B. Tripp, receiver for the South Carolina Light, Power & Railways Company, on Monday sold at auction, under an order of the United States District Court, all the property of the company, including the street railways, the hydro-electric plant and the gas and steam-electric plants. The property was bought in by the reorganization committee for $1,000,000, there being but one bid. Plans for the reorganization of the company have been completed, and the properties sold will soon be taken over by the South Carolina Gas & Electric Company, which will make extensive improvements to the plants. It is understood that Mr. Tripp will be the president of the new company.

Safety Congress to Listen to Utility Engineers

A number of prominent central-station executives and engineers are scheduled to take part in the eleventh annual safety congress of the National Safety Council, which will be held at the Cass Technical High School, Detroit, on Aug. 28 to Sept. 1. Joint meetings of the public utilities and electric railway sections will be held on Aug. 29 and Aug. 31. "Progress in Accident Prevention in Public Utilities" will be the subject of an address by C. E. Morrison, vice-president and general manager Utilities Mutual Insurance Company; "The Financial Side of Accident Prevention" will be presented by Garrett Seeley, vice-president and general manager Pennsylvania-Ohio Electric Company; "The Human Side of Our Business" will be the topic of B. I. Budd, president Chicago Elevated Railways, and H. J. Warnick, engineer Northern Indiana Gas & Electric Company, will deal with "Co-ordination Between Engineering and Operating from the Standpoint of Safety." Prepared discussions will follow these addresses.

On Wednesday, Aug. 30, J. H. Eustace, chief operating engineer People's Gas Light & Coke Company, Chicago, will speak on "The Relation of the Engineer to Accident Prevention," with a discussion by Charles B. Scott of Chicago and J. B. Douglas of Philadelphia. Homer E. Niesz will be toastmaster at a luncheon, when speeches will be made by Arthur W. Brady, president Indiana Union Traction Company, and Alex Dow, president Detroit Edison Company.

New 110,000-Volt Link in Massachusetts

Turners Falls and Pittsfield Companies' Lines Will Be Joined by Steel-Tower Line

PLANS are completed for the interconnection of the systems of the Turners Falls Power & Electric Company and the Pittsfield Electric Company in Massachusetts through the construction of a 110,000-volt double-circuit, steel-tower line from Turners Falls across Greenfield and the Berkshire Hills country, tying together the plants of the Connecticut and Housatonic valleys for economical operation. Construction work has begun under the direction of H. D. Seavey, superintendent of distribution of the Turners Falls company, the rights-of-way having been nearly all obtained, including necessary rights for crossing Greenfield and entering Pittsfield.

The tower line will be of the same heavy construction used on the other transmission lines of the company built under Mr. Seavey's direction, all of which passed through New England's great sleet storm of November, 1921, without the failure or distortion of a single tower. The line will be operated at the start at 66,000 volts, but the switching and transforming equipment installed at each end and the design and insulation of the towers will be suitable for 110,000-volt operation at any time on short notice and without appreciable additional investment.

A special feature of the line is that the towers from the Cabot Station, in Turners Falls, to Greenfield will be arranged to carry two 15,000-volt circuits for supplying Greenfield, and the towers at the Pittsfield end will be arranged to carry two 20,000-volt lines to be utilized by the Pittsfield Electric Company in its general distribution system throughout the Housatonic Valley.

The Pittsfield Electric Company now supplies energy to most of the other distributing companies and industries in the upper Housatonic Valley, and the construction of this line marks the first entrance of modern high-tension transmission facilities into that district. The design and construction of the line will be such as amply to meet the needs of this district, with plenty of spare capacity for many years.

Mississippi Removes Taxes from Utilities

A measure recently passed by the State Legislature of Mississippi provides five years' exemption from ad valorem taxation for all public utilities and many industries. The bill exempts from taxation the tangible property but not the products of railroads, textile mills, industrial and agricultural machinery industries, clothing, shoe, furniture and woodworking plants, building-material establishments, paper products, dairying companies, canneries, leather-tanning plants and all public utilities. It specifies as tax-exempt all factories of whatever nature run exclusively by water power, all conduit and pipe lines, pumping plants, natural and manufactured gas appliances, manufacturing and distribution of equipment, hydro-electric plants and steam-driven and oil-burning electric stations and ice factories.

Sponsors of the measure expect large industries to establish branch plants in Mississippi. By exempting water-power-driven plants they expect to promote rapid development.

McKinley Values Muscle Shoals at $100,000,000 a Year

Asserting that the Muscle Shoals power project would bring $100,000,000 a year into the United States Treasury if it were possible to sell the potential energy it can yield at Washington prices, Senator McKinley of Illinois, who is president of the Illinois Traction Company, has had inserted in the *Congressional Record* a prepared argument in which he declares that Henry Ford ought to "come in under existing laws which control rates for power."

"Mr. Ford proposes to buy from the government for $5,000,000," said Senator McKinley, "what has cost the government $150,000,000 and pay 4 per cent interest on the additional $40,000,000 or $50,000,000 which the government must invest to complete the dam, and in addition to that he proposes to pay the government $46,000 a year, which he calls amortizement, and $55,000 a year, which he calls repairs.

"Mr. Ford does not propose to take this property, but to have a ten-million-dollar corporation take title to it, and this title stands for 100 years. Experience with all large capital investments as corporations is that sooner or later, within ten or twenty years, they pass into control of large money holders commonly known as 'Wall Street.'"

Power Commission's Policy on Navigable Water Liberal

That the Federal Power Commission intends to maintain a liberal policy in allowing the obstruction of streams for power purposes when it is evident that the value of the stream for navigation is insignificant as compared with its potentialities as a power producer is indicated by the commission's recent action on certain typical declarations of intention affecting respectively the Saco River in Maine, the Menominee River, which forms part of the boundary between Wisconsin and Michigan, and the Connecticut River in the vicinity of Monroe, N. H. In each of these three instances the commission found, after investigation, that the river named is not as regards its character in the particular vicinity affected "navigable waters" as defined in the water-power act and that the construction proposed would not affect the interests of interstate or foreign commerce.

Death of Alexander Graham Bell

Inventor of Telephone Passes Away in His Seventy-sixth Year—For Almost Fifty Years He Had Ranked Among the Most Famous of Practical Scientists

THE death of Alexander Graham Bell at his summer home near Baddeck, Nova Scotia, took place on Wednesday last, Aug. 2. Dr. Bell had been in failing health for some time, but had not been confined to bed and the fatal termination of his illness was unexpected.

Alexander Graham Bell was born in Edinburgh, Scotland, in 1847. In 1870 he emigrated to Canada, and in 1872 he went to Boston, Mass., to teach deaf mutes—an object in which he displayed lifelong interest—afterward taking the chair of vocal physiology at Boston University. It was while living in that city that he invented the telephone—an achievement that has placed him among the most famous inventors of all ages. June 2, 1875, is recorded as the date of the birth of the telephone, and 109 Court Street, Boston, as the place. This was the location of the electrical workshop of Charles Williams, where Thomas A. Watson made for Bell the crude instruments of the "harmonic telegraph" used by the professor in his class work. It was while testing these instruments that the accident occurred which led Bell to discover that the vibration of a steel reed over an electromagnet created electrical impulses which when received on an instrument on the other end of the wire caused a perceptible vibration and a musical tone. The speaking telephone thus came into being, and the harmonic telegraph was forgotten. The first connected speech was transmitted from Bell to Watson on March 10, 1876, and passed from the former's bedroom to his laboratory at 5 Exeter Place, Boston.

A patent for the new invention was granted in 1876, and in the same year successful tests were made between Brantford and Paris, Ontario; Boston and Cambridge, Mass.; Boston and Salem, Mass., and at the Centennial Exposition in Philadelphia. The story of how the Western Union Telegraph Company refused to buy the patents for $100,000, and how, under the leadership of the late Theodore N. Vail, the American Bell Telephone Company developed the instrument until it became the business and household necessity that it is today and the most widely used of all electrical devices, is a familiar one and need not be repeated.

Dr. Bell had been the recipient of many honors from governments and learned bodies, including the decoration of the Legion of Honor from France, the Albert medal of the Society of Arts of London, the gold medal of the Royal Society of England, the Elliott Cresson medal of the Franklin Institute and the Edison medal of the American Institute of Electrical Engineers. The French Academy gave him the Volta prize of 50,000 francs, and American and foreign universities conferred numerous honorary degrees upon him. He was a prominent figure in the field of aërodromics and aërodynamics and is said to have spent fifteen years and more than $200,000 in testing his tetrahedral kite, which he originally believed would be the basis of aviation. He had several inventions in other fields to his credit and had built himself a hydroplane capable of making 70 miles an hour.

ALEXANDER GRAHAM BELL

In recent years Dr. Bell had lived at Washington, D. C., spending, however, much time in travel and having a summer home and a laboratory in Nova Scotia.

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Coming Activity in Indiana Involves Cost of $35,000,000

Two steps of much importance have been taken recently by the Indiana Public Service Commission in connection with plans of electric and interurban utilities to expend more than $35,000,000 in Indiana during the next twenty-four months for extension of electric service. The developments were:

1. The Indiana Electric Corporation was authorized to issue $7,000,000 in securities for the construction of a superpower plant near Terre Haute.
2. The commission began consideration of a petition of the Terre Haute, Indianapolis & Eastern Traction Company for a certificate of convenience and necessity for certain transmission lines in Indianapolis, which is the first step toward the expenditure of approximately $7,000,000 for improvement of the East Tenth Street power plant of the company at Indianapolis.

With these two projects under way, the commission has approved or received reports concerning other approximate expenditures on electrical development in Indiana as follows: Indiana Hydro-Electric Power Company, power plant at Monticello, $5,000,000; Indiana-Michigan Electric Company, extensions at South Bend and in St. Joseph County, $1,000,000; Interstate Public Service Company, improvements at various plants, $2,000,000; Calumet Electric Company, electrical developments in Lake County, $10,000,000.

All of the capital to be invested in the electrical enterprises, it is understood, will come from outside Indiana. Capitalists have been induced to invest these large sums in that state, officials of the companies say, because of the co-operation of the Public Service Commission in developing the electrical industry of Indiana.

The order in the Indiana Electric Corporation case authorizes the company to issue $4,500,000 in 6 per cent first mortgage bonds, $1,500,000 in 7 per cent preferred stock and $1,000,000 in common stock. The property of the company at the power-plant site will be worth from $6,000,000 to $6,500,000, the order of the commission says.

The Indiana Electric Corporation, which was authorized to merge seven large electric utilities of the state, will include the Merchants' Heat & Light Company of Indianapolis. An action to quash an injunction issued against the merger at the instance of the cities of Indianapolis and Kokomo is to be heard in the State Supreme Court in October. Plans of the corporation call for the immediate construction of a power plant with two 20,000-kw. turbo generators. The site, which is near Terre Haute on the Wabash River, was located in the heart of the coal fields so as to provide cheap fuel. Approximately 3,000 acres of coal lands are to be purchased by the company. Power generated at the plant will be sent to Indianapolis over transmission lines from the power plant, a distance of approximately 100 miles, for use by the Merchants' Heat & Light Company.

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Illinois Utility to Increase Capacity

The Public Service Company of Northern Illinois has awarded contracts for the first turbine unit of the new plant at Waukegan, Ill. This contract includes a 20,000-kw. turbine, a condenser and three 1,409-hp. boilers. Eventually the station will contain about 250,000 kw., using eight units. Preliminary plans have been completed, and work will be started about Sept. 1 so as to finish the installation of the first unit by Aug. 1, 1923. This plant is located north of the present location, and a tract of eighty acres has been procured near the lake to afford an ample supply of condensing water.

This station will eventually fit into the interconnected group of plants now ranging from the Indiana state line through the Edison properties in Chicago northward to Waukegan.

Water-Power Applications Total 20,000,000 Hp.

Five applications for permits or licenses under the federal water-power act were filed with the Federal Power Commission during the week ended July 22, making a total of three hundred and twenty-nine applications received since the creation of the commission. These projects involve approximately 20,000,000 hp., or more than twice the existing water-power installation of the country. This fact is brought out in a report issued by the commission and covering its two years of administration under the water-power act. In the last year, after the first flood of applications had come in, they aggregated 6,000,000 hp.

Up to June 30 last, the report says, the commission had authorized a total of sixty preliminary or survey permits and forty-nine licenses, the permits involving an estimated installation of 2,386,000 hp. and the licenses for power projects 1,932,000 hp.

Texas Plant to Burn Lignite

It is authoritatively stated that if the negotiations of the Texas Power & Light Company of Dallas for the lease of the municipal light and power system of Austin fall through, that company will build a large electric power station at Bastrop, 35 miles southeast of Austin, and will extend its trunk transmission line to that place from Taylor. The proposed plant at Bastrop will be in the center of the lignite coal field which will afford cheap fuel, it is explained. W. B. Head, chairman of the board of directors of the Texas Power & Light Company, and engineers representing the company have been making an investigation of the situation at Bastrop with the view of building a power station there. If the municipal light and power system at Austin is leased, the company will build a power station to cost approximately $2,000,000 it is stated.

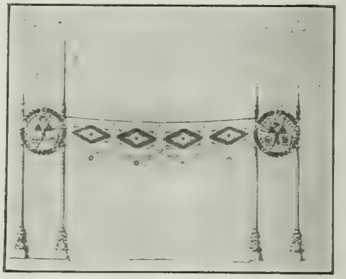
Electrical Leagues to Meet at Association Island

Plans are developing rapidly looking toward the gathering of representatives of all the local electrical leagues of the country in conference for several days in the first week of September at Association Island, Henderson Harbor, N. Y. A call was sent out recently by the Society for Electrical Development suggesting such a meeting for the purpose of affording a closer contact between local leagues in the work which they must carry out if the industry-wide movement for business development is to progress. The Joint Committee for Business Development is also supporting the move and working in close harmony with the society.

It is believed that it will greatly facilitate the organization of similar leagues in other cities, where they must be established to carry out the co-operative work of the campaign, if the past and present methods, activities and experience of existing leagues can be put on record before the industry and a working harmony established. Association Island has been suggested as the meeting place, because it is felt that the traditions of "the island" as the birthplace of organized co-operation in the electrical industry will lend a stimulating background for this meeting and that the friendly atmosphere of the informal meetings and personal contacts which the island affords will assist in welding the unity of interests. Arrangements have been made for keeping "Camp Clavarack" open for one week after the usual season.

Rocky Mountain Exposition Has Large Aims

According to the promoters of the Rocky Mountain Electrical Exposition, which, as already announced in the *Electrical World*, is to be held at Salt Lake City on Oct. 2 to 14, something more important than a temporary stimulus of business is aimed at. The larger purpose of the show is "permanently to widen the scope of the electrical market by bringing into logical contact and working relation the manufacturer, the central station, the jobber and the contractor-dealer," and to pave the way for a vast expansion of electric service to the public.



DESIGN FOR ARCHWAY OF JEWELS

The exposition, it is asserted, will be by far the best ever held beyond the Rockies, and reservations of space already made show that manufacturing companies from every part of the country will be represented. An attendance of 200,000 is thought a reasonably conservative estimate, in view of the fact that the Utah State Fair and the semi-annual conference of the Latter Day Saints will be held at the same time. The Rocky Mountain Electrical Co-operative League is carrying on an active advertising campaign in the interest of the exposition.

A brilliant illumination feature in the form of a 55-ft. "regional arch" has been designed by W. D'A Ryan especially for this exposition. At the end of the arch will be a circular emblem, 12-ft. in diameter, bearing the coats-of-arms of the six states of the Rocky Mountain group—Utah, Nevada, Colorado, Montana, Idaho and Wyoming.

National "Electrical Home" for Atlantic City

The first "electrical home" of national scope is to be opened on the Million-Dollar Pier at Atlantic City on Aug. 10, the exhibit to continue to Sept. 15. The "home" is now under construction, and every effort is being made to have it represent the last word in domestic electrical equipment. It is a representative house of the bungalow type, costing approximately $15,000, and particular attention is being given to harmonizing the electrical fixtures with the interior decoration and furnishings. It is planned to make this a genuine home, not a warehouse or a mere display of electrical devices, and only one of every type of article will be displayed.

Representatives of the electrical manufacturers and men speaking for mahogany, wallpaper, and various building trades met in New York last week, with A. Conrad Ekholm of the Million-Dollar Pier management for a final discussion of the equipment of the bungalow. Arrangements were also made for the proper demonstration of the electrical equipment.

Being opened in Atlantic City at the height of the season, this "electrical home" offers an unusual opportunity to reach people from every part of the country. During the last week, from Sept. 8 to 15, the Atlantic City Building Exposition and Fall Fashion Show will be held on the Million-Dollar Pier, and in addition Atlantic City's annual pageant is set for Sept. 6 to 8. It is estimated that no fewer than half a million people will visit Atlantic City in that week alone and that at some time during their stay they will inspect the home electric. Extensive plans have been made for publicity and advertising of this home, which has already aroused widespread interest in electrical circles.

Brilliant Lighting Planned for Brazil's Exposition

The spectacular lighting displays of the Panama-Pacific International Exposition of 1915 are to be rivaled at the Centennial Exposition commemorating a hundred years of Brazilian Independence to be held in Rio de Janeiro this fall. W. D'A. Ryan, who designed the displays for the California celebration, will supervise the lighting at the Brazilian exhibition, and the illumination will cost about $500,000.

The energy both for power and light will be supplied by the Rio de Janeiro Tramway, Light & Power Company. This company also has the contract to furnish and install all sub-stations, transformers and high-tension feeders within the grounds. It is estimated that the connected load will be approximately 3,000 kw., the night load about 2,000 kw., with a peak of 2,500 kw.

The main grounds and buildings will be flooded with light from masked cartouche and banner standards, supplemented by ornamental luminaires, mostly of the so-called lantern type. The relief lighting in the towers, minarets and windows will be rose-red and orange to give depth, texture and atmosphere. The floral effects for the most part will be in masses of solid color which will be brilliantly featured in illumination. Flags and special features will be lighted by incandescent searchlamps so as to stand out strongly against the blue-black background of the sky. The entire composition will be dominated by a scintillator in ever-changing colors. The roof and dome of the Palace of States, the largest building of the exposition, from which a domed tower rises to a height of 200 ft., will be treated with 40,000 "Novagem" jewels.

In addition to the main exposition buildings, Ihla de Fiscal, a small rock island situated in a crescent of the bay and almost entirely covered by a quaint building of German Gothic architecture, will be bathed in soft colors. It will be flanked by palm trees, which at night will stand out in scarlet against the darkness and will harmonize in effect with the banner standards, light from the windows and colored relief lighting on the structure. From the tower there will be an aurora of seven searchlight beams. While this island is approximately half a mile from the north entrance of the exposition, the colors will be reflected in the water, adding greatly to the general effect and beauty of the electrical display.

Standards Committee Adopts N. E. L. A. Meter Code

The American Engineering Standards Committee has adopted as a national standard the meter code of the National Electric Light Association. This code originated very largely with the Association of Edison Illuminating Companies, and this action of the A. E. S. C. stamps it as the best.

Electric Utility Financing in July Unsensational

ELECTRIC light and power public utility financing, which showed a slight tendency to decline in amount in June, continued on the down grade during the month of July. The total amount of stocks and bonds of this type offered investors was $51,886,100. This figure, however, does not compare unfavorably with the utility financing of July, 1921, when the volume of investments offered equaled $50,697,315. The twenty offerings listed below yielded the investor on an average 6.61 per cent. The largest single offering was the seven-and-one-half-million-dollar issue of gold bonds of the Central Indiana Power Company.

Since the beginning of the year electric utility investments have aggregated $365,890,140 and yielded a rate of return averaging 6.55 per cent. This figure, representing an increase of more than $100,000,000 over the corresponding period last year, is proof of the great activity now existing in utility financing.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Offered at	Per Cent Yield
Los Angeles Gas & Electric Corp.	$5,000,000	Twenty-five-year	General and refunding mortgage gold bonds, series E	To provide funds for additions	5½	96½	6
Texas Power & Light Co.	2,000,000	One-hundred-yr	Gold debenture bonds, series A	To provide funds for retirement of all general mortgage 8 per cent gold bonds and other purposes	6	90¾	6.60
Cumberland County Power & Light Co. (Me.)	900,000	Twenty-year	First and refunding mortgage gold bonds	To reimburse company for construction of new plant at Portland	5	89¾	5.87
Northern States Power Co. (Minn.)	2,000,000	Nineteen-year	First and refunding mortgage gold bonds	To provide funds for extensions to property.	5	91½	5.74
Central Indiana Power Co.	7,500,000	Twenty-five-year	First mortgage collateral and refunding gold bonds, series A	To acquire additional stocks and bonds of subsidiary companies	6	95½	6.35
Central Indiana Power Co.	2,000,000	Three-year	Collateral gold notes (closed issue)	For refunding and other purposes	7	99	7.39
United Railways & Electric Co. of Baltimore	2,500,000	Five-year	Gold notes	To meet maturing obligations.	6	98	6.45
Bangor Railway & Electric Co.	450,000		Cumulative preferred stock, class B	To purchase new properties and for capital requirements	7	101	6.93
Consolidated Gas, Electric Light and Power Co. of Baltimore	2,000,000		Cumulative preferred stock, series B	To provide capital for acquisition of property and to replace money expended	7	Par	7
Georgia Railway & Power Co.	500,000		First cumulative preferred stock, series of 1922	To reimburse company for acquisitions, extensions, etc.	8	102½	7.80
Associated Gas & Electric Co. (N. Y.)	270,000		Preferred stock		3	45	
Bar Harbor & Union River Power Co. (Me.)	500,000	Thirteen-year	First mortgage bonds of 1907	To obtain funds for additions.	5	90	6.15
Caruthersville & Kennet Electric Light & Power Co. (Mo.)	100,000	One-year Two-year Three-year	Receiver's certificates of indebtedness	...	8	100.9 to 102.6	7.00
Clarion River Power Co. (Pa.)	2,700,000	Twenty-five-year	First mortgage gold bonds	To meet costs of operation	6	97	6.75
American Water Works & Electric Co., Inc. (N. Y.)	1,200,000		Cumulative first preferred stock	To acquire control of Potomac Public Service Company through purchase of stock and for other purposes	7	87	8.05
Kansas City Power & Light Co.	5,666,100		First preferred stock, series A.	To reduce debt contracted for extensions and improvements and for other purposes	7	93⅓	7.50
Havana Electric Railway, Light & Power Co. (Cuba)	3,600,000	Thirty-two-year	General mortgage sinking-fund gold bonds, series A	To provide funds for retirement of notes, falling due and for additions and betterments	5	85	6.07
Southern Colorado Power Co.	6,000,000	Twenty-five-year	First mortgage gold bonds, series A	To retire existing bonds and short-term funded debt	6	94	6.50
Oklahoma Gas & Electric Co.	500,000	Nineteen-year	First and refunding mortgage gold bonds, series B of 1921	To provide funds for payment of floating debt incurred for extensions and additions	6	94½	6.50
Toledo Traction, Light & Power Co.	6,500,000	Three-year	Secured gold notes	To retire maturing obligations	6	98	6.75
Total	$51,886,100						

Illuminating Engineers Fix Convention Program

A well-balanced tentative program has been arranged by the Illuminating Engineering Society for the convention to be held at Swampscott, Mass., Sept. 25-28.

The first session, on Monday afternoon, Sept. 25, will be devoted to opening formalities, report of the secretary and reports of the committees on progress, nomenclature and standards, education and motor-vehicle lighting. On the following days papers will be presented at the morning and afternoon sessions with the exception of Wednesday afternoon, which will be occupied with entertainment and social features. One evening will be devoted to a symposium on "Fifteen Years' Advance in the Art of Lighting."

The following outline indicates the breadth and volume of subject matter to be discussed:

TUESDAY, SEPT. 26

Morning.—"Residence Lighting Practice": N. Macdonald, "Residence Lighting Practice in the United States"; M. Luckiesh, "Wiring and Lighting in the Middle-Class Home"; report of committee to prepare bulletin on residence lighting by electricity; report of committee to co-operate with fixture manufacturers; J. W. Gosling, "How to Tell Period Styles in Fixtures."

Afternoon.—"Commercial Lighting Practice": W. Harrison, "Overcoming Daylight Reflections in Show Windows"; W. Sturrock and J. M. Shute, "Effect of Light on the Drawing Power of the Show Windows"; J. L. Stair, "Illumination of Cafés and Restaurants"; W. H. Rademacher, "Lighting the Food Industries"; J. W. Lieb, "Performance of Tungsten Filament Lamps on Alternating Current and on Direct Current."

WEDNESDAY, SEPT. 27

Morning.—"Commercial Lighting Practice" (continued): H. B. Dates, "Practical Application of the Principles of School Lighting"; A. B. Emmons, "Office Lighting from the Viewpoint of Hygiene"; M. Luckiesh and L. L. Holladay, "The Cost of Daylight"; F. S. Mills, "Motion-Picture Studio Lighting"; C. E. Egeler and R. E. Farnham, "Screen Brightnesses for Motion Pictures."

THURSDAY, SEPT. 28

Morning.—"New Developments in Photometry": B. E. Shackelford and K. S. Weaver, "The Regular Icosahedron as a Substitute for the Ulbricht Sphere"; C. C. Colby and C. M. Doolittle, "A Distribution Photometer of New Design"; F. A. Benford, "Methods of Plotting Spectrophotometric Curves (Tentative)"; B. S. Mills, "A Direct-Reading and Computing Attachment for Use on the Sphere Photometer"; C. E. Ferree and G. Rand, "A Theory Regarding the Difference in Results Obtained When Using the Flicker and Equality-of-Brightness Methods of Photometry."

Afternoon.—"General Lighting Subjects": E. S. Chaffer and W. F. Bovie, "Measurement of the Electrical Response of the Retina to Stimulation by Light"; report of committee on sky brightness; S. G. Hibben, "Lighthouse and Lightship Lighting"; C. A. Smirnoff, "Influence of Daylight Illumination Intensity on Electric Current Used for Lighting Purposes in the District of Columbia."

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Practical Program Adopted for P. E. A. Meeting

For its fifteenth annual meeting, to be held at the Bedford Springs Hotel, Bedford Springs, Pa., on Sept. 6 to Sept. 9, the Pennsylvania Electric Association has adopted a comprehensive tentative program, of which the chief features follow:

THURSDAY, SEPT. 7

Morning.—Address of president; reports of committees on program, entertainment, exhibition and company employee organization; report of Public Relations Section, E. L. Smith chairman: (a) Women's information, Miss Clara H. Zillessen; (b) relations with bankers, John E. Zimmerman; (c) public speaking, Henry Harris; (d) employee relations with the public, Henry N. Muller; report of power-factor committee, Charles J. Russell.

Afternoon.—Report of Technical Section, George B. Wendle, chairman: (a) Hydraulic power, G. V. Goranson; (b) underground systems, L. W. Blaney; (c) electrical apparatus, William B. Flynn; (d) meters, S. N. McClurg; (e) prime movers, N. G. Reinicker; (f) overhead systems, P. H. Chase; (g) inductive interference, Henry Muller, chairman inductive interference committee, Pennsylvania Electric Association; A. E. Silver, chairman inductive interference committee, N. E. L. A.; Paul Spencer, member of joint comimttee on inductive interference, and others; (h) "Systematic Inspection of Lines and Equipment as a Means of Preventing Breakdowns," L. W. Heller, Duquesne Light Company, Pittsburgh; report of accident prevention committee, J. H. Shearer; "Accident Prevention," Charles B. Scott, chairman accident prevention comimttee, N. E. L. A.

Evening.—Public policy meeting: Addresses by W. H. Johnson, vice-president N. E. L. A.; M. H. Aylesworth, executive manager N. E. L. A., and William D. B. Ainey, chairman Public Service Commission of Pennsylvania.

FRIDAY, SEPT. 8

Morning.—"Engineering Education as It Applies to the Central-Station Industry," R. L. Sackett, dean of engineering of Penn State College; report of Accounting Section, H. R. Kern, chairman; (a) Classification and application of accounts, M. W. Glover; (b) customers 'records and billing methods, John F. Ford; (c) purchasing and storeroom records, J. F. Torrence; (d) fixed-capital records, C. M. Breitinger; (e) budget, George P. Landwehr; (f) federal income-tax procedure, F. Heinbokel; (g) security holders' records, R. B. Keating; (h) credits and collections, B. P. Carey; (i) accounting education, Carl M. Schubert; (j) accounts payable, L. B. Harvey.

Afternoon.—Report of Commercial Section, G. M. Gadsby, chairman: (a) Lighting Sales Bureau, John M. Orr; (b) Electric Vehicle Bureau, Drew Johnston; (c) education committee, Max Hecht; (d) Merchandising Sales Bureau, William H. Wade; (e) Power Sales Bureau, J. Cox Thompson; "More Business Through Better Lighting," G. Bertram Regar, Philadelphia Electric Company; "Rural Lines," William H. Horton, Jr., West Penn Power Company: report of rate committee, Henry Harris.

A reception to President and Mrs. A. H. S. Cantlin will take place on Wednesday evening, Sept. 6. On Saturday the remaining committee reports will be rendered and officers elected.

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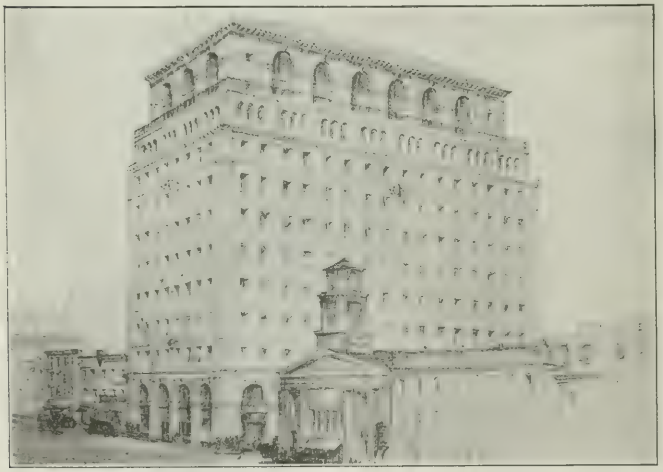
New Office Building of the Brooklyn Edison Company



The Brooklyn Edison Company has started the erection of a new million-dollar office building at Willoughby and Pearl Streets. It will be a twelve-story structure and will house all the departments of the company.

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More Power Projects Before Federal Commission

The Federal Power Commission has withheld action on an application by the city of St. Paul for a preliminary permit covering a power project on the St. Croix River. The commission withheld action pending the submissal of evidence by the city as to its authority to expend money outside of the limits of Minnesota or to purchase, condemn, own or operate property in Wisconsin. The St. Croix is a boundary stream, and a portion of the proposed works would be in Wisconsin.

The Southern Sierras Power Company of Riverside, Cal., has applied to the Federal Power Commission for a license covering a 15,000-volt distribution line, 8.4 miles long, to Palm Springs Resort, Cal.

The Empire District Electric Company of Galena, Kan., has applied for a preliminary permit covering a power project on the White and James Rivers above Branson, in Taney, Stone and Barry Counties, Mo., and in Carroll County, Ark. The dam is to be a reinforced arch 175 ft. high, the application states. The power house is to be connected with transmission lines to Joplin and will be connected with the lines of the Ozark Power & Water Company.

Charles E. Schaup, 304 Commonwealth Trust Building, Harrisburg, Pa., has applied for a preliminary permit covering a power project at the head of Sassafras Island. The project is to be operated in conjunction with the

Drumgold project in the Susquehanna River.

The Anaconda Copper Mining Company has applied for a license to cover its existing Georgetown project, now being operated under a Forest Service permit. The project is composed of the Georgetown dam, a wood-stave conduit and a power house with appurtenant structures and transmission lines.

The Holton Power Company has made application for a license for a transmission line to connect its line with the lines of the Southern Sierras Power Company at the plant of the Imperial Oil & Gypsum Company, in Imperial County, Cal.

The Southern Sierras Power Company has applied for a license for a transmission line about 2 miles long, to furnish power to the Bly stone quarry, in Inyo County, Cal.

The city of Los Angeles has filed an application for a preliminary permit to develop power on Pine and Morgan Creeks, Inyo County, Cal. The project contemplates the construction of five reservoirs with a combined capacity of about 8,000 acre-ft. A diversion canal and tunnel will carry the water to a power house on Pine Creek. The installed capacity will be about 18,500 hp.

Application has been made by the Bear Valley Utility Company for a license for a transmission line about 8 miles long, near Big Bear Lake, in San Bernardino County, Cal. The line will connect with those of the Southern Sierras Power Company and will furnish power to Big Bear Resort.

Earl Mucklow of Powell, Idaho, has applied for a license for a minor project intended to furnish power for a sawmill in the Shoshone National Forest.

Transit Commission Report Clears "Pyrene"

In a recent accident on the Interborough Rapid Transit Company's subway system in New York City many passengers were overcome by fumes, and New York papers said that phosgene poisoning had been caused by the use of "pyrene" to extinguish an arc.

A report made by the Transit Commission of New York completely exonerates the fire extinguisher. Experts from the Bureau of Mines declared that the symptoms were not characteristic of phosgene or carbon-tetrachloride poisoning. The chief of the materials-testing division of the Interborough Company asserted that "pyrene" was particularly adapted for fires produced by short circuits because it is a non-conductor. He said that if it was applied to red-hot metal, with oxygen present, phosgene gas and chlorine gas would result. Every symptom of those overcome in the subway, however, pointed to smoke fumes from the burning of insulation in a panel box, paint and varnish on the car walls and rubber cushions on the car doors as the cause of the distress, and the vapors and fumes from the carbon-tetrachloride were so diluted as to be negligible.

Brief News Notes

Ohio Electric Company Properties to Be Sold at Auction.—A sale at auction on Aug. 15 of the property of the Ohio Electric Company, which includes the Toledo-Lima interurban lines, an electric light and power plant, the steam-heating plants in Lima and the Lima street railway system, has been announced by the receiver of the company. The sale is subject to payment of mortgages of more than $1,000,000. Bids of not less than $2,000,000 will be accepted at the Toledo station of the company, the announcement says.

University Courses in Public Utilities.—Beginning with the next academic year, the University of Detroit will establish a comprehensive course in public utilities. Several other universities have established utility courses within the last few years, Ohio State University, Princeton and the Massachusetts Institute of Technology being among the latest. Utility students from the University of Illinois have, it is said, found avenues opened to them because such a course has been given at Urbana for some years.

A Mexican Hydro-Electric Scheme.—The Governor of Chihuahua, Mexico, has a project to issue $15,000,000 of bonds for the reclamation by means of irrigation of 420,000 acres of arid land in the valleys of the Conchos and San Pedro Rivers and the building of a large hydro-electric plant which will supplement the power service now being given by the Irrigation & Electric Power Company, a Canadian concern, from its big plant at Boquillas. From the reservoir that is already formed by the dam of this company the first land unit of 135,000 acres will be irrigated. The second will involve the building of a dam on the San Pedro River, the construction of an irrigation system and a hydro-electric plant and the reclaiming of 284,000 acres of land.

Consumers' Power Company Breaks Construction Record.—Breaking all company records for hydro-electric construction, the Consumers' Power Company hooked up two of its four new generating units at the Rogers station on the Muskegon River fifteen days ahead of schedule, conserving for other needs in Michigan about $15,000 worth of coal. The Rogers station of the company was destroyed by fire on Dec. 22 of last year. On July 1, with the station building only partly completed, with temporary line connections and switching equipment, and with the machines protected from the elements by shields of tarpaulin, two of the four new units were put on the line, feeding energy into the system and relieving steam plants of a load which required about $1,000 a day for fuel. The new plant is rated at 6,250 kw., and the annual output at 31,000,000 kw.-hr.

Hydro-Electric Resources of Utah.—In a talk before the Kiwanis Club at Salt Lake City, R. R. Wooley, hydraulic engineer of the United States Geological Survey, said that water-power sites in Utah are capable of developing 1,800,000 hp. for irrigation and other purposes. This estimate embraces sites on the Bear, Provo and Green Rivers and other surrounding mountain streams. Approximately 200,00 hp. is developed by the forty-six plants in operation, he said. All of the undeveloped sites are under government control.

Springfield (Ohio) Company Extending Its Service.—Contracts have been signed whereby the Springfield (Ohio) Light, Heat & Power Company will construct a 33,000-volt power line from Springfield to Urbana, a distance of 13 miles, for the purpose of furnishing an auxiliary power supply to the latter city. The contract was signed between the Springfield company and the Northwestern Ohio Light & Power Company, which is furnishing power to Urbana at present from a local station that has become inadequate.

Central Hudson Company Starting Development to Cost $2,500,000.—The Central Hudson Gas & Electric Company is preparing to construct a half-million-dollar dam on the Wallkill River at Rifton, N. Y., as an auxiliary in supplying light and power to the cities of that district, in which great industrial development is prophesied. The cost of building the new transmission line required, together with extensions to serve large industrial customers and the development of the hydraulic plant at Rifton, will be more than $2,500,000.

Hetch Hetchy Unit to Be Completed Within Two Years.—Work on the Moccasin Creek power house, a unit of the Hetch Hetchy project, will be completed within two years, simultaneously with the completion of the tunnel boring and dam and reservoir construction on the upper portion of San Francisco's forty-five-million-dollar hydro-electric undertaking, according to a statement made by the city engineers. Contracts for the machinery totaling more than $700,000 have already been let by the city, and nearly 200 men are at work at the Moccasin Creek site.

New York State Starts Work on Hydro-Electric Plant on Mohawk River.—On July 18 Governor Miller of New York State set off the blast starting the work of the state on the new hydro-electric plant southwest of the Crescent dam on the canalized Mohawk River. The act of the Governor was the first actual move of the State in hydro-electric development for other than Barge Canal purposes, $1,000,000 having been appropriated by the 1922 Legislature for the construction of power houses at the Crescent and Vischer's Ferry dam sites. It was stated by an official of the Department of Public Works that the Crescent plant would have a capacity of 16,000 hp. and that 8,000 hp. would be available by Jan. 1, 1923. It is said that approximately $6,000,000 will be ultimately spent on the two sites west of Cohoes.

S. P. E. E. Activities.—At the recent meeting of the council of the Society for the Promotion of Engineering Education the plan of the deans of Middle West engineering schools for a five-year course was presented but not indorsed. The deans agreed among themselves to go ahead as a separate unit and develop the plan as originally laid down at the meeting in Chicago on May 19. The council of the S. P. E. E. at the same meeting decided to establish a new section within the society composed of deans and directors of engineering schools. This decision is the culmination of a discussion which started at the New Haven meeting last year. The new section will deal with general administrative matters and will not incorporate the organization of Middle West deans just referred to.

German Utility Securities Offered.—A large number of German utility securities covering light and power stations, street railways and railroads have been received recently by the Reparations Commission under the terms of Article 260 of the Treaty of Versailles. Some of the securities are open to bids by the allied governments, the United States and their citizens, while others may be acquired by responsible bidders from any country. The procedure to bid on the first group requires that bids be accompanied by evidence of American nationality, by similar evidence that the bidder is not acting on behalf of a foreign individual or government, and by a surety from a responsible bank guaranteeing the total amount of the bid. The Department of Commerce will assist American banks, firms or individuals to obtain the properties they desire, not only by sending the lists to the proper officers, but also by transmitting all bids and affidavits to the State Department for submission to the Reparations Commission. The date at which bids must be submitted will be announced later by the Reparations Commission.

Upper Tennessee River Water-Power Development.—The mineral resources and power possibilities of the Tennessee River and its tributaries in North Carolina, Tennessee, Alabama and Kentucky have been made the subject of exhaustive reports of army engineers transmitted to Congress. Reference is made to possible power developments on the river from Chattanooga to Riverton and at Coulter Shoals, 40 miles below Knoxville. Recommendation is made that a more detailed survey be authorized looking to development of the river for navigation and power purposes. The reports show that a large amount of hydro-electric power is now wasted annually in the upper section of the Tennessee River. It is said that at Coulter Shoals a minimum twenty-four-hour capacity of 14,000 hp. can be developed. Its transmission would be principally to Knoxville, where there is said to be a demand for power in excess of the supply. It is asserted that for 90 per cent of the time in an average year 18,400 hp. would be available, while for 57 per cent of the time from 40,000 hp. to 44,000 hp. could be developed. The initial cost of the project at Coulter Shoals, if built by the government, is estimated at $6,346,500 and the cost of operation at $257,300 annually. If built by private enterprise, the initial cost would be increased by $400,000.

Superpower Plants at Coal Mines Advocated in Oklahoma.—A study of the plan to build electric plants at the mouths of coal mines has been made by the School of Engineering of the Agricultural and Mechanical College at Stillwater, Okla., at the request of the State Board of Agriculture. The reports of the investigators are entirely favorable to the plan, by which, it is represented, the coal fields of the state could be more rapidly developed, great savings could be realized in freight costs, and industrial development would proceed more rapidly.

Boulevard Type Lighting for Boston.—An installation of seventy-six magnetite lamps mounted about 14 ft. 6 in. above the sidewalk on boulevard-type posts will shortly be made on Boylston Street, Boston, between Park Square and Copley Square, this being the first installation of this type to be made in the business district of the city. The lamps will be mounted opposite one another with spacings varying from 75 ft. to 80 ft., and will consume about 530 watts each. All-night and every-night service will be supplied by the Edison Electric Illuminating Company of Boston on its regular street-lighting contract with the city, and the new installation is expected to contribute materially to the upbuilding of this rapidly growing business section. Twenty-two existing lamps will be changed to conform to the new installation, which requires the purchase of fifty-four new units.

Radio Compass Proves Its Value.—The radio compass, which makes it possible for a navigator to pick up a definite signal a hundred or more miles off the station from which it is sent, has proved so successful in the waters around New York Harbor, where it has been used experimentally for some months, that installations are to be made in addition at a number of important points on the Atlantic and Pacific Coast, beginning with San Francisco. Its value was exemplified in the wreck of the Onataneda, which sent out distress signals from a point off the shores of Newfoundland. She gave her position by wireless, which was found to be 90 miles in error. The distress signal was picked up by several vessels, but only one of them, the Fanad Head, was equipped with a radio compass. While the other vessels were searching blindly for the ship in distress, misled by her mistaken announcement of her position, the Fanad Head had no trouble in running directly for her and was in time to rescue the crew.

Associations and Societies

Contractor-Dealers Plan for Cincinnati Meeting.—Preliminary plans for the twenty-second annual convention of the National Association of Electrical Contractors and Dealers, to be held at Cincinnati on Oct. 9 to Oct. 14, in the Hotel Sinton, point to one of the best meetings yet held by this body. "Business Yesterday, Today and Tomorrow," "The Supply Jobber and the Electragist" and "The Central Station and Business Development" will be the topics of the opening day. On the second day there will be a business session, and Col. Edward T. Miller, secretary of the United Typothetae of America, will make an address on "How an Employers' Association Functions." On the last day, among other important business, a proposed change of the name of the association to the "International Association of Electragists" will be acted upon. Arrangements for a boat trip on the Ohio River are being perfected.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

A. I. E. E., Pacific Coast Convention—Vancouver, B. C., Aug. 8-11. F. L. Hutchinson, 33 West 39th Street, New York, N. Y.

Michigan Electric Light Association—Ottawa Beach, Aug. 21-23. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

International Association of Municipal Electricians—New Bedford, Mass., Aug. 22-25. C. R. George, Houston, Tex.

New York Electrical League—Association Island, Sept. 5-7.

N. E. L. A. Geographic Divisions — New England, New London, Conn., Sept. 5-8; Southeastern, Atlanta, Sept. 12-15; Rocky Mountain, Glenwood Springs, Col., Sept. 11-13; Great Lakes, French Lick Springs, Ind., Sept. 28-30. M. H. Aylesworth, 29 West 39th Street, New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 6-9. H. M. Stine, 212 Locust St., Harrisburg, Pa.

Association of Iron and Steel Electrical Engineers—Cleveland, Sept. 11-15. J. F. Kelly, Empire Bldg., Pittsburgh, Pa.

American Electrochemical Society — Montreal, Sept. 21-23. A. D. Spillman, Columbia University, New York City.

Illuminating Engineering Society—Swampscott, Mass., Sept. 25-28. Samuel G. Hibben, 29 West 39th Street, New York.

American Institute of Mining and Metallurgical Engineers—San Francisco, Sept. 25-28. F. F. Sharpless, 29 West 39th Street, New York.

National Association of Railway and Utilities Commissioners — Detroit, Sept. 26. J. B. Walker, New York Transit Commission, New York.

Illinois State Electric Association—French Lick Springs, Ind., Sept. 28-30. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

Indiana Electric Light Association—French Lick Springs, Ind., Sept. 28-30. Thomas Donohue, Lafayette, Ind.

American Electric Railway Association — Chicago, Oct. 2-6. J. W. Welsh, 8 West 40th Street, New York.

Empire State Gas and Electric Association —Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.

Association of Edison Illuminating Companies — White Sulphur Springs, W. Va., Oct. 11-14. Preston S. Millar, 80th St. and East End Ave., New York.

National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St.

Electric Power Club—Asheville, N. C., Oct. 30. S. N. Clarkson, 506 Laclede Gas Bldg., St. Louis.

Commission Rulings

Determination of Active Load.—An electric company may, said the Michigan Public Utilities Commission in approving certain changes in rules asked by the Consumers' Power Company, properly exclude from the connected load all vacant sockets when arriving at the determination of active load of residence lighting customers.

Acquisition of Scattered Utilities by Holding Companies Opposed.—In refusing approval of a stock issue which the Interstate Utilities Company desired to float in order to acquire small utilities in four states, the Michigan Public Utilities Commission declared its opposition to the plan of operating widely scattered public utilities by means of a holding company as not in accordance with ordinary business principles. Its experience, the commission said, inclined it to the belief that no good result is thus attained.

Redemption of Certificates and Stock Dividends.—Although the redemption of certificates of indebtedness issued to stockholders and payable only in common stock is, in the opinion of the Indiana Public Service Commission, in effect an evasion of the law prohibiting the issue of stock dividends, the commission decided to allow it in the case of the Noblesville Heat, Light & Power Company, this company having a large surplus accumulated during years when dividends were withheld, salaries of officials were insignificant and all earnings were put back into the property.

Improper Interpretation of Interest and Charges During Construction.—Passing on an application of the Wisconsin-Minnesota Light & Power Company for authority to issue bonds, the Wisconsin Railroad Commission condemned the company's practice in charging to capital account as interest and taxes during construction such part of the interest and taxes as was represented by the proportion that the actual output of the property bore to the theoretical capacity. "If this practice were uniformly followed by all the utilities of the state," the commission observed, "it would result in the rapid inflation of property accounts due to the continual charges for interest and taxes upon the property. We know of no public utility property where the output anywhere near equals the theoretical capacity of the plant. . . . In auditing the construction accounts of the company the commission has allowed as a capital expenditure the full amount of interest and taxes up to the time that the first three generators were put in operation. From that time until the final three were put in operation one-half of the interest and taxes were charged to construction because the property was half completed. After the property was completed by the installation of the final three generators no interest or taxes were included in construction account, but all became charges against the operating income of the company."

Returns from Different Branches of a Utility Must Be Kept Separate.—In passing upon an application from the Trinidad Electric Transmission, Railway & Gas Company for permission to abandon certain railway tracks, the Colorado Public Utilities Commission, answering a contention that the business of the company as a whole should be considered in deciding the question of loss, again declared, as it had had occasion to do in other cases, that the return from each branch or class of a public utility company's business must be considered separately for the purpose of determining whether service should be discontinued—not the return from the business of the company as a whole—because one class of customers must not be charged for service rendered to another class.

Deduction of Accrued Depreciation.—The Missouri Public Service Commission, in valuation proceedings for the Carthage Gas Company, remarked concerning the relation of accrued depreciation to estimates of cost of reproduction new: "Where full theoretical appreciation is included, as it is in the cost of reproduction new as of a specific date, there can be no objection to the deduction of the full theoretical accrued depreciation. In applying the cost-of-reproduction-new theory of valuation the company must accept its disadvantages as well as its advantages. However, when considering the investment as a factor in fixing fair present value, no deduction should be made for accrued depreciation unless such depreciation has been earned over and above a fair return on the investment."

Uniform Rates Ordered.—The Public Utilities Commission of Utah has entered a decision denying the application of the American Foundry & Machine Company for a special rate, based on power consumption only, with which to operate its electric furnace. The application was filed about three years ago. This case has been held pending decisions in the special contract case and the application of the Utah Power & Light Company for an increase in its regular power schedules, which cases were decided some time ago. The foundry company alleged that it could not afford to pay the regular schedule rates, particularly the demand charge, for power. The commission, however, argues that if it were to take into consideration the ability to pay of a single customer it would end in every customer having a different rate, and all uniformity of rate structure would be destroyed, with illegal discrimination the result. "Rates," it says, "must be based upon cost of service," which was the consideration kept in mind by the commission in fixing the present power rate schedule of the Utah Power & Light Company.

Recent Court Decisions

Gross Receipts of Operating Company Include Rent Paid to Power Company.—In Columbia Railway, Gas & Electric Company vs. Jones the South Carolina Supreme Court has sustained the lower court in holding that the Columbia company and the Farr Shoals Power Company, which owns the plant operated under agreement by the company first named, are separate and distinct corporations and that each is subject to the state license tax upon gross receipts, including in the case of the Columbia company the rent or money paid to the power company. (112 S. E. 267.)

Power Company Is Obliged to Supply Specified Horsepower to City's Energy-Consuming Devices at Any Time Required.—Where power company's contract with city provided that the minimum horsepower to be furnished city should not be less than 70 hp. and required the city to pay therefor "$2 for each contract horsepower of connected load, which payment entitles it (the city) to consume 25 kw.-hr. for each contract horsepower" per month, and the decree in city's action to enforce performance of contract required the company to furnish the city "a 70-hp. connected load for the operation of its waterworks system and to comply with the contract that has been filed in this cause," the company was required to supply a minimum of 70 hp. to the city's energy-consuming devices at any time it might be required. This decision was handed down by the Court of Civil Appeals of Texas in Telluride Power Company of Texas vs. City of Teague. (240 S. W. 950.)

In Damage Suit Where Death Is Ascribed to Excessive Current Count Must Allege that Necessary Current Was Safe.—In Brown vs. Mobile Electric Company it was alleged that the defendant caused the death of a motion-picture operator by furnishing him with current for use in his business at an excessive voltage. The Supreme Court of Alabama found that the count was defective because it did not allege that the reasonably necessary current contracted for was not dangerous to human life, since, if both currents were equally dangerous, the negligent furnishing of excessive current was not the proximate cause of death. The lower court did not err in sustaining a demurrer to the count thus criticised, but was wrong in charging that under the evidence the jury ought to find for the defendant, for the jury and not the judge has the duty of deciding the credibility of evidence. The finding was therefore reversed and the case remanded. (91 So. 802.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

T. E. Barnum New Vice-President of Electric Power Club

At a recent meeting of the Electric Power Club T. E. Barnum, chief engineer of the Cutler-Hammer Manufacturing Company, was elected vice-president of the association. Mr. Barnum has taken a prominent part in the activities of the Electric Power Club for many years. He has been a member of the board of governors for the past five years and in addition is representative of the club on the sectional committee of the American Engineering Standards Committee on elevator standards and also on the sectional committee on elevator safety code.

T. E. BARNUM

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L. F. Hardy Public Utilities Commissioner

The appointment of Leonard F. Hardy as a member of the Massachusetts Department of Public Utilities was recently announced. Mr. Hardy succeeds A. R. Weed, who resigned to accept an appointment as justice of the Superior Court. He was born at Weedsport, N. Y., Oct. 24, 1875, and has had a distinguished legal career. He was a member of the Massachusetts House of Representatives from 1910 to 1913 and has been in the Massachusetts Senate since 1918.

◆

A. R. Weed Justice of Massachusetts Superior Court

The appointment recently announced of Alonzo R. Weed as justice of the Massachusetts Superior Court brings to the bench a man of wide experience in the public utility field. Mr. Weed was graduated from Harvard in 1887 and three years later from Boston University Law School. He was appointed to the Massachusetts Gas and Electric Light Commission in 1906 and served as chairman from 1913 to 1919. Since the establishment of the Massachusetts Department of Public Utilities in 1919 he has served as a commissioner. In the public utility field his comprehensive grasp of the problems of modern management and his open-minded fairness have won high regard.

◆

E. L. Franklin Elected President of O. E. L. A.

Emerson L. Franklin, manager of the Warren Division of the Ohio Public Service Company, has been elected as president of the Ohio Electric Light Association. Mr. Franklin was born in Wolfville, Nova Scotia, and has spent twenty years in the electrical industry. His education was obtained in Acadia University, Wolfville, and McGill University, Montreal. He was graduated from the former college in 1900 with a B. A. degree and from the latter in 1902 with a B. S. in electrical engineering. In September, 1902, he joined the Easton Power Company, Easton, Pa., as chief engineer. In 1907 he was advanced to superintendent and five years later was made secretary. The Eastern Pennsylvania Power Company was formed in 1912 by a consolidation of electrical power companies in and around Easton, and Mr. Franklin was appointed general superintendent of this group. He resigned this position the following year to accept the position of plant superintendent of the Empire District Electric Company, Joplin, Mo., and in 1914 organized and directed "results engineering" work for the properties of the Cities Service Company in Missouri, Kansas, Oklahoma and Nebraska. In June, 1914, he was made general manager of the Trumbull Public Service Company of Warren, Ohio, and when this property was consolidated with the other Ohio properties in 1921 he was appointed to his present position. Under his management the gross income of this property has increased ten times and the output in kilowatt-hours more than twenty-five.

◆

S. Glen Vinson, secretary and general manager of the Ideal Electric & Manufacturing Company of Mansfield, Ohio, is traveling in the Orient in order to make a survey of business conditions. Mr. Vinson will include on this trip all the larger cities in Japan, China, the Philippine Islands and India. He expects to return to the United States about Oct. 1.

F. B. Chapman Receives Promotion

The vacancy which occurred a short time ago in the Eastern sales managership of the Bryant Electric Company has been filled by the selection of Frank B. Chapman as successor to George V. W. Ingham Mr. Chapman has devoted thirty years of his life to the electrical industry. In the early nineties he was connected with the Utica Electrical Manufacturing Company of Utica, N. Y., which was in reality the construction department of the Utica Light & Power Company. When the department was abandoned Mr. Chapman, with the assistance of two of his associates, incorporated the B. & C. Electric Construction Company of Utica, doing general construction work not only in Utica but also in parts of the South, where the firm installed electrical equipment in a number of cotton mills. After five years Mr. Chapman disposed of his interests and affiliated himself with the Roller Smith Company as salesman of precision instruments, circuit breakers and similar material. Two years later he resigned to accept a position as field representative with the National Carbon Company. Since 1912 he has been associated with the Bryant Electric Company in the capacity of field representative in the Middle Atlantic and Southern States. Mr. Chapman will make his headquarters at the factory in Bridgeport.

F. B. CHAPMAN

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A. E. Novey Heads New Chicago Jobbing House

A. E. Novey is the president of the newly formed Electrical Merchandising Corporation of Chicago and brings to this organization years of experience gained in the electrical field. Mr. Novey started his electrical training as a draftsman's tracer for the Kellogg Switchboard & Supply Company in 1900 at the age of fourteen years and remained there until 1905, reaching the goal of head apparatus designer. He then joined the Electrical Supplies & Fixture Manufacturing Company as superintendent of manufacture, but in 1916 became associated with the Montgomery-Ward Company as buyer in its chandelier department. In 1917 Mr. Novey transferred his service to the Peerless Light Company as advertising manager. He remained a year and then became president of the Co-operative Electric Supply Company, remaining there until March, 1922, when his new company was organized.

M. C. Rypinski Joins C. Brandes, Inc.

M. C. Rypinski, formerly radio sales manager of the Westinghouse Electric & Manufacturing Company, has associated himself with C. Brandes, Inc., New York City, as vice-president and sales manager. Mr. Rypinski's career is the story of an engineer who has successfully mastered the art of salesmanship and merchandising. His technical education was received at the Rose Polytechnic Institute of Terre Haute, Ind., from which he was graduated in 1897. Soon afterward he became a member of the engineering staff of the General Electric Company in the capacity of assistant to the chief of the standards laboratory. Between the years 1902 and 1906 he was associated with independent instrument manufacturers, and then he joined the Westinghouse Electric & Manufacturing Company of Pittsburgh, where he has obtained fifteen years of broad business and engineering experience. During the war, as chairman of the instrument manufacturers' committee and a member of the transformer manufacturers' committee, he was able to do much toward the solution of the many technical problems that confronted these bodies.

M. C. RYPINSKI

In August, 1920, he was placed in charge of the commercial exploitation of the radio telephone. The famous "KDKA" station which he and his associates erected at Pittsburgh formed the nucleus for the extraordinary growth of radio which has taken place in the past two years. As radio sales manager of the Westinghouse company he was in a position to study at first hand the commercial and merchandising problems that naturally arose in the new industry. Mr. Rypinski is the new chairman of the radio apparatus section of the Associated Manufacturers of Electrical Supplies, where the important part he has played in the establishment of radio broadcasting will make his services of great value.

◆

C. Chester Stewart, formerly chief electrical engineer with the Sinclair Refining Company, is now connected with the Oklahoma Gas & Electric Company in the capacity of commercial engineer.

W. B. Britt, formerly associated with the Engineering Service Company of Charleston, W. Va., has become the owner of an engineering and contracting business known as the Britt Electric Company.

W. B. McSpadden, new-business manager of the City Light & Water Company, Amarillo, Tex., has been appointed chairman for Texas of the executive committee of the Commercial Section of the Southwestern Geographic Division of the N. E. L. A.

F. H. Brain, a hydro-electric engineer for the city of Hobart, Tasmania, has come to the United States to spend a year studying the newest developments in hydro-electric engineering with a view to adapting them in the development now under way of Tasmania's great potential water power.

Major Cary H. Brown, assistant engineer commissioner for the District of Columbia since March, 1919, has been assigned to duty at the engineer school at Camp Humphreys, Va. As assistant engineer commissioner, Major Brown has had jurisdiction over the electrical, water and sewer departments and the office of the building inspector of the District.

Thomas F. Kennedy, formerly new-business manager of the Western Light & Power Company, Boulder, Col., and the Denver Gas & Electric Light Company, subsidiaries of the Cities Service Company, has recently been transferred to New York, where he will be assistant manager of the new-business department of the Cities Service Company.

Charles J. Nicholson, formerly connected with the Lundale Coal Company, Lundale, W. Va., has joined the Brooklyn Edison Company in the capacity of assistant engineer of electrical construction.

A. M. Jackson, chairman of the Rocky Mountain Electrical Exposition committee, is now in the East making a number of calls on important manufacturers in connection with the exposition, which is to be held in Salt Lake City next fall. His itinerary will include New York, Boston, Philadelphia, Baltimore, Rochester, Syracuse, Buffalo, Pittsburgh, Detroit, Cleveland, Toledo, Dayton, Chicago and a number of towns in Connecticut. During his absence P. M. Parry, commercial manager of the Utah Power & Light Company, will act as temporary chairman of the committee.

H. B. Kirkland Returns to the American Wiremold Company

H. B. Kirkland has returned to the American Wiremold Company as vice-president after several years with the General Electric Company. Mr. Kirkland was born in Boston in 1870 and entered the electric field as wireman's helper in Washington, D. C., in 1887, spending some years with the Marr Electric Construction Company, whose headquarters were in Pittsburgh. He entered the commercial field in 1891 and has been in the conduit branch of the industry ever since with the exception of a short period.

H. B. KIRKLAND

Obituary

George Badner, representative of the Central Hudson Gas & Electric Company in Marlboro, N. Y., recently died at his home in Marlboro. Mr. Badner had been the local representative of the company from 1901 until the time of his death. He was highly esteemed by the entire organization and also by the community in which he lived.

Harry I. Wood, fifty-two years old, a prominent figure in Louisville's business life, died at his home there July 25. Mr. Wood had been engaged in the electrical business twenty-eight years. The Harry I. Wood Electric Company was formed by him about twenty years ago and he was in active charge of it until recently. He was engaged in forming a new company when his death occurred.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic
Problems of the Producer and Distributor, with Market Reports, **Trade**
Activities, Foreign and Construction News

The Problem of Elimination

Influence of the Demands of Progress and Present Catalog Practice —Who Should Take the Initiative in Reducing Excess Styles and Types on the Multiplicity of Varieties

By F. V. Burton

Sales Manager Henry D. Sears, Boston

EVERY manufacturer of wiring devices and probably of other lines is impressed with the desirability of keeping the variety of devices which he manufactures at a minimum. Yet it is not an easy matter to handle, and the point at which this expansion should stop or production be discontinued is not simple to define.

There is no doubt that the worth of a business firm is frequently judged by the size of its catalog, and it has not been uncommon in the electrical business for small manufacturers to resort to various kinds of "padding" in order that their catalog should make an impressive showing. I do not think, however, that this has been much of a factor in the troubles of which the jobbers complain. The large manufacturers have been the offenders (if it is an offence) by being willing to manufacture almost anything that a good customer asked for, and once having made the investment in development expense, dies and tools, the best procedure has seemed to be to catalog the article, as about the only way of finding out whether or not any one else had a use for it.

Demand of Progress

It is a difficult question, also, to decide how much of a brake can be put on the development of new devices and yet not hamper the progress of the industry. New requirements are constantly developing, and it would be most unfortunate if there were not a receptive attitude on the part of manufacturers to suggestions as to new devices with which these new requirements could be met. Take as an example the matter of candle sockets. Ten years ago they were unknown. Today they are made in both the keyless and pull varieties, and the annual sales run into the hundreds of thousands. Yet they had their origin in the suggestion of one fixture manufacturer who wanted to do a better job than could be done with the devices which were previously available. I do not know of any other practical procedure. Wiring devices die from various causes, some of old age, some in infancy, and some are "still born." The only question to be decided is, how long, after life is extinct, shall a device be cataloged in the expectation of a second reincarnation.

F. V. BURTON

"Patent" Catalog

Possibly the "patent" catalog has something to do with aggravating the situation. The composition for the pages for these catalogs is paid for by the manufacturer, and he, being unwilling to admit that there are any unworthy articles in his line, pays the catalog builder for making plates that cover everything he manufactures. I have sometimes thought that it might be a help to every one concerned if the jobber would catalog only the things which he carries in stock and let the promotion of new articles be accomplished by means of the manufacturers' catalogs.

Preferential Prices

A condition which may have more to do than anything else in settling this question is the policy adopted by many manufacturers within the past year of quoting preferential prices on a limited number of the most active sellers. Take, for instance, the matter of fuseless and fusible rosettes to which Mr. Sargent refers in his recent article. Formerly these sold to the jobber at a difference of only about half a cent apiece. Today the difference is almost 6 cents. A similar situation exists regarding two porcelain receptacles listed by ourselves and most manufacturers as No. 50715 and No. 9402. These formerly sold at the same price. Today the former sells at practically half the price of the latter. When this policy has operated for a little longer time, many manufacturers will discover that there is no longer any demand for a device which once upon a time constituted an important link in their line of material.

In other words, there are a limited number of devices that can be looked upon as being commodities. The reason that some cognate device is demanded is usually that in some way it saves money to the person who is going to use it. It is therefore for the purchaser to decide whether or not the saving exceeds the additional amount asked for the device. If enough people feel that it does, that device will probably some day or other become a commodity.

The problem, therefore, is not a simple one. But it is one which demands and should receive attention and constructive help from all the parties to the distribution of electrical goods.

Excess varieties add expense and are not needed. Who should take the initiative in elimination?

The Jobber and His Future

The Five Fundamental Principles Upon Which the Electrical Wholesaler Must Develop His Business

By Frank S. Price
President Pettingell-Andrews Company, Boston

THE electrical jobber established himself in the electrical field as soon as the opportunity presented itself for the same reasons and in the same manner as wholesalers and jobbers established themselves many years ago in other lines of trade. He came into existence about thirty-five years ago when individuals began to anticipate demand and became willing to order in large lots from the manufacturer and render real service to the trade.

The jobber has continued to conduct a successful busines up to the present time. The last few years, however, have brought about many changes, such, for instance, as the increase in the number of electrical manufacturers as well as of manufacturers of other lines going into the production of electrical material. The jobbers have also increased in number proportionately. This rapid growth, constant change and other factors in the electrical industry have made it difficult for any branch to establish definite policies or policies which could remain permanent for any length of time.

Competition in the Trade

The jobber has naturally and of necessity been very aggressive in endeavoring to take advantage of every opportunity to increase his business and profits. The manufacturers, owing largely to the lack of well-established and proved trade policies, have recognized local dealers as jobbers. Many of these so-called jobbers, having little or no capital, are unable to carry an adequate stock, but solicit orders on a price basis to be shipped direct from factory. Obviously they do not function as jobbers. This practice has been particularly noticeable among the more recent manufacturers in the electrical field, some of whom are offering on staple lines what is properly termed "plunder merchandise." In fact, both jobbers and manufacturers have ignored certain points of ethics which are respected in other trades.

Competition is, therefore, very keen, and probably will be for some time to come, and the future success of the electrical supply jobber will depend more and more on his ability to conduct his business on strictly economical lines. Some jobbers who are conducting their business along the lines of the opportunist, and who depend largely upon speculative opportunities which offer only an immediate profit or advantage, will find it difficult to show a proper return on their investment. But we must expect always to have with us in some form the type of jobber who operates as a "pirate merchandiser."

Principles That Control

The future of the electrical jobber holds the greatest possibilities, but only for that jobber who conducts his business upon sound, scientific principles, developing his business by a thorough knowledge of up-to-date methods of merchandising and with a broad vision of future possibilities. The most important of these fundamental or what have been termed scientific, principles may be included under these five headings:

1. *Permanent Relations with Manufacturers.*—I mean by this that if the jobber can perform the service of distributing at a cost lower than the manufacturer, the manufacturer must of necessity recognize this fact and shape his policies so that the jobber shall receive ample and sufficient recognition. It is with such manufacturers that the jobber should establish permanent relations.

2. *Territory.*—The territory that a jobber should cover is that territory contiguous to his place of business which he can economically serve, on a sound basis, the factors of economy for comparison being:

(a) Transportation rates from warehouses to customer and the time element.
(b) Proximity to customer which would enable the distributor to obtain maximum results from minimum sales expense.
(c) The distributor's possibilities of handling credit and collections to the best advantage and with minimum expense.

In other words, it is that territory in which he will not be obliged to adopt practices which are not altogether sound.

3. *Merchandise Stocks.*—It is important to have a carefully selected and complete stock of merchandise based on the demands of the territory. The maximum number of turnovers possible should be obtained on a jobber's warehouse stock, in order to enable him to function economically. A careful analysis should be made of the number of turnovers of each commodity.

We must not overlook the fact that there are times when we must carry slow-moving stocks which may cover new lines on which we are building up a future demand and on which we cannot obtain a fast turnover until the demand is created. There will also be found some articles which a jobber must stock for which there is an infrequent demand. But such articles are a necessity in order that the customer may be accommodated.

When discussing the question of compensation with a manufacturer the number of turnovers on a particular commodity should be taken into consideration.

4. *Accounting and Cost System.*—The jobber must support his business with an accurate and adequate accounting system. The Electrical Supply Jobbers' Association devised and adopted a uniform accounting system in December, 1918, which was revised in September, 1919, and is fully covered by Information Bulletin No. 303. This system is the best available.

5. *The Administrative Features in Regard to Shaping Sales.*—This is the fifth and last heading selected, but perhaps the most important, and it surely holds forth the greatest possibilities for successful endeavor. This is particularly true because sound thinking leads us to believe that we are now at the beginning of an era of progressive expansion of electric service for the home office and factory.

A careful and scientific analysis should be made of the demand for electrical merchandise in the territory in which the jobber operates. An analysis should be made showing the demand of each class of buyers, such as dealers, contractors, industrial plants and central stations; also an analysis showing the demand for each commodity. In the case of a new device an analysis of the territory may be made based on the demand of prospective customers, and we should assist the manufacturer of such devices to create a demand.

The opportunities for sales exploitation of household conveniences or standard illuminating units offer one of the greatest fields of endeavor for the jobber. We must bear in mind, however, that with the introduction of a new device there is a sales exploitation expense that is not required on staple lines. The compensation allowed by the manufacturer as a rule does not include this expense, but somebody must meet it, and it should be definitely settled before engaging in such a practice that the expense must be met either directly by the manufacturer or indirectly by the manufacturer through the jobber. If the manufacturer will consider the creation of the new demand his problem, let him do the work. If the manufacturer expects the jobber to create the demand, then the jobber should receive a further compensation commensurate with the sales effort.

Whose Responsibility?

The jobber should be paid for handling the entire distributing function on all regular goods, and therefore should make all shipments from his warehouse except in such wholsale quantities as can be more economically handled by shipping direct from the factory. We should not attempt to handle merchandise where it is proved that the manufacturer can distribute more economically direct or through other channels. We should give careful consideration to lines which we are handling today that may be questionable and without prejudice endeavor to establish the most economical method of distributing them.

Chicago Motor Trade Reported Brisk

The July motor business for Chicago and the Middle West, according to reports from five manufacturers, have been very encouraging. One firm states that July was their best month for more than a year. Another concern says that their July sales have equaled those of May and June, two months which were very active. The sale of motors under 20 hp. is continuing steadily and the larger sizes are moving better than previously. All the companies are unanimous in reporting that the motor market has seen a decided change over the slow trade of the past year and a half. Most of this equipment is well distributed, and manufacturers state that orders and inquiries are arriving from many sources. The industrials are buying consistently, planning either for further power extension or replacements of old equipment.

Britain Is Now Canada's Best Customer

The United States, which in the fiscal year ended June 30, 1921, was Canada's best customer by a wide margin, has been displaced by Great Britain, it was disclosed when the books were balanced on June 30 of this year.

During the first period Canada's exports to the United States totaled $502,000,000 and those to the United Kingdom $307,000,000.

In the year covered by the latest report, Great Britain, with purchases amounting to $301,838,000, won first place from the United States, which shipped only $295,398,000.

English Radio Broadcasting Conditions Are Uncertain

There is still much uncertainty regarding the conditions under which wireless broadcasting will be carried out in England, according to the electrical division of the Department of Commerce.

Differences have arisen between manufacturers and the Postmaster General, and conferences are now being held, attended by representatives of between forty and fifty firms, including those which have applied for licenses to broadcast. The vital question is as to the erection of broadcasting stations, one group wishing to have the construction of all of them handled by one organization, and the other, composed of smaller manufacturers, opposing this plan, which they characterize monopolistic.

The scheme as outlined calls for eight stations, which are expected to cost approximately £20,000 each. In connection with the cost of the broadcasting program it has been suggested that the government's "listening-in" license fee be increased and that the additional sum thereby obtained be placed in a common fund out of which the program would be provided. At present it is proposed to charge for registration of receiving sets.

Industrial Electric Trucks in Better Demand

After a long period of dull business, a healthier demand for industrial electric trucks and tractors is taking shape, and the outlook for the remainder of the year is more than hopeful.

The resumption of production on a substantial scale by large manufacturing plants in many industries has resulted in the putting into service of internal transportation equipment which in not a few cases has been but partly used since the close of the post-war boom. The pressure upon factory managers to reduce unit costs is leading to more inquiries as to the applicability of trucks and tractors in labor and time-saving tasks. Some of the older units of equipment also have approached the point where replacement is worth considering, and the demonstration by manufacturers' engineers that trucks can be economically justified in much smaller plants than used to be the case is helping this business. Some difficulty is being encountered at present in the supply of steel for truck and tractor frames, but this is believed to be only temporary.

Prices on several well-known makes have been substantially reduced from the war-time levels, and a better understanding of the limitations and use of such equipment is helping to establish a much more stable market for this important electrical accessory.

Business Restrained, Declare Reviews

Business recovery has unmistakably been restrained in the last week by existing strike conditions, according to weekly reviews. Since the issuance of the order giving priority to food and fuel shipments, and the additional pressure brought to bear by national and state officials to end strikes a little more confidence has developed in trade circles.

Dun's Review says: "Although this is normally the quietest period of the year, the prevailing drawbacks tend to accentuate the summer abatement of activities and to prompt a waiting policy in different quarters. Without strikes to impede the movement, an extension of the general business expansion, allowing for seasonal fluctuations, would be witnessed."

Bradstreet's says: "The railroad and coal strikes, involving the idleness of nearly 1,000,000 men, continue the big overshadowing features of industry and trade. The dwindling of supplies of fuel and the congestion of shipments of other materials proceeding therefrom have made for a slowing down of the industrial pace."

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Loading of Freight Totaled 860,907 Cars

Loading of revenue freight totaled 860,907 cars during the week which ended on July 15, compared with 718,319 cars during the preceding week, which included a holiday, or an increase of 142,588 cars, according to reports just received from the railroads of the country by the American Railway Association. This was practically the same number of cars as were loaded during the week of June 17 last and was an increase of 86,023 cars over the corresponding week last year.

Reports just filed by the railroads of the country showed 405,120 freight cars to be idle because of business conditions on July 8, compared with 405,185 on July 1, or a reduction of sixty-five cars.

Of the total, 239,160 were surplus freight cars—that is, cars in good repair in excess of current freight requirements—while the remaining 165,960 were freight cars in bad order in excess of the normal number unfit for service.

Surplus coal cars totaled 146,743 cars, a reduction within a week of 815, but surplus box cars amounted to 61,067, or an increase of 966 cars within the same period. Surplus coke cars totaled 3,816, a reduction since July 1 of 129, but an increase within that time of 164 was reported for stock cars, which totaled 12,016.

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Platinum Advances $3 an Ounce

Platinum has advanced again, this time $3 an ounce. The rise puts the quotation for the so-called soft metal at $93 an ounce, for the medium metal at $98 an ounce, and for the hard at $103 an ounce. The medium and hard metals contain 5 and 10 per cent of iridium, respectively, for hardening purposes. Iridium itself is now priced at $185 an ounce.

New England Collections Are Fair

Differences among jobbers' views as to locations are apparent in this district as August opens, but on the whole nothing alarming is reported as to conditions. A fair average is from fifty-five to eighty days. Electrical contractors of the smaller ratings are giving the most trouble. Some houses find things tighter because of labor troubles in the textile, coal and railroad fields. Others report that they are well rewarded by constant study of and work upon outstanding accounts. Public utility and railroad buying has improved, and the outlook is good, barring a protracted fuel strike.

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Brass Company Announces Higher Prices

The American Brass Company has announced an advance on finished brass products ranging from ⅜ cent to ½ cent per pound, with the exception of high brass rods which were advanced 1 cent per pound. Brazed copper tubing is unchanged, but commercial bronzed tubing is advanced ⅜ cent.

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Fourteenth Electrical Census Issued

The Department of Commerce in a bulletin just published gives in part the following information concerning the electrical industry as gathered in the fourteenth census of manufacturers:

"Statistics for incandescent lamps for 1919, 1914, and 1909 show an increase in value over that for 1914 of $40,296,515, or 232.3 per cent. The tungsten type formed 80.9 per cent of the value of all incandescent lamps manufactured in 1919 and 68.5 per cent in 1914. The gem type was included with vacuum and vapor lamps to avoid a disclosure of individual operations.

"Production of telegraph instruments and apparatus in 1919, 1914, and 1909. The first and third groups show, for the period 1914 to 1919, increases in value of 1,211.9 per cent and 1,065.9 per cent, respectively. The figures for radio and wireless do not represent the magnitude of the installations, as they cover only the instruments and appliances turned out by the factories during the census years."

"Telephone apparatus for 1919, 1914, and 1909: The aggregate value of all telephone apparatus, parts, and supplies produced in 1919 shows an increase of $23,398,702, or 102.6 per cent, over that reported for 1914. Private branch exchange switchboards in 1919 show a value of $2,287,122, as compared with $448,203 in 1914, an increase of 410.3 per cent. For the same period the value of automatic switchboards increased 331.6 per cent."

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Metal Market Situation

No copper for domestic shipment is obtainable under the price of 14 cents delivered. Moderate inquiry is making the rounds, and a fair amount of metal is being sold considering domestic conditions. It is said that the output of Lake copper will be greatly restricted unless coal is taken into the districts quickly, as stocks at some of the most important mines and smelters are quite low.

Operating costs at the mines show a rising tendency as the result of advancing prices for materials and supplies. Shortage of experienced mining labor tends toward higher wage scale.

Foreigners do not take kindly to the Copper Export Association's method of doing its own merchandising abroad. The London traders would like a monopoly of this business. But the Export Association has established its own branches and proposes to do business with foreign consumers direct.

Copper mines of this country are today producing 60 per cent of the world's supply, while our refineries are producing 80 per cent, so that it is little wonder that the American producing industry is determined to control the merchandising of its product.

NEW YORK METAL MARKET PRICES

Copper	July 27, 1922	Aug. 2, 1922
London, standard spot	£ s. d. 63 2 6	£ s d 63 2 6
	Cents per Pound	Cents per Pound
Prime Lake	14 00	14.00–14 25
Electrolytic	13 87½	14 00
Casting	13.35	13.45
Lead, Am. S. & R. price	5 75	5 75
Antimony	5 25	5 25
Nickel, ingot	36 00	36 00
Zinc, spot	6 25	6 60
Tin, Straits	32 25	32.25
Aluminum, 98 to 99 per cent	19 10	19.10
OLD METALS		
Heavy copper and wire	10 50–11 00	10.50–11 00
Brass, heavy	5 50– 6 00	5 75– 6 12½
Brass, light	5 00– 5 12	5 25– 5 37½
Lead, heavy	4 62½–4 65½	4 62½–4 75
Zinc, old scrap	2 87½–3 00	2.87½–3 12½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

DEMAND for electrical material in all parts of the country continues fair, manufacturers and jobbers reporting good stocks for most lines. In New England dealers report that radio apparatus is creating greater interest after the serious lull of the summer months. Second-hand dealers are not bothering motor dealers as previously and stocks are good. Central stations are placing many miles of new line in order to take care of the recent heavy construction of homes. Greater demand for lamps is noted. Better grades of fixtures are moving well.

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New York

Conduit Sales Continue Brisk—Rubber-Covered Wire Demand Fair—Appliances Selling Well

Sales of electrical materials are more active this week than for the week before, jobbers in this section report. During the earlier part of the week fan sales were numerous, but their number fell during the few days of rain and colder weather. Rigid-conduit demand remains brisk despite the increase in price of July 24. Appliance demand remains steady and better than a year ago. Industrial business is good.

Conduit.—Demand continues brisk and stocks of smaller sizes are low.

Rubber-Covered Wire. — Prices are steady and demand is fair.

Lighting fixtures.—The better quality fixtures are in greater demand than last month.

Appliances. — Washers and cleaners are selling better than for many months past.

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Chicago

Brisk Market for High-Tension Equipment—Motor Sales Active—Conduit Advances

Electrical trade for July maintained a fairly high level regardless of the usual summer tendency for a trade slump. Although this business curve from individual dealers contained peaks and valleys, the summation of all the trade curves would vary but little. The motor business is continuing its steady rate started during the spring.

High-tension manufacturers are unanimous in reporting a brisk business. The call for wiring materials continues. Manufacturers' card No. 52 came out July 24 increasing the price of conduit about 6 per cent. Safety switches are selling well since most of the new installations require this type of service switch.

Wire.—Current demand for rubber-covered No. 14 wire has varied but slightly since this material is required in the building industry. Prices still range around $6.25 per 1,000 ft. in 5,000-ft. lots. Stocks are good. The call for bare or weatherproof wire is unaltered, and prices vary from 16¾ to 17 cents per pound.

Conduit.—Jobbers reports indicate that stocks on the ½-in. conduit are still low. Shipments from manufacturers have not improved, owing to the various strikes. Card No. 52 went into effect July 24, thereby making the ½-in. black sell around $47 per 1,000 ft. in 5,000-ft. lots. Stocks of the larger sizes are in better condition. Demand is still active.

Flexible Armored Conductor.—This material is moving steadily at $43 per 1,000 ft. for the No. 14 two-wire, single-strip conductor. Stocks are ample.

High-Tension Equipment.—Sales by one manufacturer have been made for three 44,000-volt, 900-kva. steel-tower substations for the Northwest, one 66,000-volt, 3,000-kva., substation and one 66,000-volt, 600-kva. substation, both for the East. Another firm filled an order for 6,600-volt disconnecting switches and indoor busbar supports for a utility in New England. Shipments of lighting arresters, cut-outs and high-tension fuses were made by one manufacturer to California.

Motors.—Reports from five manufacturers indicate that the July sales will be equal to those of June, an active month. In some instances the sales curve has risen. Most of these sales have been for motors averaging under 15 hp., although some motors ranging up to 100 hp. have been sold. These motors are well distributed in industrial plants for replacements and also for further power extensions. Stocks of dealers are in good condition and prices are steady.

Transformers.—The call for distribution transformers has been steady but with few pronounced changes. Prices are firm and shipments have been timely.

Safety Switches.—Demand for this switch is good. A few dealers report sales on the large 600-amp. size for power installations. However, the standard 30-amp. switch is creating the greatest volume of trade.

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Boston

Activity Reported in Radio—Loom Sales Better—Loom Purchases in Fair Quantities

Vigorous buying marked the beginning of the week after a rather spotty week end. Electrical manufacturers in Massachusetts and Connecticut are busier, and conditions are improving in most industries. Building contracts totaled $8,080,000 last week in New England, surpassing twenty years' record for the period. Deliveries are good on the whole, but some uncertainty exists in connection with steel products owing to labor troubles. Prices tend to harden in rigid conduit, flexible-armored conductor and pull sockets. Stocks are in excellent shape to meet increased demands. Dealer buying of radio equipment has taken a sharp upward spurt. Appliances are dull.

Radio Equipment.—Increased activity in purchasing is noted among dealers. Plans are being laid for a heavy fall business. Gaps in jobbers' stocks are being closed, and a huge wave of popular buying is expected in a few weeks.

Wire.—Rubber-covered wire moves at $6 to $6.25 per 1,000 ft. in 5,000 ft. lots. Sales are more active, owing to building booms. Better buying of waterproof is in sight. Bare is dull.

Rigid Conduit.—New quotations are out, marking advances in some fittings and stiffer pipe charges. One-half-in. galvanized, in less than 500 lb. lots, is quoted at $66.99 per 1,000 ft., and at $61.38 for black. Elbows in this size are practically unchanged from last week in either black or galvanized. Coupling are up, ½-in. galvanized being quoted at $6.37 and $5.79 according to quantity, and black couplings are $5.91 and $5.37 per 100.

Loom.—Northern New England continues to purchase this material in fair quantities. Dissatisfaction exists among jobbers and manufacturers as to current prices.

Flexible Armored Conductor.—Prices reflect sharp competition and deliveries showed some uneasiness Monday. Single strip No. 14, in 2,500-ft. lots, is quoted at $43.20 per 1,000 ft.

Motors.—Pick-up business dominates the market. Used motors no longer are causing manufacturers and distributors much anxiety. Production is far below the resources of present organizations, but better than a few months ago.

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St. Louis

Impetus to Fan Sales Noted—Fuses Market Improving—Wire Demand Slackening

Except for fans and large power equipment, virtually all lines are showing decreased activity, attributed to hot weather and vacations. Industrial business is increasingly active, and considerable interest is being manifested in industrial heating equipment. Purchases by railroads are necessarily restricted except for motors and other equipment for use in roundhouses and shops where stationary engineers and firemen are on strike. Deliveries of material for stock are becoming more difficult.

The purchasing power of agricultural districts is substantially improved. Missouri's shipment of strawberries this year was four times that of 1921; corn and cotton show material improvement since July 1, and receipts of live stock and prices for it are better than last year. The coal situation is hampering industries.

Conduit.—Prices have been raised the second time in about three weeks, the last increase being three points. Demand showed some decline this week.

Fans.—Continuous hot weather is giving a late-season impetus to sales, especially in the smaller sizes of oscillators. This demand is being used to decrease stocks, and if it continues there will be a small carry-over to next year.

Dry Cells.—Little variation is experienced from week to week in demand or supply, business being generally good. The regulator sells for $30.86 per 100 and the igniter for $31.86 per 100, both in barrel lots. The four-cell battery is quoted at $1.70 each in lots of 24.

Fuses.—Increased industrial activity is improving sales, which are about 10 per cent better than last month. Following are representative prices on 250-volt non-renewable, cartridge-type, in standard-package lots, per 100: 0-amp. to 30-amp., $4.60; 35-amp. to 60-amp., $6.90; 65-amp. to 100-amp., $20.70; 110-amp. to 200-amp., $46; 225-amp. to 400-amp., $82.80; 450-amp. to 600-amp., $126.50. Prices on renewable fuses, in lots of 100, are, per 100: 0-amp. to 30-amp., $29; 31-amp to 60-amp., $58; 61-amp. to 100-amp., $116; 101-amp to 200-amp., $232. In the same sizes fuse links are quoted at $1.74 per 100, $2.90 per 100, $5.80 per 100 and $8.70 per 100, respectively.

Wire.—Some slackening in demand for the week is found, permitting building up of slightly better stocks. Prices are unchanged, rubber-covered being sold at the following prices per 1,000 ft. in 1,000-ft. lots: No. 14, $6.25; No. 12, $9.75; No. 10, $12.50. The base on bare and weatherproof is quoted at 17 cents per pound.

Sewing Machines.—Demand for machines is extremely slow and that for motors is but little better. Stocks are low, but turn-over is very small.

Radio.—Greater satisfaction in receiving, due to the installation of a very powerful local broadcasting station, has increased interest, tending to offset the summer slump. Stocks are still low but materially better than in the spring.

Atlanta

Armored Conductor Movement Good—Brisk Demand for Conduit Continues—Lightning Arresters Slow

There has been no marked change in general conditions in the Southeast in the past week. All lines of trade are active and little anxiety is felt over the rail and coal strikes, though electrical jobbers anticipate an increase in the price of articles containing steel, because of the shortage of coke. Electrical jobbers report the outlook bright, with seasonal lines going excellently, lightning arresters excepted.

Farm-Lighting Outfits.—Jobbers report only a fair movement in this line at present, though many inquiries are received and orders are expected to materialize as soon as fall crops are harvested. Stocks and shipments are satisfactory.

Armored Conductor.—The movement in this line continues very good. Stocks, which a few weeks ago were low, have been brought up to normal, and no recent price changes are reported. Shipments are only fair.

Conduit.—A brisk demand for this item continues, despite a three-point advance in price. Stocks are very much improved over the condition several weeks ago, but shipments are not all that could be desired.

Meters.—The predicted midsummer increase in the activity of this line has not yet materialized, though it should shortly. Local stocks are reported only fair, but shipments are good.

"White Way" Lighting Equipment.—Interest in this line continues, quite a few sales being reported, and all jobbers are in receipt of an increasing number of inquiries. No recent price changes recorded and shipments are only fair.

Lightning Arresters.—The movement of this item this season has not come up to jobbers' expectations, and as a result good stocks are on hand throughout the section.

Salt Lake City–Denver

Record Fan Sales—Merchants Dissatisfied with Radio Market—Wiring Prices Are Lower

The peak of the hot-weather season is passed with indications of a good record in fan sales for 1922. The increase over the early months of the 1921 season is marked. Retail prices show a general reduction of about 20 per cent. The sizes most in demand are 12-in. and 16-in. Sales for commercial and home use stand about even.

Some merchants express dissatisfaction at the status of the radio market. They report many disappointed users and attribute the condition to the wide publicity that has been given to amateur construction. The market is unstable, the wide range of prices on sets resulting in a condition that borders on chaos.

Wiring materials for cottages are in much better demand. Cost of labor is slightly higher than a year ago, but prices are lower. Contracts are now being taken on a schedule that is 15 to 20 per cent lower than a year ago. The wire market itself is a little firmer.

Preparations for electrical demonstration schools are being promoted jointly by newspapers and merchants. Crop conditions are generally good in the Inter-mountain country. Damaging interruptions in fruit shipments are reported as being due to the railroad strike. Coal production is running far ahead of local demand, the surplus finding a good market East and West.

Portland–Seattle

Central Stations More Active in High-Tension Line Work—Prices Are Steady

Lumber production has reached normal again. New business is 8 per cent below production and shipments continue excellent.

Although grain and dairy production is somewhat reduced, it is felt that the situation of the public in general is better than a year ago. The coal strike has affected the mines in western Washington very little.

The employment situation is very materially improved, and skilled labor in many lines is difficult to obtain. Three major industries—lumber, agriculture and building—are making heavy demands upon labor at this time. The number of unemployed is far below what it was a year ago, in spite of the strike situation.

Electrical jobbers report business to be in good condition and better than a year ago. Demand for line construction material and building material is very active.

The warmer weather of the past week has had a quickening influence on fan sales, which had been experiencing a lull. Prices in all lines continue stable.

Central stations in the Northwest are more active in high-tension line construction work and power development this summer than for several years past.

Dry Cells.—No. 6, regular, are quoted at $35.50 per 100 in barrel lots of 125, and ignition cells at $36.50 per 100.

Tape.—Friction tape is quoted at $20.90 per 100 in ½-lb. rolls in quantities of fifty rolls, and rubber-covered at $19.30 per 100 rolls.

Fuses.—Edison plug fuses are quoted at $2.90 per 100 in lots of 500.

San Francisco

Many New Lighting Jobs Reported—Motor Stock in Good Shape—Cleaners Slow

Parks are being built in northern California which are a new and prolific source for lighting and power business. California leads in ratio of automobiles to population, averaging one machine to six people.

Street Lighting.—Many new jobs are reported in smaller interior cities. Jobs average about $20,000 of material.

Motors.—One factory making a "best-selling" home motor has recently put three field men in the northern California district to demonstrate the complete outfit. Local stocks are in good shape.

Radio.—Despite a sharp decrease in business, practically no repudiation of outstanding orders is reported.

Appliances.—Especial attention will be given merchandising at contractors' convention. There is a slight drop in the washer market. Vacuum cleaners are rather slow.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Hart & Hegeman to Enlarge Plant

The Hart & Hegeman Manufacturing Company, Hartford, Conn., will shortly let the contract for the construction of a reinforced-concrete factory building at its plant. It will be four-stories high, 180 ft. x 55 ft., and of firepoof construction throughout. Greenwood & Noerr, 847 Main Street, Hartford, are the architects and engineers.

Packard Electric Company Moves Its Chicago Office

The Packard Electric Company announces the removal of its Chicago office to 420 Wrigley Building and the addition to its sales force of Charles E. Drobnyk, who will assist Fred B. Duncan, manager of the Chicago district office. Mr. Drobnyk will interest himself in the sale of both transformers and automotive cable.

Torrington Company Transfers Cleaner Plant

The Torrington Company, Torrington, Conn., announces that it will in the future manufacture the company's make of vacuum cleaners at the "Standard" plant in Torrington. A six-story building will be used for that purpose. These cleaners were formerly manufactured in the Worcester (Mass.) plant of the company, which was closed early in July.

Charles H. Tenney & Company Move to Larger Quarters

Expansion of business has necessitated the relocation of Charles H. Tenney & Company, Boston, effective Aug. 1, at 200 Devonshire Street, where the organization will occupy quarters about 50 per cent larger than its former offices at 201 Devonshire Street. The entire ninth floor will be leased, and the financial, engineering and management branches of the organization will be more closely co-ordinated as a result of the change.

General Electric Company Business Improving

Business at the General Electric Company's plant continues to improve, and it is believed that by late fall the normal number of employees, about 18,000, will be on the payroll. About 15,000 employees are now working.

Radio apparatus is being manufactured on an extensive scale, and the plant has many orders to fill. Several small orders for regular electrical work have been received. A good share of the electrical work on contract recently closed by the General Electric Company for building and installing electrical equipment for the power station to be built at Crescent Dam, N. Y., will be done at the Schenectady plant.

New Quarters for Harry M. Hope Engineering Company

The Harry M. Hope Engineering Company has moved its offices from 185 Devonshire Street to 230 Boylston Street, Boston, occupying the entire seventh floor of the Bradbury Building. The new quarters of the company include about double the floor area of the former offices.

Crescentville Storage Battery Plant Receives Shipment

According to schedule the first shipment of metal for batteries in carload lots has arrived at the Crescentville plant of the Electric Storage Battery Company, Philadelphia. Two of the plate departments have started to get into shape to relieve the Allegheny Avenue factory, which is working at more than full capacity.

Habirshaw Cable Plants Shipped $820,000 Material in June

Thomas C. Perkins, chairman of the stockholders' protective committee of the Habirshaw Electric Cable Company, reports that the plants of this company at both Yonkers, N. Y., and Bridgeport, Conn., are now operating on full time. Shipments during the month of June amounted to $820,000, while incoming orders for the same month amounted to approximately $1,200,000. Total orders booked ahead amount to over $2,500,000. Figured on the basis of tonnage, the present business being done by the company is the largest in its history.

Cowan Truck Agencies Increased in Number

New agencies of the Cowan Truck Company, Holyoke, Mass., have recently been established at Philadelphia, Buffalo and Minneapolis. In the first-named city the Foster Manufacturing & Supply Company, Twentieth and Venango Streets, will represent the company in parts of Pennsylvania, Delaware and New Jersey. The Minneapolis Equipment Company, Builders' Exchange, Minneapolis, will cover the State of Minnesota, and Lewis P. Holladay, Jr., 411 Liberty Building, Buffalo, N. Y., will distribute this concern's products in western New York and Erie County, Pa.

General Railway Signal Company Receives Japanese Order

The Takata Exporting Company has placed an order with the General Railway Signal Company for 270 automatic signals to be used on the imperial government railways of Japan. The order covers equipment of the latest design and includes all auxiliary equipment, such as relays, transformers, etc., required for installation. Seventy long-range, three-indication, color-light signals are to be shipped to Kobe and 200 upper-left-hand quadrant, three-position semaphore signals are to be shipped to Yokohama.

This order, following as it does an order placed with the same company last year for 370 automatic signals, seems to indicate that substantial operating improvements are being made in the railways of Japan.

Johns-Pratt Sales Appointments Include Well-Known Men

Coincident with the establishment by the Johns-Pratt Company, Hartford, Conn., of its own sales organization, offices have been opened by the company at 41 East Forty-second Street, New York City; 35 South Desplaines Street, Chicago; 530 Call Building, San Francisco, and 161 Summer Street, Boston. Robert Charles Cole has been appointed sales manager of the electrical department, with headquarters at Hartford, Conn. George V. W. Ingham has been made Eastern sales manager and George W. Mapother, district sales manager, with offices in New York. Messrs. Fitts and Morse, of Fitts-Morse, Inc., will represent the company in New England, with the opening of the Boston office. George A. Saylor has been appointed Western sales manager with headquarters in Chicago, and A. T. Moan has been made Pacific Coast representative.

Western Electric Sales Show Fair Gain

Speaking of the improvement in sales for the first six months of 1922, C. G. Du Bois, president of the Western Electric Company, said:

"During the six months just ended our billings amounted to $99,500,000, or 7 per cent more than for the same months of last year. From past experience we estimate that total sales for 1922 will be only slightly less than the $206,000,000, the high-water mark of 1920.

"Notwithstanding this increasing business, the company was able to reduce its current bills payable by about $15,000,000 during the six months.

"Since April 1 over $6,000,000 of the 7 per cent bonds have been converted into 7 per cent preferred stock by the holders, and the company now has some 1,800 preferred stockholders, located in nearly every State of the Union. Of these stockholders about 800 are employees."

E. W. Ham Electric Company Buys New Home

The E. W. Ham Electric Company, Worcester, Mass., has purchased a concrete, brick and steel building with about 16,000 sq.ft. of floor area on Burnside Court, Worcester, and will soon move its offices and warehouse into the new location.

◆

Seek to Restrain Radio Company By Court Order

A series of wireless patent suits and counter-suits have been started in the Supreme Court, New York, against the Wireless Specialty Apparatus Company, for an injunction restraining continuance of the publication of a series of "patent warning" advertisements which have recently appeared in the technical and trade press throughout the country.

The suit is being watched with considerable interest by wireless interests, including hundreds of radio apparatus manufacturers and radio dealers throughout the country, who will be guided by court decision as to their rights in regard to the alleged patent infringements contained in the "warning" advertisements.

The suit is being prosecuted by the Freed Eisemann Radio Corporation, 255 Fourth Avenue, supported by a group of radio apparatus manufacturers known as the "Independent Radio Manufacturers, Inc."

At the office of the attorneys for the plaintiffs it was learned that the basis of the suit is the alleged injury and damage to the reputations and business of these radio manufacturers through the "warning" advertisements inserted in the newspapers and magazines by the Wireless Specialty Apparatus Company.

These advertisements, it is stated, were addressed to radio dealers and listed twenty-one separate patents alleged to be the exclusive property of the dependents. Dealers were warned to insist upon receiving written guarantees from the manufacturers selling them the apparatus, which guarantees were to hold them free from all financial losses by way of damages in case of prosecution for infringements of patents listed.

◆

C. Brandes, Inc., New York City, manufacturer of radio headsets, announces establishment of a Canadian factory at Ottawa.

The Manchester Electric Company, Manchester, Conn., has begun the erection of a transformer house on New Street, Manchester.

The Beard & Stone Electric Company, Inc., is a firm recently organized in Waco, Tex., which will deal in all kinds of electrical wares and merchandise. The company is capitalized at $30,000, and the incorporators are E. C. Beard, C. A. Stone and J. R. Davis.

The Metropolitan Manufacturing Company, 443 South Dearborn Street, Chicago, has been incorporated for general manufacturing of cooking and lighting and mechanical devices at a capitalization of $50,000 by Michael J. Breen, Damase H. Moran, Ludger D. Bergeron, William E. Dickson and Alphonse L. Caron.

The McClave-Brooks Company, manufacturer of McClave stokers, grates and steam blowers, announces that the Pittsburgh office, 1623 Oliver Building, will be in charge of A. F. Duemler, former assistant manager of the Philadelphia office. George Blair, Jr., who has been temporarily in charge of both offices, will continue in charge of the Philadelphia branch. The company also announces that it has appointed Joseph B. Nores, 834 Connel Building, Scranton, Pa., to represent it in the anthracite field in eastern Pennsylvania.

Westinghouse Sales Managers Hold Annual Meeting

In accordance with the custom of the company, the annual meeting of the sales managers of the Westinghouse Electric & Manufacturing Company was held recently at Lakewood, N. J.

The sales managers, including the managers of all departments of the company and managers of the various district offices, are the powers behind the large sales organization of the Westinghouse company and their decisions have much to do with the sales policies.

Many important actions were taken by the sales managers at their five-day meeting recently, which was presided over by H. D. Shute, vice-president of the company in charge of sales.

The accompanying photograph shows the managers just after the close of a business session.

Front row, left to right—J. A. Brett, manager, Cincinnati; H. F. Baetz, treasurer; H. D. Shute, vice-president in charge of sales; W. H. Whiteside, sales representative on the Pacific Coast; J. C. McQuiston, manager of the department of publicity.

Second row—G. H. Cox, manager, Boston; A. A. Brown, manager of syndicate operations; D. D. Faris, assistant manager of marine department; N. G. Symonds, manager, Chicago; W. K. Dunlap, vice-president.

Third row—C. C. Owens, manager, Detroit; H. A. Coles, manager, Atlanta; H. M. Southgate, manager, Washington; J. McA. Duncan, manager, Pittsburgh.

Fourth row—E. H. Sniffin, manager of power department; J. M. Curtin, manager of industrial department; J. J. Gibson, assistant to vice-president.

Fifth row—W. D. McDonald, manager, Seattle; Charles Robbins, assistant to vice-president; G. B. Griffin, manager of automotive equipment department; F. A. Estep, president of R. D. Nuttall Company.

Sixth row—T. J. Pace, manager of supply department; C. E. Heise, manager, San Francisco; H. M. Bostwick, manager of sales for Canadian Westinghouse Company; H. H. Seabrook, manager, Philadelphia; R. S. Feicht, director of engineering.

Seventh row—K. E. Van Kuran, manager, Los Angeles; W. S. Rugg, assistant to vice-president.

Top row—C. W. Underwood, manager, Buffalo; C. E. Allen, manager, St. Louis; R. B. Mildon, assistant to vice-president; J. F. Johnson, large-turbine engineer; L. M. Cargo, manager, Denver; J. S. Tritle, manager of merchandising department; M. B. Lambert, manager of railway department; A. E. Allen, manager, New York.

Foreign Trade Notes

EXTENSIONS AND IMPROVEMNTS CONTEMPLATED TO THE MANILA ELECTRIC RAILWAY. — Authority has been granted the Manila (Philippine Islands) Electric Railway, according to *Commerce Reports*, to issue 20,000,000 pesos of bonds for financing improvements and extensions.

PROPOSED TELEPHONE EXTENSIONS IN FRANCE.—Under the general plan for the reorganization of the French communication system, *Commerce Reports* states, extensive improvements are contemplated to the telephone system. The draft of the proposed legislation provides for an appropriation of 1,675,000,000 francs for its reconstruction and extension. This will include the construction of 400,000 km. of telephone toll cables, designed to provide for traffic growth for years to come and to facilitate long-distance telephone service to every part of France. New automatic exchanges will be erected to replace all the older exchanges in the large cities. Automatic exchanges will be installed generally through the rural districts, and tie lines will be provided to furnish the rural exchanges with long-distance services.

A NEW POWER PROJECT AT TSINGTAU, CHINA. — The Tsing-tao Electric Power Company, according to *Commerce Reports*, has been formed with a capital stock of 12,000,000 yen, to erect a new plant at Shufang for the purpose of furnishing power to industrial enterprises to be located on reclaimed land near the "Great Harbor" at Tsing-tao and to factories at Litsun, Shufang and Tsankou. The power station is to have a capacity of 6,000 kw. with a standby plant of 3,000 kw. The enterprise, which is to be Sino-Japanese, is said to have no connection with the municipal electric light plant to be turned over to China with the Kiaochow territory.

PROPOSED EXTENSION OF ELECTRIC SERVICE TO RURAL DISTRICTS IN THE LOIRE INFERIEURE, FRANCE. —At the spring meeting of the Conseil Général (governing body) of the Department of the Loire Inférieure, *Commerce Reports* states, the question of electrifying 167 cantons of the department not already supplied with electricity by private companies was again discussed and voted upon favorably for the second time. The plan includes a high-tension main line carrying 30,000 volts, paralleled by a second main line carrying 15,000 volts. The main line, 87 miles long, together with six transforming centers for secondary distribution, is estimated at 11,365,000 francs. The cost of the secondary distribution is estimated at about 3,000,000 francs, and the annual cost to the department for interest and operation is placed at about 1,778,000 francs. The annual consumption of electricity in the territory to be supplied is estimated at about 5,400,000 kilowatt-hours. The source of electric power has not been decided, but the water-power concession of the Paris-Orléans Railroad Company in Haute Dordogne, northeast of Bordeaux, has been mentioned. The main lines in the Department of the Loire Inférieure are to remain the property of the government, but the questions of secondary distribution and operation have not been decided. A Paris company, specialist in high-tension electric construction, it is stated, have made an advantageous offer for erecting the main lines.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A mercantile firm in Italy (No. 3,004) desires to purchase and secure an agency for the sale of metal-working machines, files and twist drills, electric generators, machinery, mechanical appliances, etc.

An engineering firm in India (No. 3,019) desires to secure an agency for the sale of electrical goods, general hardware, galvanized and copper wire, etc.

TELEPHONE APPARATUS FOR BRISBANE, AUSTRALIA.—Tenders will be received at the Postmaster-General's Department, Brisbane, Australia, until Sept. 27 for furnishing telephone apparatus as per Schedule 561, including bells, condensers, induction coils, generators, extension switches, tumbler switches, telephone transformers, etc.; also until Sept. 20 for furnishing switchboard apparatus as per Schedule 559, including "calcugraphs," timing clocks, generators, indicators, lamps, telephone sets, receivers for sets, etc.

ELECTRICAL EQUIPMENT FOR HOBART, TASMANIA.—The City Council of Hobart, Tasmania, will receive tenders until Oct. 2 for a 750-kw. rotary converter and transformer and a 550-volt direct-current switchboard panel for same.

AUTOMATIC SWITCHBOARDS FOR VICTORIA, AUSTRALIA.—Tenders will be received by the Postmaster-General's Department, Melbourne, Australia, for automatic telephone switchboards for the Ascot (Victoria) exchange as per Schedule 39, and for the North Melbourne exchange as per Schedule 40.

New Apparatus and Publications

CIRCUIT BREAKERS. — The Cutter Company, Philadelphia, has issued a ninety-eight-page booklet which describes and illustrates its "I-T-E" and "U-Re-Lite" circuit breakers.

WIRELESS INSTRUCTION.—"Construction of Radio Receiving Sets" is the title of a textbook published by the Bruce Publishing Company, Milwaukee. L. Day Perry and R. O. Buck are the authors.

BUSBARS AND CONDUCTOR FITTINGS.—The Delta-Star Electric Company, 2433-2459 Fulton Street, Chicago, is distributing bulletin 38, describing its busbars and conductor fittings. This bulletin also includes an index covering the entire line of products of the company.

GENERATING UNITS. — Bulletin No. 1,122, entitled "Steam Turbines and Alternator Units," issued by the Allis-Chalmers Manufacturing Company, Milwaukee, describes its steam-turbine and generator units, non-condensing and condensing type for sugar mills, refineries, sawmills, power and manufacturing plants, etc.

RADIO SUPPLIES. — Julius Andrae & Sons Company, Broadway and Michigan Street, is distributing catalog supplement R-2-A, covering various types of receiving equipment for radio telephone and telegraph.

RADIO INSTRUMENTS. — The Jewell Electrical Instrument Company, Chicago, is distributing an eight-page leaflet covering its complete line of radio instruments.

SUCTION SWEEPER.—The Hoover Suction Sweeper Company, North Canton, Ohio, is distributing a six-page folder covering its model 961 new improved heavy-duty "Hoover" electric suction sweeper.

METERS. — Bulletin 622 issued by the Esterline-Angus Company, Indianapolis, Ind., describes its new "Utility" voltmeter for both alternating current and direct current service. Four other graphic meters are also covered in this bulletin, including electrolysis meters, speed recorder, pressure and time recorders.

WINDOW LIGHTING. — The Display Stage Lighting Company, Inc., 314 West Forty-fourth Street, New York City, is distributing a poster covering its "Baby Hercules" border light for window lighting.

METAL-COATING PROCESS.—The Metals Coating Company of America, 495 North Third Street, Philadelphia, has issued an eighteen-page pamphlet, entitled "Schoop Metal Spraying Process," describing the "Schoop" metal-coating process.

BALL BEARINGS.—"Ball Bearings for Electrical Machinery" is the title of a sixty-eight-page pamphlet published by the SKF Industries, Inc., 165 Broadway, New York City, in which it calls attention to the advantages of the use of ball bearings in electrical machinery.

New Incorporations

THE ELM CREEK POWER & LIGHT COMPANY, LTD., Elm Creek, Manitoba, Canada, has been incorporated with a capital stock of $20,000. Harry O. Fowler is director.

THE MIDDLE WISCONSIN POWER COMPANY, Madison, Wis., has been incorporated by C. W. Kernston, William J. P. Aberg and J. B. Sanborn. The company is capitalized at $25,000 and proposes to construct and operate electric light and power plants and other public utilities.

THE CLEVELAND (OKLA.) ELECTRIC COMPANY has been incorporated with a capital stock of $100,000. The incorporators are Alexander A. Boyd, Robert E. Garrettson, Michigan City, Ind., and J. B. Myers, Cleveland, Okla.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

AUGUSTA, ME. — The Central Maine Power Company is planning to issue $289,850 in capital stock, the proceeds to be used for additions and improvements.

SALMON FALLS, N. H.—Plans are being prepared by the Salmon Falls Manufacturing Company for the construction of a hydro-electric plant. Charles T. Main, 200 Devonshire Street, Boston, is engineer.

BRISTOL, CONN.—Preparations are being made for the installation of a new ornamental lighting system on Memorial Boulevard.

WINSTED, CONN.—The Winsted Gas Company has awarded contract to L. B. Dow & Son, Ayer, Mass., for equipment for a hydro-electric power plant to be erected at Robertsville Falls, including two 300-hp. waterwheels, with generators and other electrical equipment. The new station will replace a power house which is obsolete.

Middle Atlantic States

AMSTERDAM, N. Y. — The Adirondack Power & Light Corporation is planning to increase its capital from $23,100,000 to $25,000,000, part of the proceeds to be used for extensions and improvements.

BATAVIA, N. Y.—The Gennesee Light & Power Company has increased its capital from $350,000 to $500,000 for expansion purposes.

BROADALBIN, N. Y.—The Broadalbin Light & Power Company is planning to reconstruct the buildings at its plant, recently destroyed by fire. The loss is estimated at about $25,000.

BROOKLYN, N. Y.—The present fire-alarm system in the Greenpoint section is to be replaced with a modern system with underground wires. The installation of red lamps at every fire-alarm box in the borough has been recommended.

GLOVERSVILLE, N. Y.—Arrangements are being made by the Fonda, Johnston & Gloversville Railroad Company, for an issue of $550,000 in bonds, part of the proceeds to be used for extensions and improvements to its power plant and system.

NEWPORT, N. Y.—The Newport Electric Light & Power Company has applied to the Public Service Commission for permission to purchase water-power rights and certain other property of Prentiss & Wooster on West Canada Creek, about 2 miles from Newport.

NORWICH, N. Y.—Work has been started on the erection of a 45,000-volt transmission line from Norwich to Sidney and to Oneonta, a distance of 52 miles.

PERU, N. Y.—The town of Peru has granted the Plattsburg (N. Y.) Gas & Electric Company a franchise to supply electricity here. The cost of erecting the transmission line (8 miles) is estimated at $8,000.

PERU, N. Y.—The Adirondack Power & Light Corporation, Amsterdam, has been granted a franchise to extend the transmission lines of the Northern Adirondack Power Company, Keeseville, to Peru Township and furnish electrical service here.

BLOOMFIELD, N. J.—The Standard Oil Company of New Jersey, 31 Clinton Street, Newark, contemplates building a new distributing plant, with an electric station, in the Silver Lake section, to cost about $40,000.

MORRISTOWN, N. J. — The Morris & Somerset Electric Company will issue $200,000 in bonds, part of the proceeds to be used for extensions and improvements.

NEWARK, N. J.—The Balbach Smelting & Refining Company, 580 Market Street, plans to rebuild the portion of its power plant recently destroyed by fire, causing a loss of about $20,000.

NEWARK, N. J.—The Department of Parks and Public Property has been directed by the City Commission to arrange for the erection of a power plant at the municipal market, now in course of construction, to cost about $54,000.

PHILLIPSBURG, N. J.—The installation of an ornamental lighting system is under consideration by the Department of Public Works. The plans call for ninety-six standards.

CORAOPOLIS, PA.—Steps have been taken to organize a company under the name of the Coraopolis Electric Company to construct and operate a local electric plant.

ELLWOOD CITY, PA.—The Harmony Electric Company is extending its transmission lines to furnish electricity to the residents of Wylie Hill and vicinity.

HARRISBURG, PA.—The Harrisburg Light & Power Company has issued $14,000 in bonds for extensions, etc.

LOCK HAVEN, PA.—The Lock Haven Electric Light & Power Company has issued $200,000 in bonds, the proceeds to be used for the erection of a new power plant at Castanea.

MOUNTAINTOP, PA.—The Pennsylvania Power & Light Company, Allentown, has agreed to extend its transmission line to Mountaintop if sufficient number of patrons are secured.

OIL CITY, PA.—The Citizens' Light & Power Company contemplates an issue of $95,000 in capital stock, part of the proceeds to be used for extensions and improvements.

PITTSBURGH, PA.—The Duquesne Light Company is organizing the Bellevue Light Company as a subsidiary to take over and operate the properties of the Southern Heat, Light & Power Company in the North Boroughs district.

PITTSBURGH, PA.—E. P. Griffiths and J. R. McNary, 435 Sixth Avenue, and associates are organizing the Kennedy Township Light Company and the Neville Township Light Company to construct and operate systems in the respective townships.

STATE COLLEGE, PA.—The Public Service Commission has given its approval of the sale of the property of the State Center Electric Company to the Keystone Power Corporation, Ridgway.

VANDERGRIFT, PA.—The West Penn Power Company, Pittsburgh, contemplates rebuilding its local substation recently destroyed by fire, causing a loss of about $22,000.

CHARLESTON, W. VA.—Tentative plans have been prepared by the Virginia Electric Company, successor to the Virginia Electric & Machine Works, for extensions and improvements to its system. The company recently increased its capital stock to $300,000.

CHARLOTTESVILLE, VA.—The erection of a power plant at the Geer Industrial School is under consideration.

CHARLOTTESVILLE, VA.—The Charlottesville & Albemarle Railway Company is asking for bids for a 1,500-kw., 2,300-volt horizontal steam turbine with condenser and switchboard equipment. John L. Livers is president.

North Central States

IONIA, MICH.—The State Administrative Board has authorized the construction of a new power house at the Ionia Reformatory, to cost $60,000.

MOUNT PLEASANT, MICH.—A power plant will be erected at the new cement mill of the National Portland Cement Company, on Coldwater Lake, to cost about $500,000.

SAGINAW, MICH.—Bids will be received until Aug. 8 by the secretary of the board of education, Saginaw, for construction of a manual training school building, and also for the first unit of a detached power house on Webber Street. The cost is estimated at $250,000.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, until Aug. 11 for 17,716 feet of ten-conductor and 1,000 feet of two-conductor underground lead cable for the fire department. Bids will also be received at the same time and place for cross-arms.

DAYTON, OHIO.—A permit has been granted to the Dayton Power & Light Company for an extension to the Miller's Ford station, 85 ft. x 180 ft., five stories high, to cost about $300,000.

GALENA, OHIO.—The village officials are considering a proposal submitted by the Big Walnut Electric Company offering to extend its transmission line to Galena to furnish electrical service here.

LIMA, OHIO.—The plant and property of the Ohio Electric Railway Company will be offered at a public sale on Aug. 15 by J. E. Jones, receiver, including transmission system, interurban lines, etc. Bids of less than $2,000,000, it is stated, will not be accepted.

PIKESVILLE, KY.—The Sanitary Steam Laundry Company will install an engine-driven generator set and other electrical equipment at its plant.

GOSHEN, IND.—The Middle West Utilities Company has acquired the properties of the Hawks Electric Company, the Middlebury Electric Company and the Electric Transmission Company of Northern Indiana, all operating in this section, and the Winona Electric Light & Water Company, Warsaw, Ind. The properties will be merged and extensions and improvements made.

INDIANAPOLIS, IND.—The Central Indiana Power Company has issued $7,500,000 in bonds, the proceeds to be used to acquire the properties of the Merchants' Heat & Light Company, the Wabash Valley Electric Company, the Putnam Electric Company and the Cayuga Electric Company, and for extensions and improvements.

LAWRENCEBURG, IND.—The Board of County Commissioners contemplates building an electric light and power plant at the County Infirmary.

AURORA, ILL.—The Western United Gas & Electric Company has applied to the Public Service Commission for authority to issue $120,000 in notes and $15,000 in bonds, part of the proceeds to be used for extensions and improvements.

SPRINGFIELD, ILL.—The Illinois Power Company has petitioned the Public Service Commission for permission to erect a transmission line between Springfield and Pawnee for the interchange of power with the Central Illinois Public Service Company and also for approval of contract which has been entered into with that company.

WESTERN SPRINGS, ILL.—The Village Council has granted the Public Service Company of Northern Illinois, Chicago, a franchise to install a system and furnish electrical service here. The municipal plant, it is understood, will be abandoned.

ZION, ILL.—The assessment roll, which calls for $9,600, has been filed with the county clerk for the ornamental lighting system to be installed on the Sheridan Road through Zion.

ELKHART LAKE, WIS.—The property of the Badger Public Service Company has been purchased by the Albertson Engineering Company, Milwaukee.

FOUNTAIN CITY, WIS.—The Wisconsin Railway, Light & Power Company, La Crosse, has purchased the local electric light and power plant.

HAWKINS, WIS.—The Hawkins Light & Power Company contemplates the erection of a new plant.

OSHKOSH, WIS.—The Wisconsin Public Service Company has acquired the electric and gas plants of the Oshkosh Gas Light Company. Extensions and improvements, it is understood, will be made.

WAUKESHA, WIS.—The White Rock Mineral Springs Company contemplates an extension to its power plant, to cost including equipment, about $25,000. Henry C. Hengels, 445 Milwaukee Street, Milwaukee, is architect.

NODAWAY, IOWA.—At an election to be held Aug. 15 the proposal to issue $8,000 in bonds for the installation of a municipal electric light plant will be submitted to the voters. It is proposed to secure electricity from the Lee Electric Company, Clarinda.

SHENANDOAH, IOWA.—The electric companies operating at Red Oak, Villisca, Missouri Valley, Malvern and Shenandoah, controlled by the Continental Gas & Electric Company, Cleveland, have been consolidated and will be known as the Iowa Service Corporation. Improvements will be made to the system at Villisca, to cost about $10,000.

LAVALE, MO.—The Lavale Light & Power Company, recently organized by M. S. Berkeley and Ezra Deal to take over the power plant of the Lavale Milling Company, will build an addition to the station. New equipment including a turbo-generator, etc., will be installed and extensions made to the distributing system.

NEW FLORENCE, MO.—The Missouri Utilities Company, Mexico, contemplates extending its transmission line to New Florence and installing a distributing system.

ST. LOUIS, MO.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., Aug. 15 for furnishing and installing an electric motor-driven turbine pump in local post office.

ST. LOUIS, MO.—Arrangements are being made to reorganize the Union Electric Light & Power Company and to issue $60,000,000 in capital stock, part of the proceeds to be used for extensions and improvements. Tentative plans are being considered for the erection of a large power plant in the East Side district.

ALVO, NEB.—Bids will be received by the Council until Aug. 9 for the construction of a transmission line and distributing system. The Hollister Engineering Company, Lincoln, is engineer.

ARKANSAS CITY, KAN.—Bids will be received by the City Clerk until Aug. 10 for two 1,500-gal. per-minute motor-driven centrifugal pumps and accessories. C. W. Lusk is city engineer.

COLONY, KAN.—Plans are being prepared for extensions and improvements to the municipal electric plant. Black & Veatch, Mutual Building, Kansas City, Mo., are engineers.

Southern States

ACME, N. C.—The Acme Manufacturing Company will install a new engine-driven generator set (about 250 capacity) and other electrical equipment at its power house.

CHARLOTTE, N. C.—Tentative plans have been prepared by the Southern Power Company for construction of a hydro-electric plant on the Cawtaba River, near Charlotte. It is proposed to build a dam between Van Wyck and Great Falls.

CHARLOTTE, N. C.—Negotiations are under way between the City Council and the Southern Public Utilities company for installing a new street-lighting system. It is proposed to replace the arc lamps now in use with modern lamps.

FAYETTEVILLE, N. .C—The Fayetteville Ice & Manufacturing Company is planning to rebuild the portion of its power house, recently destroyed by fire.

HOBGOOD, N. C.—Bids will be received by the Town Clerk, E. L. Bradley, until Aug. 15 for the construction of a transmission line and a local distributing system.

KINSTON, N. C.—Plans are under consideration for the erection of an administration building at the Caswell Training School, to cost about $400,000. Other buildings, to cost about $890,000, will ultimately be erected. C. B. McNairy is superintendent.

WILMINGTON, N. C.—The Tidewater Power Company contemplates erecting a transmission line from Wilmington to Warsaw (53 miles), and possibly from Warsaw to Clinton.

MACON, GA.—Proposals have been submitted to the City Council by T. J. Carstarphen and T. T. Carstarphen for the installation of an electric light plant.

SUMMERVILLE, GA.—The City Council has granted the Georgia Railway & Power Company, Atlanta, a franchise to supply electricity here. It is proposed to erect a transmission line from Lindale to Chickamauga. A substation will be erected near the city limits.

KNOXVILLE, TENN.—The installation of an ornamental lighting system on several of the streets in North Knoxville is under consideration by the North Knoxville Business Men's Association.

FAYETTEVILLE, ARK.—The Middle West Gas & Electric Company, New York City, is erecting a transmission line from Fayetteville to Rogers. When completed it is proposed to close down the plant at Rogers and furnish electricity at the latter place from the local plant.

CROWLEY, LA.—All arc lamps in the city will be replaced with improved type of street lamps.

EL RENO, OKLA.—The Oklahoma Gas & Electric Company will make extensions and improvements in the present street-lighting system. Plans for an ornamental lighting system have been temporarily abandoned.

LOCUST GROVE, OKLA.—Contract has been awarded by the town officials to the Electric Construction Company, Oklahoma City, for the erection of an electric transmission line to connect with the power plant at Pryor.

OKLAHOMA CITY OKLA.—The Oklahoma Gas & Electric Company has issued $500,000 in bonds, part of the proceeds to be used for extensions and improvements.

BELLEVUE, TEX.—L. A. Brantley, Dallas, Tex., and associates are planning to erect a light and power plant to furnish a local service.

BROWNFIELD, TEX.—An issue of $16,000 in bonds has been approved for the installation of an ornamental lighting system in the business section.

DALLAS, TEX.—The Council is considering extensions to the lighting system in the Oak Cliff section.

ELECTRA, TEX.—The Magnolia Petroleum Company will build a power house in connection with its new local repair shops, to cost about $250,000.

GALVESTON, TEX.—Work will begin at once on the one-story power house to be erected at the University of Texas. The Herbert M. Greene Company, Dallas, is architect.

McLEAN, TEX.—At an election held recently an issue of $74,000 municipal water, light and street improvement bonds were authorized.

VICTORIA, TEX.—The Southwestern Telephone & Telegraph Company will install an underground conduit system in the business district.

Pacific and Mountain States

DEER PARK, WASH.—Work will soon begin by the Mount Spokane Power Company on the erection of a three-wire, 12,000-volt transmission line from Deer Park to Clayton, a distance of about 5 miles. Electricity will be supplied to residences along the line as well as in Clayton. The cost is estimated at about $15,000. Improvements are being made at the power station on Little Spokane River, involving an expenditure of about $20,000.

EPHRATA, WASH.—Investigations are being made by the Washington Water Power Company relative to extending its transmission lines into the Rock Island district to supply electricity for irrigation purposes. The erection of 40 miles of new line from Ephrata would be required to furnish the service.

OLYMPIA, WASH.—The Council has awarded a contract to the Post Electric Company, Olympia, for the installation of an ornamental lighting system on certain streets.

SEATTLE, WASH.—The Puget Sound Power & Light Company has secured a franchise to construct new lines on Tenth and Thirty-fifth Avenues and other streets in the city.

THREE LAKES, WASH.—Arrangements, it is reported, are being made by the Three Lakes Lumber Company for rebuilding its sawmill and lumber plant, recently destroyed by fire, causing a loss of about $500,000.

HOLLYWOOD, CAL.—The Southern California Edison Company, Los Angeles, contemplates the erection of a new 33,000-volt transmission line between Hollywood and the San Fernando plant.

LOS ANGELES, CAL.—The City Council is considering the installation of electric lamps on Melrose Avenue and other streets in the St. Andrews and Marathon Street lighting district.

LOS ANGELES, CAL.—Extensions and improvements calling for an expenditure of about $6,000,000 within the next year have been announced by E. F. Scattergood, chief engineer of the bureau of power and light. The work will include seven new substations, to be located in Hollywood, Gardena, San Pedro and in the city proper, one near the Hall of Records, one in the Wilshire district, one at One Hundredth and Hoover Streets and one in the 900 block on Francisco Street, and also extensions to the municipal lighting lines.

MARE ISLAND, CAL.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 30 for circulating loop for central power plant at Mare Island. (Specification 4,684.)

NEWPORT BEACH, CAL.—The City Trustees have awarded a contract to A. C. Rice, 1963 Santee Street, Los Angeles, for the installation of an ornamental lighting system on Central Avenue, from E to Cypress Street, and on other streets.

SACRAMENTO, CAL.—Bids will be received by H. G. Denton, city clerk, City Hall, Sacramento, until Aug. 24 for construction of rapid sand filtration plant and appurtenances (Contract No. 24.) The equipment will include hydraulic and electrical controlling devices, conveyors, pulverizers, etc.

SANTA BARBARA, CAL.—The Southern California Edison Company will build a three-wire, steel-tower, 66,000-volt transmission line from Santa Barbara to the Ventura district, about 16 miles, to cost about $175,000.

SANTA MONICA, CAL.—An ornamental lighting system will be installed on Washington Boulevard and Marine Street.

SOUTH PASADENA, CAL.—The City Manager is negotiating with the Southern California Edison Company for the purchase of its local system, to be owned and operated by municipality.

VENICE, CAL.—The city engineer has been instructed to prepare plans for the installation of an ornamental lighting system on Washington Boulevard and Marine Street.

CULDESAC, IDAHO.—The Grangeville (Idaho) Electric Light & Power Company has submitted a proposal to the Commercial Club offering to furnish electricity in Culdesac.

REUBENS, IDAHO.—The installation of an electric lighting system in Reubens is under consideration. It is proposed to secure the service from the Grangeville (Idaho) Electric Light & Power Company.

CASA GRANDE, ARIZ.—The Casa Grande Valley Electrical District has entered into a contract with the Water Users Association of the Salt River Valley to furnish electricity from the Roosevelt power station in this district. The cost of the line is estimated at about $200,000. The State Legislature has appropriated $50,000 for securing electricity for the State Penitentiary at Florence, which will be included in the above project.

YUMA, ARIZ.—Bids will be received by the United States Reclamation Service, Denver, Col., until Sept. 6 for motors, transformers and switching apparatus for the valley drainage pumping plant, Yuma project, Ariz. A. P. Davis is director.

PUEBLO, COLO.—The Southern Colorado Power Company has issued $6,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

TULAROSA, N. M.—Bonds to the amount of $75,000 have been voted for the installation of a municipal electric light plant and waterworks.

Canada

MUNCEY, ONT.—Surveys are being made for Caradoc Township for the erection of a transmission line between Delaware and Melbourne, a distance of 11 miles. The cost is estimated at $33,000. J. N. Wilson, engineer, 190 University Avenue, Toronto, will have charge of the project. J. Brodie is clerk.

WINDSOR, ONT.—Dodge Brothers, Inc., Detroit, Mich., manufacturer of automobiles, will build a power house in connection with its proposed branch plant here.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 18, 1922)

1,422,815. SEPARATOR FOR STORAGE-BATTERY PLATES; G. E. Beck, Cleveland, Ohio. App. filed Dec. 17, 1920. Perforated nonconducting shell slips over every other plate.

1,422,826. ELECTRICALLY HEATED TONGS; F. O. Brown, St. Louis, Mo. App. filed Oct. 24, 1921.

1,422,837. CONNECTING TRANSMITTERS TO VACUUM-TUBE AMPLIFIERS; I. B. Crandall, Nahant, Mass. App. filed Oct. 13, 1917. Method of connecting a transmitter amplifier.

1,422,842. READING RIBBON IN SIGNALING MACHINES; Wilfrid Dougall, Montreal, Can. App. filed March 13, 1920. Signal from ribbon operated by magnets for touch reading.

1,422,877. ACOUSTICAL AID FOR DEAF PERSONS; J. P. Maxfield, Maplewood, N. J. App. filed Jan. 2, 1920. Binaural system with two radio amplifiers.

1,422,882. RADIO TRANSMISSION; H. W. Nichols, Maplewood, N. J. App. filed Sept. 1, 1915. Modulates waves in respect to wave form.

1,422,896. HEATING COIL FOR CARBURETORS; E. M. Soreny, Milwaukee, Wis. App. filed Jan. 7, 1918.

1,422,905. ELECTRIC COUPLING; C. H. Tomlinson, Mansfield, Ohio. App. filed June 22, 1912. For multiple-control circuits of electric cars.

1,422,910. TERMINAL BOX FOR ELECTRIC CABLES; C. R. Young, Bloomfield, N. J. App. filed Jan. 23, 1919. Type mounted on telephone poles.

1,422,920. MULTIPLE RECORDING INSTRUMENT; R. P. Brown and Fritz Wagner, Philadelphia, Pa. App. filed July 1, 1920. Instrument for separately recording a plurality of conditions.

1,422,931. DOOR-CONTROLLING DEVICE; H. W. Crane, Chicago Ill. App. filed Oct. 1, 1919. Door operated by motor.

1,422,992. ELECTRIC CONNECTOR; E. A. Kuen, Cincinnati, Ohio. App. filed May 24, 1920. Terminals for miniature light sockets.

1,423,039. ELECTRIC RADIATOR; C. F. Smith and G. E. Curtiss, New Britain, Conn. App. filed March 8, 1920. Convex heating unit.

1,423,045. ELECTRICAL CONNECTOR; E. Stranszky, Dover, Ohio. App. filed Aug. 20, 1918. Terminal for appliances such as flatirons, etc.

1,423,069. PROCESS FOR DISSOLVING OR RECOVERING METALS; Hans Bardt, Santiago, Chile. App. filed Sept. 17, 1921. Extracting copper by acids and then electrolyzing.

1,423,071. PROCESS FOR MANUFACTURING ELECTRODES; Hans Bardt, Santiago, Chile. App. filed Sept. 17, 1921. By electrolyzing carbonate of manganese and an excess of perchloric acid.

1,423,090. ELECTRIC MOTOR VEHICLE; J. K. Delano, New York, N. Y. App. filed July 21, 1920. Provides regenerative braking system.

1,423,107. ELECTRICAL GENERATING SYSTEM; H. A. Harrington, Cuyahoga Falls, Ohio. App. filed Jan. 10, 1920. Engine generator plant for isolated plants.

1,423,124. GASOLINE-ELECTRIC AUTOMOBILE; F. G. LeMerle, M. J. Ullman and J. E. Barry, Washington, D. C. App. filed Sept. 14, 1920. Governor adjustment maintains uniform speed regardless of grade.

1,423,141. MAGNETO-ELECTRIC MACHINE; C. Olivetti, Ivrea, Italy. App. filed June 19, 1919. For internal-combustion engines.

1,423,182. BRACKET FOR PRINTOMETERS; C. E. Brown, Chicago, Ill. App. filed Dec. 20, 1920.

1,423,309. ELECTRICAL CONDUIT SYSTEM; E. H. Curtis, Spring Valley, N. Y. App. filed July 6, 1918. Outlets adapted for setting in reinforced-concrete floor structures.

1,423,331. LIGHTING FIXTURE; K. Keller, Brooklyn, N. Y. App. filed Sept. 1, 1921. Portable lamp sockets on swivels.

1,423,345. SIGNALING METHOD AND APPARATUS; D. G. McCaa, Palo Alto, Cal. App. filed May 20, 1921. Radio receiving circuit.

1,423,380. ELECTRICALLY HEATED APPARATUS; R. F. Wherland, Stanley, N. D. App. filed Dec. 13, 1920. For heating battery compound.

1,423,497. ELECTRIC MECHANISM FOR SEARCHLIGHTS; L. C. Josephs, Jr. App. filed June 9, 1919. Portable mechanism carried in inclosed casing operated in front of mirror.

(Issued June 20, 1922)

1,420,055. SELECTIVE RECEIVING SYSTEM; H. W. Nichols, Maplewood, N. J. App. filed Dec. 18, 1920. Radio receiving arrangement employing multiple detection.

(Issued July 25, 1922)

1,423,518. FREQUENCY REGULATOR; L. Espenschied, Queens, N. Y. App. filed June 11, 1920. For any mechanism undergoing a periodic cycle.

1,423,575. TROLLEY ALIGNING HARP; S. S. Matthes, Mansfield, Ohio. App. filed Sept. 3, 1921. To maintain the collecting element in alignment with the axis of the pole.

1,423,582. MEANS FOR THE SUSPENSION OF ELECTRIC CONTACT WIRES; M. Semenza, Milan, Italy. App. filed July 21, 1921. Pair of elastic plates fulcrumed upon each other and held together under tension.

1,423,584. APPARATUS FOR ELECTROLYZING SOLUTIONS; K. E. Stuart, Niagara Falls, N. Y. App. filed Jan. 28, 1921. Discharge nozzle feeding salt in suspension to electrolytic cells.

1,423,601. DETECTOR FOR ALARM SYSTEMS; F. E. Crawford, Winchester, Mass. App. filed Aug. 12, 1918. Interruption of the door circuit will cause alarm.

1,423,622. SPARK-TESTING DEVICE FOR GASOLINE ENGINES; W. P. Mott, Chicago, Ill. App. filed March 29, 1919. Switch in spark plug circuit.

1,423,635. X-RAY CABINET AND MACHINE; W. H. Thwaites, Grand Rapids, Mich. App. filed Jan. 3, 1921. Turns horizontally and covers high-tension wires.

1,423,658. OZONE GENERATOR; H. B. Hartman, Scottdale, Pa. App. filed Jan. 24, 1920. Air-cooled, for water-purifying purposes.

1,423,672. MAGNETO IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES; J. L. Milton, Cleveland, Ohio. App. filed Feb. 18, 1913. Alters wave form to give effective timing range.

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The Passing of Alexander Graham Bell

ONE can realize the amazement of Dom Pedro, Emperor of Brazil, when in 1876 at the Philadelphia Centennial Exposition he heard a human voice through a telephone receiver and cried out, "My God! It speaks." Then the telephone was a novelty and the message was carried less than one hundred feet. Today the telephone is an indispensable adjunct of business and social life, and the human voice through its agency is now heard across the continent. What Alexander Graham Bell gave to the world on March 10, 1876, was a wire, a reed, a magnet and a clock spring—nothing like the telephone of today, but it was enough. "Salem witchcraft" paragraphers ignorantly dubbed it, little realizing that from the tiny attic in Boston had come one of the epoch-making achievements of history. Civilization freely acknowledged the debt it owed to the man whose brain conceived the telephone, so that Alexander Graham Bell was not without suitable honor or reward during his lifetime.

BUT while Bell was fertile in conception he lacked commercial shrewdness and business instinct. He had indeed planted the seed, but it remained for Theodore N. Vail to water and nourish the growing plant. It was Vail who visioned a telephone system, universal and comprehensive, made up of local units giving an immediate local service, interconnected and welded into a national, centralized and interdependent system. Although Professor Bell took up other work, he was content to remain the originator and pioneer of telephony. Selfishness or ingratitude was not in his makeup. "I may perhaps," he said, "take credit for having blazed the trail for others to come after me; but when I look at the phenomenal developments of the telephone and the great system that bears my name, I feel that the credit for those developments is due to others rather than to myself."

IT IS needless to trace the growth and influence of the telephone since its invention forty-six years ago. As Americans we can take pride in the knowledge that it was born here and that here it has reached its greatest perfection and its greatest use, for 65 per cent of the telephones of the world are in service in the United States. As we know the instrument today it is no more like the crude contrivance of Bell than the "Twentieth Century" locomotive is like the engine of Stephenson or the generating machinery of a great modern central station like the historic apparatus set up in New York City in 1882.

Thousands of engineers have contributed to the evolution of the telephone since the days of Bell and Watson. As we pause to do homage to the illustrious dead let us applaud also these workers in the field along which he blazed the first path. To do so detracts no iota from the debt civilization owes the pioneer. As Webster said of the state where Bell wrought his miracle so we may say of him: "There he is." His fame is secure.

Charles Day

A modernizing engineer, consultant and economist of nationwide reputation, and a specialist in public utility management and operation.

IN CHARLES DAY the electrical industry has the services of a technical engineer of standing and also of an economist of high rank. He first gained prominence as an exponent of manufacturing efficiency in industrial plants and was largely influential in establishing present-day production methods and building designs.

Not content with this work, he extended his activities to the public utility field, where his grasp of the problems and his capacity for organizing a business on an economic basis rapidly established him in the front rank of utility engineers and executives.

Mr. Day is now a recognized authority on public service corporations and serves as an officer or director of a large number of public utilities while his firm is retained as consultant to important banking institutions.

During the war period Mr. Day served his country in many ways. He was active on the general munitions board and the depot board. He served with Charles Piez and Arthur Mason on a committee to report on shipyard conditions. In 1917 he accompanied Colonel House's mission to England and France as an engineering adviser and was made a member of the Army War Council upon his return to this country.

Also as a trustee of the United States Shipping Board Corporation he was very active in connection with matters pertaining to the transportation of troops and supplies and, during his absence abroad, collaborated with Dwight W. Morrow and other heads of the Inter-Allied Maritime Transport Council.

In July, 1918, he went to France, accompanying Edward R. Stettinius, to secure information concerning the adequacy of port facilities for the rapidly increasing fleet. While in France he had numerous opportunities to confer with General Pershing, General Atterbury and members of General Pershing's staff. He later joined Secretary of War Baker, who was accompanied by General Hines, chief of embarkation service. Mr. Day returned with Secretary Baker just prior to the signing of the Armistice.

Mr. Day was born in Philadelphia on May 15, 1879. He graduated from the University of Pennsylvania with the degree of bachelor of science in electrical engineering in 1899 and received the degree of mechanical engineer in 1903. In 1902 the firm of Dodge & Day was formed, and in 1907, when John E. Zimmerman entered the firm, the name was changed to that of Day & Zimmerman, Inc.

In his early professional life Mr. Day was engaged in industrial problems bearing on manufacturing efficiency, and so great was his success that he was invited to lecture on the subject at Lehigh, Columbia and Harvard universities. About fifteen years ago Mr. Day became interested in the public utility field and now devotes his energies largely to that work.

In addition to his professional work Mr. Day is a trustee of the University of Pennsylvania, a vice-president and director of the Williamson Free School of Mechanical Trades, and a director of the Philadelphia Trust Company. He is a member of several social clubs.

The contacts of Mr. Day with the public utility industry at large are far-reaching and embrace both the technical side and the financial. He enjoys an enviable reputation alike as executive, consultant and economist and his influence and reputation in the electical industry is constantly increasing.

Editorial Comment

Electrical World, August 12, 1922
Volume 80 Number 7

Increasing Hydro-Electric Station Capacities

THERE may be many hydro-electric stations in the country of which the capacity can be increased with as much gain and as little expense as in the case of the Kern Canyon station of the San Joaquin Light & Power Corporation. This station, as described elsewhere in this issue, has recently been increased in rating from 3,000 kw. to 12,000 kw., an enlargement made possible because there was sufficient water available to warrant the undertaking. The work was performed with the greatest economy through the enlargement of the existing tunnel, which in any event would have required extensive repairs costing almost as much.

The electrical features of the station are in line with the trend of development, which is characterized by greater simplicity in wiring and in operation. In common with many recently built stations, this one has no low-tension buses, thereby avoiding a source of possible trouble without decreasing the flexibility of the station materially. Another point of simplification is in the excitation system. No rheostat is provided for the generator field, and the generator voltage is varied by controlling the excitation of the exciter field, which is in turn excited by a separate control unit driven by an impulse wheel provided with an oil-pressure governor. This method of voltage control has been well tried in the past and has been found to be both effective and economical. The only automatic regulation of the voltage is that obtained through the use of a potential relay which operates on high generator voltage and cuts resistance into the circuit of the exciter field. Such an arrangement has been found to be necessary when operating hydro-electric stations of this kind in parallel with modern steam-turbine stations.

The Significance of the Coal Strike

HOW long is the intelligent public going to remain an easy mark for those who mine and furnish coal? The strike has dragged itself along, as similar strikes have done before, week after week and month after month. Its immediate ending could not undo the harm or repair the loss of the long strife. The row is of the kind in which gentlemen who are dependent on the electorate for their jobs are not over-anxious to mix. The salient facts are that the public does not know what the coal miner earns, what his employer benevolently assimilates in the way of profits, and whether transportation for coal is actually to be had on the open basis of the railroads being common carriers. Until some authority has power to put the contending parties on oath and compel them to furnish full and precise information as to the facts, and until there is some power able to make both the railroads and their employees obey legally formulated decisions, there is not very much hope of an amicable, let alone a permanent, settlement of the difficulties.

The time is long past when the government should handle with gloves any of the parties concerned. The rights of the public are paramount. We note an increasing tendency just now to go in for oil-burning plants as a possible refuge from present evils. With respect to this we have abundant evidence of the efficiency and at least temporary economy of oil burning, but we advise any one contemplating a change of fuel on a large scale to sit down quietly and ask himself what power there is to control the price of oil any more effectively than the price of coal has been controlled in the last few years. The grim situation is that our present civilization has come to depend on transportation of fuel and other necessities to an extent never imagined before in the history of the world, to an extent in fact which quite upsets the older theorems of political economy. It is time for the public, which in the last resort is the governing power, to unsheath its claws and use them unsparingly on those who make its necessities their plaything.

How Can Convention Discussions Be Stimulated?

TOO many men have acquired the habit of attending conventions to listen to what other men have to say without contributing anything in return. No prompting or suggestions from the chairman will induce some of the audience to take part in the debate; but, after the formal discussion is ended and the meeting has adjourned, the same tongue-tied individuals will be found in one group or another which has remained to compare practices or experiences, exchanging just the information which should be presented at the formal meeting and then made available through a stenographic report to persons not in attendance.

This criticism can be made of most meetings nowadays, but it is rendered particularly pertinent by the comments of engineers regarding the cable-joint symposium held at Niagara Falls during the recent convention of the American Institute of Electrical Engineers. Although the information which was presented at that symposium was excellent, it was contributed by only a few of those there. Some of these speakers kept back their best remarks until after the formal meeting, and a number of men who had not taken part in the formal discussion at all virtually had a private convention after the general meeting, when their remarks were lost to all except their immediate neighbors.

Apparently only a few companies or engineers have made any serious investigations of high-tension cable joints, for the reason that these joints are rather expensive, and the few that have made experiments have done so in connection with some particular design or joint which they are putting on the market. Consequently, in their comments, the latter class refer only to data which would serve to commend their particular type of joint and in so doing probably omit considerable information of fundamental importance. The situation is somewhat complicated by patents, but these should not interfere with engineers discussing plainly such fundamental points, for example, as whether the cable-joint filling compound should be an oil, a grease or a solid at ordinary operating temperatures. It was such fundamental physical points, not connected with patents in any way, that engineers attending the meeting appeared so willing to hear discussed and so reluctant to talk about.

The problem of stimulating valuable discussion at conventions must be solved. Possibly greater success will be achieved if a list of speakers known to have important information is made before the meeting and each is asked a specific question. The audience, too, should be urged to ask questions. Every engineer who reads the papers to be presented at a convention or who hears the papers presented owes it to the electrical industry to contribute comments regarding details with which he is acquainted. We hope better discussions can be arranged for at all engineering conventions.

Unreasonable Opposition to Lighting Codes

FROM many viewpoints the drawing up of an industrial lighting code is a thankless task. Yet the existence of a recognized minimum standard of illumination means so much in safety and comfort that plant owners will do well to encourage the establishment of reasonable regulations along this line. The erroneous idea that burdensome expense goes with the use of such codes is held by too many intelligent manufacturers, judging from the testimony at a recent hearing.

It was stated by many witnesses that among many thousands of industrial plant accidents an insignificant proportion could be classified as eye injuries resulting from inadequate illumination. There is no question, however, that eyestrain results from poor illumination, and the gradual deterioration of vision arising from glare and poverty-stricken intensities on the working plane naturally does not get into the accident records of industrial hospitals and welfare departments. Others contended that millions of dollars would be required to install equipment capable of rendering service at code standards within a single state. A very little consideration disclosed the gross exaggeration of this idea, since it appeared to be based upon the total scrapping of all existing equipment and installation of the most costly material over every possible square foot of factory area.

Reasonable interpretation and enforcement of codes must be practiced if the best results are to be secured, and if this is done plant owners can wipe their slates of much needless worry. Exceptional cases occur in some industries where the illumination requirements are bound to be very different from the minima recommended, as in the manufacture of steel saws. A certain amount of glare appears useful here. One of the chief difficulties in the way of installing proper lighting is the opposition of the workers themselves, preference still being strong for localized unit lighting under the immediate personal control of the machine operator.

Publicly established lighting codes may not recommend the intensities justifiable in many cases from the production standpoint. The economic aspects may be left to the manufacturer or mercantile establishment proprietor. It is too well established now that intensified illumination contributes toward increased production to require much discussion. From the dual angle of employee welfare and production efficiency, proposed lighting codes should be considered by progressive users, and there is no place for unreasonable opposition to try-outs of codes worked up in good faith and by skilled engineers for the larger benefit of industry and business.

France Inaugurates Its Superpower System by Building a Modern Station

THE Gennevilliers station in Paris is the latest word in French power-plant design and, when compared with other French plants, represents a radical departure from existing practice. On the whole, we believe the electrical features of the plant are better than the mechanical. The omission of low-tension buses, the arrangement of the high-tension switching and the thoughtful design to eliminate hazards from fire meet our hearty approval. On the other hand, there is a complexity about the mechanical features of the plant that violates the code of simplicity so strongly advocated by American designers and makes one question the reliability of the design.

The coal-handling system uses bridge cranes, belt conveyors, bucket hoists, trolley cars and trolley hoppers. All these are interlinked in a rather complicated system—the trolley-operated hoppers for the boiler room are even controlled by block signals. In the use of two types of boilers, one equipped with chain grates and the other with underfeed stokers, another example of complexity is encountered. The use of air preheaters, forced-draft and induced-draft fans in multiple, gas filters and economizers is carried to an extreme that hardly seems warranted by fuel cost in France, which is comparable to that in New York. Also the stack used is questionable from a forcing standpoint and the location of the superheater is very unusual.

On the other hand, this plant has many features that other plants can adopt to advantage. In the first place, a steam pressure of 313 lb. and a temperature of 707 deg. F. show that the designers were not carried away by the ideas of those who advocate high steam pressures. Then the plant contains ten-stage impulse turbines with a guaranteed steam consumption of 9.46 lb. per kilowatt-hour at three-quarters load, which may be favorably compared with the seventeen-stage turbines of the Delaware station at Philadelphia, with 10.8 lb. per kilowatt-hour, and the twenty-stage turbines of the Fifty-ninth Street Interborough station at New York City, with 11.03 lb. The use of the smaller number of stages gives a very high thermal efficiency for the unit, but the mechanical efficiency is lower than that of some existing installations.

We are glad to see turbine bleeding used for feedwater heating, because it possesses inherent advantages from the thermal standpoint. Only mechanical difficulties have prevented the use of multipoint bleeding to a greater extent in this country.

Another remarkable departure in design is that this station uses about 44 per cent less condensing surface in the main units than, for example, the Delaware and Colfax plants in this country and still uses about the same volume of cooling water. This may have become possible for two reasons—cooler circulating water in summer and the better heat transfer gained by designing the condenser tubes with a greater ratio of circumference to cross-section. Mechanical troubles in operation, however, have resulted in the use of larger tubes in American practice than are called for by theoretical design.

The designers of the plant are to be congratulated on giving France such a splendid station as the starting point in the plan for a superpower system, and American engineers will await operating results with a great deal of interest. This is particularly true of the performance of the electrical system, which distributes all the energy through 60,000-volt single-conductor underground cables.

Industry Loses a Leader in Death of Frueauff

FORTY-EIGHT years are a short span in the life of man. Centuries ago they would have meant little, and a man dying at that age would have closed his eyes on the very same world on which he opened them. Today events move rapidly, and in a period no longer mighty empires have run their course and crumbled Great industries have arisen which thirty years ago were unknown. We live in a busy age, an age of achievement and immense historic and industrial importance, and naturally our age has brought forth its great men. The electrical industry is able to boast of many who have achieved greatness in its ranks. One of these, Frank W. Frueauff, was laid to rest early this week in Woodlawn Cemetery, New York, mourned by many, and particularly by those with whom he was intimately associated during the past twenty years.

Frueauff was a worker who appreciated the opportunities which the electrical industry afforded. That he made the most of these his position as head of 144 companies and his great fortune amply demonstrate. And yet with all his riches and responsibilities Frueauff never changed in temperament or lost any part of his native affability. Whether as meter reader in Denver or as head of the Doherty organization in New York, he was ever and always the same—genial, kind and wholehearted—a man who made and kept friends. As an organizer he was signally successful. Doherty and Frueauff made a wonderful combination. Frueauff was quick to grasp and interpret the vision which Doherty saw, and it was Frueauff's job to provide the organization to do the work. His loss therefore must fall heavily upon Henry L. Doherty & Company. The electric light and power industry also suffers in the untimely death of one of its youngest and most resourceful leaders, but it glories in being able to point to Frank W. Frueauff as an example for all the young men of the industry. None can be more handicapped than he was, yet he fought, struggled and succeeded. He started at the bottom and with faith and determination reached the top while still a young man. Indeed, in association work Frueauff always aligned himself on the side of the young men. He was very far from the period when he would have been content to be arrayed with the "elder statesmen" of the electrical industry. Probably he never would have reached that period had his life been prolonged, as it might have been, through another generation; for his was the spirit of persisting and invincible youth—the spirit that animates the industry in which he found his fitting sphere.

Diesel Engines Offer Means of Improving Economy in Power Production

THE Diesel engine and its use should be considered seriously by power producers. There have been some marked improvements in the engine recently, affording a still further gain in thermodynamic efficiency. At all loads for comparable sizes the Diesel engine will produce a greater output of power per B.t.u. input than any other type of commercial heat engine.

In Europe the use of the engine is on the increase and units of 10,000 kw. are available. Bearing troubles have been eliminated, temperature effects are known, constructional features and auxiliary equipment have been improved, proper flywheel design and balancing permit of parallel operation—so that the engine has passed the experimental stage of development.

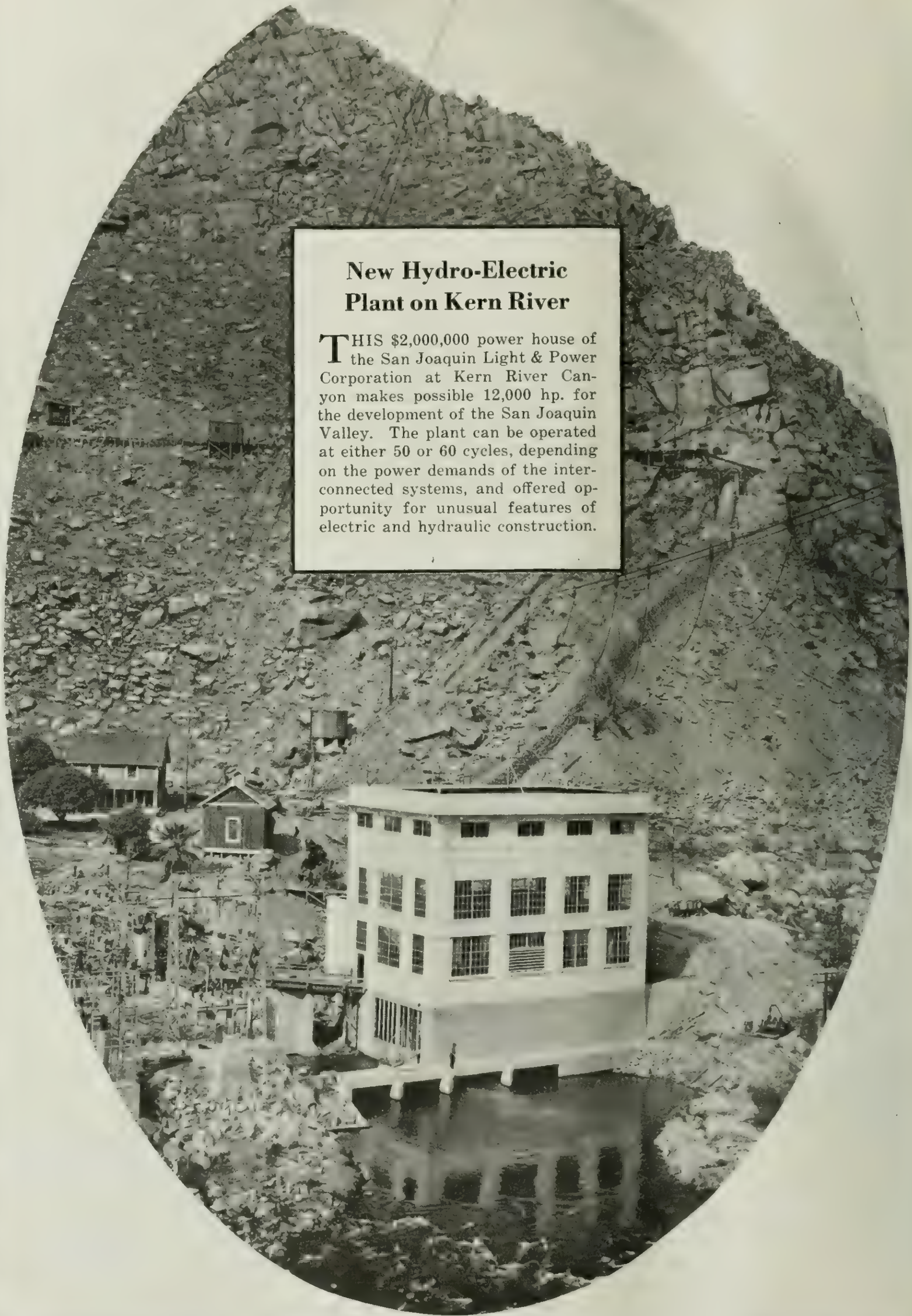
Against the high first cost and greater rate of depreciation for the Diesel must be placed its low fuel cost and its economy of space. If the whole steam-plant operating cost and operating trouble is considered, the Diesel plant-operating cost and operating trouble may be less. The installation and operation of the engine itself will involve greater cost and may require more attention than in the case of the turbine or steam engine, but the costs and troubles arising in the boiler room and with the auxiliaries of the steam plant may more than offset these conditions.

We do not consider valid the claims that fuel economy alone warrants the use of the Diesel. The data are difficult to obtain, but the general impression is that the ratio of fuel to total operating cost is now about the same in steam plants of smaller capacity as during the pre-war period. Overhead expense and wages have increased about as much as coal. Besides, the first cost of the Diesel has very materially increased since the war and fuel-oil prices are decidedly more unstable. The Diesel should be considered seriously, however, in rather small steam plants with a low load factor, because the standby charges are a minimum and the unit can be used to carry its economic load, with steam reserves and steam units for peak loads. It also has a field as a standby reserve for small water-power plants which have no other reserve and as a developer of business in districts of light load which will ultimately be served from transmission lines.

As a carrier of peak load and as reserve in steam plants that are fully loaded the Diesel engine often can be used to advantage. The inefficiency of forced steam-plant operation is obviated, and additions to steam-plant equipment can be delayed until the load grows in magnitude.

The whole situation must be considered with regard to all its tangible and intangible elements, and often costs alone will not be the deciding factor. Too frequently the engine is estimated only on the basis of balancing high first cost and high depreciation against high efficiency and low operating cost. An exact solution can be obtained only by considering all operating costs and economies and all operating convenience features for the specific situation.

Enterprising power producers should look into the use of the Diesel on its merits, and the general if somewhat vague sentiment among engineers against the use of large Diesel-type engines, despite foreign and some American experience with their use, should not prevent their development and proper employment in the power stations of the United States.



New Hydro-Electric Plant on Kern River

THIS $2,000,000 power house of the San Joaquin Light & Power Corporation at Kern River Canyon makes possible 12,000 hp. for the development of the San Joaquin Valley. The plant can be operated at either 50 or 60 cycles, depending on the power demands of the interconnected systems, and offered opportunity for unusual features of electric and hydraulic construction.

How a 3,000-Kw. Hydro-Electric Plant Was Rebuilt to Develop 9,000 Kw.

Necessity for Tunnel Repairs and Increase in Load Afforded Occasion for Enlargement — Unusual Construction Difficulties and Peculiar Features of Electrical Installation

By H. K. FOX and B. F. JACOBSEN
San Joaquin Light & Power Corporation

IN THE rehabilitation and enlargement of generating plants many problems arise which are common to all. Hence it is hoped that some engineers will be helped by the experience which the San Joaquin Light & Power Corporation had in rebuilding its Kern Canyon hydro-electric station, which is 18 miles northeast of Bakersfield, Cal.

This station was first operated in 1890 with two 400-kw. generators and enlarged in 1917 by the addition of a 3,000-kw. unit. As this did not utilize the full stream flow under the head of 230 ft. (70.1 m.), it was decided to enlarge the tunnel and build for an ultimate capacity of 13,500 kw.

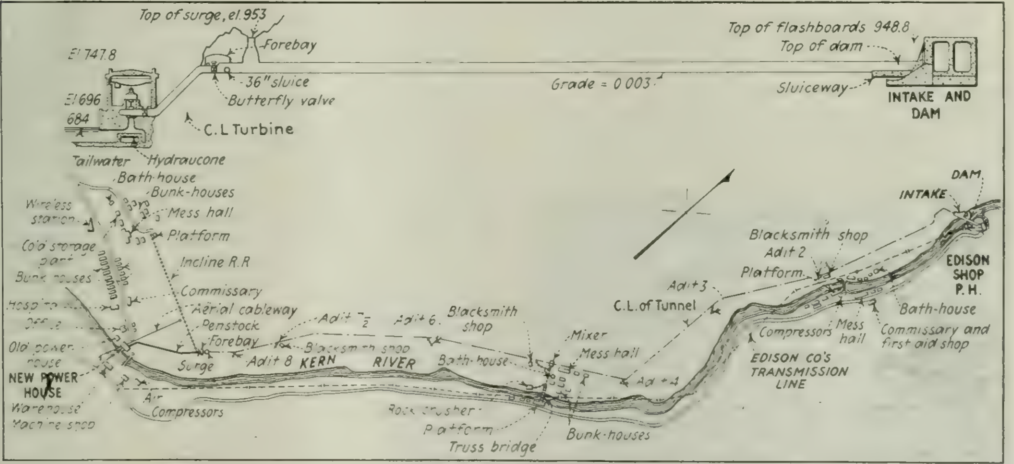
Considerable trouble had been experienced for some time with the 8,300 ft. (2,530 m.) of tunnel, and it became evident that extensive repairs of this tunnel would be necessary in the near future. Needed repairs to the tunnel had been delayed because of the fact that the plant could not be spared until the Kerckhoff station was completed in August, 1920.

In connection with the repair of the tunnel a study was made of the most economical reconstruction, and it was decided that the tunnel should be made large enough to carry a maximum of 800 sec.-ft. (22.4 cu.m. per second) and that an additional unit capable of utilizing 550 sec.-ft. (15.4 cu.m. per second) should be installed. The plant would therefore consist of the old 3,000-kw. unit in the old power house and the new 10,600-kva. unit in the new power house. The whole design was made with the idea that eventually the old unit would be removed and an additional new unit of approximately the same size would then be installed in the new power house.

UNITS OPERATE AT 50 OR 60 CYCLES

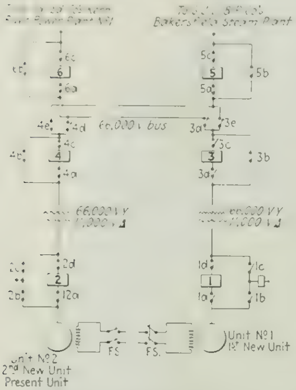
The power house is situated about 2 miles (3.2 km.) from the Southern California Edison Company's station Kern River No. 1, and a 66,000-volt tie line between the two stations has been in use for several years. This tie line enables the San Joaquin Light & Power Corporation's station to be connected to the San Joaquin system, which operates at 60 cycles, or to the Southern California Edison Company's system, which operates at 50 cycles. The connection also makes it possible to connect one or more units in the Southern California Company's Kern River No. 1 station to the San Joaquin system by operating these units at 60 cycles.

As it was desirable to retain this feature, it was decided that the new station should be so arranged that either unit could be operated independently in connection with either system, or that both units could be operated together on either system. To appreciate this condition fully it should be added that the transmission line from this station goes directly to the San Joaquin Light & Power Corporation's steam station at Bakersfield and that this station also can be operated in all or part at 50 cycles and can therefore be used to supply the Southern California Edison Company.



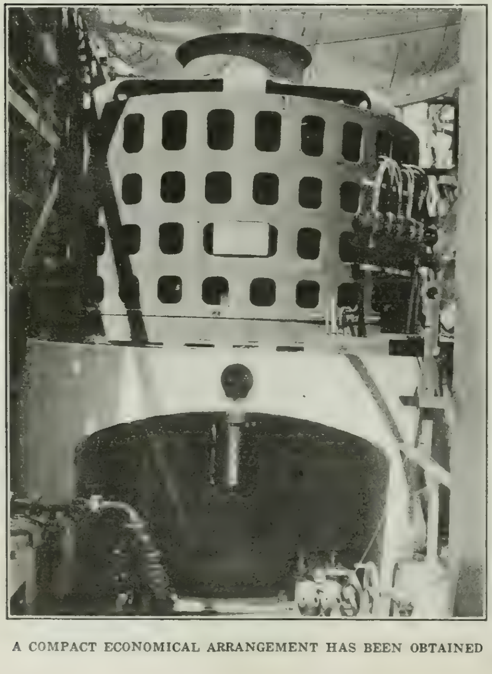
A CONSTRUCTION CAMP LAYOUT THAT FACILITATED COMPLETION OF REHABILITATION WORK

As shown in the connection diagram, oil switches No. 5 and No. 6 are provided with standard overload reverse-power relays and the reverse power element is so connected that it will trip only for outgoing power. Therefore, if, for example, the Bakersfield steam station and the Kern Canyon station are supplying power to the Southern California Edison Company's system at their Kern River No. 1 station, a short circuit on the transmission line between Bakersfield and the San Joaquin Kern Canyon station would open only oil switch No. 5, and the San Joaquin Kern Canyon station would be disconnected from the short automatically and continue to supply the Southern California Edison system. When the Southern California Edison system and the San Joaquin system are not tied together through the San Joaquin's Kern Canyon station, the potential coil of the reverse-power relay is short-circuited to eliminate selective action and oil switches No. 5 and No. 6 operate only with the overload relays.

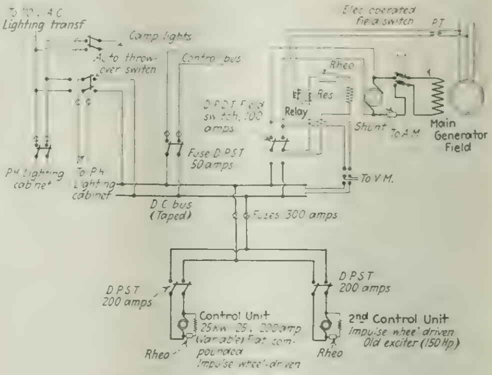


SIMPLE SWITCHING AND NO LOW TENSION CHARACTERIZE KERN CANYON STATION

Referring to the low-tension connections in the drawing, it will be seen that there is no common low-tension bus. The main advantage of a common low-tension bus is that when generator No. 1 happens to be out of service at the same time as transformer bank No. 2, then generator No. 2 can be operated through transformer bank No. 1. In a modern station the probability of any generator or any bank of transformers being out of commission is small, and the probability of coincidence is therefore extremely small. Furthermore, the advantage of being able to connect generator No. 1 with transformer No. 2 becomes of relatively less importance as the system grows. The fact that the two units in this case are of very different size, one being roughly twice as large as the other, was considered also as decreasing the advantage which might otherwise exist, and therefore the scheme as shown was adopted.



A COMPACT ECONOMICAL ARRANGEMENT HAS BEEN OBTAINED



IMPULSE-WHEEL-DRIVEN EXCITER AND HIGH-TENSION RELAY ASSURE UNIFORM VOLTAGE

This scheme considerably simplifies the low-tension lay-out and also the differential protection, which is arranged so that an unbalanced current of twice the full-load current required by the station service and auxiliaries between oil switches No. 1 and No. 3 trips these oil switches and also the generator field switch. The station service oil switch is protected by overload relays of 1-amp. setting so as to trip out in case of trouble back of this switch without interference with the operation of the main unit. Both ends of each phase of the generator are brought out through current transformers and one side is grounded. One set of these current transformers is connected through differentially connected relays with bushing-type current transformers on oil switch No. 3, and the other set of generator current transformers is used for metering.

It will be noted that all the oil switches can be shunted through disconnecting switches, and this permits of inspection and eventual repairs without shutting down the plant. Before disconnecting switch No. 3-b is closed the differentially connected relay must be short-circuited through a triple-pole, single-throw switch provided on the switchboard, since the closing of switch No. 3-b operates to decrease the current in the current transformers of oil switch No. 3 and would therefore actuate the differentially connected relay and trip oil switches No. 1 and No. 3 and the generator field switch.

Oil switch No. 1 was installed because the station as designed would have but one unit, and in case this unit were shut down the only means of getting power into the station would be from the 66,000-volt buses. Disconnecting switches No. 1-b and No. 1-c are so arranged that the station service and auxiliaries, including the motor-driven oil pump for the governor system, can be supplied either from the generator or from the transformers. Normally disconnecting switch No. 1-b is closed and No. 1-c is open, so that if oil switch No. 5 should fail to operate, the operator may open oil switch No. 1 and the auxiliaries will be supplied directly from the generator. In case generator No. 1 is shut down, disconnecting switch No. 1-c is closed and No. 1-b is open.

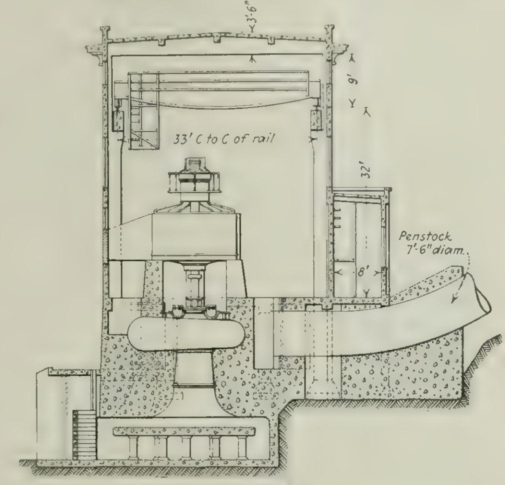
Lay-out of Excitation System

The method of excitation is somewhat unusual, as is shown in the drawing. The shunt-wound exciter is connected directly to the generator, and the voltage of the alternator is controlled by the rheostat in the exciter field. No rheostat is provided in the alternator field. The exciter field is excited from the direct-current bus, which is connected to the impulse-wheel-driven control unit. This control unit is 25 kw., 125 volts, flat-compound-wound and direct-connected to an impulse wheel provided with an oil-pressure governor. A flywheel of sufficient momentum prevents a decrease in speed of more that 2 per cent when closing an oil switch, assuming that the governor does not have time to act.

This unit is intended to maintain practically constant voltage on the direct-current bus under normal as well as abnormal conditions, and it supplies energy for the operation of the electrically operated oil switches and field switch and also for the indicating lamps. In case of emergency it also supplies about one-half of the power-house lights through an automatic throw-over switch. Eventually there will be two impulse-wheel-driven control units. It was intended to use the impulse-wheel-driven exciter of the old station as a standby, but as the penstock of this station was found to need extensive repairs this exciter could not be used, and therefore a motor-driven exciter was installed in the new station for use in case the control unit should be out of order. The use of the motor-driven control unit is a temporary makeshift of no great merit, since the main object of the control unit is to supply a constant voltage, especially during periods of abnormal conditions, and this the motor-driven unit cannot do. A double-throw field switch is provided so that the exciter in an emergency can excite its own field. This is intended for use only in case the unit is operated as an over-excited synchronous motor and in case no water is available for the control unit. The unit will not operate satisfactorily as a generator in this manner.

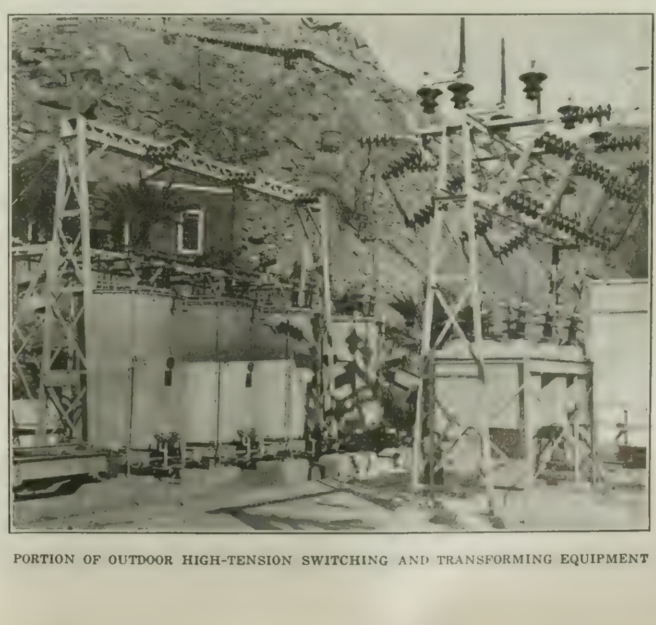
No potential regulator is used or intended for this plant, but, as indicated in the drawing, a relay is connected through a potential transformer to the generator circuit, and in case of overvoltage the relay inserts a resistor in series with the exciter field. This is necessary because speed regulation cannot be maintained so closely as with steam turbines, and in case full load is suddenly dropped a considerable increase in the generator speed, about 20 per cent, cannot be prevented, and therefore a very considerable increase in voltage may result, depending largely, of course, upon the power factor of the load.

Storage at the intake was not possible on account of the location of the Southern California Edison Company's Kern River No. 1 station. On the intake side of the river and directly over the intake site there is a very dangerous mountain slide; therefore the intake structure was designed with a cushion of loose fill over its top for protection against slides. The structure is a part of the dam and has two 6-ft. (1.8-m.) sluicegates, one in front of the rack bars for the purpose of removing coarse material, and the other behind the rack bars to clean the sand trap.



THE GENERATORS ARE SUPPORTED ON CONCRETE RINGS WHICH RAISE WATERWHEELS TO FLOOR LEVEL

The tunnel work was the major part of the job and consisted of enlarging the old tunnel from 6½-ft. x 6½-ft.



PORTION OF OUTDOOR HIGH-TENSION SWITCHING AND TRANSFORMING EQUIPMENT

(1.98-m. x 1.98-m.) section to 13½-ft. x 14-ft. (4.11-m. x 4.26-m.) section, the new tunnel to be a pressure tunnel. There are eight adits in the 8,300 ft. (2,530 m.), and as none of them was very long, all but two were enlarged, some of this work being done before the old tunnel was unwatered. The old station was shut down on Jan. 28, 1921, and immediately a track was laid the entire length of the tunnel. As all equipment was to pass through the old tunnel, the equipment was at once distributed so that work could be started from all points at the same time.

Two, and in some cases three, headings, about 250 ft. (75 m.) apart, were worked on each side of an adit, so that while one heading was being drilled the other was being mucked, thus making both operations practically continuous. On account of the excellent ventilation, due to the numerous adits and the pioneer, very little delay was caused by powder smoke. Therefore, it was possible so to plan the drilling and shooting in the numerous headings that the progress depended upon the rate of mucking, which during the last thirty days amounted to 120 linear ft. (36 m.) of tunnel per twenty-four hours.

Five-ton electric locomotives equipped with storage batteries and 2-cu.yd. (1.5-cu.m.) steel side-dump cars constituted the hauling equipment. No trolley was used nor were the batteries removed from the locomotives while being charged at the adits, as enough equipment was provided to have at least one unit always on charge, the time of charging being about three hours. These "Exide" batteries gave no trouble whatever, and in one instance when a locomotive was lost over a dump 200 ft. (60 m.) high it was necessary to go down to the river and open the switch, as the wheels were still spinning on the rocks. When hauled back to the tunnel this unit immediately resumed work without repairs.

It was a very difficult problem to determine the proper section to use in the different parts of the tunnel. From an examination of the old tunnel it would be evident that some parts were certain to need lining, and these would be driven to a lined section; while another part might look as if it should be unlined, but after enlargement it would disclose dangerous ground. Thus the section was changed many times in order to avoid unnecessary lining and at the same time to avoid driving unlined section which would need concrete. This resulted finally in three finished sections—one unlined, one lined to a size much over capacity (being short lengths where the unlined section was not considered safe), and the third being the lined section.

Forebay, Surge Chamber and Penstock

The old forebay was in a large chamber excavated at the lower end of the tunnel, and in part of this the new concrete structure was built. It can best be described as a short piece of tunnel approximately at right angles to the main tunnel, the regular tunnel forms being used, the tunnel entering at one side, two penstocks entering on the opposite side, and there being a 36-in. (0.9-m.) sluicegate in one end. A sand trap and rack bars were provided to guard the turbine from débris from the unlined section. In the remaining part of the old chamber the two butterfly valves at the top of the penstocks were placed.

Only one penstock was built for the present development, it being of riveted steel plate, 8 ft. (2.4 m.) in diameter at the top and 7 ft. (2.13 m.) at the wheel and 568 ft. (173 m.) long. It is supported on concrete piers and in addition to being backfilled has concrete anchors at the bends.

Only one new unit has been installed, but one end of the building is of temporary construction with foundations installed for one future unit. The present unit with its auxiliaries was manufactured by the Allis-Chalmers Company and consists of a 12,000-hp. Francis-type vertical turbine, operating under a head of 230 ft. (70 m.), with a plate-steel casing, butterfly valve and pressure-regulating valve, directly connected to a 10,600-kva., 11,000-volt, 60-cycle, 257-r.p.m. generator with a Kingsbury bearing, on top of which is mounted a direct-connected 864-kw., 125-volt flat-compounded exciter. A White regainer was installed in the draft tube.

Water Wheel on Main Floor

An unusual feature of this plant is that the water-wheel is reached from the main floor, there being no pit, and in order to accomplish this the generator is supported on a concrete ring, the top of which is 7 ft. (2.1 m.) above the floor. One advantage of this is that the governor, control unit, switchboard and valve-operating mechanism are all on the same floor, so that one operator and an oiler compose the entire operating crew.

The switchboard consists of four panels—control unit, exciter, generator and line panel. On the control panel is mounted an automatic throw-over switch for the station service control in addition to the regular instruments. Provision is made on the exciter panel for the future unit. On the generator panel are mounted the indicating instruments, control switches, differentially connected relays, station service relays and the exciter field rheostat.

The high-tension bus is of the outdoor type, the supporting structure being steel towers. The voltage is stepped up from 11,000 to 66,000 by a bank of 3,600-kva., single-phase transformers, which are connected delta on the low side and star-connected on the high side, with the neutral grounded. The 11,000-volt current is brought from the bus room by 800,000-circ. mil lead cables.

The cost of the development as reported to the California Railroad Commission is as follows:

Water conduits	$997,142
Penstocks	127,000
Dams and reservoirs	130,000
Building	203,000
Turbine, generator and exciters	368,000
Switchboards, switches, transformers and miscellaneous	124,753
Total	$1,949,895

The plant has been operating some time and the operating department reports it has experienced no trouble of any kind under normal or abnormal conditions.

The construction of this project was carried out under the direction of R. C. Starr, construction engineer for the San Joaquin Light & Power Corporation, whose organization consisted of the authors, who were respectively superintendent and designing engineer; J. D. McDougald, general foreman; Victor Rynning, general storekeeper; E. L. Fox, tunnel foreman; George Fisher, chief electrician; D. J. Pease, master mechanic, and W. B. McMillan, resident engineer.

Electric Fires and Electric Fire Losses During 1920*

Reduction in Proportion of Fires of Electrical Origin Apparent —Liability to Fires Is Governed by Local Conditions Which Are Controllable—Deductions from the Investigation

By **REGINALD TRAUTSCHOLD, M.E.**
Society for Electrical Development, Inc.

The report of the Society for Electrical Development on electric fires during 1919, coming out last year as it did soon after the appearance of the five-year report of the National Board of Fire Underwriters, demonstrated very conclusively the absence of any relation between the number of fires attributable to the use of electricity in residential and commercial buildings and the monetary loss resulting from such fires. This was foreseen and emphasized in the society's report of last year, but the possible difference in the interpretation of the statistics presented by the two organizations led to many conflicting and misleading statements being made—particularly in newspaper "feature" articles. For this reason the study of fire reports for 1920 has been extended to cover the question of losses occasioned by fires of electrical origin as well as their number.

As in the case of the investigation last year, the data were gathered first-hand from the official reports submitted by the fire departments of various communities and have been carefully analyzed, compared and classified. When the reports as received appeared questionable, the records were checked up by representatives of the local central-station company and by city officials, and in a number of instances valuable information has been furnished by the fire underwriters, making the tabulated records as authentic and unbiased as possible.

Complete reports on the prevalence of fires of electrical origin in residences and commercial buildings—the only class of fires which can logically be attributed to the introduction of electric service—were received from 314 communities, having an aggregate population of close to 25,000,000 people. This is probably about 40 per cent of the population of the country reached by central-station lines in 1920 and a considerably larger proportion of the people residing in communities of 5,000 or more. From 263 of these communities complete records of fire losses were obtained.

Number of Electric Fires

In the 314 communities a total of 121,999 fires occurred during the year, of which number 2,971—in residences and commerical buildings—were probably attributable to the use of electric service, giving an electric fire ratio of 2.44. This record is about 4.3 per cent better than that of the previous year, and a glance at Table I will suffice to show that this improvement has been brought about largely by betterment of conditions in the two largest cities in the country.

Table I, which presents fire statistics classified by population groups, indicates that there is little, if any, relation between the size of the communities and the prevalence of fires of electrical origin. However, the largest cities of the country, with their more stringent building regulations, better inspection systems and stricter enforcement of precautionary measures, have exceptionally low electric fire ratios, as do also some of the smaller communities, particularly those of a high residential class. It is among the large towns and more rapidly growing cities—many of them of large size—that the largest electric fire ratios occur. This is due to many and variable conditions—inflammable building construction, hazardous pursuits, climatic conditions and laxness in inspection and in protective regulation being prominent. It is for these reasons that any fire ratio based on general averages is misleading and fails to give a reliable idea of true conditions.

In the study made by the Society for Electrical Development the actual electric fire ratios for the individual communities are arranged graphically in the order of

TABLE I—NUMBER OF FIRES OF ALL ORIGINS DURING 1920

Population Group	Number of Cities	Population		All Fires			Electric Fires			Other Fires in Bldgs.		Per Cent Ratios	
		Aggregate	Average per City	Aggregate	Average per		Aggregate	In Buildings	Average per City in Buildings	Aggregate	Average per City in Buildings	Electric Fires in Buildings to All Fires	Electric Fires in Buildings to Other Fires in Buildings
					City	1,000 People							
5,000— 10,000	89	596,986	6,708	4,262	47.9	7.2	137	103	1.16	3,657	41.1	2.42	2.82
10,000— 15,000	55	649,303	11,803	4,121	74.9	6.4	144	102	1.85	3,698	67.2	2.47	2.76
15,000— 25,000	57	1,043,955	18,315	6,893	120.9	6.6	237	177	3.11	5,850	102.6	2.57	3.03
25,000— 40,000	28	884,634	31,594	5,056	180.4	5.7	217	154	5.50	4,083	145.8	3.04	3.88
40,000— 55,000	23	1,062,653	46,202	7,013	304.9	6.6	270	106	6.79	6,117	261.6	2.22	2.60
55,000— 75,000	18	1,193,270	66,293	8,346	463.7	7.0	290	179	9.90	6,942	385.7	2.14	2.58
75,000— 100,000	10	887,149	88,715	4,558	455.8	5.1	187	139	13.90	3,920	392.0	3.05	3.54
100,000— 150,000	13	1,562,430	120,187	13,106	1,008.2	8.4	845	278	21.39	11,308	869.9	2.12	2.46
150,000— 250,000	6	1,202,667	200,444	6,117	1,019.5	5.1	350	171	28.50	3,646	607.7	2.79	4.68
250,000— 500,000	9	3,302,944	366,994	15,387	1,709.7	4.7	902	549	61.00	12,674	1,408.2	3.57	4.33
500,000—1,000,000	4	3,431,310	857,828	18,502	4,625.5	5.4	1,210	688	172.00	14,324	3,581.0	3.72	4.80
Over 1,000,000	2	8,120,048	4,060,924	28,638	14,319.0	3.5	904	275	137.50	26,557	13,278.5	0.96	1.04
Aggregates.....	314	23,937,349	....	121,999	... .	...	5,693	2,971	... ..	102,676	.	2.44	2.90–2.82

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*Digest of the 1922 report by the Society for Electrical Development, Inc.

their magnitude, permitting a much more accurate appreciation of the liability to such fires. In fact, smooth enveloping curves depict with considerable accuracy the liability to fires of electrical origin in each population group. These curves are quite similar, their reliability in depicting liabilities for electrical fires being governed by the number of individual fire ratios recorded in the respective groups. The general similarity of these curves indicates, furthermore, that by giving each curve a "weighted" value, conforming to the number of communities it represents, composite curves can be drawn which will show reliable electric fire "liabilities."

Such composite curves are reproduced in Fig. 1, and it will be noted that, while the grand average fire ratio was 2.44, the fire ratio in 63 per cent of the communities was less and in fully half the places was not more than 1.4. In 40 per cent of the communities it was less than 1, and in 30 per cent not over 0.5. If only fires occurring in buildings, residential and commercial, are considered, the curves show that while in the aggregate there were thirty-four and one-half fires due to non-electrical causes to every fire of electrical origin, this ratio was not equaled in 63 per cent of the communities, and in fully half of the towns there were at least fifty-seven and one-half non-electrical fires for every fire attributable to the use of electric service. In 40 per cent of the towns and cities reporting there were at least ninety-two non-electrical fires in buildings to one electrical, and in 30 per cent of all of the communities the minimum number of fires originating from other causes was close to 150 for each one traceable to the use of electric service.

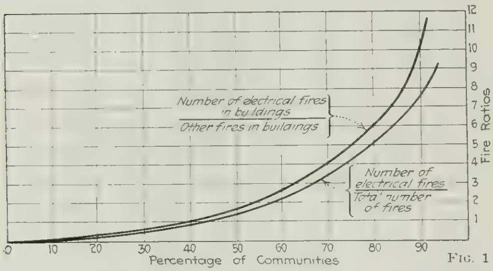

Fig. 1

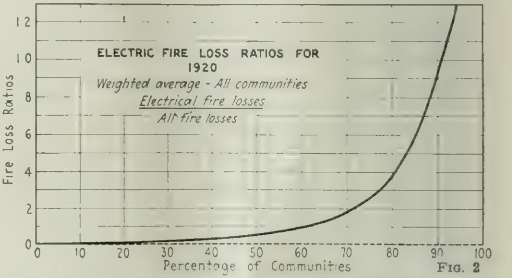

Fig. 2

FIRES RESULTING FROM THE USE OF ELECTRICITY ARE SUSCEPTIBLE TO CONSIDERABLE CONTROL AND FORM ONLY A SMALL PERCENTAGE OF ALL FIRES

These statistics demonstrate clearly that the fire risk from the use of electricity in residences and commercial buildings is susceptible of considerable control, for among the localities in which fires of electrical origin are relatively rare are some of the most thickly populated as well as many of the smaller communities.

Such an analysis may appear somewhat contradictory, but if a study is made of the causes of electric fires, the statistics are really quite illuminating in ascribing the reason for the wide variations in electric fire ratios. Generally speaking, fires of electrical origin may be classified under three main groups—(1) those which are due to static electricity, lightning, street-railway current, automobile electric systems, etc.; (2) those due to defective wiring, defective apparatus, etc., and (3) those due to carelessness in the use of electric flatirons, abuse of portable cords, overfusing and overloading of circuits, etc.

The responsibility for the fires falling in group 1 cannot in justice be laid to the use of electric service, so they have been excluded so far as possible from the fire department statistics under consideration. The fires placed in group 2, on the other hand, are attributable to the use of electric service, and, naturally, it is in their suppression that the electric industry is particularly interested. The interest of the industry does not, however, necessarily mean responsibility for the fires. On the contrary, the responsibility should be largely one of city and insurance inspectors, and this is conclusively demonstrated by the fact that in communities, large and small, where inspection, reinspection and enforcement of proper precautionary measures are most rigid the proportion of fires of electrical origin is, as a rule, substantially below the grand average.

Low Electric Fire Ratios

Probably the most striking example of low electric fire ratio is that for Chicago, where more central-station electrical energy is generated and used than the aggregate consumption for the states of Maine, New Hampshire, Rhode Island, Connecticut, North Dakota, South Dakota and Wyoming combined. Excellent records have been established in New York, Richmond, Va., Cambridge, Springfield and Lowell, Mass., Evansville, Ind., and Hartford, Conn.; and in numerous smaller communities there were no fires of electrical origin during 1920, although the use of electric service was very general. This shows that it is not the use of electricity which introduces a fire hazard, but its abuse.

The third group of electric fires, those attributable to carelessness with flatirons, abuse of portable cords, overfusing and overloading circuits, etc., would also seem to call for municipal attention or community regulation. The responsibility for such fires lies with the user of electric service—either because of ignorance or through disregard of necessary precautions. The proper use of electricity does not constitute a fire hazard, but is, on the contrary, one of the most effective agencies in reducing the liability to fires. This is generally admitted, but the serious mistake is also quite general of emphasizing the enormous losses occasioned by fires attributable to the abuse, careless use and faulty installation of electric systems—things which for the most part are preventable. The result of such ill-advised propaganda, if it had any lasting effect, would obviously be to discourage the substitution of electrical energy for other forms of light, heat and power which are themselves more or less dangerous.

The fact that the use of electric service continues to increase steadily is conclusive evidence that the public is little influenced by these alarming reports. But this is not entirely satisfactory because it signifies that the public not only disregards in large measure ill-advised warnings of the dangers of electricity, but is inclined to disregard as well reasonable precautions in its use. The impunity with which electric service can frequently be abused constitutes its chief hazard.

The unreliability of newspaper accounts was forcibly verified in a careful investigation of the fires reported as being of electrical origin in the daily press. In five out of six cases the investigations showed that the use of electricity played no part whatever in causing the fires.

ELECTRIC FIRE LOSSES

A study of electric fire losses is of interest, though of secondary importance in that the chief consideration should be the liability to fires from electric service, because the losses, no matter how regrettable, are incidental to whatever hazard may be introduced by the service. This is particularly true in view of the wide publicity given to the heavy fire losses which have been attributed to the use of electricity.

Following the same general method of analytical investigation adopted in the case of the study of the number of fires, the electric fire loss statistics culled from the 263 community reports received have been analyzed, Table II listing the collective data arranged in population groups, but there is no apparent relationship either to group population or to the prevalence of electric fires as indicated by the electric fire ratios given in Table I. The general average fire-loss ratio, based upon the aggregate of all fire losses, is 3.28, which is substantially less than that of the majority of individual group ratios, although considerably greater than the general average electric fire ratio of 2.44 given in Table I. These ratios of prevalence of and losses due to fires are not really comparable, being based upon values which cannot bear any definite relation to one another.

The composite weighted curve shown in Fig. 2 indicates that the liability to electric fire loss is well below the average of 3.27 per cent in nearly 80 per cent of all communities, and that in 60 per cent of the communities it is less than 1 cent in each dollar of total fire loss. In half the communities enjoying electric service not over ½ cent per dollar of fire loss is attributable to the use of electric service, and in 40 per cent of the communities 3 cents is a maximum electric fire loss for each $10 destroyed by fire. In twenty communities out of every 100 the electric fire losses constitutes at most 10 cents in every $1,000 of fire loss.

These statistics, based upon official statements from the fire departments of the various communities, differ greatly from those in reports published by organizations interested primarily in the question of losses on insured property, in which general averages only are presented; but this should not be unexpected. In the case of buildings, both residential and commercial, the more valuable the property, as a rule, the more apt it is to be covered by insurance, and almost invariably such buildings have electric service. This means that the losses on insured property are quite certain to be relatively much greater than those on uninsured property.

INCENDIARISM

A contributory cause to the heavy losses in insured buildings or contents of buildings which should be taken into account in any careful study of the question is incendiarism. It is estimated more or less officially that 40 per cent of all fires in New York City during recent years have been of incendiary origin. Of course, such fires always occur on insured property, and it is always difficult to trace their origin. If an incendiary fire is successful, its origin is effectively concealed and evidence of cause destroyed. Much the same absence of origin is characteristic of a disastrous fire of electrical origin.

TABLE II—FIRE LOSS STATISTICS FOR 1920

Population Group	Number of Cities	Total Fire Losses Aggregate	Total Fire Losses Average per City	Electric Fire Losses Aggregate	Electric Fire Losses Average per City	Per Cent Ratio of Electric Fire Losses to Total Fire Losses
5,000— 10,000	77	$2,317,431	$30,097	$154,018	$2,010	6.65
10,000— 15,000	50	1,735,478	34,710	42,247	845	2.44
15,000— 25,000	51	4,181,984	82,000	42,195	827	1.00
25,000— 40,000	26	1,935,405	74,439	75,076	2,888	3.88
40,000— 55,000	19	5,007,972	263,577	352,183	18,536	7.04
55,000— 75,000	14	3,382,718	241,624	436,060	31,147	12 90
75,000— 100,000	4	448,104	112,026	58,219	14,555	13.00
100,000— 150,000	9	4,699,401	522,156	51,910	5,768	1.10
150,000— 250,000	5	3,237,547	647,509	169,917	33,983	5.25
250,000— 500,000	4	3,921,212	980,303	198,886	49,722	5.06
500,000—1,000,000	2	7,475,985	3,737,993	304,945	152,473	4.08
Over 1,000,000	2	29,806,908	14,903,454	346,459	173,230	3.28
Aggregates......	263	$68,150,145	....	$2,232,115	......	3.28

SUMMARY

In the conduct of this study of electric fires, particularly as it pertains to the prevalence of such fires, numerous inaccuracies were discovered in the reports of electric fires, many more fires were found attributed to the use of electricity than were actually due to it, and many interesting comments by city and fire department officials were gathered regarding the safety of electricity when properly used. To cite these things would, however, add little of constructive value to a presentation of this character. To draw attention again to certain points of evidence and to logical deductions brought out by the study should, on the other hand, be of constructive value. These salient points are:

1. Coincident with the rapid introduction and extension of electric service, some reduction in the proportion of fires of electrical origin is apparent, indicating that the introduction of electric service is in reality a safety movement and in itself does not introduce a fire hazard.

2. The liability of fires attributable to the use of electric service is not susceptible to measurement by general averages, but is governed by local conditions which are controllable to a considerable extent.

3. The liability to fires of electrical origin in individual communities places the communities in well-defined groups in which the electric fire risk can be measured with considerable accuracy—the ranking being established by the records of previous years. Consequently, a system of classification of communities according to their liability to electric fires would unquestionably have a tendency to bring about better inspection and regulation methods in the individual communities in an attempt to improve their ranking.

4. A suitable classification of electric fires in civic and insurance reports will serve to indicate the responsibility for an excessive number of fires in any particular class, permiting the introduction of suitable remedial measures and the enforcement of suitable regulations.

Household Appliance Publicity*

A Discussion of the Question "Are We Advertising Electrical Home Equipment in the Proper Way?"

By W. P. Strandborg
Portland, Oregon

ONE of the main difficulties in the way of getting the best and most consistent results out of our advertising expenditures for electrical home equipment is that few of the central-station men—commercial managers, sales managers or advertising managers—have even an approximate idea of how much money they will be permitted to spend throughout the calendar or fiscal year. In other words, lack of definite and fixed advertising budgets (on a percentage basis), with some flexibility to care for emergency needs, impairs to a substantial degree the value of the very best efforts of the men in charge of this phase of the industry.

Lack of definite budgets prevents the commercial department from laying out a definite plan for the year ahead and interferes with or handicaps the achievement of a definite objective for the year's work. The chief reason that such a situation exists is that our central-station executives are not always so completely sold on the value of vigorous, consistent and aggressive local advertising campaigns as we ourselves are. Many of these executives, however, are coming around to our way more and more, so that the future right now looks brighter than ever for building up good and growing residential loads.

Smaller companies that do not have or cannot afford to have their own advertising managers should, by all means, place their advertising accounts in the hands of a reliable advertising agency which has the facilities and experience and equipment for handling public utility business. It is rarely safe for the small station to trust its advertising affairs to some (or any) office man who knows nothing about advertising if it expects to get a proper return for the money expended. Indeed, many of the largest and most important plants in the country turn all their advertising business over to commercial agencies, which handle the work under the direct supervision of the advertising manager of the company.

Local Conditions Modify Methods

Most of the central-station companies have been reasonably well educated as to the best media for advertising, through the co-operative advertising and sales helps furnished free of charge by the manufacturers—a gratuitous service worth thousands of dollars a year to any company that avails itself of it intelligently—and are therefore standing on pretty sure ground in this respect. But there is one danger in relying too strongly on such "boosts." Local conditions enter into the field quite frequently, and it is at such times that the local company must rely on its own ingenuity and resourcefulness to meet the condition.

Such occasions are, for example, extension of service into new territory, reduction or change in rates, drives for the reduction of excessive stocks of certain kinds, special demonstration weeks or periods, and also periods of extraordinary building operations. House-wiring campaigns might also be included in this list. Co-operative advertising and sales helps are valuable to a greater or less extent under such conditions, but to meet the problems most effectively a careful survey by the home company is vital. The advertising department has its own problem to solve at such times, mainly in determining how its appropriation may be most wisely distributed. In other words, the choosing of media in cases like this acquires greater importance than in dealing with normal and general conditions.

Occasions may arise where exclusive direct mail campaigns are greatly to be preferred to an exclusive newspaper display advertising campaign, or to a co-ordinated drive where several standard media may be used—or just the reverse may be true. Sometimes "single-shot" drives have been tremendously successful and sometimes they have fallen flat. Only study and experience can determine such matters. But what intelligent advertising does at all times is to greatly reduce, and oftentimes entirely eliminate, the guesswork in salesmanship and business building.

Mail Literature Gets Results

The writer is strongly of the opinion that the central stations, as a rule, do not avail themselves sufficiently of the abundant opportunities for creating new and expanding old business through the use of direct mail literature which is so well got up and so economically supplied to the central stations by the National Electric Light Association and by the electrical manufacturing industry. The present indications, are, however, that hundreds of the central stations are coming to see the importance of this co-operative material. All of it may be secured with the home company imprint and be used as original matter in the form of "bill stuffers" or sent out with original letters to the customer mailing list and even to new "prospects."

One weakness in our armor is almost a universal one and that is our failure to "tie into" and co-ordinate our own efforts with the various great and carefully planned national advertising campaigns which have recently sprung into more and more prominence in our industry. These are of extraordinary educational value, prepared by experts and designed to meet both national and local conditions. They are not always designed to meet local conditions 100 per cent, for that would be impossible under any circumstances, and that is why the local company should be ready to take advantage of the cumulative benefits of this high power advertising by using well-directed local copy to support it.

There never was a time when this phase of the local problem presented such excellent opportunities for efficient publicity as the present. The whole electrical merchandising industry seems to be working shoulder to shoulder this year with a view of making it the most successful business-building year in the annals of the entire industry. How widespread and comprehensive is this unprecedented co-operative movement will be apparent to any one who reads the daily newspapers. The wide-awake central-station man is, of course, familiar with it already. But most of us are overlooking or neglecting our own responsibility and opportunity to "cash in big" during these great national drives. The very momentum of these dominant advertising drives should pick us up and carry us along with it to the extent of spending at least 25 per cent as much money for advertising in our home papers as these national institutions are doing for us.

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*Paper presented before the Northwest Electric Light and Power Association, Boise, Idaho.

Electrical Layout in Bay State Cotton Mill

Safety-Front Switchboards—1,320 Watts per Lighting Circuit -Mounting of Motors and Control—Unusually Flexible and Accessible Distribution Circuits—Lighting and Power Data

By WILLIAM S. MADDOCKS
Electrical Engineer Lockwood, Greene & Company, Boston

UNTIL the construction of the Lowell (Mass.) mills of the Bay State Cotton Corporation* picker houses had always been on the ground floor, material in process advancing upward by stages until as finished yarn it reached the top. Material was carried from floor to floor by elevators. In these new mills, however, the plant has been literally turned upside down, the picker house being on the roof. Material in process descends by gravity conveyors to the lower floors, where the spinning is done, the finished yarn going to an underground tunnel, whence it is carried to the weave mill by electric tractors. The method of supplying electric service and some of the reasons for arranging the power and lighting equipment in the manner adopted are presented below.

SUBSTATION FACES MAIN OFFICE ON CITY STREET

Supplying power to the mill would have been an almost insurmountable task in the old days of rope drive, because the best available site for a power house had the disadvantage of being on the opposite site of a trunk-line railroad from the weaving mill. With electrical distribution, however, power supply was hardly a problem at all.

Energy is delivered to a substation directly across the street from the mill office by the Lowell Electric Light Corporation over three 13,200-volt, 60-cycle underground lines, this number being used to assure continuity of service. The energy is obtained at an average cost to the mill of 2.3 cents per kilowatt-hour. Aside from the reasons implied above, central-station service was selected because of the excessive investment charge which a mill plant would have entailed.

The substation, measuring about 43 ft. x 49 ft. in plan, is designed to house ultimately twelve 500-kva., 13,200/600-volt single-phase transformers and the necessary switchboard equipment. Six transformers are at present installed, the units being rated at 333 kva. each. The Lowell Electric Light Corporation standardizes on this size for the larger industrial establishments to facilitate the immediate replacement of burned-out units. Each transformer is equipped with primary oil circuit breakers having inverse-time-element overload features. No secondary oil switches have been provided, but single-pole disconnecting switches are inserted in both high-tension and low-tension sides to facilitate cutting out any transformer on short notice. While this arrangement makes it necessary to cut service off the mill while removing a transformer, the infrequency of such an occasion and the resulting simplification of the electrical layout justified it.

A "dead-front" type of switchboard is provided in the substation, the bus structure being mounted directly behind the board. Both were furnished by the Westinghouse Electric & Manufacturing Company. No lighting switches are mounted on the front of the board. All lighting is supplied by 600-volt feeders controlled by Krantz safety-type switches mounted behind the switchboard and operated by levers from the front. Local transformers reduce the potential to 120 volts for mains and branch circuits. Three 25-kva. single-phase induction feeder regulators equipped with line-drop compensators and relays insure close voltage regulation.

All the power feeders, which are 600-volt three-phase circuits, are controlled by panel-mounted oil circuit breakers equipped with inverse-time-element overload features.

TABLE I—LIGHTING EQUIPMENT AND SPACING USED IN BAY STATE COTTON MILL WITH INTENSITIES AND POWER REQUIREMENTS PER SQUARE FOOT

Process	Lamp		Reflector Type	Mounting Height (Ft.)	Spacing (Ft.)	Foot-Candle Intensity (Calculated)	Watts per Square Foot
	Watts	Type*					
Pickers	100	C	RLM	10½	14 x14	3.10	0.51
Cards	100	C	RLM	10½	10½x10½	4.80	0.91
Lappers	100	C	RLM	10½	10½x10½	4.80	0.91
Combing	100	C	RLM	10½	9½x 9½	5.90	1.11
Drawing	100	C	RLM	10½	10 x10	5.30	1.00
Slubbers	100	C	RLM	10	11 x11	4.40	0.83
Intermediates	100	C	RLM	10½	9½x 9½	5.90	1.11
Fine frames	100	C	RLM	10½	9½x 9½	5.90	1.11
Spinning	100	C	RLM	10	10½x10½	4.80	0.91
Spoolers	100	C	RLM	10½	11 x11	4.40	0.83
Warpers	100	C	RLM	10½	11½x 8½	5.70	1.02
Pilot system	75	C	RLM	15½	56		
Stairways	75	C	Deep-bowl	7½		1.70	0.60
Toilets	75	C	Deep-bowl	10		1.20	0.45
Tunnel	60	B	None	[illegible]	10	1.8	0.60
Basement	100	C	RLM	10½	14 x14	3.00	0.51
Yard lighting	500	C	RLM	55		0.55	0.51
Storehouse	75	C	None	7½	17 x18	1.35	0.24
Storehouse stairways	60	B	None	7½	. .	1.00	0.46

* Mazda.

From the transformer house to the weave mill there is a reinforced-concrete duct line containing forty 3½-in. Orangeburgh fiber ducts, and in the basement of the weave mill are splicing chambers. Feeders are carried to the yarn mill in a fiber-duct line in the west wall of the trucking tunnel. Wherever lead cables emerge from ducts they are wrapped with several layers of asbestos tape and coated with silicate of soda to prevent a short circuit in any one cable from damaging the rest.

OPEN-CONDUIT WIRING SIMPLIFIED JOB

Wiring in the mill storehouse and tunnel is run in galvanized rigid-conduit run exposed on the surface, this being done to keep the building construction and electrical contacts separate, with the further advantage that when changes are decided upon in the machinery location after the pouring of the floor slabs the conduit system is not affected as it would be if concealed.

Excellent natural lighting was obtained by the use

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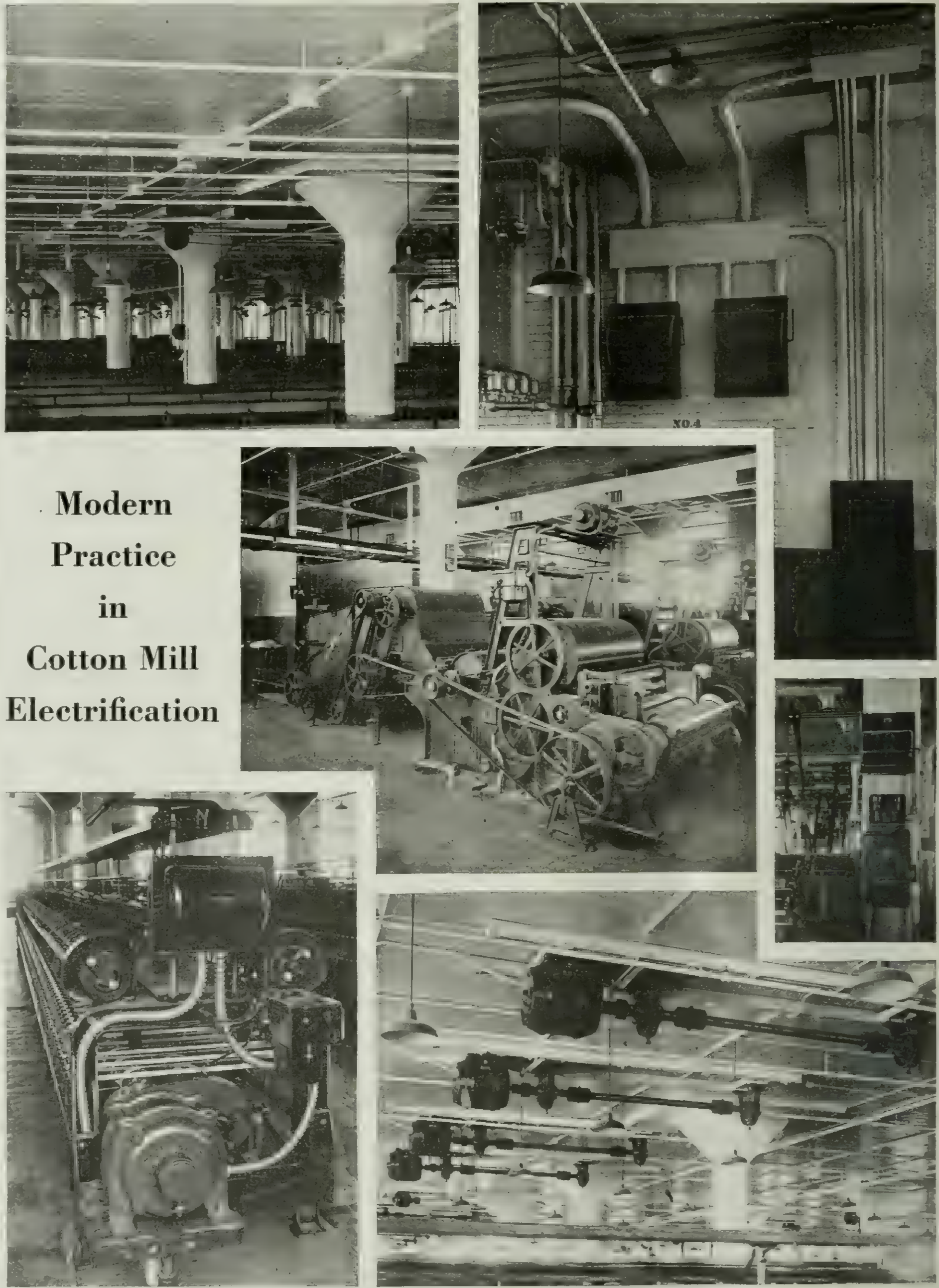
*International Cotton Mills.

Modern Practice in Cotton Mill Electrification



The use of exposed conduit, modern safety equipment and compact but convenient motor installations in a cotton mill marks another step forward in the applications of electricity to industrial service. Convenience and the unit isolation of troubles were dominant features of the Bay State Mill installation.

of steel sash and flat-slab construction with mill-white paint. The artificial lighting was determined on the basis of the data shown in Table I, and the calculated intensity checked closely with meter readings taken since the installation was made. In general, Benjamin dome RLM enameled-steel reflectors are used with 100-watt type C lamps for most of the interior illumination. All lighting cabinets are of the Crouse-Hinds safety type with push-button switches, the cabinets being of No 10 gage steel and having three-wire, three-phase mains with two-wire branch circuits.

BRANCH LIGHTING CIRCUITS TAKE 1,320 WATTS

Permission was obtained from the insurance interests and city of Lowell inspection department to use 1,320 watts per branch lighting circuit in all departments except the picking and carding sections, upon agreement to install keyless sockets out of reach of operatives and to feed directly through No. 14 wire. A pilot-lighting system of low intensity was provided on all floors and controlled by a switch in the transformer house. This service is on a separate feeder and is associated with a duplicate service from the Lowell Electric Light Corporation and from a small generator in the weave mill to insure positively continuous illumination in case of emergencies. Reflectors for general illumination are hung from reinforced slicked cord to insure good alignment and easy adjustment. A special study was made of each operation in planning the lighting layout, and the units were placed to avoid definite shadows in the working spaces. In the cotton storehouse bare lamps in box receptacles were used with wire guards but no reflectors. A locking type of guard was used to prevent theft of lamps.

TABLE II—RATING OF MOTORS AND METHOD OF ATTACHING TO MACHINES IN BAY STATE COTTON MILL

Item No.	No. of Machines	Description of Machine	No. of Motors	Hp., Each	Temperature Rating, Deg.	No-Load Speed, R. P. M.	Mounting	Type	Remarks
		PICKING MACHINING							
1	2	36-in. No. 4 bale breakers	2	7½	50	720	Ceiling	Picker*	Individual drive
2	6	40-in. single-beater breaker lappers with feeders	6	7½	40	1,200	A-frame	Picker	Individual drive
3	8	40-in. single-beater finisher lappers	8	5	40	1,200	A-frame	Picker	Individual drive
		WASTE MACHINERY							
4	1	Two-section W3 roving-waste machine	1	10	40	1,800	A-frame	Picker	Double-shaft extension Outboard bearing
		CARDING MACHINERY							
5	70	40-in. revolving flat cards	1	100	50	900	Ceiling	Standard	Group drive
6	41	40-in. revolving flat cards	1	60	50	900	Ceiling	Standard	Group drive
7	63	40-in. revolving flat cards	1	75	50	900	Ceiling	Standard	Group drive
8	36	9¾-in. sliver lap machines, 20 ends	1	50	50	900	Ceiling	Standard	Group drive
	6	11¾-in. ribbon lap machines, 4 heads							
	6	11¾-in. combing machines, 8 heads							
9	24	9¾-in. sliver lap machines, 20 ends	1	30	50	900	Ceiling	Standard	Group drive
	4	11¾-in. ribbon lap machines, 4 heads							
	4	11¾-in. combing machines, 8 heads							
10	72	Deliveries first drawing (metallic)	6	10	50	900	Ceiling	Standard	Group drive
	72	Deliveries second drawing (rolls)							
11	6	Slubbers, 12x6 bobbin, 64 spindles	3	7½	50	720	Ceiling	Two-frame flexible	Coupling drive
12	8	Intermediate, 10x5 bobbin, 92 spindles	4	7½	50	720	Ceiling	Two-frame flexible	Coupling drive
13	16	Intermediate 10x5 bobbin, 92 spindles	4	10	40	720	Ceiling	Four-frame flexible	Coupling drive
14	20	Fine frames, 8x3½ bobbin, 160 spindles	10	10	50	720	Ceiling	Two-frame flexible	Coupling drive
15	32	Fine frames, 8x3½ bobbin, 160 spindles	8	15	40	720	Ceiling	Four-frame flexible	Coupling drive
		SPINNING MACHINERY							
16	154	Ring frames, 3½-in. gage, 228 spindles	154	7½	40	1,800	Bracket	....	Individual chain drive
17	16	Spoolers, 5-in. gage, 6 travelers, 140 spindles	2	10	50	900	Ceiling	....	Group drive
18	16	Warpers, 510, 6-in.x4-in. spools	2	7½	50	900	Ceiling		Group drive

* Picker-type motors have waste-packed bearings.

MOTOR APPLICATIONS COMPACT

In the selection of motors individual drive was used for the pickers and spinning frames with two-frame and four-frame drive for roving frames and group drive for the other machines. All motors and starting equipment are of General Electric make. In mounting motors for the picker drives A-frames were used to permit a sufficient length of belting. The starting switch is mounted on the opposite side of the machine from the motor, easy of access, and is provided with both overload and undervoltage protection. Below the starting switch is mounted a "No-Ark" service cut-out which can be used as a "disconnect" in case of trouble with the starting switch. As the fuse is placed near the rigid conduit riser which feeds the motor from the floor below, the designing engineers were permitted to use flexible metallic conduit for the connections between the starting switch and motor.

The spinning-frame motor in each case is mounted on a bracket provided by the manufacturer of the frame. On account of the short distance between the frame shaft and motor shaft a Morse chain drive is used, it being inclosed in a sheet-iron case which protects the frame from oil throwing and provides a lubrication chamber for the chain.

POWER FUSES MORE ACCESSIBLE THAN USUAL

In the older textile mills it has been the practice to install a fuse wherever the size of wire was changed. This usually brought the cut-outs on the ceiling over the frames and consequently caused much inconvenience on account of their inaccessibility. In the Bay State installation a concession was obtained from the insurance interests and from the local authorities to place the protective device above the floor where it was accessible. To obtain this concession it was necessary that the tap should be one-third the current capacity of the feeder from which it branched and the protective device not over 12 ft. from the point of tap. The conduit feeding the motors was run on the ceiling of the floor below small junction boxes, being placed directly under the risers, which pass through the floor and terminate at the motor brackets. Just above the floor a type LL condulet is installed with the armored flexible conductor connected at one side. While the code does not require a disconnecting switch ahead of automatic oil circuit breakers, the engineers on this job installed an unfused "Square D" safety-type switch because of the large number of motors tapped off the same feeder. In case of trouble in any oil switch, therefore, on any frame, the trouble can be isolated by opening the safety switch. For the spinning-frame service General Electric P-10 switches were installed for shipper-rod operation.

The four-frame drives consist of a motor directly connected through a flexible coupling to a countershaft which is carried by two special high-speed hanger bearings. The motor and hanger bearings are mounted on a special structural-steel support made of channel irons placed back-to-back with metal spacers between them. Smaller channels fastened by corner angles are used for cross braces. The supports are secured to the ceiling by bolts passing between the side channels and held in inserts cast in the under side of the floor slab. The distribution of the load over a considerable area gives a good factor of safety.

No countershaft is used in the two-frame drives, and the motors are installed without bases. Connections to motors are made by flexible metallic conduit from the rigid-conduit line nearest the motor. One of the accompanying illustrations shows how successfully the installation was accomplished without interference between sprinkler piping, motor supports and conduit.

Starting compensators for the larger motors are mounted on columns and are furnished with overload inverse-time elements and no-voltage releases. To meet the code requirement of an inclosed disconnecting switch between the line and the compensator, "Square D" unfused safety-type switches were used. The compensator relay panel and the disconnecting switch are mounted on angle irons resting on the floor and braced by crosspieces and bands surrounding the columns. Rigid conduit and condulet fittings added to the neatness and compactness of the wiring. The conduit is held in place mainly by "VV" pipe clips.

Typical machine-drive data are given in Table II. The list does not include the power requirements of conveyors, humidifiers, elevators and card strippers. When these motors were ordered, the introduction of 50-deg. motors into the textile industry was just taking shape. Both 40-deg. and 50-deg. motors were purchased, but in every case where a 50-deg. motor was used it was selected so as to be 20 per cent larger than a 40-deg. motor would have been for the same service. This was considered necessary on account of the overloads experienced at times and because of the tendency of the ventilating ducts to plug with "fly" or lint. Lockwood, Greene & Company, engineers, Boston, designed and supervised the construction of the entire installation at the Bay State mills.

New Plan for Supplying Electric Service to Outlying Municipalities*

A Solution of the Problem of Establishing Uniform Rates and Regulations in Serving Small Neighboring Communities from the Lines of a City Central Station

By G. E. MILLER
Sales Manager Cleveland Electric Illuminating Company

THIS plan for supplying electric service to outlying municipalities was designed to take care of incorporated villages which are beyond the Cleveland Electric Illuminating Company's existing service lines and in territory which would probably be unprofitable for some years to come if the company made the investment within the village to supply the service desired. The municipal authorities and the citizens in such villages are persistent in their efforts to obtain electric service and are usually willing to pay either by putting up some money for the cost of building lines or by paying a higher rate for electric service. Yet generally these villages are sparsely settled, and the people appreciate that it would not pay the company to make the necessary investment to provide such service.

The company has a policy of making uniform rates for the same class of service in all territory which it serves, and we do not want to raise rates to take care of excessive investment. In cases of this kind, however, the rate which would have to be charged for electricity in order to show a profit on the investment would be so high as to prohibit the free use of service, and this we know is undesirable.

Our company has had on file with the Public Utilities Commission for some years a standard form of contract under which ordinary line extensions are made where consumers desire service beyond our existing lines. This provides briefly that the consumer put up the entire cost of making the extension and the company will refund the money thus deposited at the rate of $20 for each meter connected to the extension within a period of ten years. But that form of line-extension agreement is not applicable to the incorporated village because usually the amount of money involved in these latter cases is too much for the individual desiring the service to pay. However, where the municipality as a whole is willing to do the financing, a plan can be worked out satisfactorily. Because of limitations imposed by statute upon municipal corporations, however, in the conduct of their finances it was necessary to work out an agreement having these factors in mind.

VILLAGE EXTENSIONS

Having then a village willing to assume the cost of financing the distributing lines within its limits, we have worked out this plan. Under our method the village issues bonds, which is its only means of obtaining capital, and from the proceeds of the sale of such bonds pays for building the lines required and retains ownership of such lines. This ownership of the lines by the village is necessary because in the expending of bond money it must own something in return for the money it spends.

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*A paper presented before the convention of the Sales Managers' Association held at Association Island, N. Y., July 24-26.

In order, however, to enable us to control the situation within the municipality, notwithstanding its ownership of the lines, the plan worked out involves the leasing of the lines by us, with an option on our part to buy the property at any time during the lease period.

The essential features are as follows:

1. The council of the village passes an ordinance authorizing and directing the village authorities to build a distributing system to supply electricity to its inhabitants and to lease this distributing system to the company. This ordinance embodies in it the specific form of lease which is to be entered into between the village and the company when the distributing system has been built.

2. When it has been decided that the village wishes to obtain service under this plan, we make a detailed survey of the territory to be covered, and from the survey make an estimate of the cost of building the distributing system in accordance with our standard specifications. This estimate is then used by the village authorities in order to determine the amount of bonds to be issued by the village for this purpose.

3. When the bonds have been voted and the money from the sale of bonds is available, a contract is entered into by the village authorities with either the company or an outside contractor to build the distributing system within the village according to our standard specifications which we supply to them.

4. When the construction work is completed, we execute the form of lease embodied in the ordinance referred to above and extend our own lines at our expense and make connection with the lines owned by the village.

5. We pay no rental for the use of the village lines under the lease, the consideration in the lease being that we maintain all of the property owned by the village at our expense and that we render our standard service within the village at our standard rates for similar service elsewhere in accordance with schedules on file with the commission.

6. The leasing of the village lines is for a period of ten years, and the lease carries with it an option on our part to buy the lines from the village at any time during the lease period at a price to be agreed upon with the village authorities at the time of exercising the option to buy, and in case of disagreement as to the purchase price this is to be fixed by arbitration.

7. The only investment we have in the village is for meters and distributing transformers. We agree to put these in at our expense, as obviously these are items which are apt to be changed from time to time, and as the village will have no organization to handle such details, we feel that it is desirable that we provide these at our expense.

8. After the completion of the initial installation of lines in the village, the latter must put up all the money required for additions that may be desired during the lease period to take care of new customers or extensions.

9. A new customer coming on is handled by us in the same manner as any application would be handled in any other territory up to the point where we have made a survey and estimate of the cost of making the connection to the new consumer. When this cost has been determined, the sales department fills out a card which is sent to the clerk of the village. This card gives a brief description of the work necessary to make the connection and the cost. If then the village desires to provide service for such new applicant, the card is returned, signed on the part of the village, with a check from the village for the amount of money involved, and when this is received by us the order is put through and executed by us and service is rendered in the usual manner.

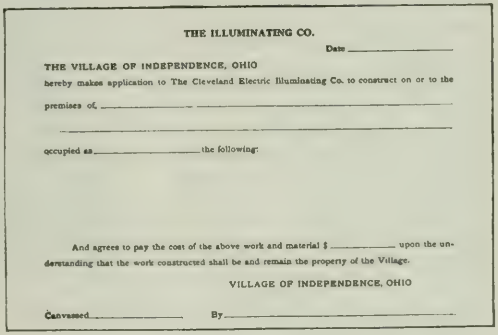
10. The lease makes provision for our connecting to the village lines should we desire to do so in order to provide service at some point beyond the village in question. The agreements now in effect provide that we pay the villages for the use of their lines in extending beyond the village limits. However, any future agreement of this kind that we make will not contain any provision for such compensation. In other words, we feel now that we should have the right to use the lines of the village for extending beyond if we desire to do so without paying it anything for such use, so long as we provide all of the service which the village desires.

11. In case street lighting is desired, the village must pay for all the equipment necessary to provide such lighting, and we then make a contract to supply the electricity, lamp renewals, glassware, maintenance, etc., charging therefor a flat price per lamp per year, depending on the size of lamp required. The charge is our usual suburban schedule for street lighting.

12. We have no franchise rights in these villages, and we will not take a franchise in territory which in our judgment is likely to be unprofitable, but the ordinance referred to under paragraph No. 1 automatically provides franchise rights within the village in the event of our exercising the option to buy the distributing system of the village.

Discourages Municipal Operation

It will be observed that under this plan the company has very little investment—only meters and transformers—within the village, and that the village as a whole pays by taxation the carrying charge of interest and sinking fund on the bonds to build the distributing system. This plan has the merit from our point of view of keeping down excessive investment, and at the same time it enables us to provide service in incorporated territory where the people are willing to carry the investment charge on the municipality as a whole. It further has the merit of preventing municipal ownership as such, because we have the right at any time within the lease period to buy the lines owned by the village.



THE ILLUMINATING CO.

Date ____________

THE VILLAGE OF INDEPENDENCE, OHIO

hereby makes application to The Cleveland Electric Illuminating Co. to construct on or to the premises of ____________

occupied as ____________ the following:

And agrees to pay the cost of the above work and material $ ________ upon the understanding that the work constructed shall be and remain the property of the Village.

VILLAGE OF INDEPENDENCE, OHIO

Canvassed ____________ By ____________

METHOD OF ESTABLISHING SERVICE TO CUSTOMERS IN OUTLYING COMMUNITIES

This card is sent to the village clerk whenever an application is received for service to some new consumer, and authority is secured to make the connection at the expense of the village.

If the territory in question should develop within a period of ten years to a point where it is self-sustaining, or if for any other reason we should desire to own these lines, we can readily obtain ownership. We would be just as willing to take over that investment under the provision of the option in the lease as we would be to spend our money for any other growth of business. If, on the other hand, the territory does not build up and at the end of the ten years is still unprofitable, we will have to face the problem as it presents itself at that time. In the meantime we have no investment there which cannot readily be removed.

Within the past year we have connected up two villages under this plan, both of which have now been operating for some months, and we are working on several others along the same lines. Thus far we have seen no difficulties whatever, and we do not anticipate any of serious moment.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

How Shall Electric Motors Be Applied?

To the Editors of the Electrical World:

Although the majority of engineers are willing to concede the fact that electric motors are superior to all other methods of furnishing power to machinery, nevertheless the fundamental ideas as to how they should be applied to obtain maximum efficiency differ considerably among various groups of individuals.

At the present time, in the opinion of the writer, the best method of applying electric motors to machinery is to build them into the unit rather than simply to attach them with the aid of a bracket and coupling.

As a general rule, when an electric motor is built integral with any machine of whatever nature the unit thus created is automatically simplified and becomes more efficient, from whatever angle the proposition is viewed.

Any sincere student of economics knows that for the manufacturers to assume they will lose ultimately by following this idea in fabricating their respective products is a fallacy, because the increase in business gained in markets made more productive by the use of this new type of unit will more than compensate in a very short time for temporary losses.

To the writer it appears as though many motor manufacturers and machinery builders, for the time being at least, are alike oblivious to the opportunities thus presented to them to increase the sale of their product.

JOHN J. BROPHY,
Electrical Engineer.

The Turner Tanning Machinery Company,
Peabody, Mass.

◆

Compares Power Factor and Property Investment Rates

To the Editors of the Electrical World:

The economic importance of correcting low power factor is emphasized by Messrs. Doran, Hodtum and Fryer in their interesting and instructive article in the *Electrical World* of May 6. One of the conclusions drawn by the authors, however, is misleading. Calculating a particular billing demand by two different methods, they apparently show "a net loss on the demand rate with power-factor correction as compared with a power-factor rate considering property investment of $12,684, or 23 per cent." For convenience these two methods will be referred to as "power-factor" and "property-investment" rates respectively. The net loss of 23 per cent in this case is attributed to the "power-factor" rate. While the "power-factor" method may not be so elegant or so accurate as the "property-investment" method, the difference in the two methods is slight and certainly not of a 23 per cent magnitude.

A few figures will serve to illustrate this point. The billing demand by the "power-factor" method was arrived at by using a standard power factor of 75 per cent. Thus: 2,800 × 75 ÷ 61 = 3,443 units to be billed.

In obtaining the billing demand for the "property-investment" method, they boost the units to be billed to 4,550 by the simple expedient of: 2,800 × 100 ÷ 61 = 4,550.

Naturally, a larger bill will result, but it is not due to the application of the "property-investment" method, but rather to the use of a 100 per cent standard power factor in place of the 75 per cent. In other words, the authors have introduced two variables into their illustration, making the conclusion obscure.

To emphasize the fact that there is much less inherent difference between the two methods than their figures show, I have refigured the demand charge by the "power-factor" method, after substituting a 95 per cent standard power factor (now enforced by some of the central-station companies):

2,800 × 95 ÷ 61 = 4,360 units.
500 at $18 = $9,000,
3,860 at $15 = $58,000,

giving a total yearly demand charge of $67,000. Paraphrasing the author's conclusion, this shows a net *gain* on the "power-factor" rate, as compared with the "property-investment" rate, of $1,171, or about 2 per cent.

L. H. RITTENHOUSE,
Professor of Engineering.

Haverford College,
Haverford, Pa.

◆

A "Controlled Jobber" Presents His Case

To the Editors of the Electrical World:

I have read with interest the article on "The Small Manufacturer's Pressing Distributing Problem" which was published in the *Electrical World* the other week. Probably this article represents the position of certain manufacturers—for instance, the manufacturer of transformers, motors, meters or fan motors. However, I do not believe that it correctly states the case for all so-called outside manufacturers, nor do I believe the condition of the small manufacturer would be materially changed if the big manufacturers had never gone into their present policy of distributing their products through certain jobbers.

My company is a Westinghouse agent-jobber, classed by the author of your article as a "kept" jobber. However, this company is ready at all times to entertain propositions from so-called outside manufacturers to sell their products, and the fact that we are "kept" jobbers would very seldom interfere in any way with our making a deal with the other manufacturers. The points to be considered would be the quality of the product, whether it duplicated lines already handled, prices, the general selling policy, and so on.

As a matter of fact, the business of this company done with the Westinghouse company is only a small fraction of its total.

The function of the jobber is selling, and to be a successful seller his organization must sell *something* —not merely warehouse everything that comes along and offer it for sale to the trade. Under that policy, which this company follows to a greater or less extent, it is very often impracticable to take on the product of more than one manufacturer of a certain article or line. This policy applies especially, of course, to appliances and apparatus, more than to ordinary standard supplies, although we are beginning to believe that it is poor business to carry duplicate lines of ordinary supplies in which there is practically no difference except in the trademark or manufacturer's name.

A "CONTROLLED JOBBER."

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

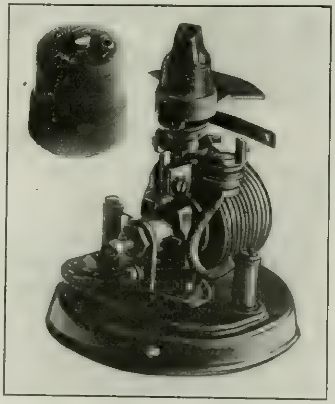
Small Breakers Replace Fuses in Holland

WHILE on a tour through Europe recently I observed the extensive use of a miniature circuit breaker on domestic and industrial circuits, feeding lamps, small motors and various small-capacity energy-consuming devices. With its cover on it has the appearance of an ordinary rotary snap switch. Its diameter is the same, and its height exceeds that of the average one in use by only about 1½ in. It is adjustable for loads from 6 amp. to 25 amp. and insulated to operate on circuits of not over 250 volts.

A particularly attractive feature of this device is the way in which it is reset after tripping on overload or short circuit on the line. When the breaker is set, an indicator, which can be seen through a small opening in the front of the cover, shows black. On tripping it changes to red. A simple quarter turn to the right and back to the left resets the breaker. Nothwithstanding its compactness and simplicity, it has proved itself over and over again under very considerable overloads, without in any case failing to open the circuit instantly and effectively.

In Europe this little circuit breaker has long since passed the experimental stage and is used on many of the municipal electric power-supply systems. In such cases it is taking the place of the main fuse at the point where the cable enters the house and is mounted, together with the meter, on a little panelboard. As the installation up to this point invariably belongs to the supply company, the breaker is sealed and cannot be tampered with. This allows the customer to reset the breaker, but makes it impossible to touch the adjustment, which incidentally makes it possible to prevent exceeding a specified maximum demand contracted for, without in any way interfering with the protective duties of the device.

The circuit breaker is being installed in this position by the municipal electric light and power systems of Amsterdam, Rotterdam, The Hague, Utrecht and all the other larger systems in Holland, including the privately owned district central stations of Gelderland, Brabant, Groningen, etc., on all new residence installations. For places beyond this point of entry they are just as extensively used for all separate circuits and in this case are mounted in groups of two, four, six, eight, etc., on suitable cast-iron bases. There is practically nothing in the working parts of this simple ingenious device that can get out of order. Every part can be made in simple operations and the assembling can be done by unskilled labor.


MINIATURE BREAKER USED EXTENSIVELY IN EUROPE

The advantage of its use is easily imaginable when one thinks how often fuses blow at the most inopportune time and usually when one has not taken the precaution of having a supply of spare fuses on hand. It might be added that this little breaker has found a very ready market in all European countries

J. M. VAN NIEUKERKEN.
Cochranton, Pa.

Record Boiler Efficiency in 60,000-Kw. Plant

SOME figures on the boiler-room performance of the Colfax station of the Duquesne Light Company at Cheswick, Pa., are given in the accompanying tabulations. These figures are taken from the daily operating records over a period of four months from October, 1921, through January, 1922. A recapitulation of the records from August last year through January (Table II), shows that during these months the average boiler efficiency was 77.5 per cent. About 9.11 lb. of water was evaporated for each pound of coal, which averaged 13,182 B.t.u. per pound. While the results are good, they do not represent the best performance possible. Further improvement is to be expected as the operating force becomes more familiar with the equipment.

The Colfax station has a rated output of 60,000 kw. This plant was described in detail in the *Electrical World* for April 2 and 16, 1921, pages 753 and 865 respectively. The station is designed for base-load operations, and under present conditions it is possible to maintain a load in excess of 50,000 kw. for most of the day. For the night periods, from about midnight until 7 or 8 o'clock in the morning, the load may fall as low as 30,000 kw.

TABLE I—BOILER-ROOM OPERATION DATA FOR DECEMBER, 1921, IN THE COLFAX STATION

Boiler No.	Lb. Water Evaporated	Lb. Coal Consumed	Hours Active	Efficiency, per Cent	Rating, per Cent	Exit Gas Temp., Deg. F.	CO_2, per Cent	Combust. in Refuse, Per Cent
0	60,020,000	6,638,060	559	76.6	172	489	9.9	26.67
2	55,291,000	6,089,230	480	76.9	185	482	12.0	26.89
3	75,435,000	8,319,030	696	76.7	174	460	10.3	28.60
4	75,542,000	8,324,290	691	76.8	175	481	11.9	25.71
5	32,242,000	3,519,710	285	77.5	183		11.5	29.55
6	73,474,000	8,138,360	688	76.5	171	479	11.7	26.88
7	70,546,000	7,761,900	640	77.0	171	481	11.0	27.18
Total	442,550,000	48,790,580	4,038	76.8	176	478	11.2	26.99

Average superheat, 132 deg. F.; Average feed temperature, 193 deg. F.; Average B.t.u. in coal, 13,283 per pound

TABLE II—AVERAGE BOILER-ROOM FIGURES FOR SIX-MONTH PERIOD IN A 60,000-KW. PLANT.

	Aug	Sept	Oct	Nov.	Dec	Jan.	Average
Average water per pound of coal, lb	9.07	9.47	9.23	9.18	9.07	8.73	9.11
Average feed temp., deg. F.	208	210	203	204	193	204	204
Average superheat, deg. F.	124	120	127	127	132	136	128
Average B.t.u. in coal per lb.	13,093	13,180	13,159	13,198	13,283	13,177	13,182
Average efficiency, per cent	76.4	78.9	78.0	77.2	76.8	77.6	77.5
Average rating, per cent	154	167	187	167	176	168	170
Average exit gas temp., deg. F	466	460	465	467	478	471	468
Average CO_2, per cent	9.2	9.3	9.6	10.3	11.2	11.1	10.1

TABLE III—AVERAGES OF HEAT BALANCE FIGURES FOR FOUR MONTHS THAT ARE WORKED OUT DAILY.

	October		November		December		January	
Coal as fired, B.t.u. per lb.	13,159		13,198		13,283		13,177	
Ash, as fired, per cent	9.28		9.37		9.14		9.05	
Moisture, as fired, per cent	4.45		4.12		3.91		4.49	
Inlet air temperature, deg. F.	70		70		70		70	
Exit gas temperature, deg. F.	465		467		478		471	
CO_2, per cent	9.6		10.3		11.2		11.1	
Combustible in refuse, per cent	26.36		29.10		26.99		26.76	
	B.t.u.	Per Cent	B.t.u.	Per Cent	B.t.u	Per Cent	B.t.u.	Per Cent
Heat absorbed by boilers	10,264	78.00	10,189	77.20	10,202	76.8	10,225	77.60
Moisture loss	55	0.42	51	0.38	48	0.36	56	0.42
Hydrogen loss	545	4.14	547	4.14	522	4.16	548	4.15
Stack loss	1,713	13.02	1,585	12.01	1,522	11.46	1,502	11.40
Ash-pit loss	482	3.66	558	4.23	490	3.69	479	3.64
Heat accounted for	13,059	99.24	12,930	97.96	12,814	96.47	12,810	97.21
Heat unaccounted for	100	0.76	268	2.04	469	3.53	367	2.79
Total	13,159	100.00	13,198	100.00	13,283	100.00	13,177	100.00

When the plant was first put in operation difficulty was encountered with clinkering, which was due in part to periods when there was pressure over the fires and in part to improper water distribution in the clinker pits. Particular care is now taken to maintain a furnace pressure below atmosphere at all times, and the water distribution has been improved, with the result that clinker trouble has been virtually eliminated. The formation of clinker on the surface walls is prevented by air cooling, Bernitz and Drake blocks being used. These blocks did not altogether prevent clinkering on the side walls. Then side-wall tuyères were installed and these have about done away with clinkering on the side walls. The amount of combustible in the ash is high, varying from 26 per cent to 29 per cent (Table III), but the necessity for early quenching of the ash to prevent clinker makes improvement in this respect doubtful. In the light of over-all efficiency the slight excess in combustible is a lesser loss than the formation of hard clinker masses would occasion.

Furnace temperatures vary from 2,500 to 2,800 deg. F. At the top of the first pass this approximates 1,000 deg. F., between the second and third passes it is 530 deg. F., and the exit gas temperature varies from 450 deg. to 480 deg., usually being about 470 deg. F.

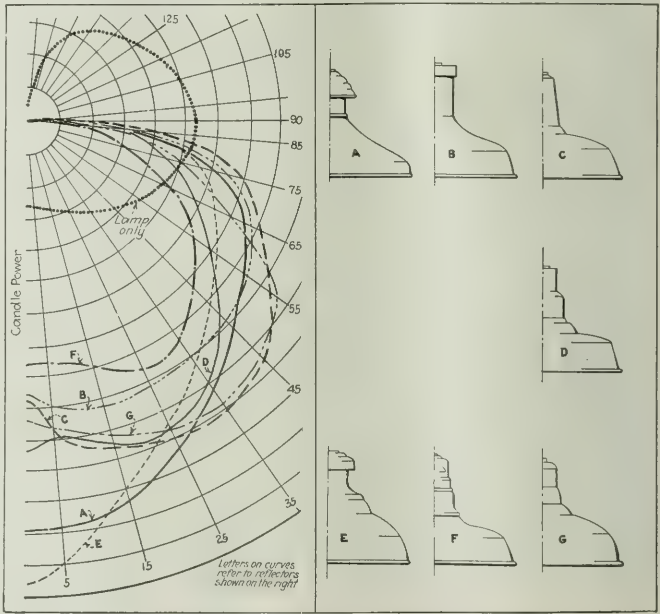
C. W. E. Clarke,
Power Engineer,
Dwight P. Robinson & Company,
New York, N. Y.

Wide Variations in Light Distribution of R-L-M Dome Reflectors

Tests made on seven standard types of R-L-M dome reflectors revealed some interesting variations in their light distribution. The curves, superimposed on polar coordinate paper for comparison, are shown in the accompanying illustration. At the right of the curves the general outlines of the different reflectors are reproduced. It may be noted that there is quite a variation in their shapes. The reflectors were secured for use with 400-watt Mazda-C lamps. As the different shapes seemed to indicate a wide variation in the light distribution, tests were made in a dark room by means of a photometer. The results were an even greater difference in the candle-power characteristic curves than was at first anticipated.

A comparison of the mechanical, thermal and illuminating characteristics of each of the seven reflectors is given in the table. The temperature rise in each case is without ventilation. Tests of a few of the reflectors showed that ventilation caused a decrease or an increase in the temperature rise at the socket depending upon the make of the reflector with its particular type of ventilation.

In industrial applications, as well as in many other cases, the mechanical design of the reflector is of great importance. It may be of greater or lesser importance than the illumination characteristic either in an industrial reflector or an artistic fixture depending upon the application. The items for engineering



DISTRIBUTION OF LIGHT FROM THE REFLECTORS ON THE RIGHT SHOW WIDE VARIATION

MECHANICAL, THERMAL AND ILLUMINATION COMPARISONS OF RLM STANDARD DOME REFLECTORS

Reflector	A	B	C	D	E	F	G
Condition of enamel	Slightly Pitted	Pitted Spotted	Good	Pitted Spotted	Heavy Good	Slightly Pitted	Slightly Pitted
Cracking of enamel under slight pressure at largest diameter	Cracked at center	None	None	Cracked at edge	None	None	Slight
Relative illumination	3	5	2	4	6	7	1
Socket	Light 1-piece	Heavy 2-piece	Light 2-piece	Heavy 2-piece	Heavy 2-piece	Heavy 2-piece	Very heavy
Temperature rise, deg F.	81	94	75	68	78	77	64
Insulation falling from wires upon socket	Slight	Yes	Yes	Slight	Slight	Slight	Slight
Socket held from turning	No	Yes	Yes	No	No, but room for hand	Yes	Yes
Weight in pounds	4	6	4	4	9½	5	4½
Nut	Light	Heavy	Light	Heavy	Light, heavy cast iron cap	Light	Heavy cap
Number of pieces	2 steel 2 copper	One	One	Two	1 steel 1 cast iron	Three	2 steel 1 cast iron
Gaskets	Steel Fiber	Rubber Asbestos	Fiber	Rubber	Brass Lead Cork	Copper Lead	None
Reflector rolled	Over	Under	Under	Under	Over, but well filled	Over	Under

consideration of an industrial reflector, after that of illumination, are: construction of lamp socket, temperature rise at socket, ease of installation, strength, weight, etc. The reflection of the maximum amount of useful light to the working plane depends upon the quality of the enamel as well as the shape of the reflector. Most maintenance trouble is found in the sockets, due to failure of the porcelain or current-carrying parts. Some reflectors are so hard to wire, especially when used with disconnecting hangers, that valuable time is lost upon installation and when making repairs.

D. W. Blakeslee,
Electrical Engineer.
Jones & Laughlin Steel Company,
Pittsburgh, Pa.

Hard-Drawn Rods Used for Arc Welding

HARD-DRAWN rod electrodes of either one of the specifications shown in the table have been standardized by a leading industrial concern on the Pacific Coast. These rods are used on mild steel, structural shapes, plates, bars, low-carbon forgings and castings. For arc welding on high-carbon and alloy steels special electrodes are used. On high-carbon steels where the weld is not to be machined but a hard wearing surface is the principal consideration electrodes containing 0.95 per cent carbon are used. If the welds must possess unusual density and uniformity in order to secure a high polish or be easily worked, covered nickel-steel electrodes are recommended for use on high-carbon steel.

SPECIFICATIONS FOR ARC-WELDING ELECTRODES, IN PER CENT

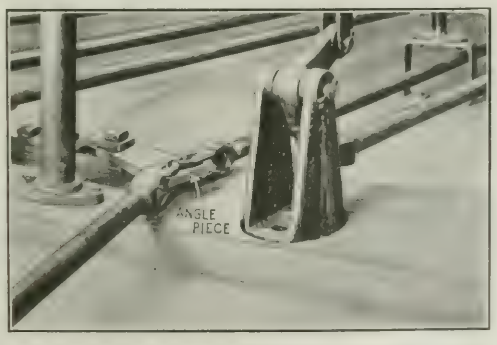
	A	B
Carbon	Not over 0.06	0.13 – 0.18
Manganese	Not over 0.15	0.40 — 0.60
Phosphorus	Not over 0.04	Not over 0.04
Sulphur	Not over 0.04	Not over 0.04
Silicon	Not over 0.08	Not over 0.06

D. N. Louis.
San José, Cal.

Bell-Crank Lever Operates Switch at an Angle

CHANGES in the oil-switch layout of the Sewall Street substations of the Cumberland County Power & Light Company, Portland, Me., required the use of an angle piece, shown by the arrow in the accompanying illustration, to change the direction of pull on the lever to meet the requirements of switch location. The bell-crank lever between the switch and the operating handle is not in a straight line, making it necessary to use two levers in the manner shown. Properly to change the direction of pull the pivoted angle piece to which the lever eyes are clamped by brass pins suitably cottered was provided, care being taken to avoid lost motion and still to secure easy movement. The angle piece in turn is pivoted to a floor clamp shown behind the pipe on the left-hand side of the illustration. This clamp is made of strap iron 1½ in. wide and ¼ in. thick. The top and second straps form a U which is spread sufficiently to permit full play of the lever. The arrangement has been most effective under the restrictions of a closely occupied switchboard and bus structure.

Field Editor Electrical World.
Boston, Mass.



HOME-MADE ANGLE PIECE DEFLECTS PULL ON CRANK LEVER

Better Power Factor by Transformer Taps

BY CHANGING the taps on the secondary of the transformers supplying rotary converters the power factor of the machines was changed from lagging to leading, bettering the power factor of the total load of the Gulfport plant of the Gulfport & Mississippi Coast Traction Company by approximately 10 per cent.

There were two 500-kw., 600-volt converters in this plant, which previously operated with a power factor ranging from 60 per cent to 8 per cent lagging. Lower taps were brought out on the secondaries of the transformers, so that with 2,3 volts on the primary the secondar voltage was just sufficient to produce 600 volts on the direct-current

TABLE I—RATE SCHEDULES FOR URBAN AND RURAL SERVICES ON FOUR ILLINOIS UTILITIES

	Bloomington & Normal Railway & Light Co		Illinois Northern Utilities		Canton Gas & Electric Co		Central Illinois Public Service Co.	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Number of consumers	678	88	585	41	2,792	88	1,166	26
Miles of pole line	12 86	38 375	8 9	15 8	21 73	31	26 36	4 92†
Customers per mile of pole line	52 8	2 4	66	2 6	128 5	2 84	44.23	5.28
Total line transformers	32	72	60	24	108	66	110	22
Total kva. capacity of transformers	191	131	419	80.5	865 5	154	744 5	81 6
Customers per line transformer	21.2	1 22	9 7	1.7	25 8	1 33	10 6	1.18
Average transformer kva per customer	.282	1 49	72	1 96	307	1.75	64	3.14
Transformer core loss, kw.-hr. per year per customer.	19.53	207.8	46.78	173 12	18 99	248.4	42 06	309.92
Average distribution line cost per customer*	$56.40	$533 10	$71.60	$468.90	$48.87	$510 25	$86.91	$452.09
Average yearly revenue	$38.91	$34.95	$37.66	$39.97	$28.60‡	$51.16	$45.24	$30 31
Maintenance of distribution system	$0.505	$3.69	$0 388	$6.595	$0.495	$6.54	$0.396	$14.31
Inspecting and testing meters	$0.120	$0.29	$0.436	$0 872	$0 245	$0.432	....	....
Removing and resetting meters	..	.	$0 083	$0.166	$0 176	$0.176	....	.....
Meter reading	$0 336	$0 931	$0.550	$2.44	$0 346	$1 36	$0 325	$2.99
Collecting accounts	$0 367	$0 367	$0.600	...	.....	....	$0 57	$0.57

* Average costs are on present-day prices † Primary lines run on high-tension; pole lines are excluded. ‡ Municipal light and power consumers are omitted.

side of the converters with all the field resistance cut out. This brought the range of the power factor control of the machines to between 90 per cent leading and unity. Before the change the field rheostats would very often burn out, whereas now no trouble has been experienced.

A. G. RIDDICK,
Electrical Engineer.
Gulfport & Mississippi Coast Traction Company,
Gulfport, Miss.

◆

Cost Study Must Be Made in Giving Rural Service

SOME of the excess costs of rural service over urban service were recently brought out by Walter A. Shaw in a hearing before the Illinois Commerce Commission. The hearing was concerned with the rules under which service to farmers shall be given and the study submitted by Mr. Shaw covered the actual conditions on a number of situations in the state. The final results of the investigation as to actual figures covering both urban and rural service are shown in Table I.

It may be seen from this table that the average distribution line cost per customer is from five to ten times as much for rural as for urban service, while the yearly income from both is practically the same. Maintenance of the rural distribution system and the annual core loss are also very much greater. The latter is calculated from the known characteristics of the transformers installed. The investment costs per consumer are on a basis of present-day costs and represent the comparative investments for urban and rural consumers under conditions as they exist.

The operating-cost figures are on a yearly basis and represent those that could be got directly from the company records or deduced from those records. The lines selected are from companies in different parts of the state and are typical of the whole state. In each case the urban and rural service is from the same power sources. In the same case E. W. Carrier of the Illinois Traction System submitted studies on the systems of two small utilities—one at Galva, Ill., and the other at Atlanta, Ill.—showing the conditions as affecting both urban and rural service. For Galva the number of consumers, the transformers with their rating, core losses and annual sale of kilowatt-hours, as well as load factors for rural and urban consumers, are given in Table II. Large industrial and power consumers are omitted in order to obtain comparable results. Table III shows the results of a year's operation on one set of consumers at Atlanta that exhibits an extreme case of operating trouble due to weather conditions. The revenue figures in general represent the effect of attempting to give rural service without a complete study of costs and the establishment of inadequate rate of schedules.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

TABLE II—COMPARATIVE TRANSFORMER CORE LOSSES BETWEEN RURAL AND URBAN COMMUNITIES

Location of load	Rural			Urban Towns on Transmission Line									Town 9*	Urban Towns *Total
	1	2	Total	1*	2	3	4	5	6*	7	[illegible]	*Total		
Number of consumers	56	82	138	429	191	102	70	12	143	87	132	1,166	649	1,815
Number of transformers	40	62	102	26	4	2	1	1	2	12	1	49	25	74
Capacity transformers, kva.	52	67	119	140.5	60	15	10	5	30	38	15	313 5	153.5	467
Annual core loss, kw.-hr.	9,864	14,016	23,880	10,140	4,200	1,104	732	444	1,968	3,396	1,056	23,040	10,500	33,540
Monthly core loss per consumer, kw.-hr.	14.7	14.3	14.5	1.97	1.84	0.90	0.89	3.09	1.15	3.25	0.67	1.65	1.35	1.54
Annual energy sold, kw.-hr	....	......	28,777	...	.	....	....	...	...	...	...	356,865	217,869	574,734
Average monthly energy sold per consumer, kw.-hr.	....	.....	17.4	. .	..	...	. .	.....	....	.	...	25.5	28.0	26.4
Ratio core loss to energy sold	....	......	1:1.2	.....	.....	....	....	....	....	....	...	1:15.5	1:20.7	1:17.2
Load factor, per cent	....	.....	2.6	.. ..	.	..	.....	...	.	.	....	13.0	16.2	14.1

* Large power consumers are omitted to make the figures comparable.

TABLE III—HIGH COST OF RURAL SERVICES SUPPLIED BY ATLANTA (ILL.) ELECTRIC LIGHT AND POWER COMPANY

All customers are on one line tapped from a 6,600-volt, single-phase line between Atlanta and McLean, Ill. The average core loss per customer per month is 32.4 kw.-hr. These data were furnished by Mr. Robinson, manager of the Atlanta (Ill.) Electric Light & Power Company. The expense to the company covers only destroyed fuse boxes, lightning arresters and burned-out transformers. No line trouble or ordinary maintenance and no operating expenses of any kind are included. To cover all of these costs just mentioned, $161.57 is available after deducting extraordinary maintenance.

Consumer	A	B	C	D	E	F	G	H	I	J	Total
Annual consumption, kw.-hr.	270	390	375	119	398	323	345	1,562	1,061	1,335	6,224
Annual gross revenue	$37.74	$54.62	$47.65	$22.20	$54.65	$47.62	$48.85	$144 29	$119.11	$141.84	$718.57
Transformer capacity, kva	3	2	2	2	2	2	5	*4.5	2	2	26.5
Annual core loss, kw.-hr.	377	342	342	342	342	342	473	648	342	342	3,892
Ratio of core loss to energy sold	1:0.8	1:1.2	1:1.1	1:0.3	1:1.2	1:.09	1:.07	1:2.4	1:3.1	1:3.9	1:1.6
Load factor, per cent	1 03	2.23	2.14	0.68	2.25	1.85	.79	3.96	6.05	7.62	2.68
Annual damage to Company's equipment due to storms and lightning.	$58 00	$58.00	$58.00	$18.00	$58.00	$83 00	$58.00	$148.00	$18.00	... ..	$557.00

* One 3-kva. and one 1½-kva. transformer.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

Electric Ship Propulsion

By Commander S. M. Robinson, U. S. N. New York: Simmons-Boardman Publishing Co. 274 pages, illustrated.

Commander Robinson has been intimately associated with electric ship propulsion for about ten years, as a post-graduate student at Annapolis and later at Schenectady, as chief engineer of the Jupiter, as specialist in the Bureau of Steam Engineering, as fleet engineer serving on board the New Mexico, and again in the Bureau of Steam Engineering during the development of the latest details of improved designs. Because of his intelligence, study and experience he has the best qualifications for telling the story. The excellence of his book is therefore no surprise. It correctly evaluates the different methods available for ship propulsion and shows their relations. It gives the characteristics of all the different types of machinery which have been used, this being the record of a vast amount of study and experimentation. It shows most of the details of actual machinery used in all the principal applications of electric propulsion which have been made and gives a good idea of the results accomplished. This book imparts information which might be used to improve greatly the art of ship propulsion. It has been produced with great care and thoroughness by a very busy man and deserves high commendation.

Handbuch der Drahtlosen Telegraphie und Telephonie

By Eugen Nesper. Berlin: Julius Springer. Two volumes, 1,253 pages, 1,321 illustrations.

This book is an ambitious review of the history and development of radio communication and contains much material of interest and value to workers in the field. Although the volumes are in German, even a smattering of that language will enable a radio engineer to dig out much useful information. The bibliographical classfication of patents and other publications, covering sixty-four pages of the second volume, is especially interesting. The general plan of the author is to devote the first volume to principles of operation and the second to the design of apparatus. The treatment of the subject is so nearly complete that to reprint the table of contents or to mention the subjects taken up would be to list by name almost all the subdivisions of the radio art.

There seem to be comparatively few important errors. The chart on page 19, indicating Hertzian and radio waves as having lengths above zero millimeters and heat waves, light waves, etc., lengths less than zero millimeters, should be corrected. In some particulars the author appears to have been misinformed or biased on historical matters, but there is evidence of a much closer approximation to impartiality than in earlier works on radio by German writers. The books are a worthy addition to any radio library both for study and for reference. Presswork, paper and binding are excellent.

Radiophone Receiving

Erich Hausmann, editor. New York: D. Van Nostrand Company. 179 pages, illustrated.

With public interest in the radiophone has come a demand for a description of what can be expected from it and how the apparatus functions. In this book, which has an introduction by Prof. Michael I. Pupin, Prof. Alfred N. Goldsmith tells how radio telephoning is accomplished, and Prof. Erich Hausmann how the simple receiving circuit is tuned. Receiving by the use of the crystal detector is described; John H. Morecroft tells about the vacuum tube; Robert D. Gibson and Paul C. Hoernel about amplifying music or speech; Prof. L. A. Hazeltine about regenerative reception, and there is a chapter on radio-telephone broadcasting by John V. L. Hogan. The stated purpose of the volume is to describe in a simple manner the methods and apparatus used for the reception of radiophone speech and music. Although intended for popular reading, the authors have succeeded in producing a work that can be profitably read by the engineer who wishes to get a broad view of the subject before taking up studies of a more technical character. The usual far-fetched analogies to explain the action of the electrical current in the radiophone receiver are avoided. The vacuum tube and its use as a detector, amplifier or regenerative receiver is covered in a way that will help the reader quickly to grasp the more technical studies that he may have to undertake. The book has none of the trashy character of so much of the radio literature floating about and it gives evidence of considerable effort to make a worth-while piece of literature.

Telephonic Transmission

By J. G. Hill. London and New York: Longmans, Green & Co. Eight volumes, 398 pages, illustrated.

The above volume has more of the nature of "collected papers" than of a "textbook." If the treatment in places appears to lack some of the characteristics one expects to find in a handbook of so broad a title, this must be explained by the richness of the author's original contributions to the art, which makes it difficult to crowd in other matter without giving too much bulk to the volume. The author is a specialist on loaded telephone lines, and the reader will especially appreciate an instructive series of chapters on the theory and practice of loading. The author's fine method of determining the conditions of optimum load is described, and there is also a valuable résumé of loading practice in Great Britain and other countries. A good deal of attention is devoted to methods of using a "standard cable" for transmission measurements and talk tests, and all through the book the author adheres to the old method of expressing transmission losses in terms of "standard cable miles." In an interesting chapter on voice composition a number of sound oscillograms are presented, and the question of average speech frequency is taken up. An original analysis of certain cost problems in telephony and a few pages on telephonic measurements are features, and there is included at the end a description of some of the first attempts of the British Post Office to apply thermionic tubes as telephonic amplifiers. This institution, and Sir William Strugo, are indeed to be congratulated on the good start thus made with the "Manuals of Telegraph and Telephone Engineering," of which series the present volume is number one.

Books Received

Switching Equipment for Power Control. By Stephen Q. Hayes. New York: McGraw-Hill Book Company, Inc. 454 pages, illustrated.

Burning Liquid Fuel. By William Newton Best. New York: U.P.C. Book Company, Inc. 332 pages, illustrated.

A Course in Electrical Engineering. Volume II—Alternating Currents. By Chester L. Dawes. New York: McGraw-Hill Book Company, Inc. 512 pages, illustrated.

America's Power Resources. By Chester G. Gilbert and Joseph E. Pogue. New York: The Century Company. 321 pages, 38 illustrations.

Continuous Wave Wireless Telegraphy. By B. E. G. Mittell. London: Sir Isaac Pitman & Sons, Ltd. 110 pages, illustrated.

Automatic Telephone Systems. By William Aitken. New York: D. Van Nostrand Company. 882 pages, 211 illustrations.

Elektromotorische Betriebe. By Dr. Ing. A. Schwaiger. Berlin and Leipzig: Walter de Gruyter & Company. 117 pages, illustrated.

The Electrometallurgy of Steel. By C. C. Gow. New York: D. Van Nostrand Company. 342 pages, 132 illustrations.

Modern Methods of Welding as Applied to Workshop Practice. By J. H. Davies. New York: D. Van Nostrand Company, 263 pages, 132 illustrations.

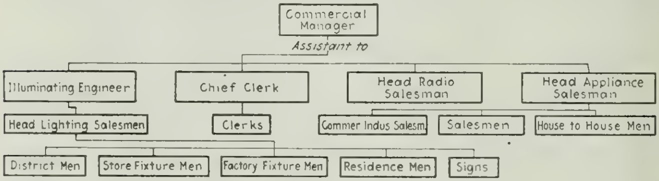
Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Building Up the Lighting Load[*]

How the Central Station's Sales Force Can Be Organized and Directed to Produce More Business

THE company with which I am associated has tried every feasible and legitimate scheme which has come to its attention for improving its organization and increasing the sale of electricity. The commercial manager in charge of building up lighting income must necessarily have to do with the sale of electrical appliances, as these have a very important bearing on the income of certain classes of the business, especially residential. I have given the man in charge of the entire commercial department the title of "commercial manager," as shown in the accompanying organization chart.



AN ORGANIZATION TO HANDLE A TERRITORY WITH WIDELY DIVERSIFIED INDUSTRIES

Lighting installations should be supervised by an illuminating engineer, he taking precedence over the man in charge of the lighting salesman. His duties should include the furnishing of blue prints and specifications, supervising all contracts turned in by the lighting salesman where there is a question of installing new or remodeling present equipment, keeping in touch with lamp, reflector, fixture and glass and other manufacturers concerned with lighting equipment, and distributing information obtained by this means to all lighting salesmen. The illuminating engineer should also prepare wiring specifications. There should be at his disposal a small laboratory where he can make photometric tests.

The head lighting salesman should be a field man, whose duties include the studying of future possibilities for increasing business, traveling with his salesmen and training them how to observe lighting equipment with an eye to improving poor installations, making notes of "prospects" and helping the salesmen to be efficient in every respect, thus increasing their earning power and making their position with the company an assured thing rather than a matter of a few months only. I have divided the work of the lighting department into five parts. As this is an age of specialization, men must be trained for a particular line of work, and they must have sufficient work to do in that particular line. The five divisions are:

1. District Salesmen.—The district men should take care of minor calls which come to the company each day. The average man can handle twenty calls a day. In their particular line they do not need to be students of illuminating engineering. They must, however, know the company's methods of doing business and must maintain a courteous attitude toward the public.

2. Commercial Salesmen.—Store-lighting salesmen must have a knowledge of illuminating engineering, as the central-station company should sell illumination and not fixtures. There has been little, if any, standardization of store-lighting equipment. The possibilities in this class of business are enormous; its growth depends upon the caliber of the men employed.

3. Factory Salesmen. — Factory salesmen must be of a higher type and have a greater amount of illuminating engineering knowledge than store-lighting salesmen. More work has been done to develop and standardize factory lighting equipment than in any of the other classifications. The whole matter rests with the salesmen to sell the factory owner the proper lighting equipment, the illuminating engineering division having previously prepared blueprints showing the right layout for a lighting system. This service is offered to all factories and stores.

4. Wiring Salesmen.—When we were in the wiring business we also furnished this service to all prospective residence customers. It is not our object to urge the "prospect" to purchase the fixtures and wiring from us; the service is rendered to promote the use of modern, scientifically designed equipment.

5. Maintenance Service. — We have found from surveys and investigation that if lighting equipment does not receive the proper cleaning service and other attention it will cost the customer about twice as much for electricity. That is, a fixture that is not cleaned will in thirty days reduce the lighting efficiency 40 per cent. I believe I am safe in saying that very few owners of factories or stores have their fixtures thoroughly cleaned once each month.

◆

Keeping Power Customers "Sold" on the Service

ON THE theory that an ounce of prevention is worth many pounds of cure in maintaining a high standard of service and satisfaction in customers' minds, the Denver (Col.) Gas & Electric Light Company has adopted the practice of calling on its large power users at stated intervals with a view to anticipating and preventing any cause for complaint. The plan was developed about two years ago by D. C. McClure, electrical superintendent, and differs from the usual method of keeping in touch with customers in that it provides for the systematic and regular visitation of the large power consumers by members of the engineering, distribution and generating divisions of the electric department.

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[*] Part of a paper presented by Oliver R. Hogue, head lighting agent Commonwealth Edison Company, at sales managers' convention, Association Island, New York, July 24-26, 1922.

A schedule has been drawn up and so arranged that each member of the "visiting committee" is required to make a certain number of calls each month, and the schedule is rotatively arranged so that each man calls on every power user before a second visit is made to the same customer.

The system acts as a perpetual safety valve for the customer. Grouches are not allowed to accumulate, and the customer feels that there are some real human beings in the utility who are truly interested in giving service, because the callers have no goods to sell and receive no commission for the call.

The benefits of good service and the bad effects of poor service are called directly to the attention of these key men of the operating department. It brings the truth home when a superintendent of an iron foundry leads the caller up to a pile of slag and says, vehemently, "See that pile of slag! That's what we got when we had to drop the bottom out of this cupola in the middle of a heat to avoid freezing it, when your power went off last Thursday. Several tons of good coke and iron utterly wasted."

On the other hand, it means considerable when the manager of a company hands the visitor a good cigar along with his thanks for getting his line up so promptly during the last blizzard.

The members of the visiting committee, being technical men, occasionally discover improper operation or poor conditions of the customers' equipment, and correcting the trouble there and then often eliminates a complaint.

Central Station Keeps Rent List for Customers

A LIST of "rents" available in the different wards of the city is maintained by the Hartford (Conn.) Electric Light Company for the convenience of the public. The list is filed on a bulletin board in the contract department, and has attracted appreciative visitors for many months. As a service to people who visit its offices, the company finds this helpful information board a means of acquiring both popular good will and interesting the public in house-wiring and service matters generally.

UTILITY'S LIST OF HOUSES FOR RENT

Electrical Men Should Use More Large Appliances

THE crying need for electrical men to show the way in the use of electrical appliances, especially the larger ones, cannot be more strikingly emphasized than by a study of the accompanying data compiled by Rey E. Chatfield, secretary-manager of the Electric Service League of British Columbia. Of 175 queries sent out to members of the industry in Vancouver, replies were received from 105, showing an aggregate of 241 appliances in actual use. These are tabulated as follows:

	No. Used
Chafing dishes	2
Electric fans	6
Electric irons	79
Grills	20
"Hedlite" heaters	13
Immersion heaters	5
Percolators	15
Water Heaters	4
Ranges	8
Suction cleaners	19
Toasters	50
Warming pads	11
Washing machines	9
Total	241

This tabulation reveals some startling facts. Apparently out of these 105 electrical men not one has in his own home an electric refrigerator, dishwasher or ironing machine. Only nine use washing machines and only eight are using electrical ranges. There are nineteen vacuum cleaners used among 105 electrical men. That would indicate that they are less than 20 per cent sold on this one appliance. Even the two most generally used devices, electric flatirons and toasters, are far from being in use 100 per cent. The average number of appliances used by each of these 105 electrical men is only 2.29.

Here is a condition where every electrical man should "stand aside and watch himself go by." If he is such a poor customer for his own wares as these figures indicate, how can he expect to convince the housewife that she can profitably use five or six or more different electrical appliances? Central-station executives can help this situation to an appreciable degree by selling electric devices to employees on long extended payments at a price to cover cost. Some companies already have such a plan in effect, but those that have not, and the contractor-dealers also could well afford to adopt it.

What Other Companies Are Doing

Chicago, Ill. — Electrical energy output at the operated public utility properties of the Standard Gas & Electric Company during the week ended July 8, 1922, increased 7.8 per cent over the corresponding week of 1921. Applications were received for 1,969 new electric services, covering 894 kw. of lighting and 1,424 hp. in motors. Connected load reports show a net gain of 321 consumers, with 516 kw. of lighting and 170 hp. in motors.

Providence, R. I.—New Lighting meters contracted for in commercial and residential installations during the first seven months of 1922 on the system of the Narragansett Electric Lighting Company totaled 2,284, a gain of 37.1 per cent over the same period in 1921. For the first six months of the current year the value of house-wiring contracts totaled $172,167. The company's lighting department, headed by F. A. Gallagher, Jr., is now a month ahead of its "bogie" for this year to date. Steady soliciting by a staff of nine men is responsible for this gain.

Boston, Mass.—Electrical appliance sales by nine companies under the management of Charles H. Tenney & Company gained 66.5 per cent in May, 1922, compared with the same month last year, the total being $33,985 against $20,411. The Malden (Mass.) Electric Company sold $14,190 in appliances, topping the list, and the greatest proportional increase was attained by the Suburban Gas & Electric Company, Revere, Mass., whose sales rose from $417 to $2,753.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Hydro-Electric Plant in Partenstein, Austria.—A. KVETENSKY.—This plant, with a present output of 30,000 hp., contains a number of unusual features. Local conditions made it necessary to install the three-story power house in a shaft 22 m. deep, blasted out of the solid rock. A head of 188 m. is utilized in two 15,000-hp., 600-r.p.m. vertical-shaft Francis spiral turbines, tested for 87 per cent overspeed. Space and necessary foundations are provided for a third unit of the same size. The thrust bearings of the turbines operate without oil under pressure. To stop the turbines quickly after shutdown, a reverse-running Pelton wheel is fastened to the vertical turbine shaft below the thrust bearing. The direct-connected generators deliver 12,000-kva., three-phase current at 5,500 volts and 50 cycles. A 65-kw. exciter is keyed to the end of the shaft. Each generator feeds a 12,000-kva., three-phase transformer to step the voltage up to 110,000, carried on two steel-aluminum trunk lines to the city of Linz. It is of interest to note that the layout of this transmission line, which goes through difficult country, was mapped from a set of airplane photographs taken for this particular purpose. Steel towers, spaced 200 m. apart, coated by the zinc-spray method, support the line.—*Elektrotechnik und Maschinenbau,* May 14 and 21, 1922.

New Hydro-Electric Plant in Province of New Brunswick.—A well-illustrated description of this plant, just completed on the Musquash River near St. John, with particular reference to the intake and storage dam, pipe line, hydraulic and electrical equipment, transmission line and switching station. The plant contains three 2,900-kva., three-phase, 13,200-volt generators.—*Electrical News,* June 1, 1922.

Generation, Control and Switching

Rapid Automatic Circuit Breaker.—J. CANDIE.—To prevent commutator flashovers on rotary converters a French concern has developed a new, quick-opening automatic breaker, which is described in this paper, together with a number of oscillographic records showing its performance. According to the setting and the amount of energy ruptured, the breaker will open in about 0.07 second to 0.02 second. Tests with this breaker, made on a 75-kw. and later on a 250-kw., 600-volt rotary, showed that its action was quick enough to prevent any brush fire during short circuits with currents as high as 8,000 amp. A very minute description of the arrangements of the different tests is given. The author claims that such a breaker will give better protection of a rotary than the so-called anti-flash boards between brush holders.—*Revue Générale de l'Electricité,* May 20, 1922.

Recent Developments in Power Production.—D. L. SELBY BIGGE.—A summary of the advances that have been made in the economics of power production during the past eleven years is given. The need for remodeling steam generating plants is pointed out, the tendencies in steam-plant methods are noted, and the advances that have been made in turbine and condenser design are detailed. A typical colliery power station is described. The author thinks much remains to be done before the bed rock of economy in power production is reached.—*Electrician,* June 16, 1922.

Transmission, Substations and Distribution

Mechanical Design of Overhead Lines.—A. JOITEL.—Based upon the requirements of the French safety rules, the author develops a new line of formulas for the safest and simplest layout of overhead transmission lines. Of particular interest are the new alignment charts, which give a sufficiently accurate result by purely mechanical means. Each of the six charts in the article is explained by an actual example. The line constants for both copper and aluminum conductors may be obtained from the charts.—*Revue Générale de l'Electricité,* July 1 and 8, 1922.

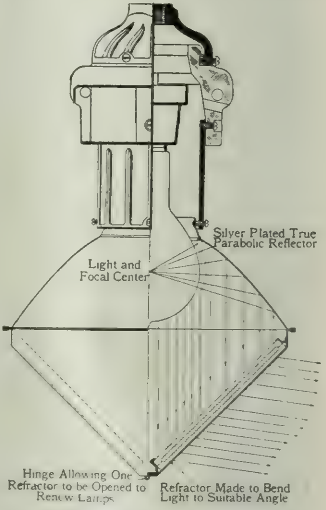
Units, Measurements and Instruments

Short-Circuit-Proof Current Transformers.—W. SKIRL.—The paper describes the latest types of "bar transformers" for currents of 300 amp. and up, suitable in secondary energy supply to operate a wattmeter, a relay and a meter. For currents between 10 amp. and 300 amp. a similar type, but with a loop as primary, is described. This latter type, however, is only overload-proof. A small spark gap built into the smaller transformers gives protection against sudden overvoltages. The long insulating tubes in which these instrument transformers are placed make the construction very suitable for a wall or a ceiling entrance bushing, which is of great advantage for indoor switching stations of several stories. Some of the single-bar transformers designed for 300 amp. have withstood satisfactorily a dead short circuit from a 60,000-kva. generator in which a crest value of 114,000 amp. was reached before the breaker opened. — *Siemens Zeitschrift,* May and June, 1922.

Temperature Measurement of Electric Machines.—A. TAUBER.—A resistance thermometer is described using an alternating-current operated bridge method with a two-winding indicating instrument. The author gives a mathematical analysis of the method, with diagrams and photographs of the apparatus used. The measuring resistance itself can be confined to a surface as small as 4 sq.in., a feature of importance in the exploration of so-called hot-spots in electric machines.—*Bulletin Schweizer Elektrotechnischer Verein,* June, 1922.

Illumination

Highway Lighting.—H. H. ASHINGER.—The proper lighting of highways is accomplished by fulfilling at least two equally important conditions—(1) providing a clear view of the whole roadway for a considerable distance ahead of the car, and (2) elimination of glaring lights within the range of vision of the driver. The lighting unit shown in the accompanying illustration meets these exacting requirements. This consists of a porcelain housing which contains the series socket for a type C "Mazda" lamp, a reflector and a double set of refracting prisms. The reflector is made of porcelain-enameled steel, reflective white inside with bottle-green enamel on the outside. Its shape is parabolic and so arranged with relation to the refractor prisms that all light is thrown on a long stretch of road.—*Electrical Journal,* May, 1922.


Silver Plated True Parabolic Reflector
Light and Focal Center
Hinge Allowing One Refractor to be Opened to Renew Lamps
Refractor Made to Bend Light to Suitable Angle

GLARING LIGHT ON HIGHWAYS PREVENTED BY THIS UNIT

Effect of Color of Walls and Ceilings on Resultant Illumination. — A. L. POWELL.—No matter how carefully designed a lighting system may be as to type and size of lamps, type and make of reflector, spacing height, etc., if the surroundings are not adapted to reflecting such light as strikes them, then an inefficient system may result. The ceiling and wall surfaces in a room are secondary sources of light, and merely increasing the reflection coefficient of the ceiling a slight amount may greatly increase the effective illumination. It is important that the ceilings be as light in color as possible. The actual finish must also be considered as a glossy surface introduces glare and a flat or matte finish is essential. Gloss enamel produces a glaring surface while flat enamel overcomes this objection and is easy to clean. The paint must be composed of chemically inert substances ground exceedingly fine to produce density and mixed with an inert vehicle which is impervious and non-porous when dry. — *Bulletin L. D. 102A, Edison Lamp Works.*

Motors and Control

Diagrams for Coil Winders.—A. C. ROE.—A card system for keeping complete motor repair data is explained, based on the records of a large repair shop over a two-year period. Among the coils for which winding data are given are mush, threaded-in diamond puller, insulated puller, mold-wound and strap-copper coils. Tables give the cross-sectional area of bare copper straps and bars, diameter and area of round and square copper wire with various insulations and dimensions, and cross-sectional area of bare and double-cotton-covered ribbon wire.—*Electrical Review and Industrial Engineer,* June, 1922.

Rotary Converter Adjustable-Speed Sets.—L. H. HOOK and F. R. BURT.—A description of how two rolling-mill machines, an 8-in. five-stand mill and a 14-in. seven-stand mill, were changed from steam to electric drive. In the 8-in. mill a constant-speed 292-r.p.m., 500-hp. motor was installed, directly connected to the mill through a flexible coupling. An interesting feature of this installation is that since the mill was electrified the tonnage has been almost doubled on certain schedules. In the case of the 14-in. mill, where variable speed was desired, two steam engines were replaced by two duplicate 1,000-hp. rotary-converter adjustable-speed sets of the constant-horsepower type. Some operating figures are included comparing the steam and electric drive. The over-all increase in tonnage has been estimated at 10 per cent, which is considered a conservative figure.—*Paper read before the Association of Iron and Steel Electrical Engineers at Chicago.*

Heat Applications and Material Handling

Carolizing and Calite.—G. H. HOWE and G. R. BROPHY.—Some time ago T. Van Aller discovered the process of calorizing to prevent oxidation of materials at high temperatures. An alloy, called calite, has been developed by this process to make cast parts which will not corrode or oxidize.—*General Electric Review,* May, 1922.

Industrial Electric Heating for Factories.—WIRT S. SCOTT.—In the opinion of the author the rate of development of industrial load depends upon three things—the thoroughness with which the specifications are made, the selection of proper equipment, and successful apparatus. The first part of the article is taken up with a short history of this development. This is followed by a number of applications, composed partly of installations in operation and installations pending, which are examples of good application of electric heating. These installations are: Baking and drying of enamel, paint, varnishes, etc.; bread, pie and pastry baking; glass annealing; vitreous enameling; melting pots of various descriptions; china decorative work, clay and mineral products; hardening, tempering and annealing steel; application to chemical industries and annealing of copper, brass and aluminum. The article is followed by a table showing examples of furnace applications, giving the work, type of furnace used, etc.—*Electric Journal,* May, 1922.

Electrophysics, Electrochemistry and Batteries

The Nature of Speech and Its Interpretation.—HARVEY FLETCHER.—Owing to recent developments in the electrical transmission of speech it is possible to produce speech sounds at varying degrees of loudness and with definitely known amounts of distortion by electrical means. A method has been developed for measuring quantitatively the ability of the ear to interpret the transmitted speech sounds under different conditions of distortion and loudness. It was found that the intensity of undistorted speech which is received by the ear can be varied from one hundred times greater to one-millionth less than the initial speech intensity without noticeably affecting its interpretation. Apparatus designed to reproduce speech and preserve all of its characteristic qualities must transmit frequencies from 100 to above 5,000 cycles with approximately the same efficiency. —*Journal of the Franklin Institute,* June, 1922.

Traction

Present Status of the Electrification of the Austrian State Railways.—PAUL DITTES.—A special issue of this paper has been devoted to an elaborate report of the execution of the electrification program of the Austrian State Railways. The article comprises thirty-four pages, with fifty-seven illustrations, and describes the progress made in erecting and augmenting the main power stations on the Spullersee, the Ruetz and the Mallnitz. A noteworthy construction is the 8,000-hp. twin-runner Pelton wheels for the Ruetz plant, designed for a head of 160 m. (525 ft.), 3,000 l. (800 gal.) of water per second, and 333 r.p.m. At present forty-seven locomotives of three different types have been ordered for the Western lines.—*Elektrotechnik und Maschinenbau (special issue),* June, 1922.

Control Equipments for Pacific Electric Railway.—W. M. HUTCHISON.—This company has recently added twenty motor cars and trailers to its system which are arranged for operation at both 600 volts and 1,200 volts direct current. Some of the outstanding features discussed are the employment of rugged reliable line switches specially designed for heavy use, the arrangement of main-circuit apparatus to insure proper overload protection, the use of separate unit switches to establish normal and short field connections, overvoltage protective devices, and the electro-pneumatic switch system.—*Electric Railway Journal,* June 24, 1922.

Telegraphy, Telephony, Radio and Signals

High-Frequency Resistance of Inductance Coils.—GREGORY BREIT.—On account of the importance of inductance coils in radio communication, careful studies, both theoretical and experimental, have been made on capacity effects and other effects in these coils at radio frequencies. A formula for the resistance of this type of coil is derived which takes into consideration both the skin effect and the capacity effect for the case of a short single-layer solenoid, and the results of experiments are given which check with this formula. Other formulas for current distribution and resistance are also derived.—*Scientific Paper No. 430 of Bureau of Standards.*

Miscellaneous

Peculiar Fatal Accident. — S. JELLINEK.—A scrubwoman standing with bare feet on a wet floor touched the glass of an electric lamp bulb and was killed. Medical examination proved that death was due to electrocution. A very thorough investigation showed that the installation was in every respect perfect. Upon close examination of the lamp bulb it was found that there was a small streak of lime, extending from the brass of the lamp base along the glass for about 2 in. This path was sufficiently conductive to pass enough current to kill a person. The electrical examiner made very thorough experiments to duplicate this peculiar condition in the laboratory and came to some surprising results. By means of a fine brush dipped into a variety of liquids small streaks were painted upon the glass of an incandescent lamp, beginning at the brass of the lamp base, ending at the tip of the lamp, and with a voltmeter measurements were made at 220 volts to determine the conductivity of these streaks. Potential curves were then plotted for the whole distance from tip to base. These curves are included in the original article. The investigator found that the danger from the streaks decreased considerably as the streaks dried out, but that high humidity in a room will restore most of the danger. —*Elektrotechnische Zeitschrift,* June 15, 1922.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

Permit Does Not Govern

Attorney-General Holds that Federal Power Commission May Refuse License to Permittee

A FORMAL opinion just rendered by the Attorney-General of the United States at the request of the Federal Power Commission (see *Electrical World* for July 29, page 239) has virtually denuded the preliminary water-power permit of its value. In his opinion Attorney-General Daugherty holds that conditions can be inserted in the license which were not indicated in the preliminary permit and that a license may be refused even if the permittee has complied with all the provisions laid down in the preliminary permit.

Since large expenditures frequently are necessary to make the preliminary investigations, it is believed that this interpretation of the law will discourage expenditures for that purpose and put a further obstacle in the path of water-power development. It is very generally believed that this was not the intent of the law, and steps will be taken at once, it is believed, to secure an amendment to the act which will make the preliminary permit sufficiently binding to justify applicants in incurring the expense necessary for the preliminary investigation. The opinion is of particular importance at this time in that it relieves the Federal Power Commission from any obligation to issue a license on the Giraud application covering a power site at Diamond Creek on the Colorado River.

DISCRETION VESTED IN COMMISSION

An extract from the opinion is as follows:

"The determination as to what conditions the license shall contain involves to a very high degree the exercise of judgment and discretion, and I find nothing in the law to indicate that the commission will or can exhaust its judgment and discretion in settling the terms of the preliminary and temporary instrument.

"If it has happened that the commission, in formulating any particular preliminary permit, has in fact set forth so fully and completely the terms and conditions to be embodied in the license as to make it seem unfair or unconscionable, after the permittee has expended time and money in formulating plans on the basis of those conditions, to add new and more burdensome ones, the situation presented will be one which the commission will meet, of course, in a just and equitable manner. With that, however, I have nothing to do."

STATE OFFICIALS TO DISCUSS LAW

A conference of attorneys-general from various states to discuss the constitutionality of the federal water-power law, which New York State has attacked in the United States Supreme Court, will take place in New York City on Sept. 21, according to an announcement by Attorney-General Newton of New York.

The conference was called by him with the view of enlisting the co-operation of every state with water power resources, developed or potential, in the pending suit to test the federal act.

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Hydro Commission Plans Huge Niagara Station

Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, has plans for another great hydro-electric development at Niagara Falls. Speaking at Galt, Ontario, recently, Sir Adam said: "We are quite ready to finance a new 80-ft. canal from above Niagara Falls to Queenston. That would be much larger than the Chippawa Canal. It would make available 1,000,000 hp. for the people of Ontario. We have most of the necessary property bought. The next canal will cost $100,000,000. Do not let that frighten you. We have $235,000,000 liability now and we have no defaults, but there is always propaganda against us and always misrepresentation. Hydro has never cost the taxpayers of the province one cent."

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Rumored Competition in Serving Indianapolis

Investigation of the circumstances that led the Terre Haute, Indianapolis & Eastern Traction Company to apply to the Indiana Public Service Commission for a certificate of convenience and necessity to operate its electrical service lines in Indianapolis has been started by the corporation counsel of that city. Objection has been made to the plan by the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company, the two power utilities which now operate electric service plants in Indianapolis. The Public Service Commission will hear the petition some time this month. John W. McCardle, chairman of the commission, said that it was his impression that the railway company did not seek to supply energy in Indianapolis.

Coal Crisis Nearing Solution

Satisfactory Outcome Expected from Cleveland Conference—President at Work on Railway Strike

ALTHOUGH no definite result of the conference between operators and labor leaders at Cleveland had been made public before the *Electrical World* went to press, there are those who look with confidence for a settlement of the coal strike very soon. The conference adjourned on Wednesday for twenty-four hours in the hope that the operators of Indiana and Illinois would see their way to join it. So great is the demand for coal and so short is the supply that prices have risen to a point where the operators would be willing to sign any reasonable wage agreement, provided it would terminate in a year.

A settlement of the coal strike at this time, while it would insure full mine production, would not remove entirely the tension caused by the coal shortage. Rationing would be necessary for months to avoid hardships. Many electric public utilities are dangerously near a shutdown owing to lack of fuel, particularly in the coal-mining states. The federal government has shown no disposition to aid the utilities in such states, but on the contrary has put the problem of fuel supply squarely up to the state governments. Nevertheless, the various public utility associations have opened headquarters at Washington so as to be of service in obtaining and shipping coal.

Until a settlement is reached in the railroad strike little headway can be made. There are indications, however, that the President will be able to effect some settlement before Congress meets again. If these plans miscarry, drastic steps may be taken, in which case it is confidently asserted that the public will back the President to the limit.

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Utilities Appoint Fuel Representative at the Capital

Realizing that the strikes of coal miners and railway men have produced a very serious shortage in coal for public utilities, the Joint Fuel Committee, which represents the National Electric Light Association, the American Gas Association and the American Electric Railway Association, and of which John W. Lieb, New York, is chairman, has arranged for executive representation of the public utility industry at Washington. Col. John Price Jackson of Philadelphia will be the executive operating under the Joint Fuel Committee at the capital. His headquarters will be at 949 Munsey Building.

Colonel Jackson was formerly dean of engineering and professor of electrical engineering at the Pennsylvania State College, state commissioner in charge of the Pennsylvania Department of Labor and Industry, chairman of the Pennsylvania Industrial Board, and during the war chief of the Labor Bureau and deputy director of the Army Service Corps. He is well informed on conditions in Washington. Until retained for the work he has just undertaken he was manager of the industrial relations committee of the Philadelphia Chamber of Commerce.

Colonel Jackson took charge at Washington on Tuesday, Aug. 8, and in a letter from New York headquarters all member companies were invited to communicate with him direct, by letter or wire, on all matters arising out of the present emergency. He will have a competent staff to assist him and will be supported by the Joint Fuel Committee and the headquarters staffs of the three public utility associations.

New York State Utilities Form Fuel Committee

Executives of utility companies from all parts of New York State met at the offices of the Public Service Commission on Aug. 5 and established the Utilities Fuel Committee, which will work with the Governor's Fuel Commission. John W. Lieb was made chairman, and C. H. B. Chapin secretary.

It will be the function of this committee to keep account of the fuel needs of all electric railway, gas, electric, water and steam utilities, private and municipal; to ascertain their stocks on hand and the supply ordered, and to see that coal is obtained by those companies which must have it if it is possible to obtain. All applications from New York State utilities for coal or for priority shipments in future must be approved by this commission before action on them is taken by the state body.

A. I. E. E. Meets at Vancouver

More than Two Hundred Delegates Assemble in British Columbia City—President McClellan Discusses Present-Day Problems and Eulogizes Pioneers

THE Pacific Coast convention of the American Institute of Electrical Engineers, held at Vancouver, British Columbia, this week, was entirely successful. On Wednesday evening the registration had reached 213. Retiring President McClellan presided over the convention, which was conducted as a part of his administrative year. In his opening speech, following Lieutenant-Governor Nichols' address of welcome, Mr. McClellan, taking his cue from the fact of meeting on Canadian soil, laid emphasis on the extended significance of the word "American," which is now recognized as applying not only to the United States but also to the great English-speaking sister democracy on the North American continent.

O. B. Coldwell, vice-president of the A. I. E. E. for the Northwest, spoke of the unlimited opportunity and obligation of the electrical engineer in that region, which is "short on population and long on natural resources." With the opportunity for the use of electricity on the farm and in the home, the electrical engineer in the Northwest has more to do than anywhere else in the country.

One of the important features of the convention was the dinner Wednesday evening, at which President McClellan made the principal address. Paying tribute to the spirit of the pioneer who broke trails to the Northwest and to the pioneer engineer who made transportation and communication possible to the same region, he pointed out that there is no longer any frontier and that present problems are more or less permanent. The problems today are concerned with internal organization, which has replaced external force, and this will largely be industrial organization. He dwelt on the need to conserve human resources in contradistinction to the past waste of natural resources, declaring that there must be organization for production and for the enjoyment of life on the American standard, that this entails multiplication of mechanical production, and that the distribution of goods must be based upon a transportation system of highest economy. All of this means that there must be power everywhere on tap, that the farm will depend upon electricity, that industry will be entirely electrified, and that there will be extensive electrification of railroads. He said that the nation is just entering an era of power. The electrical engineer of the West, with his high-voltage transmission, brings hydro-electric power to the back door, and the electrical engineer of the East develops super-steam stations with increasing economy.

Mr. McClellan asked what part the engineer will have in this development in its larger aspects. He will always have his technical part, of course, but in addition, the speaker asserted, he must rise, with full right to be there, to the plane of the lawyer and the economist in solving broader problems. He must, that is, develop the professional spirit as well as technical ability.

The convention adopted a suitable resolution on the death of Alexander Graham Bell. It paid a tribute also to Honorary Secretary Ralph W. Pope, who did pioneer electrical work in British Columbia many years ago. The local members provided entertainment, including scenic and inspection trips.

Abstracts of technical papers and discussions will be given in an early issue.

Coal Supply in Middle West

Commonwealth Edison Saves Fuel Through Rail Strike—Shortage in Some States

THE loss of the elevated and street railway load by the Commonwealth Edison Company, Chicago, during the recent six-day strike resulted in a saving of 1,900 tons of coal daily. Outside of this drop in railway load, E. J. Fowler, the statistician for the company, informed a representative of the *Electrical World*, the strike had little effect on the production of electrical energy. The railway load, which is supplied completely by the Commonwealth Edison Company, is about one-third of the entire load on the company's lines.

Comparing the railway load on Aug. 2 with the same day in July, it was found that there was a decrease of about 92 per cent. The 8 per cent not accounted for represented the energy used by the railway shops, the Chicago, North Shore & Milwaukee Railroad and the Chicago, Aurora & Elgin road.

Mr. Fowler verified the report that the company had a thirty-six-day supply in the bins and a ten-day supply en route. The Public Service Company of Northern Illinois, serving fifteen counties in the northeastern part of the state, has supplies for the same length of time.

Reports from Other States

The Detroit Edison Company reports about 30,000 tons of coal on hand, or a ten days' supply at a daily rate of consumption of 3,000 tons. According to President Dow, unless coal which is ordered can be moved into Detroit service will have to be partly suspended.

No request that service be discontinued because of lack of fuel will be granted Indiana utilities, according to officials of the Indiana Public Service Commission. The coal situation has, however, become so acute in that state that certain public service companies have announced they will ask permission to suspend service within a week or two unless they get coal. Many of them have refused to pay soaring prices for fuel. John McCardle, chairman of the Indiana Public Service Commission, has been appointed fuel administrator, and plans are being formulated by the Governor to insure state institutions and public service companies an adequate coal supply.

Although reports from twenty Wisconsin utilities indicate that there is a thirty-day supply of coal on hand, the fuel situation is becoming serious in that state. With the coal supplies of the Wisconsin Public Service Company at Green Bay, Sheboygan, Oshkosh and Manitowoc nearing exhaustion, the Railroad Commission placed these plants on the priority list to receive each from three to four cars of coal daily. The Wisconsin Traction, Light, Heat & Power Company, at Appleton, has also been informed by the fuel board that enough coal will be supplied to keep its plants in operation.

O. C. Merrill Attacked

Accused of Discriminating Against Interior Department, Secretary of Power Board May Be Ousted

Opposition has arisen to the policy of O. C. Merrill, executive secretary of the Federal Power Commission, based on charges of discrimination against the Department of the Interior in the conduct of his work under the water-power act. Since Mr. Merrill was for many years an engineer in the service of the Department of Agriculture, it is contended in some quarters that he is unable to forget his old affiliation and is extending unduly the jurisdiction of that department over water-power matters. Others contend that the War Department is being allowed too great a voice in matters pertaining to the country's power resources. This is said to be made possible by the fact that the chief counsel, the chief engineer, the assistant chief engineer and one assistant engineer are army officers, detailed from the War Department. In addition, the chief accountant, the assistant chief accountant and one assistant engineer are paid by the War Department. The chief accountant, while paid by the War Department, was drafted from the staff of the Interstate Commerce Commission.

Those who favor a greater participation by the Interior Department in the commission's activities point out that the work is of a type with which the Geological Survey, a branch of that department, has been concerned since its inception and that the survey has organized twenty-two districts, covering the entire country, and has in the field nearly a hundred engineers trained in power investigations. For nearly a year Secretary of the Interior Fall has not participated personally in Federal Power Commission matters. In this he has been actuated principally by his belief that interdepartmental boards are mistakes where administrative duties are undertaken in that they allow a subordinate secretary to exercise the far-reaching powers usually intrusted to Cabinet officers.

How the Work Is Divided

The annual report of the commission, which covers its operations up to Nov. 1 last, shows that matters submitted to the Geological Survey for investigation, report and supervision are approximately three times as great in proportion as those submitted to either the Department of War or the Department of Agriculture. Sixty-nine of the applications filed up to that date affected navigable waters and, according to Mr. Merrill's interpretation of the act, had to be referred to the War Department. In the same manner 150 projects were referred to the Department of Agriculture for report, since they affected the national forests, while the remaining forty-one were referred to the Geological Survey, since they affected public lands where neither navigation nor forests were involved. In addition, it is pointed out that in the two intensive investigations which the commission has undertaken—those of the Columbia and the Deschutes—the federal members of the board have consisted of one from the War Department and two from the Interior Department.

The basic cause of the friction between Secretary Fall and Mr. Merrill is their diverging opinions on conservation, the former holding liberal and the latter much stricter views on this subject. It may be asserted confidently, however, that the electrical industries, which at first feared that Mr. Merrill's theories might be pushed to the point of throttling development, have come to a very general opinion that he is practical and entirely willing to be reasonable and sympathetic with the industry without losing sight of the public's interest. He has had to struggle with the difficulties due to having to run his office with borrowed personnel. His incumbency, moreover, involves a personal sacrifice in view of the much greater financial returns that private employment would bring him. For the latter reason it is entirely possible that Secretary of War Weeks and Secretary of Agriculture Wallace, both of whom are in accord with Mr. Merrill's policies, may not feel inclined to make an issue of the matter if Secretary Fall carries his opposition to the point of asking that the President remove Mr. Merrill from the secretaryship of the commission.

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International Radio Congress at Chicago

The use of short waves for radio telephony was considered in a paper written by Guglielmo Marconi and presented at the international radio congress held in Chicago during the "Pageant of Progress" on Aug. 7. Since Senator Marconi was unable to attend the opening session, his paper was read by George H. Clark of the Radio Corporation of America. Explaining his experiments with short waves, the inventor declared that, apart from the difficulty caused by fading, these waves were much more efficient in directive sending than the longer waves. By using reflectors in much the same way as in searchlamps, he had found that the absorption loss was decreased and the possibility of directing his waves increased. He likened the apparatus to an eye which could be so adjusted as to be blind in all but one direction and especially keen in that one. From an energy standpoint this method of directing short waves required less power, since effort was concentrated over a few degrees of arc rather than dissipated by sending uselessly in every direction.

Dr. J. H. Dellinger, physicist of the Radio Laboratory at the Bureau of Standards, dealt with the inductive-interference problem in radio telephony.

Reorganization Plans Ready for Union Electric

The Missouri Public Service Commission on Aug. 4 issued an order permitting the Union Electric Light & Power Company of St. Louis to reorganize by forming a new company with a larger capitalization. Under the order the authorized capital stock of the new company will be $25,000,000 of preferred and 650,000 shares of common without par value. The outstanding stock of the present company is $6,000,000 of preferred and $11,015,200 of common. The initial preferred stock is to be issued share for share in exchange for the outstanding shares of the present preferred, and five shares of the new common stock are to be exchanged for each share of the present common. The remaining common shares of the new company will be sold for $20 each. The paid-in capital of the new company will therefore be $19,000,000.

The order authorizes the present company to turn over all its property, franchises, surplus, reserves and other assets to the new company. After all the processes of absorption are completed, the new company, which will be known as the Missouri Electric Light & Power Company, will dispose of its assets to a new Union Electric Light & Power Company, with identical organization, and in that way the present name will be retained.

According to an announcement by Louis H. Egan, president of the company, the purpose of the reorganization is to provide a financial structure which will permit the expansion of the company to meet the growth of its business and which will be sufficiently elastic to meet the varying requirements of investors. It is estimated that the new financial plan will permit expansion to about four times the company's present size.

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Ten-Million-Dollar Station Is Planned by Detroit Edison

Preliminary engineering work for a central station on Slocum's Island to cost ultimately $10,000,000 and have a rating of 60,000 kw. has been finished, and, although no construction is likely to be undertaken this year, work on the plant may be under way before the end of 1923, according to President Alex Dow of the Detroit Edison Company. This station will on completion rank with the recently constructed Marysville plant of the Detroit company and will come to the aid of the Delray plant, which now serves the down-river district. It will supply sections of west and northwest Detroit and release much power for use in the central part of the city. It is also planned to use the new plant to serve not only the river cities but places as far south as Monroe and inland to the field now served by the Huron River plant. This plan will be aided by the use of overhead transmission lines.

Frank W. Frueauff Laid to Rest

Noted Public Utility Operator Buried in New York, Mourned by a Host of Friends—Tributes from Some of His Confreres in the Electrical Industry

ON MONDAY of this week Frank W. Frueauff, an account of whose death was published in the last issue of the *Electrical World*, was buried in Woodlawn Cemetery, New York. A host of friends and business associates attended the funeral service held in his home on Fifth Avenue. The office of Henry L. Doherty & Company, of which firm Mr. Frueauff was the junior member, was closed on that day out of respect to his memory. Among those in attendance at the funeral service was a committee of the National Electric Light Association, comprising Past-presidents John W. Lieb and W. C. L. Eglin, President Frank W. Smith and Executive Manager M. H. Aylesworth.

Mr. Frueauff's sudden and unexpected death came as a great shock to his business associates and friends. Messages of sympathy and condolence were received from all parts of the country by his widow, and some tributes from his business associates and confrères are appended here. Mr. Frueauff, when he collapsed, had under his arm proofs of photographs of himself taken a few days previously. One of these photographs is reproduced on this page.

Doherty's Tribute to His Former Partner

Naturally the man who next to his immediate family was most shocked by Mr. Frueauff's sudden death was Henry L. Doherty. At the request of the *Electrical World*, Mr. Doherty prepared the following statement:

"Frank W. Frueauff was more than my sole partner, my closest friend and my expected successor. The relationship between us was that of younger and older brother, and I, as the older brother, not only had unqualified faith in him but a great pride as well and had always leaned heavily upon him in both business and personal matters. The thought never crossed my mind that he would be taken in advance of me.

"We have been associated for nearly a quarter of a century, and during all of that time he was a man of most careful and temperate habits. If right living and right thinking alone would insure long life, he would have lived long beyond the allotted three score years and ten.

"It has always been my theory that the man who builds up an organization should step down and out while he is still young and vigorous, and so determine by actual test whether that organization can run itself. This I have done for a long time now, devoting myself solely to matters having nothing to do with the routine operation of our business, and have found that we have an organization well qualified to run itself.

"Recently I had been urging upon Mr. Frueauff that he adopt the same policy. This he had done of late to a large extent, and he was planning a vacation in Europe at an early date.

"It would seem almost an apology for me to enumerate the qualities in Mr. Frueauff which call for the usual statement of appreciation. No words could convey such a thought to those who were familiar with both of us so well as the unfailing confidence and the unfaltering faith I have always shown in him.

"Mr. Frueauff had unusual executive ability. He was especially successful in choosing men to fill the responsible positions in the organization. He made few mistakes. Today the general managers of the properties throughout the country and the twenty-six division managers and heads of departments at headquarters in New York, most of whom he selected, will in efficiency and in ability compare favorably with any similar body of men in the nation.

FRANK W. FRUEAUFF
(From a photograph taken just before his death)

"Possessing as he did the power to win and hold not only the co-operation but also even the affectionate regard of his associates and employees, Mr. Frueauff seemingly directed the affairs of the several companies without effort. His control, however, was absolute. He knew every essential detail of the 120 or more subsidiaries of the Cities Service Company. His accurate memory of these details was a constant source of wonder among the executives.

"We shall miss Mr. Frueauff sorely, but owing to the splendid training he gave to the younger men in our organization his loss will be the heaviest from the standpoint of losing our beloved friend and companion. It is a great tribute to his business ability that he left his business affairs in such shape and had so well trained other men to take up his duties that the business will not suffer thereby."

Loss Felt by Industry

Mr. Frueauff was probably best known to public utility men, and these all mourn his loss.

"In the removal from public utility service in the prime of life of Frank W. Frueauff the utility companies of the country have lost one of their most prominent leaders and wisest counselors," said John W. Lieb of the New York Edison Company. "With a modest and unassuming personality, his was yet a forceful character ever ready to co-operate and advance the best interests of the industry in which he played so conspicuous a part. He did not hesitate to devote his energies to the initiation of new and progressive policies, popularizing the business and aiming at the establishment of closer relations between the utilities and the communities which they served. He will be greatly missed from the devoted circle of his friends as well as from the wide sphere of his business associates."

Gen. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, said:

"The death of Frank W. Frueauff was untimely. The future held great promise for him. His splendid qualities as a man and high order of natural ability would have carried him far. His intimate friends had long recognized these qualities and he had already achieved great business success; but, if he had lived, I think the next few years would have placed him as an outstanding figure in American affairs. In my frequent contacts with him I found his clear-sightedness and absolutely honest methods of thinking refreshing interludes to ordinary business experiences.

"His attitude of mind toward his duty as an official of public utility corporations always demonstrated a full recognition of the proper relationship of public utilities and the public, and his influence in the electric light and power field always promoted an enlightened conception of public rights.

"The industry has suffered a great loss. His friends genuinely grieve for the loss of a superior man. His untimely death was most deplorable."

Mr. Mitchell's Tribute

Among the men who came into intimate contact with Mr. Frueauff in a business way is Sydney Z. Mitchell of the Electric Bond & Share Company. The Doherty and the Bond & Share organizations have properties in the same states, and some of these are interconnected. Speaking of Mr. Frueauff, Mr. Mitchell said: "Frueauff belonged to the progressive school in the electric light and power industry. He was a great believer in organization and economic combination and had a keen perception of the value of public relations.

"As the operating head of the Doherty organization Mr. Frueauff was confronted with a great variety of problems, because the Doherty holdings embrace large oil and gas properties as well as electric light and railway companies. To operate any one group alone is a man-size job, so one can well imagine the great strain that Frueauff was constantly under. He never showed it, however, and outwardly was always calm and affable. He was a tower of strength to Mr. Doherty and to the organization he directed. It is a great public loss that Mr. Frueauff should be taken away in the prime of life. He made his mark in the world, however, and all who were privileged to know him feel his loss keenly."

TRIBUTES FROM OTHERS PROMINENT IN THE INDUSTRY

W. C. L. Eglin, vice-president of the Philadelphia Electric Company, who preceded Mr. Frueauff as president of the National Electric Light Association, was greatly impressed by the spirit with which Mr. Frueauff, who during Mr. Eglin's presidency was the ranking vice-president, engaged in association work. "He stuck to me like a brother," said Mr. Eglin. "He never neglected any assigned duty but was always anxious to help. When he was elected president he kept up the progressive work started in previous years and did it so well that, despite the fact that he came out of Denver a comparatively obscure man, when he relinquished his office he was one of the best known and most highly respected men in the industry."

To Martin J. Insull, who manages the largest syndicate in the public utility field, Mr. Frueauff's calm, mature and honest judgment has always been a source of admiration. "Frueauff," he said, "was one of the most optimistic men regarding the electrical industry that it was ever my privilege to know. Well grounded in utility work, gifted with common sense and with an uncommonly attractive personality, he exerted a wholesome influence upon all within the circle of his acquaintance. It is impossible to estimate the value of his work for the industry. That he did much is freely admitted, and the noble thing about it all is that he did it so modestly and unobtrusively. His death is indeed a great loss."

As many young men in the electric light and power business have reason to know, Mr. Frueauff was always their stanch advocate. President Frank W. Smith of the N. E. L. A. dwelt on this trait of Mr. Frueauff's. "Mr. Frueauff," he said, "on numerous occasions has been most outspoken for the young men of the industry. He always insisted that the N. E. L. A. should not neglect them. 'I know what the National Electric Light Association has done for me,' Frueauff would say, 'and I want every other young man in the business to get the same inspiration and help that I got out of it.' While we all lament his death, none, I am sure, will miss him more than the young men who are struggling to advance themselves, because Frueauff was their best friend."

M. H. Aylesworth, executive manager of the association, knew Mr. Frueauff when he was in Denver and spoke in most glowing terms of his ability as an organizer. "While his rise was rapid and unbroken," said Mr. Aylesworth, "no one who knew Mr. Frueauff could expect anything less of him. His was a personality that was bound to succeed. Mr. Frueauff grew up with the Denver Gas & Electric Light Company, and so marked became his ability that any keen observer could see that Denver was too small to hold him. He was capable of greater things. Henry L. Doherty knew it and gave him the opportunity to show his ability. Frueauff was young, enthusiastic and resourceful, and the work he accomplished will always be an inspiration to the industry. We can ill afford to lose men of the Frueauff type."

Rate Dispute at Springfield, Ohio, Terminated

After a controversy of six months over the domestic electric lighting rate in Springfield, Ohio, agreement was reached on Aug. 5 between members of the City Commission and representatives of the Springfield Light, Heat & Power Company for a reduced rate operative for two years. The rate agreed on is 8½ cents for the first 30 kw-hr., 6 cents for the next 30 kw.-hr. and 3 cents for all additional energy over 60 kw.-hr. The new rates will apply on bills from and including the September accounts.

Until last fall the rates in Springfield were 12 cents for the first 15 kw.-hr., 7 cents for the next 45 kw.-hr. and 3 cents for all additional energy. In December the company voluntarily reduced the rate to 11 cents, 7 cents and 3 cents. The efforts of the city to force a still lower rate have already been recounted in the *Electrical World*. Finding itself facing a long and costly legal battle, the City Commission began negotiations to compromise, and the new rate agreement is the final result.

Under the terms of the agreement the city obtains light for all municipal structures at a flat rate of 3 cents regardless of the amount of energy consumed.

Denver Men Want National Gathering in Colorado

Not only has the Society for Electrical Development made plans for a country-wide conference of representatives of local electrical leagues to be held at Association Island, Henderson Harbor, N. Y., in the first week of September, as recorded on page 290 of last week's *Electrical World*, but the Electrical Co-operative League of Denver is contemplating a similar meeting, also of national scope, to be held during the joint convention of the Rocky Mountain Division of the National Electric Light Association and the Colorado Electric Light, Power and Railway Association at Glenwood Springs, Col., on Sept. 11-13. A questionnaire has been sent to all electrical organizations asking their views upon the feasibility of holding such a meeting, and definite decision will be withheld until a consensus of opinion is obtained.

Americans to Join in Brazil's Engineering Congress

American engineering societies have been invited to participate in the activities of the international engineering congress to be held at Rio de Janeiro, Brazil, during the forthcoming world's fair in that city.

In order to carry out a co-operative program a committee has been formed from the membership of the A. I. E. E., A. S. M. E., A. S. C. E. and A. I. M. E. to act in this country, and another committee has been organized in Brazil from resident members. The first committee is made up as follows:

American Society of Civil Engineers: J. W. McConnell, Fred Lavis, Verne L. Havens, Milton H. Freeman and John H. Dunlap.

American Institute of Mining and Metallurgical Engineers: F. Linwood Garrison, George W. Tower and F. F. Sharpless.

American Institute of Electrical Engineers: Percy H. Thomas, Maurice Coster and F. L. Hutchinson.

American Society of Mechanical Engineers: Dwight P. Robinson, Percy H. Thomas, C. H. Crawford, Maurice Coster and Calvin W. Rice.

Percy H. Thomas is chairman of the joint committee, Ernest Hartford secretary and Verne L. Havens chairman *pro tem.* C. H. Crawford will be chairman of the Brazilian committee and will appoint other members. Verne L. Havens, editor of *Ingeniería Internacional*, will act as liaison officer between the two committees.

Calvin Rice, secretary of the A. S. M. E., plans to attend the congress in connection with an extended tour of South America. Other prominent American engineers also will attend.

San Diego Company to Issue 5 per Cent Bonds

Declining interest rates are reflected in a modified order of the California Railroad Commission permitting the San Diego Consolidated Gas & Electric Company to issue in place of $1,500,000 6 per cent bonds a like amount of 5 per cent bonds. The minimum selling price of the 5 per cent issue was fixed at 82 per cent of face and accrued interest. The company had asked to sell the bonds at not less than 80. In regard to this Commissioner H. Stanley Benedict, who wrote the decision, said: "I believe that a minimum price of 80 and accrued interest for applicant's 5 per cent bonds is too low. It occurs to me that applicant should be able to obtain at least 82 and accrued interest for its 5 per cent bonds, and this order will fix the minimum price for which the bonds may be sold at that figure."

Rural Lines to Be Debated by Michigan Association

Rural lines, tree trimming and other practical problems will form the topics of discussion at the ninth annual convention of the Michigan Electric Light Association, to be held at the Hotel Ottawa, Ottawa Beach, Mich., on Aug. 21, 22 and 23. President Smith of the National Electric Light Association will make an address, and John F. Gilchrist, vice-president of the Commonwealth Edison Company, Chicago, is to present the public relations side of utilities problems at the banquet. Ample provision for dancing, golfing and other entertainment for delegates and ladies has, as usual, been made. The tentative program follows:

MONDAY, AUG. 21

Evening.—President's address, J. K. Swanson; report of wiring and meters committee, J. C. Langdell; address, F. W. Smith, president N. E. L. A.; stereopticon address, "Radio," George Y. Allen.

TUESDAY, AUG. 22

Morning.—Report of committee on rural lines, E. Holcomb, with discussion by F. D. Avis, G. W. Brower and C. B. Calvert; address, T. A. Kenney, member executive committee N. E. L. A.; report of State Committee on Public Utility Information, Alfred Fischer, committee director, with discussion by F. A. Newton, S. B. Tuell and H. A. Fee.

Afternoon.—Golf tournament.

Evening.—Banquet; address, "Public Relations," John F. Gilchrist, vice-president Commonwealth Edison Company; "Word Sketches and Poems," Edgar A. Guest.

WEDNESDAY, AUG. 23

Morning.—"Tree Trimming," by a representative from the Public Service Company of Northern Illinois; "Aspects of State Regulation," Sherman T. Handy, Michigan Public Utilities Commission; discussion of report of wiring and meters committee, A. S. Albright, Henry Roseberry and G. E. Lewis.

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Iron and Steel Men Adopt Preliminary Program

A tentative list of the subjects to be discussed at the Cleveland convention of the Association of Iron and Steel Electrical Engineers, to be held from Sept. 11 to Sept. 15, has been drawn up officially. It includes these topics: "Improvement in Efficiency of Electric Power Supply," "A Review of Steel-Mill Electrification," "Boiler Practices of 1922," "Education" and "Safety," "The Gas Engine as a Prime Mover for Power Generation," "Steam Turbines," "Judging Combustion from Gas Analysis," "Electrification of the International Nickel Company's Works for Monel Metal," "Some Considerations in the Electrification of the Steel-Plant Railroad Yard," "Power in the Iron and Steel Industry," "Control, Motor, Lighting and Crane Standardization," "Electric Furnaces," "Electrical Developments in 1922" and "Investigation of Insulators for Steel Mill Service."

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College Teachers Attend the Westinghouse Conference

A crowded program covering all phases of electrical manufacturing engrossed the attention of a group of college professors who have been attending the annual summer conference at the works of the Westinghouse Electric & Manufacturing Company in East Pittsburgh, Pa.

These men were placed in the several departments of the works to obtain a first-hand knowledge of electrical equipment and design procedure, while inspection trips to steel mills, power plants and other industrial works in and around Pittsburgh were taken to make them familiar with the operating aspects of engineering. The conference, as usual, proved very popular.

The University of Pittsburgh, in accordance with its annual custom, tendered the visiting teachers a banquet and made arrangements for housing them in one of the fraternity buildings. Carl S. Coler, manager of the educational department of the Westinghouse company, has been in general charge of the conference, which ended Aug. 10.

COLLEGE PROFESSORS AT WESTINGHOUSE CONFERENCE

Top row, left to right—H. A. Haugh (Yale), R. F. Chamberlain (Cornell), W. J. Diederichs (Iowa State), C. B. Gordy (Michigan), F. N. Tompkins (Brown), F. C. Hockema (Purdue), W. O. Schubert (Clemson). Bottom row, left to right—L. A. Wilson (Oklahoma Agricultural and Mechanical), F. A. Spencer (Norwich), W. V. Dunkin (Idaho), J. H. Belknap (Oregon Agricultural), M. N. Vallas (Tulane), D. L. Markle (Pennsylvania State), L. N. Street (Syracuse) L. S. Foltz (Michigan Agricultural).

Brief News Notes

Colorado River Hearing Postponed.—Secretary Hoover has announced that the meeting of the Colorado River Commission, of which he is chairman, which was to have been held in Santa Fe, N. M., on Aug. 1, has been postponed until Aug. 28, because the coal and railroad strikes make it impossible for him to leave his post at Washington.

Portland, Me., to Have New Power Station.—The Cumberland County Power & Light Company is building a 10,000-kw. standby station at Portland, Me., which is to be completed and ready for operation about Oct. 1. The station is to burn oil fuel and to be used at periods of low water power. It is being built on the tidal flats upon 1,500 piles capped by a concrete mat 4-ft. thick. The oil tank will have a capacity of 30,000 barrels and the stack will be 225 ft. high.

Indiana Company Would Issue 5 per Cent Bonds.—The Indiana General Service Company has appealed to the Indiana Public Service Commission asking for repeal of the 7½ per cent interest provision in a recent order by the commission authorizing the company to issue $3,547,500 worth of bonds. The company told the commission that provision had been made for floating the bond issue with only 5 per cent interest and asked authorization at that rate. The company operates power companies in Marion, Muncie and other cities.

Noblesville (Ind.) Company Seeks to Expand. — The Noblesville Heat, Light & Power Company has petitioned the Indiana Public Service Commission for authority under the 1921 condemnation act to condemn eight acres northeast of Noblesville, Ind., on both sides of White River, acquiring the property from the White River Corporation. The company desires to use the property as a dam site for an electric power project. The company has been unable to obtain the land by negotiations, the petition said. The land is owned by Indianapolis water utility interests.

Turning Peat Bogs Into Electricity.—Despite its troubled political life, the Dail Eireann of Ireland finds time for the consideration of practical questions. Its committee on peat recently rendered a report in which it says that the Irish lowland and mountain peat bogs can develop power cheaply by means of gas engines and on a large scale by turbo-alternators. Nearly 4,500,000 acres of bog are available. "We are of opinion that four stations, each of about 20,000 kw. constant load, would more than suffice for Ireland's requirements of combined nitrogen for the manufacture of nitrogenous fertilizers and explosives," says the report. "We are of opinion that in the near future at least one station of 20,000 kw.

rating should be erected by the state in a suitable locality. A portion of the electric power developed can be utilized at the bog for the manufacture of calcium cyanamide and the remainder can be transmitted to the centers of industry."

Iowa Utility Assists Municipal Plant.—With its coal supply down to its last ton, the Corydon (Iowa) municipal lighting plant sent through the town officials an appeal to the Iowa Southern Utilities Company and promptly received enough coal to tide the plant over for a few days. The company also offered to furnish energy to the town if the latter would connect up with the company's high-tension line two miles away. The Iowa Southern began storing coal for a strike emergency nearly a year ago and has sufficient supplies on hand to allow operation until Oct. 1.

Summer Course in Industrial Organization.—The seventh annual summer session in industrial organization and administration will be held at the Pennsylvania State College from Aug. 28 to Sept. 9 under the immediate direction of Prof. Edward J. Kunze, assisted by Prof. J. O. Keller and P. P. Henshall of the department of industrial engineering. The course is an intensive one, designed to meet the needs of manufacturers, superintendents, personnel directors, accountants, production managers and all others who pilot the affairs of industry. Bulletins may be had from Prof. Edward J. Kunze, State College, Pa.

More Oklahoma Developments.—A controlling interest in the Southwestern Light & Power Company of Devol, Okla., has been purchased by E. C. McCain of Pawhuska and P. J. Minck of Tulsa. At present this company is purchasing electrical energy from the Wichita Falls, (Tex.) Light & Power Company. Its object is to extend service to other towns within the radius of 25 miles. The Eastern Oklahoma Light & Power Company has contracted to install distributing systems and build high-tension lines to connect with the Sand Springs Light & Power Company's line. The Sand Springs company has completed its line to Avant, Bigheart, Pershing and Pawhuska.

Electrification of Tasmania.—Tasmania, the smallest and for years the quietest of the six Australian States, has been electrified in the last six years, according to A. W. Ferrin, recently American Trade Commissioner in Australia. Isolated from the mainland by 200 miles of water and only partly developed as a pastoral, agricultural and mining community, Tasmania is extremely mountainous. In the very center of the island are six lakes at an elevation of 3,000 ft. The largest of these lakes is 21 miles long and 3 miles wide. Just before the war a company manufacturing carbide decided to utilize this lake for hydro-electric power and began the development of an ambitious plan. In 1917 the project was turned over to the state, which has since expanded it. It is announced that within a short time 50,000 hp. will be obtained and not many months thereafter 100,000 hp. Numerous industrial enterprises are preparing to use this power.

Celebrate End of Year's Work at Mitchell Dam.—The closing day of the first year's work on Mitchell Dam, on the Coosa River at Duncan's Riffle, was celebrated recently by officers of the Alabama Power Company, which owns the property, by a tour of inspection. The pouring of concrete has been going forward at a rapid rate for the past three months, and there is a section of masonry on either side of the river several hundred feet long and nearly 100 ft. high. Good progress is also being made on the power-house construction, about half way of the river and just above the dam. Power-house machinery is being received daily and stored in the warehouses along the river. If the construction proceeds according to schedule, the dam will be completed within the next ten or eleven months.

Employment Service of the Four National Engineering Societies. — An employment service for engineers of every variety of training and experience is conducted by the four national engineering societies of the United States. This service, a recent announcement says, brings in touch with the business men the 50,000 trained technical men who are members of these societies, and one of its objects is to show to commercial houses the aid which engineers are rendering to others in the same lines and to help these firms and corporations to obtain similar assistance. This service is in a position to supply chemical engineers, civil engineers, mechanical engineers, electrical engineers, sales engineers, production managers, superintendents and other trained executives. It is under the direction of W. V. Brown, with an office in the United Engineering Societies Building, 29 West Thirty-ninth Street, New York City, and is free to employer and employee.

Radio Guidance for Post Office Airplanes.—The Post Office Department has been experimenting successfully with radio-telephonic apparatus designed to make possible communication with night-flying airplanes carrying mail and thus to guide them along their route, and as a result of the experiments it is probable that a night airmail service will be established. Radio will also be used to report ground conditions at the stations to planes in flight. If a heavy fog settles over San Francisco, the flyer with mail will be warned to land elsewhere. The passenger and mail planes between England and France are equipped with radio sets for such emergencies. Further experiments which will now be conducted by the Air Mail Service look toward simplifying the radio equipment in order to reduce the weight. The airmail plane detailed at Bolling Field, Washington, now carries radio equipment weighing about 200 lb.

Associations and Societies

Ontario Association of Electrical Contractors and Dealers.—This association will convene at Toronto Nov. 13 and 14.

Executive Board of American Engineering Council to Meet.—Findings in a nation-wide survey of the three-shift day in industry will be placed before the executive board of the American Engineering Council of the Federated American Engineering Societies at a meeting to be held in Boston on Sept. 8 and 9. The question of government reorganization, involving a proposal to establish a national Department of Public Works; reforestation problems, international affiliations with engineering societies, flood control and water supply and plans for the country-wide expansion of the Federated American Engineering Societies will be discussed, in addition to reports of numerous committees which are considering questions of national interest.

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Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Michigan Electric Light Association — Ottawa Beach, Aug. 21-23. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

International Association of Municipal Electricians, New Bedford, Mass., Aug. 22-25. C. R. George, Houston, Tex.

New York Electrical League—Association Island, Sept. 5-7.

N. E. L. A. Geographic Divisions — New England, New London, Conn., Sept. 5-8; Rocky Mountain, Glenwood Springs, Col., Sept. 11-13; Southeastern, Atlanta, Sept. 12-15; Great Lakes, French Lick Springs, Ind., Sept. 28-30. M. H. Aylesworth, 29 West 39th Street, New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 6-9. H. M. Stine, 212 Locust St., Harrisburg, Pa.

Colorado Electric Light, Power and Railway Association—Glenwood Springs, Col., Sept. 11-13.

Association of Iron and Steel Electrical Engineers—Cleveland, Sept. 11-15. J. F. Kelly, Empire Bldg., Pittsburgh, Pa.

American Electrochemical Society — Montreal, Sept. 21-23. A. D. Spillman, Columbia University, New York City.

Illuminating Engineering Society—Swampscott, Mass., Sept. 25-28. Samuel G. Hibben, 29 West 39th Street, New York.

American Institute of Mining and Metallurgical Engineers—San Francisco, Sept. 25-28. F. F. Sharpless, 29 West 39th Street, New York.

National Association of Railway and Utilities Commissioners — Detroit, Sept. 26. J. B. Walker, New York Transit Commission, New York.

Illinois State Electric Association—French Lick Springs, Ind., Sept. 28-30. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

Indiana Electric Light Association—French Lick Springs, Ind., Sept. 28-30. Thomas Donohue, Lafayette, Ind.

American Electric Railway Association — Chicago, Oct. 2-6. J. W. Welsh, 8 West 40th Street, New York.

Empire State Gas and Electric Association —Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.

Association of Edison Illuminating Companies — White Sulphur Springs, W. Va., Oct. 11-14. Preston S. Millar, 80th St. and East End Ave., New York.

National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St.

Electric Power Club—Asheville, N. C., Oct. 30. S. N. Clarkson, 506 Laclede Gas Bldg., St. Louis.

Commission Rulings

Stock Issue for Purpose of Extending Corporate Life of Company Disapproved.—An application of the Citizens' Electric Company of Battle Creek, Mich., for permission to issue stock for bond retirement was refused by the Michigan Public Utilities Commission, which held that the obvious purpose of the stock issue was to increase the voting power of the majority stockholders so that they could extend the corporate life of the company against the wishes of the minority stockholders, who wished its affairs wound up at the approaching expiration of its charter.

Consolidating Department of a Utility in Order to Fix Return.—In valuation proceedings for the Tucson Gas, Electric Light & Power Company the Arizona Corporation Commission decreed that the gas and electric departments of the utility might be consolidated for the purpose of fixing return since it appeared that there was no way to make the gas department earn its full return—"a plan," said the commission, "which, however much it may be at variance from numerous rate-making theories, seems to be the only alternative to permitting the utility to discontinue the unprofitable branch of its business."

Depreciation Must Be Distributed Over Life of Property.—The New York Public Service Commission in deducting accrued depreciation from the valuation of a natural-gas department of a utility (Elmira Water, Light & Railway Company), although it was asserted that past earnings had not been sufficient to provide for it as it accrued, said: "The cost of depreciation or liability of renewal should be distributed over the life of the property. Any other method is unfair alike to the investors and the consumers. The company has the right to demand that the rate or price at which the commodity is sold shall be sufficient to reimburse it for the cost of this part of its capital consumed in service, and the consumer has the right to demand that this cost be fairly distributed."

Discriminating Rates in Tennessee.—The Tennessee Railroad and Public Utilities Commission has issued an order establishing rates for the Tennessee Power Company and requiring the cancellation of all special contracts with consumers. The commission said: "These contracts were made at different times and run for different periods. The rate to be charged each customer for the service rendered is set out in his respective contract. These rates differ widely from each other and seem to have been fixed without reference to any definite rule or system. . . . After duly considering all evidence in the case, the commission is of the opinion that the rates as fixed in said contracts are unjust and insufficient; that the rates as fixed in said contracts are unjustly discriminatory, both as between the particular contract customers themselves and as against non-contract customers, and that the general public welfare requires that all said contract rates be abrogated."

Idaho Commission Lowers Valuation.—The assessed valuation of the Grangeville Electric Light & Power Company has been reduced $125,000 to $462,833.24, by the Idaho Public Utilities Commission. In the same order the commission denied the company's application to put into effect a schedule of rates filed last summer, declaring they were too high. The commission also fixed the valuation on which the company may base its rates at $480,333.24, this amount being the $462,833.24 plus $17,500 allowed by the commission for working capital. From the evidence submitted at the hearing it was shown that the company's revenue for the year ended Dec. 31, 1921, was $87,955.93. Computing the required revenue from the various allowances made, the commission found that the company should be getting $87,023.91 annually in revenue, which will pay operating expenses, including federal income tax, allow 2½ per cent for depreciation, and give the company an 8 per cent return on its investment. For the reason that the company's annual revenue now is slightly more than required, the commission denied the company's application to put into effect a schedule of rates much higher than those now prevailing.

Rural Extensions in California.—Extensions to agricultural service in which the revenue to be derived was insufficient to justify the San Joaquin Light & Power Corporation making a free extension have been made by requiring the applicants to guarantee for a period of three years an annual gross revenue equal to one-third of the cost of the extension, the California Railroad Commission asserts, adding: "Although this was an optional rule which an applicant might select and which might prove advantageous under certain conditions, yet the extension rule proper, in which consumers advance to the company a certain portion of the cost of the extension to be refunded on the basis of a percentage of the monthly bills for service, was in only a few instances explained or offered to the consumer. As a result many consumers have not received the advantage of the more favorable rule. The San Joaquin company should give each consumer who has guaranteed a definite annual revenue or who has made an advance in order to obtain service the option of advancing an amount equal to the difference between the cost of the extension and three times the estimated annual revenue or guaranteeing in three years a total revenue equal to the cost of the extension, as provided in the present rules."

Recent Court Decisions

Confiscation and Rate of Return.—Issuing a decree for the Alton Water Company to enjoin the Illinois Commerce Commission from enforcing penalties for collecting water rates in excess of those allowed by the commission, the United States District Court for the Southern District of Illinois declared that the commission had no authority permanently to suspend a schedule of rates fixed by the company without making any findings of fact or fixing new rates. In valuation proceedings the commission must consider the fair present value of the property as a going business, and the original investment or actual cost has no bearing on the question of rates, unless such cost was incurred under conditions and prices substantially the same as those prevailing at the date of the inquiry. The enforcement of a schedule of rates which would yield only from 0.5 to 1.5 per cent on the present value of the utility's property is taking such property without due process of law (279 Fed. 869).[*]

Damages for Inductive Interference Denied to Telephone Company.—A suit brought by A. F. Phillippay as receiver of the Connell-Kahlotus Telephone Company against the Pacific Power & Light Company to recover the cost of metallicizing its telephone line to prevent inductive interference was on appeal decided in favor of the defendant by the Supreme Court of the State of Washington, which held that it was the duty of the telephone company "to standardize its line in a way that would prevent interference in accordance with good modern engineering practice, when to maintain a single line it must make use of something which it does not own"—that is, the earth on which it is dependent for its return circuit. "There is no claim," the Supreme Court said, "that the power line was not constructed, maintained and operated in accordance with the best standards of modern engineering practice. . . . The induction from the power line to the telephone line in no manner injured any property of the telephone company but only interfered with its use. When the power line was not energized the telephone could be used, the buzzing noise not being present. There was no way that the power line could have been constructed, operated or maintained which would prevent interference by induction. . . . It is suggested that since the telephone company was first upon the highway it has a superior right. But this position cannot be sustained. The authorities are against the rule of superior right based upon priority."

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[*] The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

New Jersey Public Service Company Engages G. M. Ogle

George M. Ogle has become connected with the Public Service Electric Company of New Jersey as power representative. Mr. Ogle goes to this new position after thirteen years of varied experience in public utilities and electrical construction engineering. He was born in Louisville, Ky., Feb. 23, 1891, and was graduated from Vanderbilt University in 1912 with the degree of electrical engineer. Upon graduation he became connected as assistant commercial engineer with the Edison Electric Illuminating Company of Boston, which position he filled for three years, his work consisting mainly of preparing cost reports. This work was continued as power engineer for the Brooklyn Edison Company from 1915 to 1916.

G. M. OGLE

Mr. Ogle entered the employ of the general engineering department of the Westinghouse Electric & Manufacturing Company in 1916 as general engineer and handled engineering problems dealing with the electrification of the rubber, paper, cement, chocolate and shipbuilding industries. In 1918 he was appointed chief electrical engineer of the United States Shipping Board, Northern Atlantic District. This work consisted in the laying out of all electrical power equipment pertaining to shipyards under control of the Emergency Fleet Corporation from New York Harbor to the Canadian border. Mr. Ogle has filled the position of chief electrical engineer for the Vulcan Iron Works, Inc., Jersey City, since 1920 and has resigned this position to accept the one already mentioned. He has devoted a large amount of time to research work dealing with the effects of electric current on the human body. This work has been carried on through the research department of the Westinghouse Electric & Manufacturing Company and also in connection with the use of electricity at Sing Sing Prison for electrocution purposes.

New General Secretary of Commonwealth Edison Benefit Society

Herbert A. Seymour, superintendent of employees' service, has been appointed by the council of the mutual benefit association of the Commonwealth Edison Company, Chicago, general secretary to succeed Herbert A. Fife, who after two years' service has resigned to resume his engineering duties.

Van Horn Treasurer of T. P. & L. Company

J. E. Van Horn of Dallas, Tex., has been elected treasurer of the Texas Power & Light Company, succeeding William Reiser, deceased. Mr. Van Horn entered the public utility field in 1903, when he became associated with the Southwestern Telegraph & Telephone Company, Dallas. Later he joined the Western Union Telegraph Company, and in 1912 he associated himself with the Texas Power & Light Company. He was elected assistant secretary and assistant treasurer in March, 1914. In February, 1921, he was elected secretary and assistant treasurer, succeeding as secretary C. E. Calder, who became president.

J. E. VAN HORN

F. J. Howes Made Chief Engineer

Franklin J. Howes has recently been made chief engineer of the Rochester Gas & Electric Corporation in charge of design, construction and operation in all departments of the company. Mr. Howes entered the service of the Rochester company in 1908 as assistant to the mechanical and electrical engineer and seven years later was made head of the engineering department. He was born in Iowa in 1880 and began electrical work with the H. Mueller Manufacturing Company at Decatur, Ill. Before becoming associated with the Rochester company Mr. Howes had been connected with the Utah Copper Company, Bingham, Utah, and with the Scantic Mining & Milling Company, White Cross, Col.

F. J. HOWES

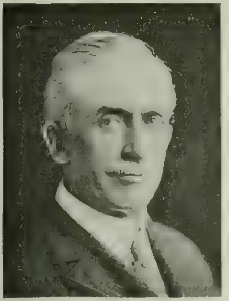
Prof. A. J. Wurtz Resigns from Carnegie "Tech" Staff

Prof. Alexander J. Wurtz, who has been in charge of the department of electrical engineering of the Carnegie Institute of Technology since 1905, will retire from the staff next fall to devote all his time to research work in electrical engineering for the division of co-operative research of the institute. The acquisition of Professor Wurtz by the research division is of particular interest to electrical engineering companies because of his contribution to the development of electrical engineering. He is the discoverer of the five non-arcing metals and has made many notable inventions during his career.

John F. Cahill, superintendent of the Troy Electric Light Company, recently resigned to take a well-earned rest. In this position Mr. Cahill completed thirty-six years and six months' active service, and his resignation was received with general regret by the officials of the company. He will be succeeded by David B. Taylor, who has been assistant superintendent for six years and is therefore very familiar with the duties of his new position.

F. M. Kimball Manager of Motor Sales Division

Fred M. Kimball, formerly manager of the small-motor department of the General Electric Company, has been selected to direct the operation of the motor sales division of the recently organized merchandising department of the company. Mr. Kimball has under his supervision four distinct branches—relations with motor dealers, general sales service, general-purpose direct-current motors and general-purpose alternating-current motors. He was born in Vermont in 1861 and had his technical training at the Massachusetts Institute of Technology. He entered the employ of the Merchants' Electric Light Company of Boston in 1883 and later was transferred to the American Electric & Illuminating Company, where he was made constructing engineer. After engaging in the manufacture and sale of electrical supplies, Mr. Kimball joined the Edison General Electric Company, continuing with it until the formation of the General Electric Company, when he was made manager of the lighting supply and railway supply department for the New England district. In 1898 he was appointed manager of the small-motor department, which post he has filled until the present time.



F. M. KIMBALL

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E. H. Rosenquest of New York has recently been appointed the representative of the Empire State Gas & Electric Association in the Chamber of Commerce of the United States. As national councilor, Mr. Rosenquest fills the role of liaison officer between the national chamber and his own organization on important questions.

Beaudry Leman, who fills the vacancy on the board of the Shawinigan Water & Power Company caused by the retirement of S. Ray Marshall of London, England, is a prominent French-Canadian engineer. He began his engineering career in the employ of the Shawinigan company twenty-two years ago and for six years devoted his time to important hydro-electric developments. He was largely instrumental in the progress of Shawinigan Falls during its early development as a model town and took a notable part in the construction of the railway connecting Three Rivers with Shawinigan Falls and Grand' Mère. He also made the preliminary surveys for construction of the Cedars Rapids Manufacturing & Power Company's plant at Cedars Rapids and was responsible for a number of hydro-electric reports for the Province of Quebec.

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Claude J. Holslag Made Director of American Welding Society

Claude J. Holslag has recently been elected a director of the American Welding Society. Since the spring of 1918 Mr. Holslag has been associated with the Electric Arc Cutting & Welding Company of Newark, N. J., where he has been indefatigable in his efforts to advance the belief he has long cherished that alternating current is the ultimate solution of arc welding. His zeal has not been in vain, for he has been quite successful in convincing others of the soundness of this theory.

Mr. Holslag was born in Addison, N. Y., Dec. 12, 1885. He received his early training in the public schools of the state and in 1908 was graduated from Columbia University with the degree of electrical engineer. Before joining the Electric Arc Cutting & Welding Company Mr. Holslag spent ten years with the electrical department of the New York Central lines.

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Edwin D. Wood, electrical operating engineer of the Louisville Gas & Electric Company, has been elected president of the Exchange Club of Louisville.

J. F. Gardiner, formerly investment editor of the Chicago *Journal of Commerce*, has entered the advertising and publicity department of H. M. Byllesby & Company.

John S. Rilling has been recently reappointed a member of the Pennsylvania Public Service Commission by Governor Sproul.

B. F. Bardo has been appointed superintendent of electrical transmission at the Coscob (Conn.) power plant of the New York, New Haven & Hartford Railroad.

J. B. Black, general sales manager of the Great Western Power Company of California, has recently been appointed acting general manager of the company.

A. A. Packard, superintendent of the Middletown division of the Connecticut Power Company, has been appointed manager of that division, succeeding L. A. Keen, who recently resigned.

Hylon T. Plumb of Salt Lake City, Utah, has been elected vice-president of the American Institute of Electrical Engineers for the ninth district. Mr. Plumb is Intermountain engineer of the General Electric Company at Salt Lake City. He has been with this company for the past twelve years, the first two years of which he spent at the Denver office. Prior to that he was professor of electrical engineering at Purdue University and other educational institutions. He has been very active in Institute affairs and was general chairman of the 1921 A. I. E. E. convention committee, which so successfully handled the Salt Lake City convention.

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T. W. Rolph to Manage Street-Lighting Department

Thomas W. Rolph has been appointed managing engineer of the scientific street lighting department of the Holophane Glass Company, Inc., New York City, with works at Newark, Ohio. After being graduated from Cornell University with the degree of E. E., he became associated with the Holophane company as commercial engineer. From 1913 to 1920 he was employed in the metal-reflector division of the General Electric Company.

T. W. ROLPH

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G. I. Nicholson, who was formerly sales manager for the Harry I. Wood Electric Company, Louisville, has organized a new sales organization at that city, to be known as the Nicholson Sales Company.

Harvey Ball, who has been connected with the Ball Electric Company of Burley, Idaho, has resigned to accept a position as manager of the Murtaugh Light & Power Company, with headquarters at Murtaugh, Idaho.

Thomas W. Peters, formerly associated with the Black & Decker Manufacturing Company of Baltimore, has been recently made general superintendent of the Potomac Public Service Company.

A. E. Morphy, secretary of the Southern California Edison Company, has resigned after fifteen years of service with the company to become secretary-treasurer of the Pacific Gasoline Company. Clifton Peters, assistant secretary, has been advanced to the position of secretary.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Our Business with Declining Prices

The Old Habits Which We Must Shake Off—How the Retailer Controls Our Opportunity

By Jacob A. Kahn

President Capital Electric Supply Company, Salt Lake City

BECAUSE the present generation has done its business almost entirely in an era of rising prices, deep in most men's minds is the feeling that high prices mean good business. We have been told that three times in our national history prices have multiplied two and a half times, that each of these periods followed close after a great war, and that fluctuating but consistent price declines followed—each time lasting from twenty-five to thirty years—and that we must now proceed to unlearn all our past price experience and educate ourselves to operate under declining prices for the next quarter century. But we all cling to our old mental habits. We hate to admit that prices are not the gage of business. And yet we know that if high prices did make good business, Russia today would be the most prosperous nation in the world.

It is time that we men who sell accepted the new order of things and settled down to the long pull ahead. We must buy more scientifically and sell more intensively and more intelligently. And our salesmen must be better trained and must work harder.

I recently heard of an experience of a large department store. The managers found that their drug department was not doing a satisfactory amount of business. They tried an experiment. They put a lot of trays in their showcases upon which they placed articles that would naturally go together. On one tray were a tooth brush, tooth powder, tooth paste, listerine, mouth wash, etc. On another tray were safety-razor blades, shaving cream, soap, face lotion, talcum powder, etc. They carried out the idea throughout every line. If a customer said, "I want a tooth brush," the tray containing a whole assortment of associated articles was placed on the counter. They found that the first month after this innovation was applied their drug business increased 500 per cent.

J. A. KAHN

This showed conclusively that the salespeople had not been selling and suggests a lesson that dealers in other lines could well afford to adopt. If a customer comes into an electric store to buy any article, he should be sold by display and suggestion other articles that naturally associate themselves with the article asked for. It is a fundamental principle.

It is not generally appreciated that 90 per cent of all goods sold at retail in the United States are bought by women. That being the case, we should select salespeople who will appeal to women and who know how to serve them. Their appearance, language, courtesy, chivalry and habits should be above reproach. They should become experts in their line so that the impression made will be so favorable that the customer will tell her friends how thoroughly the process of manufacture, the use, care and durability of the article was explained by "Mr. Smith of the electric store."

The man who will succeed in the next twenty years will be the one who adopts this attitude most quickly and most completely. For business is going to be what we make it. It is the merchant who has an honest policy, a well-located store, properly arranged to display his stock attractively, and kept clean and inviting by representative salespeople, rightly trained and instructed in the new order of business, who will succeed and prosper. If he can *create* business out of possibilities that exist, but that might not naturally develop if not created by him, his company can secure a profitable volume of trade. And it is the province and positive duty of every one of us to spread this sort of gospel.

The jobber and the manufacturer are at the mercy of the retailer. If he does his part of the job by making sales and not merely supplying demands our business will grow. If not, we cannot hope to expand it.

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The Real Key to the Motor Market

Manufacturers Themselves Must See that Their Machines Are Properly Applied in Service

By a Motor Manufacturer

ELECTRIC motors have been so long and so extensively sold that they have come into a position in the market that is staple to a degree not yet enjoyed by the majority of electrical devices used directly by the public. As a result many motor manufacturers have come to feel that they are indeed manufacturing a staple article which can be sold with comparative freedom from responsibility as to who may ultimately own and use it. The resale of small motors locally is left largely to the dealer or contractor, who is supposedly competent and inherently inclined to advise properly his customers in the selection of their purchases. In consequence a great many motors are being put to improper work, and the relying public is not being sufficiently protected.

Most Troubles from Misuse

Analyze the cases of trouble that are reported to every manufacturer of electric motors and what do you find? Here it is an open-type motor that has been sold to a grain elevator and become clogged with dirt. Or here is a squirrel-cage machine that has been put on pumping service where mud and water have been splashed on it. One large manufacturer told me recently that 55 per cent of the cases of trouble on his motors are caused by the armature striking the field because dirt has got into the machine, prevented proper lubrication and worn down the bearings. I believe that this is a fair statement of the general condition. And the reason is either that the wrong types of motors are being used too often, because nobody sees to it that the machine is selected for the work it is to do, or they are improperly installed so that they are not protected or are inaccessible for investigation and maintenance.

The popularity of electric motors depends upon their success in service, and their success in service depends on the manner in which they are used. Clearly, therefore, the development of further markets is tremendously affected by this matter of selecting the right motor for the job. Some one must censor the applications of motors, and I believe that it can only be done by the motor manufacturer himself, because he is not only interested in their sale but in the reputation of that particular machine in each particular class of service. He is more concerned in permanent satisfaction and the upbuilding of a good name for the motor than the dealer is.

Buyer Looks to Maker

Clearly we have all of us got to appreciate that it is an essential part of the motor manufacturer's job to follow each order through and learn the actual purpose for which it is desired and the conditions under which it is to be used. The public buys a motor because people are coming to believe that an electric motor is the most dependable and economical service of power. They rely on the manufacturer because they know little about electric motors themselves. It is therefore part of the responsibility of the manufacturer to see that each motor that is sold is going to give the perfect service that can only be assured where the machine is working under conditions for which it is adapted and designed.

Very often it takes trained and technical men to tell the user what kind of a motor will give best results, and the broader the experience the easier and surer will be the advice. But the main point is the matter of service to the relying public. It has been too long and too much neglected, and the time has come when it should be organized into every manufacturer's own system so that it will be done. Here is the real key to the motor market.

Survey of Business Conditions

Say Construction Will Stop Unless Coal Is Given

That the greater part of the construction projects now under way will be forced to shut down for lack of construction materials unless the present coal priority order is modified is the statement made by the Associated General Contractors of America in a petition of protest to the Interstate Commerce Commission. It is the opinion of the contractors that the action of the commission is so drastic as to defeat its own purpose to keep industry in operation by practically shutting down the second largest industry in the country, upon which 11,000,000 people depend for their livelihood.

The contractors are in favor of priority for coal for the first four classes established by the commission, including special purposes, government uses, public utilites, medical supplies and domestic consumption, but contend that building materials are just as important to construction as coal is to other manufacturers and should have equal place with it after the first four classes are served.

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See Strong Radio Demand in Near Future

That within a very short time the demand for radio apparatus will be as strong as ever, and that the call, while it will not be so wild as it was in the fall of 1921, will be on a much more substantial basis, is the opinion expressed by a leading New York manufacturer. He says:

"The reason why I look for this return of business is that I have been in business for three years and conditions this summer are almost identical with those of the last two years. The business has always returned from the middle of August to the first of September with a rush. I cannot see why conditions should not be the same this year.

"I have noted a number of instances where prices have been materially reduced on both apparatus and parts; however, I do not look for any further reductions, but rather for a stiffening in price."

A manufacturer in Indianapolis reports to the *Electrical World* that his current radio sales are 30 per cent of what they were six months ago. "Deliveries are not any longer than normal," he says. "We made a reduction in price thirty days ago, but we may be compelled to raise the price later on. The outlook for the next six months is very good. We base this prediction on the fact that this is a seasonable business and in the fall is almost certain to pick up."

"Crystal prices have not changed, except in cases where amateur dealers thought they could control the market," says the head of a large crystal supply company in Illinois. "The outlook for a splendid business is very encouraging, and we are preparing for the rush.

"There was some business during the slack season, but about three weeks ago a large amount of inquiries commenced to pour in, and in the past two weeks we have enjoyed a very liberal trade considering present weather conditions."

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Outputs of Copper Mines

At the present time the Calumet & Arizona Mining Company is producing about 3,500,000 lb. of copper monthly.

Arizona Commercial's output in July totaled 677,000 lb. of copper, compared with 823,000 lb. in June.

The smelter output of the Old Dominion Company last month amounted to 2,110,000 lb. of copper, compared with 2,047,000 lb. in June.

The North Butte Mining Company produced 800,000 lb. of copper in June, the first full month's production since the word was given to resume operations late in May.

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Chicago Building Construction Steadily Advancing

Building permits for Chicago issued during the first seven months of this year, totaling 7,569, with a frontage of 233,949 ft., are valued at $127,712,000. This is more than has ever been spent for construction in any twelve months, the high mark heretofore being the 1921 record at $125,004,510. Up to Aug. 1 permits for 3,904 residences and 2,238 apartment buildings were taken out, according to a report of Building Commissioner Bostrom.

This will mean approximately 13,500 new homes, as against 4,566 built in 1921. Although the average cost per building in 1892 was about $5,000, in 1919 it jumped to $17,000 and in 1921 to $18,670.

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Interest Shown in Fuel Oil Installations

Interest in fuel oil installations is being shown by utilities and industrial plants throughout the country, reports from correspondents of the *Electrical World* indicate. Although most companies state that their present soft-coal supplies are reasonably satisfactory, they are planing for the future when stocks will lower because of a sharpened demand brought on by the colder weather.

Oil companies are most active in broadening their market for this product. At the present time there is a large supply of fuel oil in the United States. It is reported that the Shipping Board alone owns 3,000,000 barrels. This is a revival of the tendency first manifested in 1919, when there was an oversupply of fuel oil following the cessation of the war. At that time New England led the way in the adoption of fuel oil for industrial use. The Providence-New Bedford industrial district contains a large number of oil-burning plants.

In New England the coal strike has sharpened interest in the fuel-oil-burning installations although the present soft-coal supply is reasonably satisfactory, it is said. None of the syndicates or important individual companies is reported as putting in a fuel-oil installation, although one small street railway in Massachusetts has made plans to do so.

In the New York district it is stated that the coal situation is not quite so acute as in other districts but that several companies have made inquiries about fuel oil. These consider oil-burning installations a progressive measure and a method of keeping on the safe side of labor troubles and coal strikes.

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Failures Decline

Whereas a week ago the South was the only section of the United States to show an increase in number of business failures, this week it has the largest decrease. The East also reports a substantial decline, the West a slight reduction, and the Pacific States no change in their total, with the result that the aggregate number of defaults reported to R. G. Dun & Company this week is 347, as compared with 407 in the previous week. For the corresponding period a year ago 329 insolvencies were reported.

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Brass Sheet Demand Improves

Commercial bronze sheets are reported in better demand than for several months, and jobbers are again receiving orders for brass sheets from the spinning and stamping trades.

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Electrical Exports Show a Decided Increase

Exports of electrical machinery and apparatus took a decided upturn in June. The value of these exports was $6,216,514, or nearly $1,700,000 greater than for those of May. The total, however, is still under that of June, 1921. The detailed figures, which are those of the Bureau of Foreign and Domestic Commerce, follow:

Atlanta Jobbers Experiencing Credit Difficulties

Despite the fact that demand deposits and saving accounts throughout the Atlanta (Ga.) section have shown a healthy increase in July over June, an unusual amount of difficulty has been experienced by electrical jobbers in collections, especially on small accounts.

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Volume of Business Increases

The volume of business for the week ended Aug. 2, was a trifle short of $8,809,000,000, marking an increase of $565,000,000, or about 7 per cent over the total of $8,244,000,000 reported for the preceding week.

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Crystal Decorated Lighting Fixtures in Demand

Lighting fixtures decorated with crystals such as were in vogue in the Colonial days are attracting much interest. This style, which has been on the market for several months, has been selling steadily.

Although the call for these fixtures has so far come largely from the wealthier people because of their high price, a leading manufacturer reports that a demand for them from those of smaller financial resources is growing steadily. Amusement places and hotels are also among the users of fixtures embellished with crystals. Anticipating a revival of demand, a manufacturer recently went to Czechoslovakia, where he ordered large quantities of crystals. The fact that imports have increased considerably has induced Czechoslovakia crystal manufacturers to raise their prices from 50 to 75 per cent in the last few months.

ELECTRICAL EXPORTS FOR JUNE, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

	June, 1921 Value	June, 1922 Value
Electrical glassware, except for lighting		$7,775
Electrical porcelain		163,712
Carbons for electric lighting, electrodes and batteries	$24,211	116,421
Insulated wire and cable (iron and steel		42,768
Other manufactures of aluminum	88,247	140,031
Copper wire (bare)	221,994	162,321
Insulated copper wire and cable	588,211	147,974
Generators:	581,992	
Direct-current—		
Under 500 kw.		49,006
500 kw. and over		25,059
Alternating-current—		
Under 2,000 kw		17,070
2,000 kw. and over		4,220
Accessories and parts of generators		385,584
Self-contained lighting outfits		31,138
Batteries:	246,844	
Primary—dry		109,494
Primary—wet		17,974
Storage		149,808
Transforming or converting apparatus:		
Power transformers		952,494
Other transformers		60,739
Rectifiers		3,151
Condensers, double-current and motor generators, dynamotors, synchronous and other converters		346,702
Transmission and distribution apparatus:		
Switchboards and panelboards, except telephone		368,479
Switches and circuit breakers		127,779
Fuses and fuse plugs		14,620
Watt-hour and other measuring meters		58,286
Volt, watt and ampere meters and other recording, indicating and testing apparatus		84,194
Lightning arresters, choke coils, reactors and other protective devices		185,246
Motors, starters and controllers:		
Motors, under 1 hp		64,154
Stationary motors—		
1 hp. to 200 hp		154,598
Over 200 hp.		99,514

	June, 1921 Value	June, 1921 Value
Railway motors		2,252
Electric locomotives	252,771	
Railway		4,856
Mining and industrial		74,483
Other motors	1,437,812	52,678
Rheostats, controllers and other starting and controlling equipment	85,568	86,103
Accessories and parts for motors		122,249
Electric appliances:		
Electric fans	45,540	93,742
Electric lamps—		
Arc	167	811
Incandescent—		
Carbon-filament	11,985	1,494
Metal-filament	246,450	80,196
Other electric lamps		9,619
Flashlights		19,702
Searchlights and projectors		5,430
Motor-driven household devices		64,561
Domestic heating and cooking devices	77,866	36,186
Industrial electric furnaces and ovens		48,094
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.		41,933
Signal and communication devices:		
Radio and wireless apparatus		547,364
Telegraph apparatus		18,468
Telephone apparatus, including switchboards		420,820
Police, fire and burglar alarms		2,287
Railway signals, switches and attachments		54,735
Bells, buzzers and annunciators		5,819
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	106,890	102,765
Insulating material		70,413
Metal conduit, outlet and switch boxes		26,912
Sockets, outlets and receptacles		42,027
Other wiring supplies and fixtures	105,436	119,848
Other electrical apparatus not elsewhere specified	2,366,675	751,356
Total	$6,956,143	$6,216,514

British Copy Our Appliance Selling Methods

Give Much Attention to Increasing Use of Small Heating Devices—Wired-Home Exhibitions in the Same Manner as Here

ELECTRIC lighting systems in England find that each year the average size of domestic installations connected to their lines is becoming smaller, according to the statements made in a report just issued by the Commerce Department.

As a result of the changing economic conditions in Great Britain there has been apparent during the past year or two considerable alteration in the policy of British central-station systems. The load-building methods of American operating companies have been carefully studied, and many of our merchandising ideas have been adopted in England.

Much attention has been given to increasing the use of small electric heating devices, and in connection with such campaigns there have been one or more instances where "electric homes" have been opened for public inspection in the same manner as in this country.

Under existing conditions the electric lighting companies are finding it best to push small devices to the greatest extent at the present time, since this requires little capital expenditure on their part and results in a better diversity factor than does the load from electric ranges. Again, the small devices as a rule use current at a somewhat higher rate per kilowatt-hour than do cooking installations, and the return from such loads is naturally more profitable to the central-station system.

The merchandising of small appliances in England does not appear to have been developed to the efficiency attained in this country.

While in this country the electric iron and toaster have been pressed before the public to the point where they are generally accepted as staple articles of merchandise, the use of the electric flatiron in England is still frequently regarded as a highly progressive step on the part of the purchaser.

In connection with the development of heating and cooking load, British companies have to some extent developed a rental system similar to that often employed by them in connection with motor installations. Under this so-called "hire scheme," which is regarded as essential in developing the cooking load, the rental is supposed to cover all maintenance expenses as well as the overhead charges. The "hire scheme," while employed mainly in connection with the installation of electric ranges and radiators, is used by some companies even for electric flatirons.

On the whole, the attitude of the British electric light companies toward domestic load promises a steady increase in the use of household appliances, and a growing market for American devices should result. The outlook is such that American manufacturers who are interested in the British market will probably find it profitable to send competent sales engineers over to England for a time to co-operate with their local representatives and to carry on in conjunction with central stations some of the intensive selling campaigns which have been successful in this country.

Conditions in England as regards socket devices and electric ranges are different from those in this country. In the first place, the bayonet socket is universal, and its construction is such that it will not permit the free plugging in of devices that is possible with the screw-base socket.

Good American Appliance Market in Cape Town

Valuable information in regard to present market conditions in Cape Town, South Africa, for the sale of electric heaters, electric irons and electric toasters has just been issued in *Commerce Reports* of Aug. 7. The article says in part:

"Owing to the fact that houses and office buildings in Cape Town are not equipped with central heating systems and in many cases have no heating facilities at all, there is a good demand for electric heaters. Houses and office buildings which are wired to receive electricity at power rates can be heated thus quite economically.

"The coiled-wire style of heaters are the most popular in Cape Town, although there are some of the large-bulb style sold. Most of the heaters handled are of English manufacture, and those priced at about $15 have the best sale. The American heaters exported to this country are for the most part too large and too expensive to find a ready market. Heaters that consume more than one unit of electricity are almost unsalable. Those consuming from 0.5 kw.-hr. to 0.75 kw.-hr. per hour find the best sale. One large retailer states that if American heaters could be obtained of the coiled-wire type, consuming 0.5 kw.-hr. per hour and selling for $15 or less, many could be disposed of.

"Formerly American munfacturers enjoyed almost a complete monopoly in the sale of electric flat-irons in Cape Town, but the recent reductions in prices of English irons and the re-entry of Germany into the field have almost killed the sale of American irons here. The average present retail prices of a 5-lb. iron of American, English and German manufacture are, respectively, $9.50, $8.50 and $7. Dealers state that more German irons are being sold than all the others put together and that both retailers and wholesalers make a larger profit on them. It would seem that unless manufacturers can so price their irons that a retailer may sell a 5-lb. model for $8 or less, then this market will be entirely lost to American electric irons.

"America still retains most of the electric toaster business in Cape Town, no German toasters apparently having been put on the market here, and English toasters at equal prices being considerably inferior to American makes. While the demand here is not great, it is believed that more electric toasters would be sold if their prices could be lowered from the present $9 at which the best-selling American make is priced.

"The high prices charged for spare parts for American electrical appliances are also much against their sale in this country. As an example of this, an element for an American 5-lb. iron costs the retailer here $2.75, whereas the same part for the same size of English iron costs $1.25. Other parts for American appliances are correspondingly high."

Bank Clearings Gain

The margin of increase in bank clearings over last year's figures narrowed appreciably this week, an agregate of $6,827,146,000 at twenty cities in the United States, as reported to *Dun's Review*, representing a gain of 12.1 per cent over the $6,089,329,412 of a year ago. Last week, in contrast there was an increase of 22.2 per cent. On the other hand, this week's clearings are only 3.3 per cent less than the $7,060,830,972 of this period of 1920, whereas there was a reduction last week, as compared with the total of two years ago, of 6.8 per cent.

Metal Market Situation

Demand for electrolytic copper continues strong at the price of 14 cents, delivered. Both wire and brass companies are buying in large quantities.

Foreign buying is rather small but fairly regular again. Weakness in exchanges is helping to restrain buying, together with the general outlook of political affairs, which will not change for the better unless England, France and Germany can arrive at some workable solution of the reparations problem.

NEW YORK METAL MARKET PRICES

Copper	Aug. 2, 1922	Aug. 9, 1922
London, standard spot	£ s. d. 63 2 6	£ s. d. 63 2 6
	Cents per Pound	Cents per Pound
Prime Lake	14.00–14.25	14.00–14.25
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	5.75	5.75
Antimony	5.25	5.25
Nickel, ingot	36.00	36.00
Zinc, spot	6.60	6.60
Tin, Straits	32.25	32.37½
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	10.50–11.00	10.50–11.00
Brass, heavy	5.75– 6.12½	5.75– 6.25
Brass, light	5.25– 5.37½	5.25– 5.50
Lead, heavy	4.62½–4.75	4.62½–4.75
Zinc, old scrap	2.87½–3.12½	3.00– 3.37½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

CONDITIONS affecting the electrical market have not changed during the week, reports from all over the United States indicate. Smaller sizes of motors are moving in a better way than for some months past. Appliance sales are in greater volume, flatirons and toasters receiving the most attention. Better grades continue to hold the fixture market. Washers and cleaners are selling better than a few months ago. Central-station companies are giving pole makers more business than usual and forging ahead to build additional lines in order to take better care of new construction.

New York

No Price Changes Reported—Lower Conduit Stocks—Plenty of Lamps—Motors Active

Demand for electrical materials continues steady. No price changes are reported. Stocks of conduit are lower and many orders are moving, despite the two price advances of last month. Outlet boxes are selling well.

Greater activity is reported for fixtures and domestic appliances. Washing machines and cleaners are in better demand than for some months past.

Lamps.—Prices are unchanged. Stocks are plentiful and demand continues only fair.

Flexible Armored Conductor.—Demand is very strong, stocks are lower and prices are slightly higher.

Motors.—Smaller sizes are moving best. Stocks ample and prices steady.

Chicago

Trade Unsettled by Car Strike—Conduit Still Scarce—Fans Move Slowly

Business along electrical lines has been somewhat disjointed this wek because of the street-railway strike. Although some jobbers maintain that the effects of this strike have been small, delays of construction and transportation uncertainties have all aided to slow up the forward advance in business.

Conduit in the smaller sizes is still hard to get and the market remains active. Wiring materials are selling steadily. All dealers have ample stocks of fans, but the call has been slow.

High-tension manufacturers have reported another brisk week of business.

Conduit.—The supply has not improved greatly since this material is absorbed by the trade as rapidly as shipments can come in. Demand is still brisk, and the ½-in. black pipe is quoted at $47 per 1,000 ft. in 5,000-ft. lots. Stocks are spotted, but most dealers report a scarcity of the smaller sizes.

Fans.—A summer season of fairly constant temperature has created a slow-moving market. Dealers have excellent stocks and state that with the present selling rate enough fans will be on hand to start next year's business.

Fixtures.—The usual summer dullness is here, but dealers report that the building activity is still producing a steady demand for a popular-priced fixture. The railway strike has given builders a chance to come down town this week and look over stocks since transportation difficulties have slowed up the rate of building. Industrial and office fixtures are also a bit sluggish.

Boston

Lamps Selling Well—Motor Sales Confined to Smaller Sizes—Washers Are Dull

Trade shows improvement in the face of nation-wide labor difficulties. Building operations hold up well throughout New England. Electrical manufacturing is gaining slowly but surely. Prices are somewhat unsteady, and in Boston jobbing circles conditions are disturbed because of the tendency of some houses to quote too close to the edge of profit under sharp competition. Wiring materials are in active demand, and the sale of small motors is better though not at all striking in comparisons. Electric utilities are well supplied with fuel in the main and are developing new business. Appliance sales are running more slowly in many establishments, but radio batteries are beginning to move faster in anticipation of fall trade.

Wire.—No. 14 rubber-covered is quoted firm at $6.25 per 1,000 ft. in 5,000-ft. lots. The volume of orders is brisk and substantial. Fair sales of weatherproof are noted, largely on account of central-station distribution jobs.

Flexible-Armored Conductor.—The demand is active for this material, the price being $43.20 per 1,000 ft. on No. 14 single-strip in 1,000-ft. lots. Stocks are still adequate.

Lamps.—An exceptionally good sale is reported for this season of the year. Street-lighting purchases are better, and the sale of lamps for domestic and mercantile requirements is good. Prices are firm.

Motors.—Sales are mainly confined to smaller sizes below 5-hp. and 10-hp. rating, with occasional inquiries for larger units. "Proposition" work is very active, but resulting orders are sluggish. Motor stocks are being rounded out wherever withdrawals have reduced lines. Inconspicuous betterment work in shops and mercantile establishments is absorbing many motors from month to month. Prices are firm.

Dry Cells.—Sales are in good volume, and recent extensions of discounts to cover smaller-sized lots have resulted in increased orders. No. 6 cells in barrel lots move at $30.22 per 100 and igniters at $31.22. Stocks are satisfactory. The seasonal demand for flashlamp batteries is good.

Storage Batteries.—Industrial-truck batteries are moving better, and radio batteries are in much more active demand than for some time. Vehicle batteries are not showing much life in the market at the moment.

Appliances.—Sales appear largely dependent on price at present. Vacuum cleaners have been moving under pressure of competitive designs and accumulated stocks. Washers are dull, but fans and toasters are showing some activity. Flatirons are doing well and occasional spurts in hollow ware are recorded, but these are not very well sustained this month. It is expected that hard selling work will yield reasonably good business in appliances as soon as the vacation season ends.

Atlanta

Lamp Market Better—Activity in Fuses Quickens—Fair Demand for Poles Reported

The movement in all lines of electrical supplies has been satisfactory during the past week, with prices holding steady. Up to date the railroad shopmen's strike has not particularly interfered with shipments, though some delay is experienced in certain lines. Building in the section continues active, July permits in Atlanta totaling 454 with a valuation of $1,280,226, and this activity is causing a healthy demand for all lines of electrical building material. Manufacturing and industrial expansion will shortly boost sales in the heavier lines of electrical equipment.

Lamps.—Movement has held up well all summer, and jobbers report an active market this week, due to dealers bringing their fall stocks up to normal. The 40-watt and 60-watt types seem to be the most popular. Shipments are satisfactory and no recent price changes are reported.

Radio Equipment.—Comparative dullness has prevailed during the summer months, but a brisker demand is expected with the advent of fall. The use of radio among the farmers becoming more general. Satisfactory stocks are on hand, though shipments are reported only fair.

Fuses.—Activity has quickened considerably in the past month, jobbers reporting good business. The plug fuse continues the best seller, though it is to be noted that the refillable type is gaining in popularity. Stocks throughout the section are in good condition with shipments satisfactory.

Panel Boards.—As a reflection of the building activity in this section a very brisk movement is reported. The small sectional board continues the most popular, though some of the larger lighting and power panels are moving.

Poles.—A little better than fair demand is reported in this line, with the Southern cedar variety leading in popularity. Shipments are reported only fair. Representative prices, f.o.b. Atlanta, are: Western red cedar, 30-ft., 7-in. top, $8.35; 35-ft., 7-in. top, $11.55; Southern cedar, 30-ft., 7-in. top, $5.30; 35-ft., 7-in. top, $7.

Pole-Line Hardware.—Despite two price advances in the past month, a good demand is reported. Local stocks are ample with fair shipments.

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St. Louis

Jobbers Report Moderate Decline in Volume of Trade—Interchange Conduit to Meet Demand

Jobbers report a moderate decline in volume of trade this week. Coal and rail difficulties are not affecting the market materially except in conduit, hardware and other ferrous items, though business with the industrials may suffer soon because of their enforced reduction of operations for lack of fuel. Because of possible shortage conduit sales have increased and stocks are very low. Stocks generally are well in line, but deliveries are becoming slower daily.

Building permits issued in St. Louis indicate decreased activity, the July figure being $1,985,947, as compared with $2,436,755 for June. The decrease is principally in permits for industrial and commercial structures, but it is known that a large amount of industrial construction is pending and will probably be under way by fall.

Conduit.—Interchange between jobbers is necessary to meet the demand, and stocks of some are entirely exhausted. Deliveries from the makers are poor owing to rail difficulties. Because of the decreased supply some users are laying in extra stocks. Representative quotations, in lots of 100 ft. or more, per 100 ft., are: ½-in. black, $5; ½-in. galvanized, 5.73; ¾-in. black, $6.36; ¾-in. galvanized, $7.16.

Pole-Line Hardware.—A general increase in prices of 5 per cent was made Aug. 1. Stocks are in average condition and demand is fairly active.

Poles.—There is a fair amount of transmission work in progress, and requirements for distribution extensions are comparatively strong. Stocks are in good condition and no difficulty is yet experienced in making satisfactory delivery. Northern white cedars, carload lots, f.o.b. St. Louis, with 7-in. tops, sell as follows per 100: 30-ft., $9.60; 35-ft., $16.10; 40-ft., $20; 45-ft., $22.85. Similarly, Western reds are priced: 30-ft., $7.20; 35-ft., $9.95; 40-ft., $12.05; 45-ft., $15.80; 50-ft., $18.40.

Cross-Arms.—Representative prices on 3¼-in. x 4¼-in. Washington fir arms, with standard boring, f.o.b. St. Louis, lots of 1,000 linear feet or more, are, per 100: 3-ft., $49.35; 4-ft., $65.80; 5-ft., $82.25; 6-ft., $98.71; 8-ft., $131.61; 10-ft., $164.51. Demand and stocks are firm.

Porcelain.—A price advance of about 10 per cent is reported. Stocks are conservative and sales are good. Representative prices are: Split knobs, $9.10; 2½-in. tubes, $3.65; 3-in. tubes, $4.10; two-wire or three-wire unglazed cleats, 9.10, all prices being per 1,000 pieces in barrel lots.

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Salt Lake City—Denver

Demand for Fans Falls Off — Expect Good Market for Air Heaters—Waffle Irons Active

Crop conditions are favorable. Scattered cases of labor troubles due to violent interference are reported. Coal production is still far ahead of local demand, making exportation to centers of scarcity highly profitable.

Construction for July this year ran ahead of construction for July, 1921, by nearly 40 per cent. Considerable attention is being given to house wiring, with sufficient publicity and demonstration, resulting in a better demand for electric power.

The fan season is rapidly waning, a spell of cool weather having checked the volume of sales. From present indications, however, stocks carried over will not be excessive.

Air Heaters.—Response is not heavy, but jobbers believe air heaters will be amply stocked before the fall demand begins. Portable headlight heaters in several sizes and designs will be pushed.

Waffle Irons.—General interest is growing, with a resulting increase in sales. The type with patented turnover feature is especially in demand.

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Portland—Seattle

Jobbers Report No Price Fluctuations—Railroad Strike Situation Not Affecting Shipments

Lumber mills are catching up on production. Production for mills, in the Northwest for the week ended July 29, was 4 per cent above normal. New business was 6 per cent below production and shipments were 4 per cent below new business. Exports from Portland for July experienced an appreciable slump due to the decrease in shipments of grain and flour. Shipments of this season's crops are arriving, and in a short time the grain movement will be in full swing. Construction work continues to be very active. Although it is not quite up to the record for June, it is, however, appreciably better than for July, 1921, the total number of permits being 17 and the valuation 52 per cent greater.

Electrical permits also show a falling off from June, 1921, but show an increase in number of about 34 per cent over July, 1921. The valuation, however, is less than for July a year ago, due probably to a larger number of smaller contracts at this time. Manufacturers report business picking up slowly.

This pick-up started about three or four months ago. Inquiries and sales are both good—in fact, a great deal better than last year at this time. More optimism is felt now than at the first of the year. With the exception of some minor fluctuations, prices generally have been steady for several months. The railroad strike situation is not affecting shipments to any great extent, as many of them are coming by water.

Jobbers report business to be about the same. While not so active as might be desired, yet it is appreciably ahead of a year ago. There have been no price fluctuations of any importance during the past week. The peak of the fan season is over.

Conduit.—Half-inch black conduit is quoted at $6.65 per 100 ft. in less than carload quantities and galvanized at $7.20 per 100 ft.; ¾-in. is $8.60 per 100 ft. for the black and $9.40 for the galvanized. Armored conductor, double-strip, No. 14, is quoted at $61.70 per 1,000 ft. in 250-ft. coils.

Conduit Boxes.—Three-inch boxes are quoted at $14,40 per 100 in quantities of 100, 4-in. boxes at $16.80 per 100 in the same quantities.

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San Francisco

Conduit Prices Firm—Occasional Shortages in Lamp-Cord Sizes—Range Business Increasing

Building maintains a record pace, although some predict considerable decline before the end of the year. Retail-store business shows some improvement. Power business is excellent. Collections are slower, running about fifty-five days. The railroad strike is approaching a serious crisis, with deteriorating rolling stock.

Conduit.—Half-inch black conduit, $6 per 100 ft.; ½-in. galvanized, $6.50 per 100 ft., in any quantity. Stocks are good. The big jobs are nearly completed.

Lamp Cord.—There are occasional shortages of vital sizes. No. 18 cotton, twisted, $12 per 1,000 ft.; No. 18 single-silk light insulations, $10.50 per 1,000 ft.; No. 16 cotton, light, reinforced, $26 per 1,000 ft.

Motors.—This is proving a good year. Large office building installations have required an unusual quantity of the larger sizes. An unrestricted irrigation load and an exceedingly dry and hot summer have produced excellent sales of 5-hp. to 10-hp. sizes.

Farm Plants.—Decided improvement is evident. All makes are doing well.

Ranges.—Business is being increased by steady, conservative methods. One of the larger companies is featuring a progressive series of about sixty demonstrations, lectures and entertainments, gradually covering its territory.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including **Important Orders**
and Contracts for Apparatus and Equipment

Attention of Trade Called to Death of Frank Toomey

Attention of the electrical trade is called to the death of Frank Toomey, Sr., founder of Frank Toomey, Inc., manufacturer of boilers and engines in Philadelphia, who died Aug. 2 at Scranton, Pa.

Mr. Toomey was born in Liverpool, England, seventy-two years ago, of Irish-English parentage, and came to this country when a young man. He became connected with the Baxter Engine Company of Hartford, Conn., and had charge of its exhibit at the Centennial Exposition at Philadelphia in 1876, starting in the same year the business which now bears his name.

He was instrumental in disposing of several thousand of the Baxter boilers and engines in the eastern part of the United States and was one of the first to rebuild and guarantee the equipment which he sold.

The corporation will be conducted by the present officers—Frank Toomey, Jr., president; James A. Condor, vice-president, and Harry S. Curry, secretary and treasurer.

National Radio Chamber Is Organized in Washington

Radio apparatus manufacturers from all parts of the country met in Washington, July 26, and effected a temporary organization of the National Radio Chamber of Commerce. The officers elected were: President, W. H. Davis of Pennie, Davis, Marvin & Edmunds, New York; vice-president, Harold Powers, American Radio & Research Corporation, Medford Hill, Mass.; secretary, George Lewis of New York; treasurer, Cloyd Marshall, Dubilier Condenser & Radio Company, New York.

Dr. L. du Plessus Clements spoke for Secretary Hoover in urging the manufacturers to co-ordinate the various fields of wireless activity.

"We have the opportunity to become the leaders of the radio industry throughout the world," he said. "It is up to this convention to fulfill the important task of creating a National Radio Chamber of Commerce so powerful and progressive that the radio industry of this country can introduce American standard supplies throughout the world at American prices. Radio is a coming public utility, even more important than the telegraph and telephone.

"One problem which overshadows all others in importance is the change of the radio dabbler to a standard, regulated radio subscriber. It proves the necessity for increased broadcasting activities, the introduction of a low-priced short-range radio broadcaster, sold at a price within reach—its action and practical application governed by standard rules laid down by the National Radio Chamber of Commerce. In this way can radio activity be harnessed to public service."

Commander Hooper, U. S. N., stressed the importance to be gained from properly co-ordinating the manufacturing and government radio interests of the country so that in a national emergency the vast potential army of more than 1,000,000 radio operators would be at the instant service of the government.

Captain Guy Hill of the Army Signal Corps urged standardization of radio parts so that should it be necessary for military forces to utilize all radio sets in a national emergency, the smaller units for composing the receiving sets might be interchangeable.

Industrial Conference to Be Held Nov. 22 and 23

State Industrial Commissioner Henry D. Sayer has announced that the New York State Industrial Conference, held under the auspices of the New York State Department of Labor, will take place in Buffalo, Nov. 22 and 23. Sessions of the conference will be held at the Hotel Lafayette, which will also be its headquarters.

While the conference of 1922 will cover the same ground as did the former Industrial Safety Congress of New York State, the scope will be broadened to take in industrial matters of general interest as well as industrial safety.

The underlying theme of the Buffalo conference will be "Elimination of Waste in Industry," and several leading men in industry from all parts of the country and state will be present and take part in the discussion.

Westinghouse Balance Sheet Presents Strong Position

The Westinghouse balance sheet presents a strong position. It shows approximately $96,000,000 current assets, with about $9,000,000 current liabilities of all sorts, giving working capital of some $87,000,000. Working capital position has been bettered by $2,000,000 since the close of the last fiscal year on March 31. Accounts payable are less than $4,000,000.

There are, roundly, 30,000 on the pay roll, or about 8,000 less than at the peak of Westinghouse operations.

Power-plant construction is an important factor in the operations of the electrical companies this year. The ability of power and lighting companies to borrow funds for development purposes is bringing these concerns into the electrical market with some good-sized orders. For instance, Westinghouse recently closed a contract for power equipment aggregating $500,000 for one unit.

Another large shipment of Westinghouse material started from Pittsburgh for Valparaiso, Chile, on July 31. The train was of thirty-three cars, carrying 2,400,000 lb. of railway electrification apparatus, part of the seven-million-dollar contract for electrifying the Chilean State Railways.

The reorganization of the supply sales department of the Westinghouse Electric & Manufacturing Company has resulted in the transfer of the industrial heating section from the supply sales department to the industrial sales department. Wirt S. Scott, well-known industrial heating expert, is directing the activities of this unit of the Westinghouse sales organization, and associated with him are M. R. Armstrong, A. T. Ruttencutter, H. W. Lincoln, John M. Strait and C. R. Dakin.

Upholds Right of German Firm to Resume Business

The right of a German company to resume business in this country and solicit trade from its former customers after its American property had been seized and sold by the Alien Property Custodian was upheld in an opinion filed in the federal court in New York City recently by Judge Augustus N. Hand.

The case was an action in equity brought by the Koppel Industrial Car Equipment Company against the Orenstein-Koppel A. G., of Berlin, formerly known as the Orenstein-Arthur Koppel Company, in an effort to prevent the German corporation from again doing business in this country. The Koppel Industrial Car & Equipment Company was the purchaser of the good will and property of the German concern, including its plant at Koppel, Pa., near Pittsburgh. After the war the German corporation established an office at 50 Church Street, in the name of L. E. Hellmann. Eric Joseph, named as a defendant in the suit, is now in charge of the New York office. Before the war he was in charge of the entire American business.

The Alien Property Custodian made a deed to the Koppel Industrial Car & Equipment Company of the property and good will of the foreign corporation, and it is the contention of the American company that this transfer prevents the German company from now doing business in this country. Judge Hand rejected this contention.

The Maring Wire Company, Muskegon, Mich., manufacturer of magnet wires, announces the appointment of Jordan & Company, 305 Broadway, New York City, as its sales representatives in the metropolitan and New England territories.

Form G. E. Merchandise Department

G. P. Baldwin Appointed Its Manager—Will Handle Resale Business, a Field Which Has Important Problems Deserving Careful Attention

Preliminary announcement has been made of the personnel and organization of the merchandise department of the General Electric Company, which became effective Aug. 1.

The department will be directed by G. P. Baldwin, general merchandise manager, with H. C. Houck as assistant merchandise manager. Mr. Houck will also be in charge of the administrative division, headquarters of which will be at Bridgeport, Conn. This division will consist of the following: Sales promotion section, J. A. Corcoran; commercial research section, G. T. Fielding; advertising department representative, F. S. Ackley; publication bureau representative, H. H. Reeves; supply-house operation, H. F. O'Malley.

The commodities sales division will be directed by F. W. Hall as manager and J. O. Wetherbie as assistant manager. The sections will include: Wiring devices, J. C. Dallam, Bridgeport; conduit products, A. J. Young, Jr., Sprague Electric Works, New York; code wires, W. H. C. Smith, Schenectady; fans, R. J. Heaney, Pittsfield; Tungar rectifiers, R. E. Russell, Schenectady; transformer specialties, R. Troy, Pittsfield; miscellaneous, C. K. Mead, Schenectady.

F. M. Kimball will be manager of the motor sales division. Other sections include: Relations with motor dealers, C. H. Scott, Lynn; general sales service, L. E. Smith, Lynn; general-purpose direct-current motors, E. T. McDuffee, Lynn; general-purpose alternating-current motors, J. F. Johnson, Lynn; Sprague apparatus products, C. F. Scott, Sprague Electric Works, New York.

EXPLANATION OF FORMATION

The function of the merchandise department will be to handle the resale business of the company. Its formation means that the sale of products in this field, hitherto directed by several departments, will have the undivided attention of a department organized for that definite purpose. Thus its efforts will be centralized upon the problems of this branch of the electrical business, and among the desirable features of the new arrangement is that it will make for consistent sales policies covering merchandise handled by the General Electric Company and the companies affiliated with it.

This department has been organized in recognition of the importance of the resale trade field. It represents a realization that this field has problems of its own that deserve the careful study and attention of an organization created for that specific work.

Mr. Baldwin, who is at the head of the merchandise department was born in California and was graduated from Stanford University in 1896, afterward engaging in the street-railway business and becoming road engineer of one of the large Western traction road companies. He then became connected with the Stanley Electric Manufacturing Company, being one of its representatives on the Pacific Coast. He came into the service of the General Electric Company and was made manager of the Pittsburgh office about thirteen years ago. From there he was transferred to Philadelphia as district manager. During the war he was on the staff of Gen. George W. Goethals at Washington. He has made an extensive study of the problem of distribution and marketing.

PERSONAL HISTORIES GIVEN

Mr. Houck, assistant manager, is a native of Tennessee and a graduate of the University of Pennsylvania. He has been in the service of the company since 1899. In that year he entered the testing department of the company and on completing his work there joined the lighting department. In 1902 he was transferred to the Cleveland local office as a lighting apparatus salesman and was later made manager of the supply department of the Cincinnati district and eventually assistant manager of the Cincinnati district office. In 1912 he returned to Schenectady as assistant to D. C. R. Bullen, manager of the supply department, and was soon thereafter made assistant manager of the department. Since 1917 he has been in charge of all business handled through distributors.

Mr. Wetherbie, assistant manager of the commodities sales division, completed his work in the testing department of the Lynn works of the General Electric Company in 1904 and entered the production department at that plant. Two years later he was transferred to the supply department as an electric fan sales specialist. There was at that time no separate fan sales section of the supply department, and when as a result of the great expansion of the company's fan business such a section was organized. Mr. Wetherbie was chosen to head it and continued in that position until about a year ago, when he was appointed assistant to Mr. Houck.

The General Electric Company announces the erection of a second plant at Oakland, Cal., part of which will be devoted to increased facilities for the manufacture of switchboards and the remainder occupied by meter and instrument laboratories, service shops and offices. The tract where the new plant will be erected comprises 24 acres in the vicinity of East Fourteenth and Fifty-four Streets, Oakland. The project represents an investment of $200,000 and is the result of the initiative of Dr. Addison, Pacific Coast manager for the General Electric Company, and E. O. Shreve, local manager. The construction contract has been placed with the San Francisco office of the Foundation Company, and E. E. Talmadge will be the engineer in charge of the construction. He expects to have the plant completed early in December.

Dubilier Condenser Business Reported Increasing

The Dubilier Condenser & Radio Company, New York City, has issued a report stating that current earnings are running above those for May and June and that there are prospects of a still further increase.

Recent expansion of the company's business has been due partly to the extensive advertising campaign of Dubilier's invention, known as the Ducon device, for obviating the necessity of aërial installation. Production of "ducons" will shortly be at the rate of 5,000 daily. In addition the company is reported to have orders on hand for more than a million condensers and "micadons."

The company numbers among its customers the Westinghouse Electric, General Electric, DeForest and other big radio part-manufacturing concerns.

R. W. Cramer & Company, Incorporated

The firm of R. W. Cramer & Company, 136 Liberty Street, New York City, was incorporated early in July as sole United States distributor for several Swiss electrical manufacturers. Time switches, remote-control switches, precision thermometers and precision pressure regulators are among the electrical apparatus manufactured by F. Sauter, S. A., Basle; electric clock systems, chronoscopes and chronographs are made by Favarger et Cie., S. A., Neuchatel, and the products of A. Stoppani et Cie., S. A., Berne, carried by the company, are precision rheostats, stop watches and time movements. In addition there is carried a line of water-level indicators for hydro-electric installations. W. R. Cramer is in charge of the office.

Louisville Radio Dealers to Hold Exposition

Radio dealers in Louisville, Ky., will hold a radio exposition in the lobby of the Liberty Insurance Bank, it has been announced. More than a dozen dealers have signified their intention of entering the exhibit. All kinds of apparatus will be on display and in operation, and broadcast programs of the Louisville *Courier-Journal* will be received, according to the announcement. Expert electricians will be present to explain the equipment.

Local electric dealers have established "concert halls" for radio fans since the inauguration of the Louisville *Courier-Journal's* broadcasting station and have good crowds in their stores every evening, according to reports.

Foreign Trade Notes

A NEW POWER STATION FOR FINLAND.—A new electric power station and saw-mill, according to *Commerce Reports*, is to be erected in Forssa, Finland by Forssa, A B, to be ready in the summer of 1923. Wood will be used as fuel.

PROPOSED WATER POWER DEVELOPMENT IN JAVA, EAST INDIES.—The N. V. Nitrogen Syndicate contemplates the development of the water falls of the Mamasa River, near Patewali, Celebes, according to *Commerce Reports*, for which water rights have been secured. It is estimated that from 150,000 to 200,000 hp. can be developed. The project includes electric power plants, nitrate plant and iron and zinc smelter, involving an expenditure of about 50,000,000 florins ($20,000,000).

ELECTRIFICATION OF RAILWAY IN CHILE.—Preparations are being made by the Nitrate Railways Company, Ltd., a British corporation operating the principal railway system in the Province of Tarapaca, Chile, *Commerce Reports* states, for the electrification of the Iquique-La Carpas section, a stretch of about 17 miles with heavy grades. The preliminary estimate of the cost of the work is placed at £2,000,000. The proposed work was covered by a contract made between the Nitrate Railways Company and the Chilean government in July, 1921. Although this contract has been declared void by the Chilean Congress, representatives of the railway state publicly that so far as the company is concerned the contract is in full force and effect. All contracts for material and work will be given out at the head office of the company at 10 Cannon Street, London, E. C.

PROPOSED ELECTRIFICATION OF BOMBAY RAILROADS.—Work will be started at once, according to *Commerce Reports*, on the electrification of the Bombay, India, steam railroads, all work to be completed by 1927. The cost is estimated at 40,000,000 rupees. The first step in the project will be the equipment of the Harbor branch, which is 7 miles long and connects the Victoria Terminus with the Port Trust Railroad. No equipment, it is understood, has yet been purchased for this branch. The Tata Hydro-electric Power Company will furnish all the power from existing substations. The second step will be the electrification of the main line of the Great Peninsula Railroad from Victoria Terminus to Kurla. Power will be provided by two substations of 3,500 kw. each. Bids for this section will be asked for in about six months. The third stage will be from Kurla to Thana, 14 miles, which will require an additional 3,500 kw. The final stage is from Thana to Kalyan, the extreme limit to which the steam suburban lines run, which is 34 miles from Bombay. This extension will require 2,000 kw. additional power. Meanwhile the Bombay, Baroda & Central India Railroad, a two-track line, is to electrify its suburban lines from Colaba Station to Virar, a distance of 38½ miles. No decision has been reached on the Port Trust Railroad. The government of India, it is understood, will provide the necessary funds for the proposed work. Messrs. Merz-McLellan, London, are consulting engineers.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

A firm of importers in China (No. 3,041) is desirous of being placed in touch with manufacturers of machinery, electrical apparatus and supplies, mechanical supplies, etc., who are not already represented in that country.

An electrical engineer in Norway (No. 3,049) wishes to secure the representation of manufacturers for the sale of electric switches and insulators.

A government official in Palestine (No. 3,057) desires to receive technical information, such as catalogs and trade journals, on water supply, hydro-electric power and kindred public utilities.

An agency is desired by a firm in Italy (No. 3,061) for the sale of raw materials for industries, machinery, electrical apparatus, etc.

An engineering firm in Italy (No. 3,070) desires to secure an agency and purchase electrical machinery, including motors, transformers, conductors, compressors, transmission materials, metallic wire half-watt lamps, and electrical appliances in general.

The representative of a firm in South Africa (No. 3,141) is in the United States and desires to secure an agency for the sale of electrical supplies and equipment, automobile accessories, etc.

PROPOSED LIGHTING PLANT IN MEXICO.—A small electric lighting plant, according to *Commerce Reports*, is needed in the town of Puerto Vallarta, Jaliscoo, Mexico. The town has a population of about 2,000.

New Apparatus and Publications

PORTABLE INSTRUMENTS.—Bulletin No. 20 issued by the Jewell Electrical Instrument Company, Chicago, describes its patterns No. 2 and No. 8 of portable instruments.

ALTERNATING-CURRENT MOTORS.—The Mechanical Appliance Company, 228 Third Street, Milwaukee, has recently placed on the market a new line of "Watson" multispeed alternating-current motors.

ADJUSTABLE CONDENSER.—The O. C. White Company, 15 Hermon Street, Worcester, Mass., is distributing a small folder describing its type "IVC" "Vernier" condenser for wireless receiving sets.

LIGHTING UNITS.—The Holophane Glass Company, Inc., 342 Madison Avenue, New York City, has recently placed on the market a new series of its reflector-refractor type of inclosing globes.

BATTERY-CHARGING OUTFIT.—The Hobart Brothers Company, Troy, Ohio, has placed on the market a smaller size "HB" constant-potential battery charger.

FAN FRAME.—The American Blower Company, Detroit, has brought out a new fan frame, which is used with the "Sirocco" "Ventura" fan in kitchens and small houses.

ELECTRIC WELDING.—"Arc Welding in Electric Railway Shops" is the title of a publication, known as leaflet No. 1,824, issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., which describes the many advantages of arc welding.

RHEOSTAT.—J. E. Jenkins Company, 59 East Van Buren Street, Chicago, has recently placed on the market the "Jenkins" vernier rheostat, designed for use with radio receiving sets.

MOTOR STARTERS AND CONTROLLERS.—The Cutler-Hammer Manufacturing Company, Milwaukee, has brought out a new standard line of motor starters and controllers for use in office and public buildings, schools, theaters, etc.

ELECTRIC CHAIN HOIST.—The Yale & Towne Manufacturing Company, Stamford, Conn., is distributing an eight-page leaflet covering the "Yale" model 20 electric chain hoist.

RADIO APPARATUS.—The Phoenix Electric Company, Mansfield, Ohio, is distributing a leaflet describing the "Phoenix" radio apparatus.

SMALL MOTORS.—Bulletin No. 203 issued by the Ohio Electric & Controller Company, 5900 Maurice Avenue, Cleveland, describes its alternating-current induction motors and direct-current ball-bearing motors, in sizes from ⅛ hp. to ⅓ hp.

POWER HOE.—The Link-Belt Company, 910 South Michigan Avenue, Chicago has issued book No. 444, in which it describes the "Link-Belt" power hoe (improved drag scraper).

New Incorporations

THE WILLIAMS BATTERY COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $3,000,000. The incorporators are A. H. Williams, T. J. Town and J. H. Phillips, Philadelphia. The Capital Trust Company of Delaware is attorney.

THE NEW PROSPECT LIGHT COMPANY, Anderson, S. C., has been incorporated by J. Boyce McClure, L. C. Bolt and H. S. Garrison.

THE HARLEM VALLEY ELECTRIC COMPANY, New York City, has been organized by J. G. Deane, W. Cook (care of Deane & Cook, 15 Park Row, New York) and others. The company is capitalized at $100,000 and proposes to generate and distribute electricity in portions of Dutchess and Putnam Counties.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company has been granted a permit to erect an addition to the turbine room and substation at its plant at Kelly's Falls. The cost, which includes a 12,000-kw. turbine and equipment, is estimated at $350,000.

BURLINGTON, VT.—The city Electric Light Department is securing the right of way for the erection of a transmission line from the present terminal on North Avenue to the municipal electric plant.

BEVERLY, MASS.—Plans for the proposed new high school, to cost about $750,000, provide for a vocational department.

WORCESTER, MASS.—Plans are under way by the New England Power Company for the development of an additional 48,000 kw. on the Deerfield River. The plans call for an ultimate development of 128,000 kw.

HARTFORD, CONN.—The Hartford Electric Company is securing the right of way for a high-tension transmission line from South Meadows to Warehouse Point.

NEW BRITAIN, CONN.—A one-story power house will be erected at the new state normal school to cost about $750,000. Guilbert & Betelle, 546 Broad Street, Newark, N. J., are architects.

NEW HAVEN, CONN.—The Fire Department has petitioned the Board of Finance for an appropriation of $50,000 for the installation of a new Gamewell fire-alarm system.

NEW HAVEN, CONN.—Provision has been made in the budget for next year for the installation of 110 additional ornamental lamps on several streets in the city.

NEW LONDON, CONN.—Plans are under consideration by City Manager Barlow for extending the ornamental lighting system into the square at the foot of Chapel Street.

SOUTH MANCHESTER, CONN.—Plans are being prepared by Reeds & Thorpe, engineers, 60 Prospect Street, Hartford, for extensions to the power plant of the J. W. Hale Company.

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North Atlantic States

BALDWIN, N. Y.—The Town Board has granted the petition to change the street-lighting system from gas to electricity. The present plans call for the installation of 275 lamps. The Nassau Light & Power Company furnishes electrical service here.

BOMBAY, N. Y.—Shields Brothers will purchase motors and other electrical equipment for their new local plant for the manufacture of Indian goods. J. J. Shields is head.

BROOKLYN, N. Y.—The Brooklyn Edison Company is preparing plans for the construction of a twelve-story service and operating building at Willoughby and Pearl Streets, to cost $1,000,000. McKenzie, Voorhees & Gmelin, 1123 Broadway, New York, are architects.

ELMIRA, N. Y.—Extensions and improvements, to cost about $350,000 are under consideration by the Elmira Water, Light & Railway Company. Bids, it is understood, will soon be asked for equipment for the plant.

HOLLAND, N. Y.—The Public Service Commission has granted the Depew & Lancaster Light & Power Company, Lancaster, permission to supply electricity for lamps, heaters and power in Holland.

JAMESTOWN, N. Y.—Extensions will be made to the power plant in connection with other improvements to be made at the Jamestown Worsted Mills, Inc., including the installation of new pumping machinery, ash-handling equipment, condensers, etc. The cost of the entire work is estimated at about $100,000.

MINEOLA, N. Y.—The Long Island Lighting Company has acquired the property of the Nassau Light & Power Company and will merge the property under its present name. The consolidated company will issue $3,000,000 in bonds and $3,000,000 in capital stock, part of the proceeds to be used for extensions and improvements.

NARROWSBURG, N. Y. — The Public Service Commission has approved a franchise granted by the Town Board of Tusten to Robert B. Huebner, Narrowsburg, to furnish electrical service in that town. Mr. Huebner will also supply electricity in Narrowsburg and vicinity.

NEW YORK, N. Y. — The New York Steam Corporation, 280 Madison Avenue, operating power utilities in the financial district, has issued $1,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

NIAGARA FALLS, N. Y.—The Niagara State Reservation Commission is planning to replace the present stairway at the Cave of the Winds with an elevator or lift, to cost, including all equipment, etc., $80,000. A. T. Clearwater, 280 Wall Street, Kingston, is chairman.

SACKET HARBOR, N. Y.—The Campbell's Point Association has entered into a contract with the Campbell Transmission Company for lighting the resort grounds and buildings. The transmission line will extend from Sacket Harbor to Smithville.

YONKERS, N. Y.—Steps have been taken by the city officials for the removal of the overhead wires on Main Street and in Getty Square.

CAMDEN, N. J.—A one-story power plant will be erected at the new furniture factory of the J. B. Van Sciver Company, Front and Federal Streets. The Ballinger Company, 105 South Twelfth Street, Philadelphia, is architect.

HAMMONTON, N. J.—A portion of the power house and ice-manufacturing plant of the Littlefield Ice & Coal Company was recently destroyed by fire, causing a loss of about $27,000.

MILLBURN, N. J.—The Millburn Electric Company will begin work at once on the erection of a 33,000-volt transmission line to Morristown, to connect with the plant of the Morris & Somerset Company.

ALLENTOWN, PA. — Plans are being considered by the City Council for placing all wires underground in the business section of the city.

CARLISLE, PA. — Contract has been awarded to the Keystone Engineering Company, Lebanon, for the installation of an ornamental lighting system in the business district, to cost $15,000.

FOXBORO, PA. — The Clarion River Power Company has applied to the Federal Power Commission for permission to build three hydro-electric plants on the Clarion River—one to be located near Foxboro, one in the vicinity of Beaver and another near Mill Creek. C. B. Hawley, Munsey Trust Building, Washington, D. C., is in charge.

HARRISBURG, PA. — Application has been made to the Federal Power Commission by Charles E. Schaup, Harrisburg, for a preliminary permit for a water-power development on the Susquehanna River, at Sasafras Island, in York and Dauphin Counties.

JENKINTOWN, PA.—The Philadelphia & Suburban Electric Company will add a fund of $1,500,000 to its recent appropriation of $1,938,760, for extensions and improvements at Jenkintown, Coatesville, Pottstown and Phoenixville.

PHILADELPHIA, PA. — Plans for the proposed twenty-story office building to be erected at Fifteenth and Chestnut Streets for Albert H. Greenfield provide for a power plant. The cost of the building is estimated at $4,000,000.

PITTSBURGH, PA.—The Duquesne Light Company will build three new substations, to cost with equipment about $900,000. One will be located in the Northside district, one at Bellevue, and the other at Wilkinsburg.

WAYNESBORO, PA.—Arrangements are being made by the Waynesboro Electric Company for the installation of an ornamental lighting system in the business district. The plans call for about forty lamps.

EASTON, MD.—Bids will be received by the Easton Utilities Commission until Aug. 17 for extensions to the municipal electric light plant, including erection of addition to power station, the installation of a turbo-generator set, exciter set, switchboard, condenser, cooling tower, etc. Carl J. Kiefer, Fourth National Bank Building, Cincinnati, is consulting engineer.

MONTVALE, VA.—The Montvale-Thaxton Transmission Company, recently organized, contemplates the erection of a 6,600-volt transmission line (13 miles) to connect Thaxton and Montvale, to cost about $9,000.

NORFOLK, VA.—Bids will be received by Charles E. Ashburner, city manager, until Aug. 17 for the construction of an electric substation for use in connection with the municipal terminal, to include substation equipment, underground conduits and street lighting. The Folwell-Ahlskog Company, 600 Seaboard Bank Building, is engineer.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Aug. 22 for 25,000 fuse covers for use at Iona Island. (Schedule 85.)

North Central States

CADILLAC, MICH.—The City Commission contemplates the construction of a municipal power plant, for which a bond issue is being arranged.

EAST JORDAN, MICH.—Bonds to the amount of $70,000 have been voted for the installation of an electric light and power system.

GRAND RAPIDS, MICH. — Plans are under consideration by the Consumers' Power Company for extensions and improvements to its system, to cost about $1,000,000. The work will include the installation of new steam turbines and auxiliary equipment, underground conduits, etc.

LAKE CITY, MICH.—At a recent election the proposal to purchase the local electric light plant to be owned and operated by the municipality was carried.

PORT HURON, MICH. — The Egyptian Portland Cement Company, Fenton, will install a power house in connection with its proposed new cement mill at Port Huron. The former car works of the Grand Trunk railroad will be remodeled for the plant.

CLEVELAND, OHIO.—Bids will be received by the commissioner of purchases and supplies, City Hall, until Aug. 18 for fiber conduit for division of power and light.

LORAIN, OHIO. — The Lorain County Electric Company is preparing plans for a three-story addition, 40 ft. x 300 ft., at its local power plant, to cost about $300,000.

MUNCIE, IND. — The Indiana General Service Company has issued $3,322,000 in bonds, part of the proceeds to be used for extensions and improvements.

SOUTH BEND, IND.—The Indiana & Michigan Electric Company has petitioned the Federal Power Commission for permission to build a hydro-electric plant at Kings Landing on the St. Joseph River, in Berrien County, Mich., to cost about $1,200,000.

CHICAGO, ILL. — The Commonwealth Edison Company has filed plans for the construction of a six-story power plant, 120 ft. x 280 ft., at One Hundredth Street and the Calumet River, to cost about $1,000,000. The George A. Fuller Company, 140 South Dearborn Street, has the general building contract.

HARRISBURG, ILL.—Surveys have been made by the Central Illinois Public Service Company for the erection of a double-circuit, 66,000-volt tower transmission line from its new power plant at Muddy to West Frankfort. A new sectionalizing switching station will be built at West Frankfort to control the high-tension lines to Muddy, Fenton, Orient Mines, Nos. 1 and 2, Zeigler and Marion. A new switching and transformer station of 21,000 kw. capacity will be erected at Muddy. The equipment of the power station at Muddy will include a 5,000-kva. Allis-Chalmers turbine and three 1,000-hp. Springfield boilers.

MORRIS, ILL.—Plans are under consideration for the installation of an ornamental lighting system on Washington and Liberty Streets, to cost about $14,000. Bids have been received for the work.

OTTAWA, ILL. — Contract has been awarded by the Silica Company for the structural steel work for its proposed new power plant.

MINNEAPOLIS, MINN.—The Northern States Power Company has petitioned the Federal Power Commission for permission to build a hydro-electric plant on St. Croix River, near Kettle Falls.

ST. PAUL, MINN.—The City Council has engaged Adolph F. Meyer, consulting engineer, to make investigations and report on two power sites on the St. Croix River which the city is considering developing.

COUNCIL BLUFFS, IOWA.—The Chicago, Burlington & Quincy Railroad Company, Chicago, will build a one-story power house in connection with its local locomotive shops.

DUBUQUE, IOWA.—The Dubuque Electric Company contemplates the construction of a three-story addition to its power plant, to cost about $300,000.

STORM LAKE, IOWA. — An electric pumping plant will be installed in connection with the municipal waterworks, to cost about $100,000. R. U. Kinne is city clerk.

WATERLOO, IOWA.—The Citizens' Gas & Electric Company, it is understood, will soon call for bids for the construction of a hydro-electric plant, to cost about $100,000. A 500-ft. dam will be built.

BRANSON, MO.—Application has been made by the Empire District Electric Company to the Federal Power Commission for permission to build a hydro-electric plant on White and James Rivers, above Branson. The project will include a transmission line from dam to Joplin. It is proposed to develop from 40,000 hp. to 80,000 hp.

KANSAS CITY, MO.—Improvements are contemplated to the hospital at Leeds Farm, including the installation of electric, ice and refrigerating plants, addition to buildings, etc. It is proposed to submit a proposal to issue from $100,000 to $150,000 in bonds for the work to the voters at the November election.

KANSAS CITY, MO.—The Kansas City Power & Light Company has issued $5,666,000 in capital stock, part of the proceeds to be used for extensions and improvements.

KENNETT, MO.—The Caruthersville & Kennett Electric Light & Power Company is preparing plans for extensions and improvements to its local power plant, to cost about $40,000.

ST. LOUIS, MO.—A company is being organized by C. T. Dana, 1505 Del Norte Avenue, to build a hydro-electric plant on the Black River, to cost about $500,000. Fuller & Beard, Chemical Building, are engineers.

SEDALIA, MO.—The construction of a municipal electric light plant is reported to be under consideration by the City Council.

WATERTOWN, S. D. — At an election held recently bonds to the amount of $225,000 were voted, the proceeds to be used for completing and maintaining the new municipal electric light and power plant.

WHITE RIVER, S. D.—Plans are under consideration for the construction of a hydro-electric plant on Little White River for which bonds have been authorized.

COFFEYVILLE, KAN.—An election will soon be held to submit to the voters the proposal to sell the municipal electric light and power plant to the Kansas Electric Utilities Company.

COLONY, KAN.—The Council has called for bids for extensions and improvements in the municipal power plant. Black & Veatch, Mutual Building, Kansas City, Mo., are consulting engineers.

LYONS, KAN.—The Bevis Salt Company will install two electric turbo-generators and auxiliary equipment, in connection with its proposed evaporating plant, to cost about $175,000.

Southern States

PILOT MOUNTAIN, N. C.—The contract for the municipal power plant and dam on the Ararat River has been awarded to M. E. Jones, Granite Falls. The cost of the system is estimated at $40,000.

PINE TOPS, N. C. — Bids have been asked by the Council for the erection of an electric transmission line from Tarboro to Pine Tops. W. E. Gobb is clerk.

RAY CITY, GA. — The Council has awarded a contract to McGraw & Company, Thomasville, for the construction of an electric lighting system and waterworks.

CITRA, FLA.—The Citra Ice, Light & Development Company is planning to erect an electric plant to furnish electricity in Citra and in Island Grove across Orange Lake as well as power to the packing plant.

QUINCY, FLA.—Bids will be received by the city of Quincy at the office of the city clerk until Aug. 24 for equipment, etc., for water and electric plant, including one "Unaflow" engine directely connected to a 210-kva. two-phase, 2,200-volt generator, one three-panel switchboard, two centrifugal pumps and motors, feed-water pump and heater, motor-driven air compressor, surface condenser and one 200-hp. boiler. The J. B, McCrary Engineering Corporation, Atlanta, Ga., is engineer.

TAMPA, FLA.—Extensions and improvements to be made to the wharf and dock facilities will include the installation of traveling cranes, freight-handling and conveying equipment, etc. The cost of the entire work is estimated at $600,000. A. D. Hall, city manager, is in charge.

VERO, FLA.—At an election to be held on Aug. 18 a proposal to issue $40,000 in bonds for extensions and improvements to the municipal electric light plant will be submitted to the voters.

MEMPHIS, TENN.—The properties of the Memphis Gas & Electric Company will be sold at public auction Aug. 28 under a federal decree, which fixed $5,385,000 as the minimum price.

CORINTH, MISS. — Arrangements are being made by the City Council for an issue of $100,000 in bonds for the installation of a municipal electric light plant. Fuller & Beard, Chemical Building, St. Louis, are consulting engineers.

PLAQUEMINE, LA.—Bids will be received by F. Wilbert, Mayor, and the Board of Aldermen until Sept. 15 for remodeling the electric light plant and waterworks, to cost about $150,000. Swanson-McGraw, Inc., United Fruit Building, New Orleans, are engineers.

BARNSDALL, OKLA.—The Council is negotiating with the Bigheart Light & Power Company for extensions to the street-lighting system, to cover the entire town.

NOBLE, OKLA.—Bonds to the amount of $11,000 have been voted for the erection of a transmission line to secure electricity for local service.

PAULS VALLEY, OKLA.—The Southern Oklahoma Power Company has acquired the property of the Washita Power & Light Company. Extensions and improvements will be made.

AUSTIN, TEX.—The installation of a 5,000-kw. turbo-generator in the municipal electric light plant is under consideration. The cost is estimated at about $150,000. Walter L. Eyres is chairman of water and light commission.

CORPUS CHRISTI, TEX. — The Gulf Coast Power Company, a subsidiary of the Central Texas Power Company, has been granted a franchise to erect new transmission lines in different part of the county.

CORSICANA, TEX.—The Council is considering the installation of an ornamental street-lighting system in the vicinity of North Tenth Street.

DALLAS, TEX. — The Dallas Power & Light Company has applied to the Public Utilities Commission for permission to build an addition to its generating plant, to cost $2,180,000.

FORT WORTH, TEX.—The City Commission contemplates the installation of an ornamental lighting system on Park Place Drive from Eighth Avenue to Forest Park. Plans are also under way for the installation of a lighting system at Polytechnic, a recently annexed suburb.

FREDERICKSBURG, TEX.—Funds for lighting the Fredericksburg Road from the city limits to the 10-mile post have been raised by the Fredericksburg Road Improvement Club.

TEMPLE, TEX.—The Council has authorized the installation of an ornamental lighting system in the business section of Main Street and Avenue A.

Pacific and Mountain States

MONTESANO, WASH.—The Washington Coast Utilities Company, New York Block, Seattle, has acquired the power plants of the Northwest Electric Light & Power Company at Elma and Montesano. Extensions and improvements will be made to include the erection of a transmission line from Montesano and Elma to Aberdeen, about 12 miles, and a new substation at Montesano.

SEATTLE, WASH. — The Puget Sound Power & Light Company is planning to erect a 110,000-volt transmission line from its hydro-electric plant on Puget Sound to Wenatchee, a distance of about 120 miles, to cost $800,000.

SPOKANE, WASH. — Arrangements are being made by the Washington Water Power Company for the erection of a 60,000-volt transmission line from Lind to Colfax and Pullman. This line will duplicate the service now being given to the Palouse country.

STEVENSON, WASH.—A removable permit has been granted to the Skamania Electric Light & Power Company by the County Commissioners to erect and maintain an electric line along the Columbia River highway from the eastern boundary of Multnomah County to Ellahurst.

YAKIMA, WASH.—The installation of an ornamental lighting system in Yakima is under consideration.

GLENDALE, CAL. — The Council has approved plans for an ornamental street-lighting system on San Fernando Road, from Los Felix Road to Pacific Avenue.

LOS ANGELES, CAL.—Los Angelas Gas & Electric Corporation will make extensions in its plants on Du Commun and Howard Streets, to cost about $58,000.

LOS ANGELES, CAL.—The City Council has adopted ordinances calling for the installation of ornamental lamps on portions of Lucerne and Santa Monica Boulevards. Plans are also being considered to install ornamental lamps on Laveta Terrace.

PORTERVILLE, CAL.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system on Main Street between Morton and Oliver Streets, to cost about $15,000.

LOS ANGELES, CAL.—The property of the Chandler Shipbuilding Company at San Pedro Harbor has been acquired by the Pacific Coast Borax Company, Kohl Building, San Francisco, to be used as a refinery. The proposed plant will cost about $1,000,000 and will include a power house, machine shop and other buildings. Crushing, mixing, conveying machinery, etc., will be required.

SACRAMENTO, CAL.—Bids will be received by the State Department of Public Works, Division of Architecture, Sacramento, until Aug. 29, for plumbing, heating and ventilating system and electrical work for library, court and office buildings (State Capitol Extension Group). The cost is estimated at $150,000. Weeks & Day, Phelan Building, San Francisco, are architects and engineers.

SAN FRANCISCO, CAL.—The continuation of the "Path of Gold" lamps from Powell Street to Van Ness Avenue is under consideration by the Geary Street Improvement Association.

SHELLEY, IDAHO.—The property of the Shelley Light & Power Company has been purchased by the Utah Power & Light Company. The plant will be connected with the system of the Utah company operating in the Intermountain country.

Canada

CALGARY, ALT.—The Alberta Hydro-Electric Company contemplates building a hydro-electric plant on the Bow River. The project includes four dams, the first of which will cost about $500,000.

FORT WILLIAM, ONT. — Plans have been announced by the Consolidated Water Power & Paper Company, Wisconsin Rapids, Wis., for extensions and improvements to its local property, recently acquired from the Kaministiquita Paper & Pulp Company. The cost of the proposed work is estimated at $1,000,000 and will include doubling the output of the plant and installing a new 100-ton paper mill. The hydro-electric plant, which now has a generating capacity of 1,500 hp., will be increased at once to 10,000 hp. The name of the local company is known as the Thunder Bay Paper Company. George W. Mead, Wisconsin Rapids, Wis., is president and general manager.

NIAGARA FALLS, ONT.—The installation of a new ornamental lighting system on several streets in the North End is under consideration. The plans call for sixty-nine standards, to cost about $24,125.

PETROLEA, ONT. — The Peninsular Sugar Company is receiving bids for the construction of a one-story and two-story plant, 250 ft. by 800 ft., and a one-story power house, 175 ft. by 225 ft., to cost about $1,500,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 25, 1922)

1,423,686. Electrotinning; Louis Schulte, Chicago, Ill. App. filed July 12, 1920. Solution of potassium fluoride with a slight excess of hydrofluoric acid.

1,423,734. Oscillator for Magnetos; H. O. Putt, Elkhart, Ind. App. filed Dec. 9, 1919. Cam engages trigger.

1,423,735. Oscillator for Magnetos; H. O. Putt, Elkhart, Ind. App. filed Feb. 20, 1922. Novel winding disk.

1,423,737. Art of Transmitting Pictures and the Like; H. K. Sandell, Chicago, Ill. App. filed Sept. 10, 1919. Electromagnetic circuits capable of sending and receiving impulses translatable into pictures.

1,423,738. Sheet Perforating Machine; H. K. Sandell, Chicago, Ill. App. filed Dec. 6, 1920. Operates with comparatively great rapidity.

1,423,742. Heater Unit; H. A. Silverman, New York, N. Y. App. filed May 5, 1921. Particularly for motor-car radiator.

1,423,806. Electric Heating Device; W. F. Lebzelter, Elizabethtown, Pa. App. filed Sept. 3, 1921. Simplified means for supporting and supplying current.

1,423,815. Electroplating Process; N. V. Park, Niles, Mich. App. filed July 6, 1921. Air injecting pipe with a plurality of orifices.

1,423,839. Device for Automatically Controlling the Output of Electrical Plants; M. Doloukhanoff, Charlottenburg, Germany. App. filed March 23, 1922. Number of machines increased automatically according to demand.

1,423,889. Power Cable Reeling Mechanism for Self-Propelled Machines; J. S. Townsend, Harvey, Ill. App. filed April 13, 1921. Overhung bearing.

1,423,897. Connector Switch; G. A. Yanochowski, Chicago, Ill. App. filed Aug. 1, 1917. Two-dimension type for telephone exchange.

1,423,898. Automatic Telephone System; G. A. Yanochowski, Chicago, Ill. App. filed June 6, 1918. Records number called.

1,423,899. Automatic Telephone System; G. A. Yanochowski, Chicago, Ill. App. filed July 5, 1918. Simplified circuits, small number of relays, switch contacts and mechanical parts, and novel details of construction.

1,423,911. Portable Electric Lantern; A. D. Cardwell, Rockville Center, N. Y. App. filed May 27, 1920. Two lamps of different candlepower and tail-light with novel battery arrangement.

1,423,914. Electrical Arc Welding; J. Churchward, New York, N. Y. App. filed Jan. 14, 1920. Employs tungsten electrode that will not contaminate weld.

1,423,924. Adjustable X-Ray Tube Holder; E. L. Edwards, Indianapolis, Ind. App. filed March 20, 1920. Enables firm support in variety of positions.

1,423,926. Voltage Regulating System; G. Faccioli, Pittsfield, Mass. App. filed Aug. 31, 1921. Gives any desired magnitude and phase at a predetermined point.

1,423,930. Telephone Switchboard Apparatus; B. Freile, Bogota, N. J. App. filed Aug. 30, 1920. Compact and convenient arrangement of checking terminals.

1,423,956. Tipless Incandescent Lamp and Similar Article; L. E. Mitchell and A. J. White, Cleveland, Ohio. App. filed March 20, 1919. Exhaust tube attached to stem tube which carries filament mounting and lead-in wires.

1,423,958. Dynamo Electric Machine; A. H. Mittag, Schenectady, N. Y. App. filed March 29, 1920. Field windings arranged to operate with more than one number of poles.

1,423,959. Frequency Changer; A. H. Mittag, Schenectady, N. Y. App. filed April 29, 1920. Constructed of conventional induction-motor parts.

1,423,985. Cementing and Protecting Composition; L. E. Barringer, Schenectady, N. Y. App. filed Nov. 18, 1919. Shellac, ammonia, sodium, silicate and silex.

1,423,996. Arc Barrier for Dynamo-Electric Machines; J. L. Burnham, Schenectady, N. Y. App. filed Jan. 7, 1922. Inclined to commutator so as to lift arcs occurring under brushes or between segments.

1,424,003. Control System; C. B. Connely, Scotia, N. Y. App. filed Nov. 23, 1921. Electromagnetic switches are prevented from being reclosed until controllers are in off positions.

1,424,016. Electrical Apparatus; L. A. Haworth, Dalton, Mass. App. filed Oct. 13, 1920. Improved means of retaining windings in a predetermined relation.

1,424,065. Signaling System; E. H. Armstrong, Yonkers, N. Y. App. filed June 27, 1921. Obtain enormous amplification of varying currents by modifications of regenerative principle.

1,424,070. Automobile Direction Indicator; J. B. Blair, Decatur, Ill. App. filed Sept. 20, 1917. Electromagnetically or mechanically operated.

1,424,088. Composition for Coating Metals for the Purpose of Permitting Electric Currents to Operate by the Action of Light; H. L. Falk, New Orleans, La. App. filed Dec. 10, 1921. For use in reproduction of sound waves which have previously been photographed.

1,424,091. Radio Electron; C. R. Fountain, Macon, Ga. App. filed Jan. 21, 1919. Includes a common source of electrons, two control elements, one on either side of this source of electrons, a perforated medium strongly attracting electrons, and another medium capable of liberating electrons under violent electronic impacts.

1,424,141. Electrical Oscillation Generator; L. F. Fuller, Palo Alto, Cal. App. filed June 16, 1919. Involves rugged water-cooled anode tip.

1,424,144. Battery Cover; Bert Kunkel, Hart, Mich. App. filed Feb. 11, 1921. Detachably secured and provided with bushings for battery connecting wires.

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Dreams That Come True

EVERY industry at some time or other finds itself sorely in want of old men who dream dreams and of young men who see visions. It needed not the voice of the seer to proclaim "where there is no vision the people perish," for from antiquity man's imagination has always been the means of his salvation. Civilization is indebted not so much to ideas as to ideals, for an ideal is an idea intensified—an idea shot through with beauty and animated by faith. It was the dream of a Western passage to the Indies that led to the discovery of America, and it is the dream of universal electric service that will keep our inventors, our engineers and our executives at work until the invisible genie that dwells in the coal mines and the running rivers is at every man's beck and call.

OUR industry is yet young. It abounds with men with power to see and to do those things which are essential to its upbuilding. But there is a great gulf between conception and fulfillment. Franklin with his kite coaxed the lightning from the sky, but the thunderbolts of Jove never ceased to work havoc with electrical machinery until Thomson, Wurts and Steinmetz found a way to render them harmless. Edison many years ago had a clear vision of central-station electric service, but it was only through the instrumentality of such men as Insull, Lieb, Edgar and McCall that his dream was realized. Polyphase currents were at first a day dream in the mind of Nikola Tesla, but when he told his vision to George Westinghouse it became to the electrical industry first an ideal and then a reality. Rural telephone service was for a long while a seemingly impracticable theory, but John J. Carty with his "bridging bell" put it into effect. To get the power out of falling water and transmit it as electricity to distant cities was a fond idea of many electrical engineers, and it was nothing more until H. H. Sinclair harnessed Mill Creek in southern California, but from that time onward high-tension transmission became a reality. For years the metallurgists struggled with ores which would not yield to treatment in the ordinary furnace, but in quick succession came Cowles, Bradley, Héroult and Acheson and electrometallurgy became a productive art. These are but a few examples, taken at random from the electrical industry, of men who idealized what others saw. Telegraphy, illumination, the new radio art—every branch of our industry—could be drawn on for others.

OUT of dreams has been born our modern civilization, with its widespread comfort, its material well-being, its growing opulence. The dreamers are not without honor either in their own country or abroad; but with their names must ever be coupled the names of those who make the dreamers' dreams come true—the men of affairs, sagacity and worldly wisdom who, if they themselves dream not, at least know the true dream from the false and, knowing, dare transmute it into fact. For the prophet unsupported sees only what might and not what shall be so.

William Henry Blood, Jr.

Engineer and consultant, whose distinguished services on behalf of electrical fire prevention and public utility economics number him among the foremost advisory experts of the industry.

ELECTRICAL engineering is a many-sided profession. The experience of relatively few embraces every principal branch of the industry, nor to very many men is it given to create for themselves high reputations in more than one field of technical service. To William H. Blood, Jr., electrical engineer with Stone & Webster, Inc., belongs the distinction of having worked in the manufacturing, jobbing, contractor-dealer and utility fields and acquired thereby a breadth of outlook and seasoned judgment which have exerted a powerful constructive influence upon electrical progress for virtually a generation. From one end of the continent to the other he has traveled an average of 30,000 miles per year, investigating utility problems at first hand, reporting upon proposed developments and existing situations, passing upon intricate questions of fire protection, testifying as an expert witness in commission and court cases, analyzing industrial opportunities, recommending betterments, and in general serving as guide, philosopher and friend to member companies of the National Electric Light Association through his official connection as insurance expert of the association and as advisory engineer for the great Boston organization with which he has been associated for twenty-eight years. Mr. Blood has made valuations of probably a hundred companies and has examined properties aggregating in value about two billion dollars. He has had occasion professionally to visit 180 out of 192 principal cities of the United States.

To appraise Mr. Blood's work in electrical fire prevention and measure the influence of his untiring labors upon the National Electrical Code would indeed be difficult. Certainly no other engineer in this country is more responsible for putting the grounding of secondaries upon a mandatory basis where once it was prohibited. For over a decade he has been chairman of the committee on grounding of the National Fire Protection Association and for many years has been insurance expert of the N. E. L. A. He was president of the latter body in 1905-6 and was the first president of the Electric Vehicle Association of America, serving two years in 1911-12. Always a firm champion of progress, Mr. Blood has insisted that safety go hand-in-hand with development, and his keen philosophic insight into the trend of the industry has never led him into visionary pastures. His contributions to the press embrace an extraordinary variety of topics associated with the economic, human and engineering phases of electrical development. More than 2,700 reprints of his recent paper upon "The Passing of 'Depreciated Value' in Rate Cases" have been welcomed by interested readers in circles concerned with regulation. For two years he was a faculty member of the Harvard Graduate School of Business Administration, and he still lectures upon "Public Utility Operation." He is a fellow of the A. I. E. E.

Mr. Blood was born in Boston on March 29, 1866. He was educated at the Massachusetts Institute of Technology and in 1888 entered the industry at the Thomson-Houston factory in Lynn, soon being promoted to have charge of the second floor of Factory C, assembling and testing alternating-current machinery. In 1890 he was placed in charge of the repair department of the Northwest Thomson-Houston Company at St. Paul, and from 1891 to 1894 was a partner in the Franklin Electric Company, Kansas City, building about thirty central stations and several electric railways and waterworks, and doing a contractor-dealer and jobbing business. He joined the staff of Stone & Webster in 1894 and has always held a prominent position in that organization as a consultant at every stage of its extraordinary development.

Editorial Comment

Electrical World, August 19, 1922

Volume 80 Number 8

Life on the Farm More Attractive

THANKS to electric service and the automobile, the farmer's wife is becoming more and more contented with her lot, and contentment, according to Holy Writ, is great riches. In this there is cause for rejoicing, for before we can have a back-to-the-farm movement, and such emigration is absolutely essential, there must be a stay-on-the-farm inclination. That evidently has now come to pass, for in response to the question "Do you want your daughter to marry a farmer?" sent by a Minnesota agricultural publication to farmers' wives all over the country 94 per cent answered in the affirmative. Only 480 out of 7,000 said that they were dissatisfied with their lot.

What the answer to such a question would have been a generation ago one can very well imagine. Now the home of almost every moderately well-to-do farmer is equipped with running water, electric lights, electric labor-saving devices of all sorts, a telephone, a phonograph, an automobile, and lately a radio set. Isolation, loneliness and lack of contact with the world of affairs are things of the past. The farm, the city and the great pulsating world are now linked together.

We have no desire to stress unduly the part which electricity has played in this transformation. Suffice it to say that it has been exceedingly great. It is therefore becoming more and more obligatory for electric light and power companies to extend their lines into rural communities whenever and wherever this is economically possible. Fortunately the great majority of electric light and power companies have already recognized this duty and have brought untold happiness and comfort to the farmer as well as profit to themselves. It is for the others to do likewise.

The Larger Strategy of Hydro-Electric Development and Power Transmission

WHILE some sections of the country have the advantage of high hydraulic head, they are sometimes handicapped by unreliable, insufficient or non-uniform supply. In such cases it is necessary either to preserve the flow during periods of plenty or to provide other means, generally steam plants, for helping out the supply of power during the dry season. Which of these plans of operation is the more desirable depends on the amount and kind of market and again on the facilities for storage. Now and then, as in some of the great California systems, it is practicable to back a hydro-electric plant by what is substantially complete seasonal storage, and where this can be done all the run-off can eventually be utilized, and utilized at such rates as may prove desirable for various reasons. Where such wholesale storage is not practicable and one has to be content with storage over a few days at most, there will necessarily be great loss of run-off at certain seasons, although the plant may be able to work up to a reasonable maximum on its storage water. If, however, the run-off is to be utilized without great storage facilities, the only other recourse is to overdevelop the hydraulic side of the enterprise, so to speak, and then to reinforce it by steam power. The economy of this feature depends on the certainty and regularity of the market. A good mountain stream at one end of a transmission line and a mouth-of-the-mine system plant at the other end make a combination that is pretty nearly invulnerable as regards regularity of service and general economy, given a reliable market. And right here is the place where he who plans transmission systems must be a duly certified and accredited prophet, able to see with his mind's eye what is going to happen to the mines and the rate and development of the energy market, that he may properly plan his plant for a high factor of utilization.

Young Men for Counsel

IT HAS been suggested that subordinate employees of central-station companies would profit much by being invited to attend local committee meetings as they are held in different cities by the membership of the National Electric Light Association and other associations. It is a good idea. For, although the natural limitations of space prevent attendance in too great numbers, there can be no reason for not inviting in as guests as many men from the local company as can be accommodated.

Committee meetings held in the right spirit are most valuable to those in attendance. In a sense they are short-time intensive conventions. The viewpoints of rising young men in company departments brought into fresh contact with outside minds and practices are, potentially at least, worth obtaining. The good of such gatherings to all concerned is anything but one-sided.

It will be an influence of no small benefit in preparing our young men for counsel by bringing them early into contact with questions of policy and industrial problems which they do not meet in their own work.

Making Use of the Engineer

NOT only are the place and the purpose of the engineer still very vague in the mind of the general public, but often men responsible for the management and operation of shops and plants fail to realize that engineers have very specific duties and a very definite place in the scheme of things and that it would be of great managerial advantage to make use of them in their proper sphere. The *Electrical World* has constant proofs that this condition exists in the many questions that are asked it each day, such, for example, as these: "Where can we find a general rule for figuring the proper size of motors for various kinds of work?" "How can we lay out house wiring?"—no data on the house being given. "How can we build most cheaply a line between two points?"—distance only being given.

When a man wants to clear up a point of law he has learned to go to a lawyer. When he is ill he seeks the advice of a physician. It is true that some persons still use patent medicines without a professional prescription, and an analogous process is altogether too prevalent in the engineering field. After much grief it will always be found that in engineering as in medicine no patent nostrum can be used indiscriminately and that a thorough grounding in fundamentals and much study are necessary to solve an engineering problem with any degree of satisfaction.

Every year our universities graduate men who as their practice grows become competent to handle the engineering problems that are generally met. There also are many men who, though not college-trained, have acquired through experience equal competency to solve these problems. It is the duty of these men to see that their place in the community is understood, so that their fellow citizens in general will call for them when they are needed and mutual benefit from the application of their knowledge be wrought.

Savings Depositors Are a Measure of Industrial Stability

IN THE present conditions in the industrial and political world it is of interest to know the number of savings depositors in several nations. The United States has 100 out of every 1,000 inhabitants, Switzerland 554, Denmark 442, Belgium 387, France 346 and England 302. If one desired to measure the countries of Europe in the order of their political contentment, educational standards and the degree of industrial cooperation between capital and labor, the number of savings depositors per 1,000 inhabitants would furnish apparently an excellent yardstick.

A small financial holding determines whether or not a man is a responsible and sensible citizen or an irresponsible and envious being, readily swayed by agitators and demagogues. In order that there may be a large number of savings depositors only education is needed. To save requires foresight, and this can only be obtained by educational methods. Knowledge is power as never before. Why not attack our industrial situation intensively with an educational program?

Business Statistics for Electrical Men

IN THE year 1921 a total of 19,652 manufacturing and trading companies in the United States went into bankruptcy, with liabilities aggregating more than $627,000,000. Practically all of these failures were the results of mistakes in judgment. Thousands of other business firms also made mistakes that lost them money. And the principal reason why they made these mistakes in judgment was that they did not base their thinking on facts.

Business executives every day are called upon to make decisions involving large sums of money. These decisions are guided by the information in their possession. Too often this information is indefinite, fragmentary or distorted. The results of these decisions are molded by the influence of conditions, carefully weighed but with uncertain knowledge, and it is no wonder that disaster often follows.

There is available today to every manufacturer, jobber and large contractor in the electrical industry and every central-station executive a source of facts quite unknown to many, but of great practical value. It is the "Survey of Current Business" now published monthly by the Department of Commerce. By the use of curves, diagrams and tables this survey presents a clear, complete and accurate statistical review of current business movements, a vision of economic trends and the conditions affecting the different industries and various sections of the country. It provides the basis of an exact knowledge of the state of prosperity and the state of mind in other business circles that can be made a guide of inestimable value.

The greatest handicap to the salesman and to the executive who plans his work in the development of any enterprise is that the world is so large and the opportunity so great. There is so much that can be done that the effort is often too scattered, the butter spread too thin. And the reason is that men are apt to plan and work without an economic picture of their opportunity —that is, a broad knowledge of the conditions that are affecting their customers. Yet there are no influences more vital to a business enterprise than these movements and situations in the industries with which it comes into contact. This government statistical service for business men cannot be recommended too highly for practical daily use by the executives of the electrical industry.

Values for Rate Making

IN A RECENT talk before the Iowa Section of the National Electric Light Association John A. Reed, in reviewing the legal decisions of interest to Iowa utilities, called attention to the fact that court decisions had not yet fixed any definite price basis on which utility valuations should be made. He also pointed out that there is no mathematical formula by which such valuations can be calculated, but that the tendency of the courts is to consider original cost, reproduction cost at present-day prices, five to ten-year average costs, depreciation figures and many other factors in arriving at the fair value of a property for rate-making purposes.

The confusion existing in the matter of the proper basis of value for rate-making purposes is a matter of concern to utility men because it makes for public distrust. To add to the complexity of the situation today, there is a noticeable dropping off in enthusiasm among the advocates of the prevailing-price theory as the prices of materials drop and as it becomes evident that the theory means the writing off of considerable amounts invested when market levels were at the highest point.

Mr. Reed's position as a utility owner, and, more particularly as an attorney of many years' experience in Iowa, should give pause to the ardent advocates of any of the various theories that are proposed. The value of a utility property is finally measured by the character of the service it gives to the community. If investments are intelligently made and efficient service developed by proper management, the owners are entitled to compensation for their efforts. If investments are carelessly made and inefficient service given, the owners must suffer the penalty. This is an unalterable law of the economic world. Commissions, courts or any other governmental agencies are powerless to change it. For this reason it is entirely probable that there will never be any one method of valuing properties established, since no method based on material and labor costs is more than an important element in the value of a property.

Service, management, the intelligence exercised in the building up of a property and all the other intangibles that go into the make-up of a business hav part, and ultimately, whether the public wills or not, they will find recognition, unless it is to be assumed that the entire utility business is to go to wrack and ruin. There are too many cases in the country where intelligent management and frank dealing with the public have brought fair treatment and good returns on investment without even the mention of a valuation to allow any one to say that wrack and ruin is the only end. If a basis of proper public relations and confidence is built up, the question of the proper value of a property for rate-making purposes is quite likely to drop out of sight, since the lack of confidence caused by a policy of secrecy and a feeling, born of ignorance on the part of the public, that there are tremendous and uncalled-for profits in the utility business has been largely responsible for the prominence of the question in court and commission proceedings.

Broadcasting Experience Over Power Networks Suggests Problems for Research

IN THE carrier-current broadcasting tests that were recently carried out in Chicago and Cleveland, reported in this and the July 15 issue of the *Electrical World*, several interesting observations were made. One of the most important of them is the fact that it was possible to pick up such signals on an ordinary antenna without any connection between the receiving set and the power system. This experience is borne out by some other tests in the Middle West that have not yet been discussed publicly. The question that is raised at once is what interference will such broadcasting produce on other uses of radio. As yet there are no definite data to show how far from the power circuits the signals can be picked up. If the distance is at all great, such broadcasting would undoubtedly come into the same class as straight radio broadcasting and would be subject to all the regulations imposed on ordinary radio communication.

Another experience that seems to stand out in the Chicago tests is that the power load on the system has some effect on the transmission of the signals. Whether this applies only to such systems as that in Chicago, where power and lighting loads are handled on a tremendous scale, or whether the effect is due to the extent to which the conductors are loaded or to the characteristics of cables under high-frequency current conditions, are questions which the tests are not extensive enough to answer.

The tests made so far do indicate clearly three of the problems on which research work must be concentrated in order to make such broadcasting a practical possibility. They are (1) confining the signals to the power conductors to avoid interference with other radio traffic, (2) increasing the range of transmission in such a way that the use of the conductors for this purpose will be independent of system-load conditions, and (3) determining the optimum wave length to be used.

Balanced Load Development Is Needed

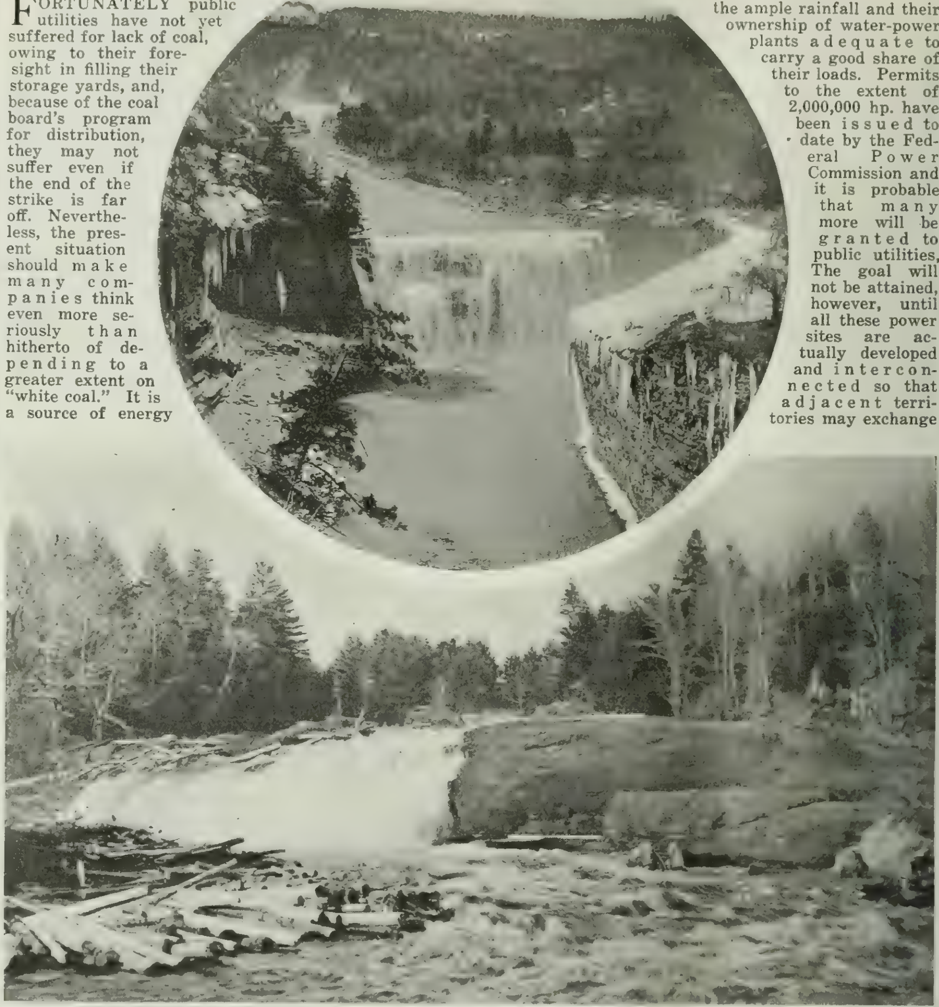
THE vice-president of one of the large business statistical organizations recently told a group of utility men that the time had arrived when central stations could no longer expect to escape the effects of industrial depressions. Looking back over the history of the past thirty years, he pointed out the fact that in all the depressions the light and power industry as a whole seemed to have escaped any dip in the curve of business development until the depression from which we are now emerging came along. While there are no indications of another slump taking place in the near or distant future, his statement calls attention to the fact that the present is one of rapid transition in the industry. In general the business of the central station up to the war had been derived to a large extent from the fields that are least affected in their activities by industrial depressions. The big field of industrial power supply was either largely untouched or supplied to a great extent from isolated plants that could shut down during a depression with no effect on the utility field.

With the war came a development that revealed the inherent advantage of an energy supply from large central sources, and the result has been a turning toward the central station that is gratifying to men who have fought for this type of recognition so long. This condition brings with it new responsibilities in the building of central-station business. In general the industry has suffered only slightly as compared with other industries during the present period of depression. An analysis of the situation, however, reveals a marked falling off of business for some of the central stations that had gone the longest distance in developing the power demand from industrial concerns and in some cases had taken on large war industry loads. The average was held up by the central stations in fields less devoted to industrial development. Fortunately in the present situation central stations were in an overloaded condition and the decrease in business was a help because of the chance it gave to catch up. Another saving factor has been the tendency on the part of industries, as they came back to partial activity, to call on the central station for their energy supply. As a consequence any available capacity has been absorbed and the central stations are still in the position of having to catch up with the enlarged demand on their facilities.

It is only necessary to imagine the condition that would have existed if the electrification of industry had been on a much more complete basis to see that the men responsible for business building in the central-station field have a real problem and a big responsibility to face in the future. That problem is the proper balancing of load taken on so that even a general depression will not affect the revenues seriously. In some cases executives who have seen the handwriting on the wall are protecting their properties by diversification of locality, selecting property units in such a way that there is a diversity of industry great enough to insure against a general slump in revenue under almost any conditions. The problem is one that must have serious study and requires a careful laying out of new business-getting policies to prevent a badly balanced load development, particularly on the part of central stations located in areas with little industrial diversity. The rapid increase in the use of household appliances is a saving element in the situation.

Developed Water Power—A Remedy for Coal Shortage

FORTUNATELY public utilities have not yet suffered for lack of coal, owing to their foresight in filling their storage yards, and, because of the coal board's program for distribution, they may not suffer even if the end of the strike is far off. Nevertheless, the present situation should make many companies think even more seriously than hitherto of depending to a greater extent on "white coal." It is a source of energy that can be relied upon more confidently than can coal because its availability cannot be destroyed by strikes or similar contingencies. Although statistics are lacking, there is no question that a number of electric service companies in the East have been saved much apprehension during the last few weeks by the ample rainfall and their ownership of water-power plants adequate to carry a good share of their loads. Permits to the extent of 2,000,000 hp. have been issued to date by the Federal Power Commission and it is probable that many more will be granted to public utilities. The goal will not be attained, however, until all these power sites are actually developed and interconnected so that adjacent territories may exchange energy in emergencies. Superpower transmission lines are not absolutely essential to this scheme. The problem is chiefly one of exchanging surplus electrical energy over short distances and a logical use of water storage facilities in the combined hydraulic and steam plant systems of the country.



Distribution at 2,200 Volts Should Be Considered for Industrial Plants

When More Than 3,000 Kw. Is Required It May Often Prove More Economical and Also Facilitate Mechanical Layout of Circuits—Compromises Sometimes Required in Practice

By A. S. WELLS
Holyoke (Mass.) Water Power Company

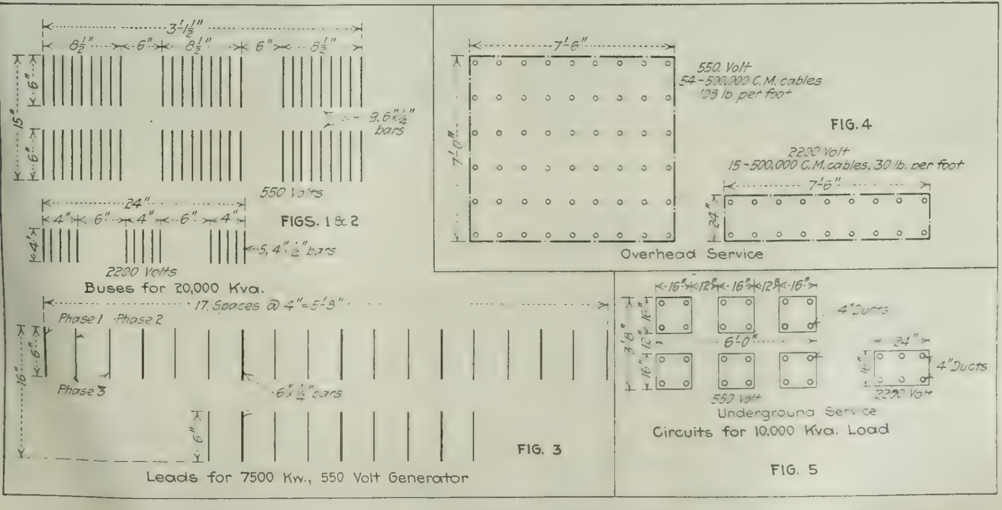
VOLTAGES higher than 550 were seldom considered in the early electrical installations in industrial plants because the total electrical load was small, the greater part of the mill being driven by direct mechanical drive from steam engines or waterwheels. As these old mechanical drives are gradually electrified and the generation of power becomes centralized many of these low-voltage systems become very unwieldy. When there is already a large investment in low-voltage equipment it is not always easy to make a change to a higher voltage, but no new installation which may develop a capacity greater than 3,000 kw. should be designed today without giving consideration to 2,200-volt distribution.

The most serious difficulty with a large low-voltage system under average industrial-plant conditions is often not so much the question of voltage drop as the purely mechanical problem of arranging and supporting the enormous amount of copper in buses and lines. Then, too, with large alternating currents the eddy currents and skin effect may be very pronounced. For instance, the writer recalls one 4,000-kva. installation in which the buses ran exceedingly hot with a current density of only 800 amp. per square inch, whereas at 2,200 volts the same kilowatts could have been carried without undue heating.

To get some idea of the relative space required for conductors at 2,200 and at 550 volts, consider, for instance, the problem at one large mill which has two 7,500-kw., 550-volt, three-phase generators and several smaller units, with a total peak load of about 20,000 kva., or 21,000 amp. Assuming this current carried in a single bus, the cross-section required is $21{,}000 \div 800 = 23$ sq.in., or say eighteen 6-in. x ¼-in. bars per phase. For proper ventilation these bars should be spaced at least 1 in. apart, and with 6 in. between phases the space occupied would be as shown in Fig. 1. Taking 20,000 kva. at 2,200 volts, we would require $20{,}000 \div (1.73 \times 2.2 \times 1{,}000) = 5$ sq.in. of copper, or five 4-in. x ¼-in. bars, and the space required would be as shown in Fig. 2.

The generator leads for a 7,500-kw., 550-volt machine also represent quite a problem. Cable is out of the question, so flat bus is commonly used, often with the leaves of the different phases interspersed to reduce reactance and obtain better current distribution. For such an arrangement (Fig. 3) the space required is considerable, and the designer who assumes that the generator leads can be run in anywhere after everything else has been installed may find himself in trouble.

To carry the comparison on through the system, Figs. 4 and 5 show graphically the space which would be occupied by feeder lines for 10,000 kw. at 550 volts and 2,200 volts, both underground and overhead. Providing proper space for such a group of lines as shown in Fig. 4, whether overhead, underground or through mill build-



FIGS. 1 TO 5—RELATIVE SPACE REQUIRED BY BUSES, GENERATOR LEADS AND FEEDERS FOR 2,200 VOLTS AND 550 VOLTS

ings, is no small problem if a safe, neat and efficient installation is required.

Comparing 550-volt and 2,200-volt systems solely from the standpoint of first cost, it is, of course, true that for work installed in the mill buildings much of the money saved in copper must be spent on expensive lead-sheath cable and conduit since insurance regulations require all 2,200-volt wiring to be inclosed in a continuous grounded metal-conduit system. On the other hand, it should be recognized that at 2,200 volts we are compelled to adopt a type of construction which is in the main coming to be considered good practice for 550-volt work. In other words, while the difference between the cheapest possible 550-volt installation and the cheapest 2,200-volt work may be in favor of 550 volts, the difference in cost between the first-class installations will often be in favor of 2,200 volts even for interior mill construction.

SHALL 2,200-VOLT MOTORS BE USED?

Having once decided to consider 2,200-volt distribution, the next question is whether to continue this voltage through to the individual motors or install small substations at load centers for transformation to a lower voltage. Many factors are involved in the solution of this problem, including such questions as the following:

Will the majority of motors be in sizes of 25 hp. or above?

Are there many motors already in service at a lower voltage?

Can the motors and starters be placed in dry places and protected from mechanical injury?

Can substations be located near load centers?

What will be comparative cost of the two systems?

As a matter of fact, there will always be at least a few small motors requiring 550 volts or less, and the scheme chosen will be a compromise to best suit average conditions. If the proportion of small motors is not great, a three-wire, 220-110-volt lighting system can be installed and the small motors run on the lighting transformers at 220 volts, three-phase. If most of the motors are small or a large number are already installed at low voltage, a system of 550-volt or 440-volt substations will be advisable.

The writer has in mind two actual cases which illustrate these extremes. The first installation has been in successful operation for several years and the second was a preliminary solution planned to meet future conditions.

A CASE WHERE 2,200 VOLTS PAID

In the first case a property consisting of three rather widely separated mechanically driven mill buildings, each with a single engine, was to be electrified and all power eventually supplied from a central generating station at mill No. 2. Two mills required 1,500 indicated horsepower each and the third 1,000. A very few small motors were supplied by a 150-kw., 550-volt engine-driven generator which also carried the lighting load. The new system could, therefore, be designed to fit the conditions without reference to the motors already installed.

The first step was to lay out four preliminary distribution systems: (1) 550-volt overhead distribution, 550-volt motor; (2) 550-volt underground distribution, 550-volt motor; (3) 2,200-volt overhead distribution, 2,200-volt motor; (4) 2,200-volt underground distribution, 2,200-volt motor.

In each case it was proposed to run feeders inside the mill buildings where possible in preference to out-of-door locations, and overhead lines where necessary would run over the roofs on frames rather than on poles through the yard. Cost estimates on these four propositions were as follows:

Item	550-Volt		2,200-Volt	
	Overhead	Underground	Overhead	Underground
Switchboard	$5,000	$5,000	$3,000	$3,000
Wiring	24,150	44,000	15,900	19,300
Wire towers or ducts	1,050	7,282	825	4,692
Motors, starters, etc.	13,834	13,834	16,547	16,547
Total	$44,034	$70,116	$36,272	$43,539

This analysis showed clearly that the 2,200-volt system would be cheaper. The arrangement of mill machinery was such that the use of motors in sizes from 25 hp. to 250 hp. was most efficient, and as an ultimate load of 10,000 kw. was entirely possible a straight 2,200-volt system was laid out, starting with a 2,000-kw. and a 500-kw. turbine generator and motors rated at about 1,200 hp. Existing 550-volt equipment was tied in through a bank of three 75-kva. transformers, 2,200/550 volts, and the few small motors required in the new installation were connected to this 550-volt system.

For mill No. 3, where about 1,000 hp. in motors was installed, two feeders were run, using No. 4/0 three-conductor, rubber-covered, lead-sheath conductor in conduit for interior work and No. 2/0 weatherproof for outdoor lines. At the switchboard each feeder was protected by an automatic hand-operated, remote-controlled oil switch, and from this point the cable was carried through full size to the motor-starting compensators without further protection. At the entrance to the mill, however, a non-automatic oil switch was placed in each line in a locked compartment to serve as an emergency disconnecting switch in case of trouble on the line. Workmen could also open these switches and lock the compartment door so that there would be no chance of lines being made alive through misunderstanding at the power house or by interference of unauthorized persons.

Such a simple system is, in the opinion of the writer, much better adapted to the average moderate-sized industrial plant than any combination of elaborate protective devices, because with the exception of the motor and the compensator there is no equipment outside of the power house which requires attention, while first cost is low and operation thoroughly reliable.

The second example referred to above is the case of a large paper mill which, with an ultimate electrical load of about 10,000 kw., had already installed 5,250 kw. generating capacity at 440 volts. It seemed probable that the next unit installed would be a 10,000-kw. machine, and as 440-volt generation in that size is not a practical proposition, the question arose as to just how the distribution system could best be modified to meet this condition efficiently without involving too great expense or upsetting production, the latter being especially important in a paper mill. While the present motors were nearly all in sizes 50 hp. and above, the expense of changing them to 2,200 volts did not seem justified, and, furthermore, the use of 2,200 volts would hardly have been safe for machines or operators, owing to the unavoidable splashing of water about the motors and switches and the generally damp condition prevailing.

The logical compromise was therefore a system of substations receiving current from the power house at 2,200 volts and distributing it at 440 volts. In the portion of the property already motored the secondaries of these substations would simply tie in with the existing feeders without disturbing individual motor circuits or in any way interrupting production. Equipment in substations would consist of transformers and simple switching equipment, all necessary meters being installed at the power house. No attendants would be required other than the usual troubleman assigned to each mill under the existing system. Present 440-volt generating equipment would be tied in with the new 2,200-volt bus through three-phase transformers, and there would be no low-tension switching equipment or buses in the power house, thus replacing the present switchboard with one that is much more compact, more easily operated and which is adapted for unlimited expansion.

Losses in transformers would be more than balanced by savings in transmission, and the cost of substations would in a large measure be offset by reduction in cost of the 2,200-volt switchboard as compared with one of equal capacity at 440 volts. Many new motors could be operated at 2,200 volts, thus further reducing transmission losses.

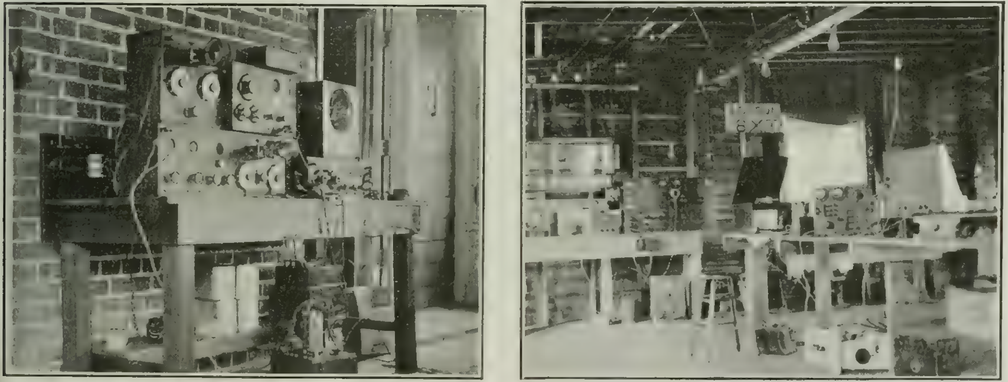
Substation compartments must in such an installation be of fireproof construction, with special provision for preventing the spread of oil fire to the surrounding manufacturing space. In general, separate houses 10 ft. or more from mill buildings would be preferable to a location within the mill, but in this particular case there was no suitable space for such an arrangement, and fireproof compartments in existing buildings were considered to be satisfactory.

Many other similar examples could be cited, but the cases described above, although they do not by any means cover the field, are typical and serve to emphasize the need for careful study in laying out industrial power systems.

"Wired-Wireless" Broadcasting

A 50-Watt Transmitting Set Accomplishes Good Transmission Over Electric Lighting Wires—Tests Tend to Show an Optimum Wave Length for a Given System—Modification of Power Installation Not Necessary

By **R. D. DUNCAN, Jr.**
Chief Engineer United States Signal Corps Research Laboratory, Bureau of Standards



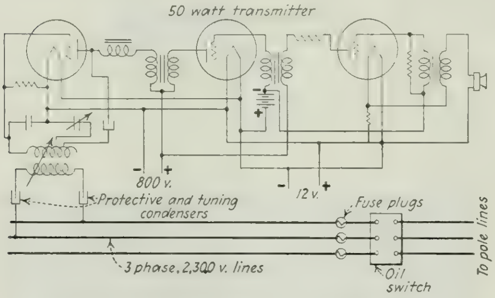
RADIO SENDING AND RECEIVING ON LIGHTING SERVICE NETWORKS INTEREST MANY CENTRAL STATIONS

THE extremely rapid growth of radio broadcasting since its start, scarcely two years ago, has resulted in such an increasing radio congestion of the ether for wave lengths in the proximity of 360 m. that both the federal government and the commercial companies have been attempting to devise means to relieve the situation. The recommendations of Secretary of Commerce Hoover's radio committee, allocating definite bands of wave lengths for certain classes of broadcasting, have been widely published and are a step in the proper direction.

Another method by which such congestion may be greatly relieved, suggested by Major-General George O. Squier, Chief Signal Officer, U. S. A., is that of broadcasting by "wired wireless" over existing electric lighting and power wires. Wired wireless, which is an invention of General Squier, is a form of directed radio transmission and in this particular instance consists merely in substituting for the radio antenna at both the transmitting and receiving stations the electric light wire network. The terminal apparatus is in general similar to standard radio apparatus. By this means the radio energy is not radiated in all directions into space, only a small portion of it reaching the desired recipient, but is directed to flow along a definite plane directly into the customer's home. Such a system would effect a great conservation of energy, making possible the use of small transmitting powers and, with the proper choice of wave lengths, would result in operation with the minimum radiation.

In other words, it should be possible to broadcast into an electric light socket and to plug the receiving apparatus into a similar socket, just as we now do an electric iron, toaster or other familiar electrical appliance. This is precisely what was done in Washington. During the months of March and April, at General Squier's direction, the writer conducted a series of experiments over the light wires of the War Department building and, in co-operation with the Bureau of Standards, over the lines of the Potomac Electric Power Company in Chevy Chase, D. C., during which music and speech were successfully broadcasted into and received from the 115-volt lines.

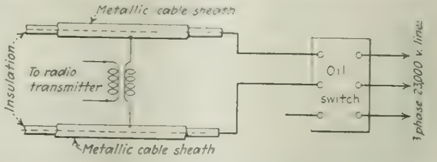
The possibilities of such a system of dissemination of information and its probable effect upon the electric lighting industry were so apparent that the North American Company of New York City, which operates the public lighting utilities of a large number of cities, offered the facilities of its systems to the Signal Corps for further experiment. During the month of May, in co-operation with the North American Company and the Cleveland Electric Illuminating Company, very successful wired-wireless broadcasting was accomplished over the lines of the latter company in Lakewood, a suburb of Cleveland.



PROTECTION FROM HIGH VOLTAGE WAS INSURED BY USING CONDENSERS

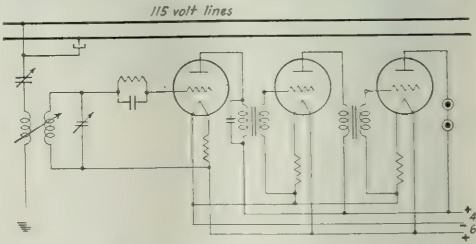
In the Cleveland experiments the transmitter was placed approximately 1½ miles from the Lakewood substation and was arranged so that it could be operated either into the 115-volt lines or into one set of the 2,300-volt, three-phase feeders. The major portion of the distribution system in Lakewood is aërial, though all lines enter the substation through underground cables of varying lengths. The transmitting apparatus consisted of a 50-watt unit, utilizing the plate system of modulation operating through specially designed transformers. The receiving apparatus consisted of a coupled circuit tuner, a vacuum-tube detector and a two-stage audio-frequency amplifier. During most of the tests the receiving circuit was purposely maintained in the non-regenerative condition so that the only amplification obtainable was that due to the amplifier.

Different methods of connecting the transmitting and receiving apparatus to the lines were tested. The most successful results were obtained with the transmitter connected between any two of the three-phase, 2,300-volt lines and with the receiving apparatus connected between the 115-volt lines and the ground. Apparently there was sufficient induction between the high-voltage conductors on the pole line or capacity coupling in the underground cables immediately adjacent to the substation to insure that, so far as reception was affected, it would not seriously matter to which two of the three high-voltage wires the transmitter connection was made. On overhead lines protection from the high voltage was obtained by means of protective condensers, which also served the purpose of tuning. A second method of connection, which is especially effective where transmission lines of the higher voltages are used, employs a section of a high-voltage cable in which the capacity between the metallic cable sheath and the conductors is employed for coupling instead of specially introduced protective condensers. The receiving apparatus was either plugged into the light socket or connected to the 115-volt lines on the pole, depending upon the particular location of the receiver. Ground connection was effected in the normal way.



THE CAPACITY BETWEEN CABLE CONDUCTOR AND SHEATH CAN BE USED FOR COUPLING

Five wave lengths—viz., 350, 420, 710, 3,800 and 13,000 m.—were tested. Of these the three lower gave neither consistent nor dependable results when received at different points on the lines. Furthermore, on the short wave lengths there was appreciable radiation from the lines, as was evidenced by the fact that fair radio reception was obtained on an antenna several miles from the transmitter. The latter result is more or less contrary to certain theoretical predictions which have been made relative to radiation from transmission lines at high frequencies. To reduce the radiation effect and also the attenuation or linear dissipation of the useful high-frequency energy, which should decrease with increasing wave length, the wave length was increased first to 3,800 m. and then to 13,000 m., of which 3,800 m. gave the best results both as to the quantity of speech received and as to the quality of modulation. Assuming the transmitter conditions to be the same for both wave lengths, this would indicate the existence of an optimum wave length for the particular distribution system operated on. It points to the possibility of the existence of similar optimum wave lengths for other transmission systems. Time did not permit investigation of the region of wave lengths between 3,800 m. and 13,000 m. to settle this point more definitely.



RECEIVING APPARATUS IS CONNECTED TO A CONVENIENCE OUTLET

Further to investigate the radiation effect, wherever possible careful comparison was made between reception over the 115-volt lines and on an antenna. On the 3,800-m. and 13,000-m. tests and with the same order of magnitude of line current obtained at the shorter wave lengths the very faintest reception was observable on the antenna at certain times only. With the same receiver conditions a good quantity of speech was receivable from the lighting wires. This result was obtained on a number of tests, and it is believed it is perfectly general.

Receiving tests were made at seventeen different localities within the suburb of Lakewood, there being in some cases a number of repetitions of tests. The greatest air-line distance from the transmitter was approximately 4 miles. However, judging from magnitude of speech received at this point, this distance could have been materially increased. Special pains were taken to receive on feeders differing from the one to which the transmitter was connected, thereby necessitating that the received high-frequency energy be transmitted back through the substation and out again over a different feeder, through the step-down transformer and into the home containing the receiving apparatus. When transmitting on 3,800 m. every test that was made in the Lakewood district yielded positive results.

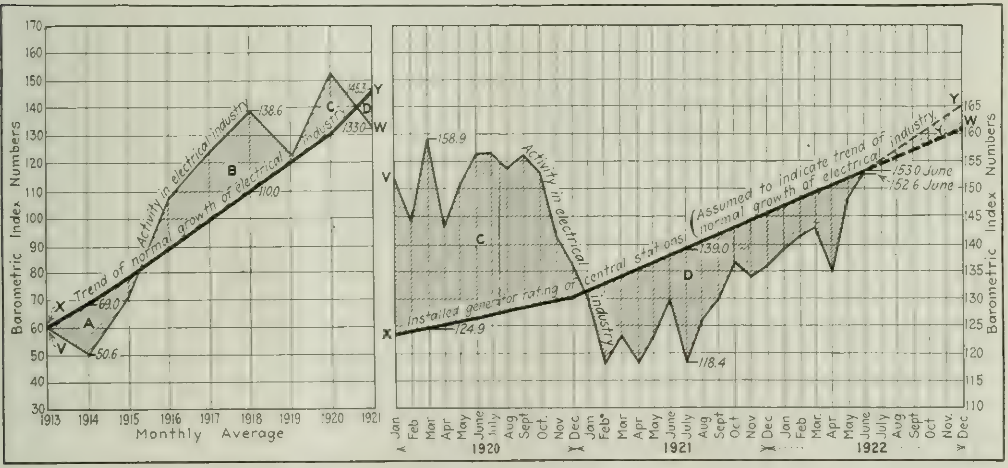
It is to be noted that throughout these experiments no changes were made or required in the transmission system. Contrary to the belief which seems to prevail, no bypassing condensers or circuits of any description were required at the hundreds of transformers scattered along the lines. If the transformers did not function in their natural manner, there was apparently sufficient capacity between the primary and secondary windings to afford a low reactance path to the high-frequency currents. Furthermore, owing to the low transmitting powers required, the high-frequency voltages applied to the lines were very low and subjected neither the lines nor the equipment to damaging influences.

The conclusions which may be drawn from the Washington and Cleveland experiments are that, from a technical standpoint, wired-wireless broadcasting over electric power wires is entirely feasible, and that with the proper choice of wave lengths the radiation from the lines may be reduced to such an extent that it will not interfere with present radio communication. The experiments which have been made were limited in their scope and have been confined mainly to two cities.

The writer wishes to acknowledge the interest and support shown in this investigation by Major-General George O. Squier; also the co-operation of the North American Company of New York City and the Cleveland Electric Illuminating Company.

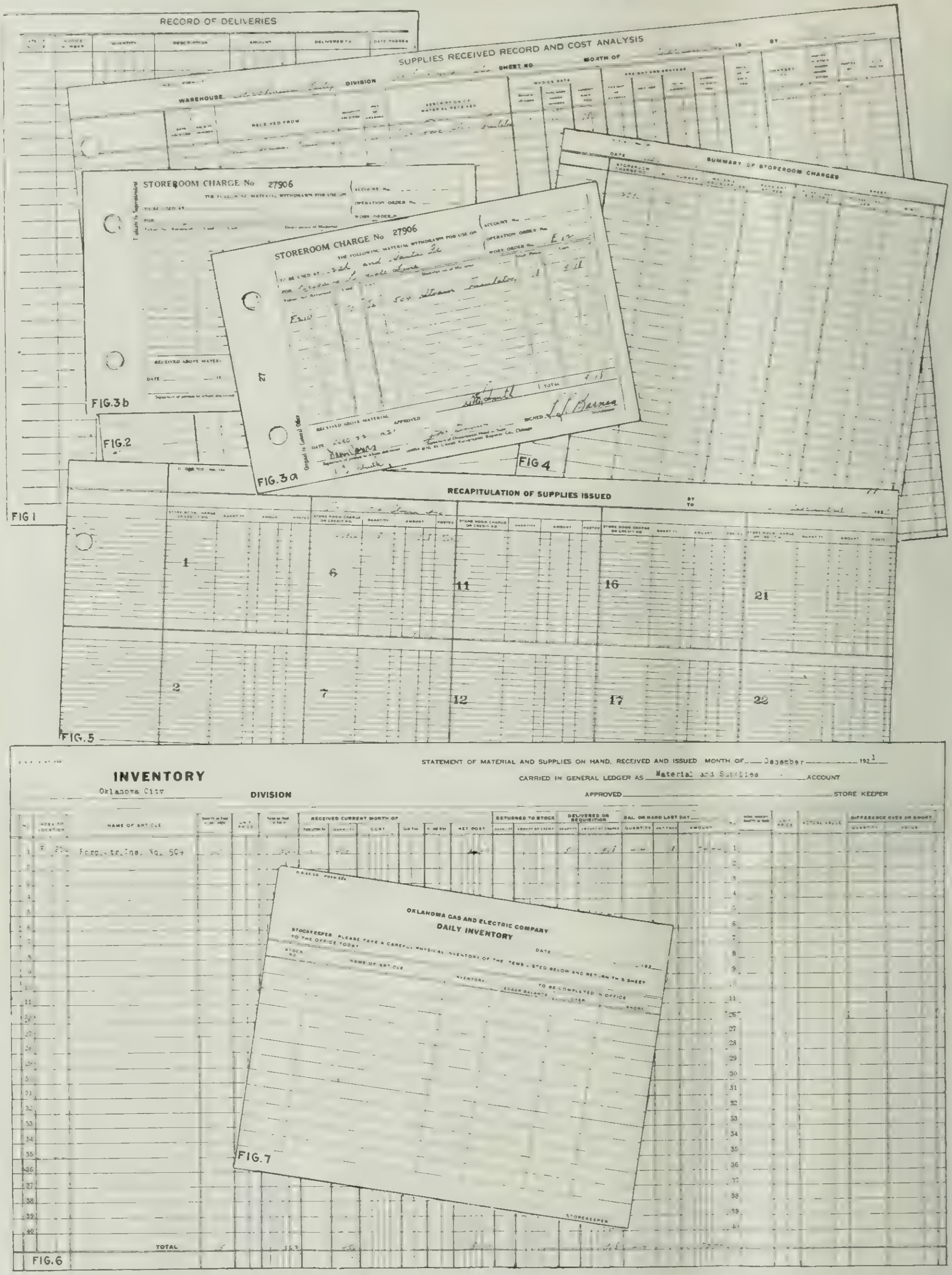
Labor Troubles Affect June Electrical Business

INDEX figures upon which the "*Electrical World* Barometer of Business Conditions in the Electrical Industry" is based indicate that during June further advances were not so great as in the preceding months. A part of the falling off was no doubt due to seasonal slackening, but more potent causes were the long-continued coal strike and the uncertainty connected with the railroad difficulties. Preliminary figures for June indicate, however, that the operations of the electric light and power branch of the industry broke all former output records by more than 80,000,000 kw.-hr. Although a large proportion of this increase in output by the central stations of the country was undoubtedly due to the addition of tens of thousands of new residential lighting customers during the month, the fact remains that only one of the primary industries which are the largest consumers of electrical energy reported decreased activities during June as compared with May.


ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS

The "*Electrical World* Barometer" indicates that during the month of June business conditions in the electrical industry taken as a whole showed an increase of 4.3 points on the barometer scale. The electrical industry as a whole during June was operating at only four-tenths of a point below what would have been the point of seasonal demand if growth in the industry had been normal. In May it was operating at four points below the point of normal demand.

The Principal Forms Which Are Used in the Stores System of the Oklahoma Gas & Electric Company



RECORD OF DELIVERIES

FIG 1

SUPPLIES RECEIVED RECORD AND COST ANALYSIS

WAREHOUSE DIVISION

FIG. 2

STOREROOM CHARGE No 27906

RECEIVED ABOVE MATERIAL

FIG. 3b

STOREROOM CHARGE No 27906

FIG. 3a

SUMMARY OF STOREROOM CHARGES

FIG 4

RECAPITULATION OF SUPPLIES ISSUED

FIG. 5

INVENTORY

Oklahoma City DIVISION

STATEMENT OF MATERIAL AND SUPPLIES ON HAND, RECEIVED AND ISSUED MONTH OF December 1921

CARRIED IN GENERAL LEDGER AS Material and Supplies ACCOUNT

APPROVED STORE KEEPER

TOTAL

FIG. 6

OKLAHOMA GAS AND ELECTRIC COMPANY
DAILY INVENTORY

STOCKKEEPER PLEASE TAKE A CAREFUL PHYSICAL INVENTORY OF THE ITEMS LISTED BELOW AND RETURN THIS SHEET TO THE OFFICE TODAY

DATE 192

STOREKEEPER

FIG. 7

1. Reverse side of the purchase order on which "material received" data are entered. 2. "Supplies received" record and cost analysis. 3a and 3b. Storeroom charge form on which material is issued from the storeroom. 4. Daily summary of storeroom charges. 5. Recapitulation of supplies issued which is balanced weekly with the daily summary of supplies issued. 6. Monthly inventory of supplies on hand, received and issued. 7. Daily inventory on which items for inventory are listed to be checked. This is the method by which a constant check on the stock is kept. Ten or more items are checked daily and give a good indication of the daily condition of all the stock.

Co-ordinating Material Handling

Handling of Materials on Oklahoma Properties from Receipt to Disbursement and Final Accounting Average Costs of Any Material Item Used in Pricing Stores Requisitions

By PAUL HOHEISEL
Accountant Stores Department, Oklahoma Gas & Electric Company

IN AN article in a recent issue of the *Electrical World* the basic organization of the material-handling system of the Oklahoma Gas & Electric Company was discussed. But the success of any storeroom system is dependent naturally upon the ease and regularity with which it operates, and the problem of co-ordination is as important as the basic plan itself. It is essential, therefore, to a full understanding of our method of handling materials and supplies that the actual routine be described in detail. It is as follows:

Material Receipt Routine.—Exceptional care is given to the receipt of materials, and except for such items as are delivered directly to the job on which they are to be immediately used, all material is received at one point. Weights and quantities are verified and the quality is inspected. The receiving copy of the purchase order (Fig. 1) in duplicate is sent to the storeroom file, and the quantities, descriptions and proportional weights are listed on the reverse side. The material is tagged and placed in its proper bins according to the stock symbol provided by the storeroom office prior to sending the copy of the purchase order to the receiving department.

All freight or express charges are attached to their sustaining purchase order and after completion in the receiving department are sent to the store office. The follow-up copy of the purchase order is then removed from the storekeeper's file and matched, and both copies of the purchase order are approved by the storekeeper and distributed to the "material and supplies" account.

From there they are sent to an invoice clerk, who enters the data from the reverse side of the receiving copy in a receiving ledger (Fig. 2), and the shipment is given a receiving number according to the order of its receipt in a particular month. For example, the tenth receipt in December is numbered as "12-10." This receiving number is entered on both copies of the purchase order, which are then filed alphabetically as to the vendor until invoices are received.

Receiving Ledger Must Balance

As the invoices are received they are matched with their proper purchase orders and entered in the receiving ledger, under the head of the receiving number as shown on the purchase orders. After entry they are stamped as entered, certified by the storekeeper, and the invoices with one copy of their order attached sent to the voucher department for payment. As the vouchers are paid they are debited to "material and supplies." Thus at the close of the month's business the receiving or cost-analysis ledger must balance with the totals of the vouchers issued. The receiving copy of the purchase order is retained at the storeroom and filed for future reference.

A petty cash account is handled by the storekeeper for the payment of freight and express bills. These are carried through the receiving ledger in the same manner as invoices and applied against the proper materials. As the entries of these are completed, they are sent to the voucher department, the storekeeper is reimbursed and the "material and supplies" account is debited.

After the invoices and expense bills of a shipment have been passed for payment, the amounts charged in the receiving ledger against the received articles are totaled and entered in the stock ledgers under the proper account. This account is the same as the one designated on the purchase order at the time it was first received and entered in the ledger from the receiving sheet.

Material Disbursement.—More trouble and inefficiency can exist in the disbursement of materials than in any other branch of storeroom routine. Extra effort has been made to provide detailed bin cards and card indexes whereby ready reference to the contents may be had and to see that the proper stock numbers or symbols are clearly shown on all requisitions or charges sent for pricing and deduction from the stock records.

Nothing is allowed to leave the storeroom without proper authority for disbursement. This authority is in form of a storeroom charge slip (Fig. 3), presented in duplicate and signed by department heads or their agents.

Use Price Books

As the stores clerk removes articles from a bin in filling an order he enters before each item on both copies of the storeroom charge the stock symbol as shown by the bin card. As the material is delivered to the messenger he is required to sign for receipt of the material, and the stores clerk signs to show delivery.

Each morning the price clerk sorts through the charges of the previous day and ascertains by the stamped numbers that all charges have been received by him. The charges are then divided according to departments, priced and extended.

The prices are obtained from price books, which are small and easily handled and eliminate the inconvenience of the heavy ledgers. Each month the stock ledgers are analyzed to obtain new unit prices and the receipts, both quantities and amounts, are added to the previous month's balance on hand. From these are deducted the disbursements, and the remaining quantity or balance on hand is divided into the amount on hand. The quotient gives the average unit cost.

This method works well in practice, and all values are absorbed when material is exhausted. In pricing, the average cost is used from one period of analysis to the other, with the exception of cases where stock becomes depleted in mid-month and a new consignment is received. In such a case the new actual cost is used for pricing for the balance of the month.

In pricing and extending the amounts are shown on both the original and duplicate storeroom charges and when all extensions have been totaled the charges are numbered consecutively with a series which begin anew the first of each year. By this number the storeroom charge is identified in future transactions. The originals and duplicates are separated, and the totals of the original are listed on a "Daily Summary of Storeroom Charges," form (Fig. 4) in the column of the account under which the material is carried. The total of this sheet represents the day's disbursements. After listing, the original charges are taken to the departments from which they were issued and approved by the department heads and upon return they are attached to the summary sheet and sent to the general office for distribution.

The duplicate charges are then posted as to quantities and amounts under their proper accounts in a "Recapitulation of Supplies Issued" book. This book (Fig. 5) is composed of large blocked sheets each capable of handling from one to twenty-five accounts, depending upon the number of disbursements on an article. The arrangement of the sheets and accounts are in most cases in the same order as the stock ledgers, though deviations are made by the posting clerk.

WEEKLY POSTING PRACTICED

Each block on this "recap" sheet is numbered and bears the description and symbol of the account. Postings are made from the charges showing the charge number, quantity, amount and date. Once a week these postings are totaled and balanced with the week's disbursements as shown by the "Daily Summary of Storeroom" charges. The totals are then transferred to the proper accounts in the stock ledgers under the columns of "material checked out." With the final posting the stock ledgers will show the same amounts as that which has been applied against the various operations by the cost-accounting department. In the totaling of each account in the recapitulation book the clerks are instructed to ascertain the relations of the quantity and amount of each account, and the unit prices established should when multiplied by the totaled quantity equal the totaled amount. The cause of any noticeable difference can therefore be at once found and the proper corrections made.

Monthly Inventory Report.—At the close of the month's business, after all postings have been made from the receiving ledger and "Recapitulation of Supplies Issued" book to the stock ledgers, the transactions of each account are analyzed and summarized to arrive at a new balance on hand. This is done by adding the previous balance on hand to the total receipts and deducting the total disbursements, which will leave the new balance on hand. The quantity balances are then divided into the values for the establishment of the new unit prices.

The transactions are then entered on a large statement or inventory sheet (Fig. 6) which contains the names and symbols of every item in the "material and supplies" account, in the same arrangement as the stock ledgers. The descriptions or names are "shapirographed" so that a six months' supply of sheets can be made at one typewriting. The sheets of each classification of the stock account are totaled separately, permitting a distinct report to be made of each, and the classifications when recapitulated give the standing of the entire "material and supplies" account.

Transient Stores Account.—This account is provided to accommodate the handling of incidental items purchased for immediate use, the purchase of which usually originates with the department heads. In this case requisition is made on the purchasing department by the department head and a copy is sent to the storeroom. Attached to the storeroom copy is a storeroom requisition debiting the account for which the material is to be used. This charge is then attached to the receiving copy of the purchase order, and both are sent to the receiving department.

TRANSIENT LEDGER USED

When the material is received it is checked in the same routine as "material and supplies," and labeled with a green tag, designating that the material is not in stock and also the work to which it has been charged. It is then held for demand from the proper department, and the receiving copy and storeroom charge are sent to the invoice clerk, who enters the data in a "transient stores receiving" ledger. A receiving number is given the shipment just as with "material and supplies," only prefixed by the letter "T," and upon receipt of the invoice proper entries are made and the total of the invoice entered on the storeroom charge. The invoice and charge are stamped "transient stores" and sent to the voucher department. From the voucher department the charge is sent to the cost-accounting department, where the work is charged and the account credited.

Unclassified Construction Supplies.—This account contains the cost of all electric meters and transformers, gas meters and regulators. The methods of receipt, disbursement and accounting are the same as those for other materials, and a special stock ledger is maintained so that more suitable accounting relations can be maintained with the general office construction books.

Perpetual Inventory.—In order that a close check may be kept on the material, the storeroom office daily provides a list of ten or more articles (Fig. 7) on which a count is taken, and these lists are then compared with the records. Any shortages or "overages" are investigated and the differences adjusted. By this perpetual inventory a much closer balance is maintained.

Handling of Salvage.—Very little material of salvage value is returned to the storeroom with the exception of copper wire. The department employs an old lineman whose duty it is to sort through the salvage wire and to select usable lengths, splice them and form them into coils, and these coils are taken into stock, the proper removal order being credited. The amount of wire that can be reclaimed for further use is surprising.

Shipping of Materials to Branch Stores.—The branch stores make requisition on the purchasing department for materials needed. The purchasing department refers the requisition to the central store, and if in a position to handle it, the central store requests a shipping order from the general office containing the quantity and the description of the requisitioned articles and instructions for forwarding. Three copies are received by the storeroom. At the time of shipment a storeroom charge is made debiting the branch store, and the amounts as shown by the storeroom charge are entered on two copies of the shipping order. One copy is sent to the general office for billing while the other priced copy is held for file. The third copy of the shipping order is immediately sent with the bill of lading to the consignee for identification of the shipment.

Present-Day Practice in Making Cable Joints

Composite Opinions of Experts on Various Phases of Cable Joining Careful Workmanship Considered More Important than Methods Employed—No Uniformity of Practice Indicated

Steps in the process of making high-tension cable joints which demand the most attention of manufacturers and operators were emphasized in a symposium held at Niagara Falls, Ontario, during the recent convention of the American Institute of Electrical Engineers, under the auspices of the cable research committee. Virtually every shade of opinion was expressed by experts in cable joining, and the views of engineers supervising the highest-voltage underground systems in this country were expounded. The discussion showed a great diversity of opinion regarding the methods which should be used, indicating that considerable investigation and observation must be undertaken before operators as a whole will accept any specified method of making joints as the best. It was many times reiterated at the meeting that the satisfaction obtained from any joint is dependent more upon the human factor and care employed than on the method of making the joint. Several methods, if properly employed, will give good results and minimize failures at the joints. Operators who were not fortunate enough to be at this meeting should find valuable information in the following report:

Marking of Conductors.—The marking of conductors, which can be done readily enough by the manufacturer, for the purpose of facilitating connection of wires of the same marking, was discussed briefly. The consensus of opinion seemed to be that it is difficult to handle in such a manner that similar wires in abutting cables will come together without twisting the cables considerably and making non-uniform splices. Abroad nearly all cable conductors are marked, however little attention is paid to the markings when the cables are installed. It was brought out that the polarity of cables can be taken care of more easily by making so-called cross joints in the cable system.

Copper Sleeves.—According to a written communication from R. C. Powell of the Pacific Gas & Electric Company, the copper connectors carry practically all the current between the ends of joined cables. This observation was based on tests in which a piece of asbestos was placed between the abutting ends of conductors and the conductivity of the joint made in this manner compared with one in which the abutting ends of the conductors were in contact. Present practice indicates that the actual cross-section area of the copper sleeves should be somewhat larger than the conductors joined, figures having been given indicating 2 to 25 per cent greater area.

The necessity of properly tinning the conductors before making a joint in order to avoid heating and consequent failures was emphasized by Mr. Reid. On the other hand, N. E. Buck of the Commonwealth Edison Company brought out the fact that, with sector cable particularly, it is difficult to form the conductors, tin them and put them in a sleeve without having a loose sleeve. His practice is to insert the conductor in a sleeve with a "V" slot opening into which the solder is poured.

According to the opinions expressed, the general tendency is to use copper sleeves not shorter than 2½ in. and to lengthen them as the size of the conductor increases.

Soldering.—A great variety of soldering fluxes are used and in general the results obtained therewith have been satisfactory in so far as avoidance of corrosion is concerned. The most common cause of trouble in soldering joints is carelessness in removing surplus solder rather than in the use of fluxing compounds.

Heat Destroys Insulation

Conductor Insulation.—The majority of speakers expressed themselves in favor of "stepping back" or "penciling" the insulation on each side of the copper connectors after soldering the joints in order to remove the effects of the hot solder on the ends of the insulation, to provide a long creepage surface and to facilitate the application of insulation without creating air pockets. A. F. Hovey, Standard Underground Cable Company, declared that the space between the end of the conductor and insulation should not be more than ⅛ in. to ¼ in. because the cable insulation is the best that can be applied. This space should be filled with linen twine saturated with paraffine and wound very tight. In applying tape to the stepped insulation E. B. Meyer, Public Service Production Company, said that his company uses black cambric tape, petrolatum being applied between each layer. The necessity of penciling the insulation depends on the kind of compound used, said D. D. Clarke, Kansas City Light & Power Company. With non-flowable compounds there is no trouble, but with flowable compounds there is liable to be unless the insulation is penciled.

The importance of carefully handling the material used in insulating joints was emphasized by Mr. Reid, who maintained that the quality of workmanship is the most important factor in obtaining good splices. With proper supervision of well-trained joiners it is possible virtually to eliminate all joint failures. Compared with workmanship the kind of compound to be used is of small importance, it being possible to obtain satisfaction with almost any insulating compound, provided that the joint is well wrapped.

A hand-wrapped joint which has given excellent satisfaction on the Detroit Edison Company's 23,000-volt system was described by A. A. Meyer of that company. The joint is made under very complete instructions and close supervision. Careful precautions are taken, such as leaving the tape in the compound until applied, warming the tape and keeping it warm, preventing foreign material from getting into the insulation, and careful cutting or penciling of the insulation. A special tool is used for this last operation. A large part of the secret in making a good joint, Mr. Meyer declared, is in perfect penciling of the conductor insulation so as to avoid air pockets. Besides, the compound is carefully tested for coefficient of expansion, melting point and dielectric strength.

Two general opinions were expressed regarding the relative merits of hand-formed and machine-formed joints. Speakers in favor of hand-formed insulation, while admitting that considerable supervision is necessary in order to insure high-grade workmanship, expressed the belief that good results can be obtained by close supervision and that dependence on the quality of the compound can be eliminated to a great extent. On the other hand, those in favor of the formed insulation prefer eliminating, as far as possible, the human element in the making of splices and favor depending upon high-grade insulating compounds for results. Experience of the last ten years has proved that such compounds can be secured.

Filling Compound.—In Cleveland, said C. N. Rakestraw, it is the practice to start new splicers on 11,000-volt joints instead of the lower-voltage type, because the personal equation in the former is of minor importance compared with the quality of insulating compound, whereas the workmanship necessary in the lower-voltage splice must be of a high caliber.

In order to eliminate joint failures it is necessary to have a compound that will neither crack nor flow, according to D. D. Clarke. In eitner case an air pocket may result which will be followed by corona and eventually by trouble. It is a mistake to think that hard compounds are always brittle and that soft compounds are plastic or non-brittle. Investigation has often shown that the hardness of the compound has little to do with its brittleness. Some compounds, when very hot, may be soft and still brittle, while other very hard compounds will not break readily.

On the other hand, N. E. Buck contended that a compound which will flow very slightly will give the best satisfaction under all temperatures according to his experience. Compounds that are too soft tend to migrate under high temperatures and those that are too hard will crack at low temperatures.

When selecting insulating compounds, said W. H. Cole, Edison Electric Illuminating Company of Boston, it is necessary to distinguish between joints which have machine-formed insulation and those having hand-formed insulation, since the duties to be performed by the compound are very different. In hand-insulated joints wrapped by careful workmen a compound with low dielectric strength may be satisfactory as it has but little duty to perform. On the other hand, with machine-formed insulation the duty of the compound is of greatest importance, and it is therefore necessary that the compound have proper characteristics as to fluidity and dielectric strength in order to obtain satisfactory operating results.

The importance of boiling out joints was emphasized by A. O. Hoeftmann, American Steel & Wire Company. This is done by pouring hot paraffine onto the conductor insulation before wiping the lead sleeve in order to remove any moisture left by the hands of the joiner. The paraffine is allowed to run over the joint until no bubbles appear.

The Commonwealth Edison Company also makes a practice of boiling out its cable joints, according to Mr. Buck, compound being poured into the joint through a funnel at the lower end and allowed to flow out an opening at the high end of the joint. The compound is allowed to flow over until no bubbles appear, about one gallon or so being sufficient.

Originally, all 15,000-volt cable joints in New York City were hand-made, according to Philip Torchio, New York Edison Company, but owing to the large number of failures it became necessary to devise some other method of making joints. The vacuum joint which was developed is shown in the accompanying illustration. Excellent results have been obtained with this joint which well warrants the additional expenditure. One important advantage of this joint is that it saturates the cable for quite a distance back from the joint. The vacuum process of making joints is essential in high-tension work, declared Mr. Torchio, but with voltages below about 10,000 a good splice can be made with either formed or hand-wrapped insulation without employing the vacuum process.

Removing the air from a cable joint and providing a reservoir for the compound are both essential factors in making satisfactory cable joints, H. C. Dean, New York & Queens Electric Light & Power Company, agreed. He suggested that on cables with a decided grade it might be advisable to insert a vacuum-filled joint at the top of the grade to replace the compound, which might otherwise drain out of the cable and leave the splice dry.

AIR POCKETS DANGEROUS

Wiping of Lead Sleeve.—Referring to the frequent statement that wiping of joints overheats the interior of cables to such an extent that some of the filling compound is driven out, leaving voids or air pockets, D. W. Roper, chairman of the meeting, asked for experiences in this connection. C. T. Sinclair, Pennsylvania Water & Power Company, responded by stating that he had found a temperature of 340 deg. F. existing within the lead sleeve of a cable at the end of one minute after wiping and 360 deg. at the end of six minutes, according to thermocouple measurements. In his opinion, this is hardly an injurious temperature unless the splicer takes a very long time to wipe the joint, in which case the outer layer of insulation may be injured. Mr. Rakestraw, Cleveland, pointed out that he knew of several places where joints had been remade several times and that no bad effects had been observed so far from this cause.

Filling the Joint.—Joints filled with paraffine have caused trouble in Detroit, said A. A. Meyer, observations indicating that the paraffine had cooled too rapidly after it was put in, thereby shrinking and not properly filling the joint. As a result the cable compound was drawn into the joint, leaving the cable dry and subject to failure.

Even a poor joint may stand up well in service if the sleeve is properly filled, declared Mr. Rakestraw. This requires keeping the compound sufficiently hot, pouring a large amount of compound through the sleeve to remove the entrained air and moisture, and adding compound at intervals after the initial cooling to make sure that the joint is absolutely full. The advantage of using a funnel in the lower opening of the sleeve and allowing the compound to run out an opening in the top was again emphasized.

The wrapping of joints with blankets and pads during cold weather at the time of filling in order to prevent rapid cooling of the compound was commended by several speakers.

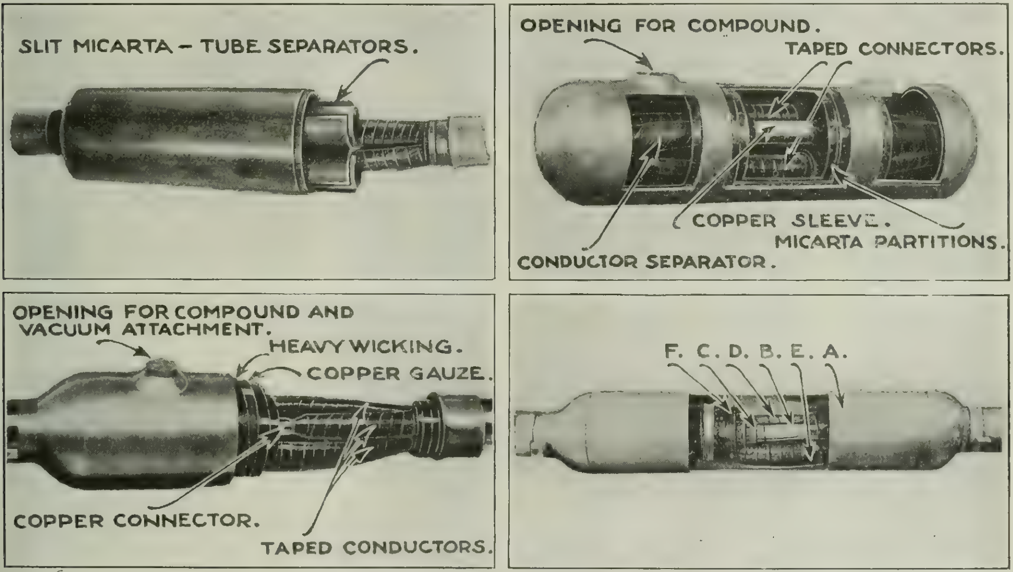
Mr. Hovey emphasized the need of making the joiner determine the temperature of the compound by means of a thermometer, instead of allowing him to depend on guesswork or on a temperature reading made by the helper. Considerable cooling may take place between the time the helper takes his reading and the time that the compound is poured into the joint. A thermometer partly covered with a brass casing is a convenient instrument to use.

The proper temperature at which to pour the compound depends upon the nature of the compound. The temperature must be determined by careful experiment.

Methods of Testing Experimental Joints.—Several types of cable joints have been made by the Commonwealth Edison Company and subjected to an accelerated life test, declared D. W. Roper, who said that voltages 60 to 70 per cent above normal were applied. In practically every case the failure occurred in the cable and not in the joint. The speaker attributed this to the dielectric loss because the distances in the joints were such that the loss was considerably smaller in the joint than in the cable. This would indicate that an accelerated life test is liable to be valueless if conducted at a considerable increase in voltage.

Commenting upon this experience, A. H. Kehoe, United Electric Light & Power Company, pointed out that some factor may have been stressed beyond the elastic limit, causing the unsatisfactory results obtained. He contended that the results would be more reliable if the tests were made at 20 per cent over voltage rather than with a higher voltage, although some satisfactory tests have been made at 300 per cent above normal voltage.

The major source of trouble in cable joints, declared



FOUR TYPES OF HIGH-TENSION CABLE JOINT THAT HAVE PROVED SATISFACTORY

Left top.—This construction is used for 12-kv. and 33-kv. cable joints by the Commonwealth Edison Company. Split tubes, made of the same material as the cable insulation, are used. The joints are gravity filled with semi-solid compound.

Right top.—Specially shaped micarta partitions that interlock to form a separate cell for each conductor constitute the feature of this joint, used by the United Electric Light & Power Company, Brooklyn Edison Company, Interborough Rapid Transit Company, Duquesne Light Company, and Puget Sound Power & Light Company. Tape is wrapped over the exposed conductor to act as a barrier to longitudinal current creepage. The ends of the lead sheath just inside the tape are belled to produce the desired voltage gradient.

Left bottom.—The cable joint is hand-wrapped with oil-saturated paper tape. In a similar manner an outer jacket is wrapped over the three conductors, properly spaced and packed with a saturated filler. This jacket is then pierced at several points so that the oil will enter its interior freely. Over the jacket copper gauze is applied, and around it a heavy lamp wick. After the joint is completed it is subjected, by means of a vacuum pump, to a vacuum of about 27 in. to 29 in. and then filled with a liquid compound. To supply any oil absorbed by the joint and the cable connected to it, a special pressure cup full of oil is applied and left connected for twenty-four hours, after which time the cup is removed and the hole capped and sealed. The New York Edison Company and the United Electric Light & Power Company have now in use over 1,600 joints of this type. The first 290 joints have been in operation at 24,000 volts since the summer of 1915.

It is believed that the oil in the vacuum-filled joint will permeate through the copper strands into the cable a long way from the joint, thereby maintaining saturation of the layers of paper in contact with the copper and thus helping to heal any displacement that the ends of the cable may be subjected to in reeling on the drum or handling during installation and racking in the manhole.

The vacuum process adds from $2 to $3 to the cost of the joint, but Philip Torchio, chief electrical engineer of the New York Edison Company, believes that it should be used for voltage higher than 13,200.

Right bottom.—This cable joint is used by the Public Service Electric Company on three-conductor paper-insulated 26,400-volt underground installations. After the cables have been trained to their proper positions in the manhole, 10 in. of the lead sheath is removed from the end of each cable and the belt insulation removed to within ⅝ in. of the lead. Next, 1½ in. of the insulation of each conductor is removed. A 24-in. lead sleeve (*A*) is then slid over one end of the cable and the ends of the cable sheath are slightly belled out so that there will be no acute edges for static discharges toward the conductors. Copper connectors (*B*) are slipped over the ends of the conductors, soldered and thoroughly cleaned. Starting 1 in. back from the end of the paper insulation (*C*), the insulation is removed half way down to the conductor forming a step in the insulation. After this has been done the exposed insulation is boiled out by pouring melted paraffine on it. Narrow strips of cotton tape (*D*) boiled in paraffine are used as a filler between ends of insulation and connectors. One layer of cotton tape is then wrapped around each connector, followed by successive layers of varnished cambric cloth, which are applied until the original insulation is level-full. Each conductor is now wrapped to a point (*E*) 3 in. from the outer insulation until the insulation over the connector is 40 per cent greater than the original insulation. A band of insulation is then wrapped around the individual insulated conductors equal to the original belt. Following this the lead sleeve is centered and sealed with a wiped joint, after which ¼-in. holes are cut in each end for filling with "Ozite" compound. After a thorough filling to exclude all air, the openings are carefully sealed and the entire length, including the joint, is covered with cheesecloth and cement for fire protection.

H. R. Woodrow, Stone & Webster, Inc., is the impossibility of preventing the formation of air pockets. There is a gradual deteriorating effect which causes air pockets that break down at high voltage. Hence what is needed in a life test is a cumulative test of the effects of such breakdowns. He spoke of making tests in which the material was not stressed beyond its elastic limit and in which 100 per cent voltage was applied, citing these as the best conditions which he had found for comparing different types of joints under the same conditions.

A test similar to that used in determining the effect of alternate heat and cold on porcelain insulators was suggested by W. D. A. Peaslee. In the test mentioned hot and cold air are alternately blown across the test object every fifteen or thirty minutes. This would be a valuable test, the speaker contended, if expansion and contraction of joints is accountable for their breakdowns, since it would hasten the results of such action. Since cable undergoes wider cycles of temperature variation than insulators, such a test might be well worth including in acceleration tests, he concluded.

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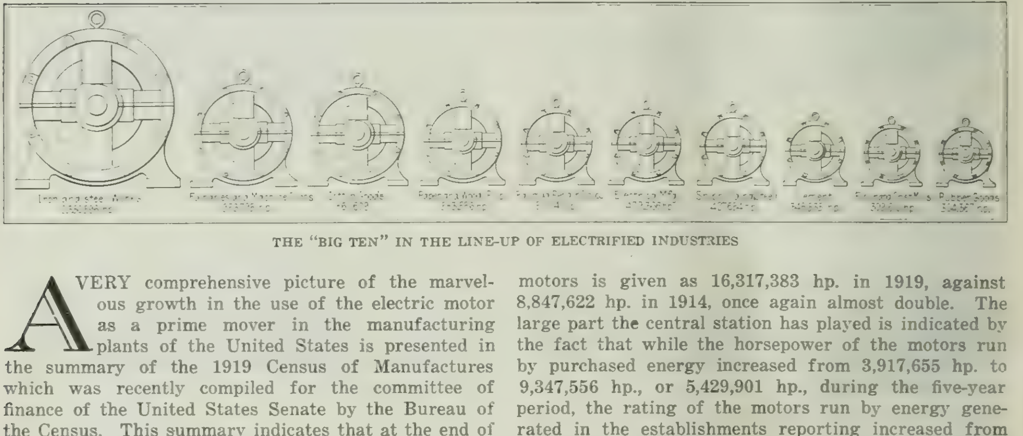
Iron and Steel Works Lead in Total Installed Motor Rating

Number of Electric Motors in the Manufacturing Plants of the Country Is Placed at 1,483,039, of Which More than Two-thirds Are Run on Energy Purchased from Public Utilities



THE "BIG TEN" IN THE LINE-UP OF ELECTRIFIED INDUSTRIES

A VERY comprehensive picture of the marvelous growth in the use of the electric motor as a prime mover in the manufacturing plants of the United States is presented in the summary of the 1919 Census of Manufactures which was recently compiled for the committee of finance of the United States Senate by the Bureau of the Census. This summary indicates that at the end of 1919 there were 1,483,039 electric motors installed in the 237,855 establishments reporting on horsepower. In 1914 the number of installed motors was given as 772,362, showing that the number had almost doubled during the five-year period. The total rating of these motors is given as 16,317,383 hp. in 1919, against 8,847,622 hp. in 1914, once again almost double. The large part the central station has played is indicated by the fact that while the horsepower of the motors run by purchased energy increased from 3,917,655 hp. to 9,347,556 hp., or 5,429,901 hp., during the five-year period, the rating of the motors run by energy generated in the establishments reporting increased from 4,929,967 hp. to 6,969,827 hp., or only 2,039,860 hp. In 1914 the installed motor load of the isolated plants exceeded that of the central stations by over a million horsepower, while in 1919 the central-station connected motor load led by almost 50 per cent.

TABLE I—TOTAL NUMBER AND RATING OF ELECTRIC MOTORS INSTALLED IN THE MANUFACTURING PLANTS OF THE UNITED STATES IN 1919

			ELECTRIC MOTORS					
			Total		Motors Run by Electrical Energy from Private Generating Plants		Motors Run by Electrical Energy Purchased from Central Stations	
Industry	Number of Establishments Reporting Horsepower	Aggregate Horsepower	Number	Horsepower	Number	Horsepower	Number	Horsepower
Total for all industries	237,855	29,575,242	1,483,039	16,317,383	487,039	6,969,827	996,000	9,347,556
Chemicals and allied products	4,744	1,431,083	55,655	891,909	25,482	422,200	30,173	469,722
Food and kindred products	50,645	2,671,546	156,671	1,364,231	40,217	419,238	116,479	945,020
Iron, steel and their products	17,870	8,128,545	296,707	5,096,469	126,513	2,586,707	170,248	2,509,835
Leather and its finished products	4,655	388,588	34,118	260,903	11,322	118,296	22,796	142,607
Liquor and beverages	1,107	376,774	16,819	148,038	10,786	84,364	6,033	63,674
Lumber and its manufactures	36,377	3,445,765	64,592	757,100	21,384	313,789	43,212	443,305
Metal and metal products	4,129	941,652	42,235	631,462	13,203	218,938	28,880	412,524
Miscellaneous industries	50,073	4,217,776	325,739	2,865,387	102,547	1,034,589	223,237	1,830,681
Paper and printing	29,114	2,397,175	179,771	1,037,467	27,666	420,147	152,105	617,320
Railroad repair shops	1,970	648,345	33,896	550,157	18,739	295,161	15,157	254,996
Stone, clay and glass	9,887	1,549,909	38,367	860,395	13,905	304,595	24,462	555,810
Textiles	23,618	2,983,520	201,265	1,514,169	61,078	633,166	140,211	881,003
Tobacco manufactures	1,347	45,398	5,528	29,501	1,958	13,819	3,570	15,682
Vehicles for land transportation	2,319	349,166	31,676	310,195	12,239	104,818	19,437	205,377

Table I gives a summary of the prime-mover data gathered in the 1919 Census of Manufactures tabulated under fourteen groups of industries. The aggregate primary power in the manufacturing plants of the country at the end of 1919 was 29,575,242 hp., which includes the machinery necessary for the operation of the private electric generating plants. If the estimated horsepower of the prime movers in private generating plants is subtracted from the aggregate horsepower, a total of 25,386,000 hp. is left as the primary power actually used for manufacturing purposes, of which 16,317,383 hp., or 64.4 per cent, is electrical.

The industries included under "iron and steel and their finished products" lead the country in total installed rating. The electrification of this industry is all the more marked when the fact is considered that the large amount of electrical energy used for industrial heating in the iron and steel mills involves only such motor installation as is necessary in the operation of the heating apparatus. Motors totaling 2,586,707 hp., or 50.8 per cent of the total electric motor installation in the iron and steel industry, are run by energy manufactured in private generating plants. This is the only industrial group in which a major portion of the installed motor rating is run by privately generated energy. It should be noted, however, that almost fifty thousand more motors in the iron and steel industry are run by central-station energy than by energy generated in private plants. The average size of the motors installed in iron and steel plants is 17.8 hp., against an average of 11 hp. for the whole country.

As indicated in Table II, in 1919 there were fifty-six American unit industries having a total electric motor installation of more than 50,000 hp., of which only one reported motor installation in excess of 1,000,000 hp. In seventeen of these industries the horsepower of the motors run by energy generated in private plants exceeds the horsepower of the motors run by purchased energy. "Steel works and rolling mills" easily lead all industries, with 2,350,596 motor horsepower, this industry being 71.5 per cent electrified. "Foundry and machine-shop products," however, lead in number of installed motors, reporting 88,258, followed by "electrical machinery apparatus and supplies" with 80,495 motors.

TABLE II—AMERICAN INDUSTRIES HAVING AN ELECTRIC MOTOR INSTALLATION OF OVER 50,000 HP. IN 1919

Rank in Horsepower of Installed Electric Motors	Industry	Number of Establishments Reporting Horsepower	Aggregate Primary Horsepower	ELECTRIC MOTORS					
				Total		Run by Energy Purchased from Public Utilities		Run by Energy Generated in Establishment	
				Number	Horsepower	Number	Horsepower	Number	Horsepower
1	Iron and steel, steel works and rolling mills	499	3,820,917	85,480	2,350,596	22,053	695,097	63,427	1,655,499
2	Foundry and machine shop products	10,597	1,054,840	88,258	953,795	63,061	660,037	25,197	293,758
3	Cotton goods	1,278	1,840,201	61,455	861,609	38,152	515,309	23,303	346,300
4	Paper and wood pulp	722	1,861,089	17,756	583,586	6,001	236,662	11,755	346,924
5	Cars and railroad shop construction	1,470	594,515	30,185	500,141	11,636	207,630	18,549	292,511
6	Electrical machinery, apparatus and supplies	1,345	438,839	80,495	479,366	42,023	235,605	38,472	243,761
7	Shipbuilding, steel	157	475,567	20,616	427,654	18,296	377,862	2,320	49,792
8	Cement	117	488,808	8,500	345,535	4,138	182,486	4,362	163,049
9	Flour-mill and grist-mill products	10,673	876,405	11,493	309,610	9,667	263,497	1,826	46,113
10	Rubber goods	404	354,188	13,616	304,367	7,083	153,214	6,533	151,153
11	Lumber and timber products	25,185	2,418,937	12,401	279,478	4,013	83,872	8,388	195,606
12	Automobiles	308	287,323	25,702	270,356	14,283	176,930	11,419	93,426
13	Iron and steel, blast furnaces	193	1,581,432	7,450	242,554	1,004	48,204	6,446	194,350
14	Chemicals	486	376,940	17,452	235,973	10,492	126,419	6,960	109,554
15	Automobiles parts and bodies	2,271	256,919	23,421	220,214	21,773	202,458	1,648	17,756
16	Engines, steam, gas and water	364	190,021	17,496	213,727	10,008	103,315	7,488	110,412
17	Slaughtering and meat packing	1,004	359,212	16,491	213,548	8,954	117,913	7,537	95,635
18	Coke, not including gas-house coke	155	224,879	5,919	209,163	1,950	74,551	3,969	134,612
19	Lumber, planning-mill products	5,232	419,671	20,466	199,694	16,944	162,195	3,522	37,499
20	Brass, bronze and copper products	1,011	265,688	11,227	183,594	8,759	142,996	2,468	40,598
21	Printing and publishing, newspapers and periodicals	12,735	194,361	53,614	172,786	48,987	154,947	4,627	17,839
22	Cars, steam railroad, not including operation	92	157,865	10,157	170,485	3,462	62,827	6,695	107,658
23	Worsted, goods	283	295,533	12,299	166,919	4,024	37,869	8,275	129,050
24	Structural ironwork, not made in steel works	1,073	165,347	14,218	166,460	9,600	114,411	4,618	52,049
25	Ice	2,778	572,970	8,169	158,552	5,658	132,438	2,511	26,114
26	Bread and other bakery products	17,151	165,950	41,311	146,388	37,602	125,665	3,709	20,723
27	Leather, tanned, cured and finished	656	218,238	10,601	143,935	4,329	58,494	6,272	85,441
28	Glass	359	207,430	9,720	143,125	3,397	52,864	6,323	90,261
29	Confectionery and ice cream	5,487	179,991	23,429	138,344	19,787	115,069	3,642	23,275
30	Furniture	2,756	262,703	19,546	136,721	12,962	86,527	6,584	50,194
31	Brick and tile, terra-cotta	2,216	405,746	4,838	133,354	3,408	105,846	1,430	27,505
32	Locomotives	17	97,187	5,763	118,873	2,927	59,084	2,836	59,788
33	Food preparations, not elsewhere shown	1,675	150,230	10,908	112,798	8,798	91,643	2,110	21,159
34	Liquors, malt, including cereal beverages	718	324,431	14,539	110,755	4,678	41,844	9,861	68,911
35	Petroleum, refining	257	238,906	6,665	108,625	3,576	51,385	3,089	57,240
36	Silk goods	1,332	176,825	35,310	107,982	22,579	75,234	12,731	32,748
37	Marble and stone work	3,338	170,132	6,728	106,033	6,065	94,028	663	12,005
38	Agricultural, implements	497	128,249	7,993	100,263	4,594	47,842	3,399	52,421
39	Machine tools	697	100,433	11,408	98,817	7,751	70,037	3,657	28,780
40	Oil and cake, cottonseed	708	290,911	2,402	93,400	1,964	82,256	438	11,144
41	Fertilizers	564	125,939	4,535	93,111	3,758	79,886	777	13,225
42	Knit goods	1,962	151,601	15,509	91,137	10,928	59,680	4,581	31,457
43	Iron and steel, forgings	239	101,951	6,078	90,693	4,948	73,738	1,130	16,955
44	Paving materials	852	191,543	1,868	86,730	1,708	81,179	160	5,551
45	Wire	66	119,451	3,329	86,646	2,148	55,030	1,181	31,616
46	Boots and shoes	1,391	120,632	16,279	83,792	11,698	55,690	4,581	28,102
47	Automobile repairing	14,825	82,691	19,684	63,575	19,537	63,057	147	518
48	Minerals and earths, ground	403	127,074	1,669	61,457	1,473	55,529	196	5,928
49	Steam fittings and hot-water apparatus	247	67,504	4,953	58,232	4,154	45,187	799	13,045
50	Paints	551	73,702	3,552	55,853	2,270	36,685	1,282	19,168
51	Gas manufacture	767	238,467	3,235	55,403	1,413	33,363	1,822	22,040
52	Sugar refining, not including beet sugar	19	52,541	3,923	54,668	3	360	3,920	54,308
53	Coal-tar products	169	68,342	5,507	53,693	2,162	27,376	3,345	26,317
54	Smelting and refining, zinc	39	73,604	2,171	52,996	639	13,508	1,532	39,488
55	Boxes, wooden packing, except cigar	1,051	144,048	4,930	51,680	3,727	39,165	1,203	12,515
56	Tools	1,072	68,381	5,164	50,494	4,584	42,220	580	8,274

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Conductivity of Copper-Clad Steel

To the Editors of the Electrical World:

In the article entitled "Copper-Clad Steel Wire Advocated for Distribution Circuits," published in the July 22 issue of the *Electrical World*, a correction should be made. The conductivity of the "mechanical grade" is approximately 30 per cent that of copper, instead of 30 per cent less than that of copper as asserted on the first page of the article. B. C. DENNISON.

Carnegie Institute of Technology,
Pittsburgh, Pa.

Jobber's Willingness to Cut His Profit

To the Editors of the Electrical World:

I have read with a great deal of interest your article entitled "To Untangle Our Distribution Snarl" in the July 8 issue of the *Electrical World*. Having made a study of the psychology involved between the eternal quadrangle of manufacturer, jobber, dealer and consumer, I was sorry to note that you did not bring out in your article one of the chief causes of friction between the manufacturer and the jobber—one that must, sooner or later, be eliminated. That is, the tendency on the part of the jobber to cut his profit.

Much of the complaint on the jobber's part as to the lack of profit on some lines is due essentially to his own shortsightedness, as the natural conclusion for a manufacturer to reach when he finds the jobber is cutting prices is that the jobber is satisfied with a smaller margin of profit. The manufacturer accordingly takes advantage of this deduction and reduces the jobber's margin when the next period for a price revision arrives. This tendency on the part of jobbers is responsible for a great deal of their financial loss and unrest in handling staple lines where margins have been brought down to so low a point that I fail to understand how they handle them at all.

Working on the theory of giving to the jobber a profit that will earn him a return on his investment equal to that which the manufacturer expects, we have started out in the marketing of a new product by giving the jobber a long margin of gross profit. We have done this believing that the experiment is worth what it will cost us and in an effort to establish definitely whether the jobber really appreciates a margin of this kind or whether he will take advantage of the fact and lower prices in an endeavor to increase his sales or deplete his stocks.

We have found that a sliding scale of discounts, based on the loading system, is one of the greatest evils attributable to the manufacturers' price schedules, as there is no better way to encourage price cutting than to work on such a basis. This scaling of discounts in proportion to quantities makes it very difficult for the small dealer to maintain a competitive position against the larger dealer, for the reason that in most cases the larger dealer will cut the retail price on standard items to a point where the small buyer is unable to compete and make a profit. The old trick of the large dealer in offering the salesman an order if he will sell at the best price is one that generally works as few salesmen are able to turn down a sizable order at a price at which they know their house can make a profit. This generally results in the salesman being able to convince his house that this customer is a valuable one and should be accorded the best price to hold his business.

We can see very little reason for a sliding scale of discounts to the dealer, as the manufacturer relies on the jobber for quantity business, and when he has established a good profit for the jobber, specifying a fair initial order so as to insure a representative stock and to compensate for the discount which the manufacturer gives, from then on the distribution problem should be made as easy as possible. Where a sufficient profit is provided the jobber should be able to make sales with little friction or effort.

We hope that when you are next tackling this particular problem you will go into these phases of the matter. I think you will arrive at the same conclusions we have reached and find that the industry will respond to a more or less standard system of distribution based on simplicity.

Our definition of a concern entitled to our jobbing price is one which carries a representative stock of supplies valued at not less than $25,000, issues a catalog and employs two or more traveling salesmen.

We waive the catalog requirement where the stock carried is considerably in excess of our minimum requirements. We note that your definition of a jobber virtually coincides with this, and we are glad to know that this is so. S. D. LEVINGS, Treasurer.

Betts Electric & Manufacturing Corporation,
New York City.

Need for More Information on Circuit-Breaker Tests

To the Editors of the Electrical World:

I have read with interest the editorial in the *Electrical World* for July 8 on the Baltimore circuit-breaker test records. As I sent a man all the way to Niagara Falls to be present at the convention and discuss these tests, I fully agree with your criticism. The manufacturers did not give any real details as to what actually happened and wherein breakers which failed were to be strengthened in the future. This was disappointing, because we have during the past six months spent large sums of money and given the use of our system to the manufacturers for the making of very complete tests on 22,000, 44,000 and 110,000-volt circuit breakers. Tests were made on our system such as have never been made before on any system, and short circuits as high as 750,000 kva. were opened. These tests, made under actual operating conditions, gave us most valuable information, and we believe the manufacturers also profited greatly from them.

If the manufacturers do not desire to publish in detail the results of their tests, it seems to me there is no place where the apparatus committee of the National Electric Light Association could function to better advantage than in conducting a complete set of oil-switch tests for the benefit of the member companies. I am sure there are now several operating companies which would willingly loan the use of their system for such tests. W. E. MITCHELL, Assistant General Manager.

Alabama Power Company,
Birmingham, Ala.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Selection of Mill-Type Motors

Proper Speed Characteristics and Ability to Carry Maximum Load Without Undue Mechanical Strain Main Problem—Inclosed Motors Usually Required

MOTORS to operate steel-mill auxiliaries, cranes, hoists, lift bridges, drawbridges, machinery for handling ore and coal and other similar apparatus are usually built with cast-steel frames, large shafts, heavy bearings and long sturdy armatures of small diameter. The armature diameters are kept small in order to reduce the flywheel effect and the amount of energy required to accelerate them. The fields have interpole windings to enable the motors to commutate heavy overloads without injurious sparking. On account of their sturdy construction mill-type motors are able to carry loads of short duration running as high as three times their one-hour rating or four and one-half times the continuous or five-hour inclosed rating. While both totally inclosed and open frame mill motors are built, most mill applications require totally inclosed motors. Hence the following discussion has been directed particularly to this type.

Totally inclosed mill motors are rated in two ways—by the mill rating or by the crane rating. Both are based on a temperature rise of 75 deg. C., which is not harmful on account of the heat-resisting qualities of the insulation. The mill rating is the one-hour capacity of the motor with 75 deg. C. temperature rise, and the crane rating is the half-hour capacity with the same temperature rise. The one-hour rating is the one most commonly used.

Mill-type motors are seldom used for applications where the load is continuous unless the atmospheric conditions are such that a totally inclosed motor is required. There are many applications where the motor is used only occasionally and where the load requirements are such that there are definite periods of acceleration, running at balancing speed and retardation. In many such cases the motor is in use such a small part of the time that the heating of the motor is a minor consideration. Selecting a motor for an application of this kind is largely a matter of choosing one which has the proper speed characteristics and which can carry the maximum load without being subjected to undue mechanical strain. There are other applications where the cycle of operation is fairly well defined and where the cycle is repeated often enough to cause considerable heating of the motor windings. In such cases it is necessary to calculate the heating effect of the load cycle and select a motor with a continuous rating high enough to go through the cycle for long periods without overheating.

There is still another type of application in which a new element enters, that is, the element of time. Examples of this type of application are screwdowns, lift tables, side guards, manipulator fingers and roll tables. In these cases there is no definite cycle of operation. For example, the motor on a blooming mill

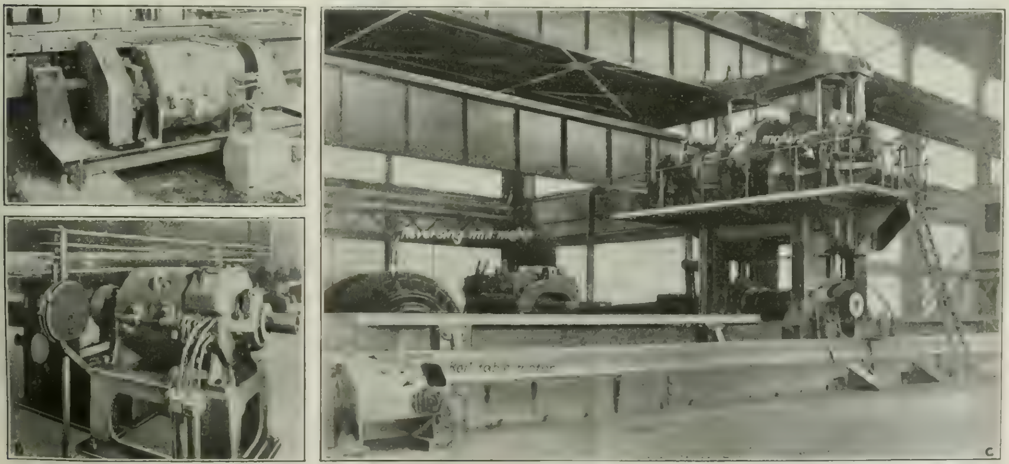


FIG. 1—MILL-TYPE MOTORS MUST BE OF STURDY CONSTRUCTION TO CARRY HEAVY OVERLOADS

A—Mill-type motor driving blooming-mill roll table. B—Same type of motor installed for operating furnace doors. C—Electrically driven blooming mill. Roll-table motor may be seen in the lower left-hand corner. The screwdown motors are on the mill platform. Reversing motor for driving rolls in the left background.

screwdown is required to move the top roll of the mill a certain distance after each pass. The distance which the roll is lowered varies for every pass, and the number of times the motor is started and stopped for each motion depends upon the skill of the operator. When a bloom is finished the top roll is raised 15 in. or 20 in. or more so that the next ingot can be entered in the rolls. This is practically the only time when the motor has time to reach friction load speed. It is quite possible to have two motors on a drive of this type which give the same friction load speed and have one motor give unsatisfactory operation. This is illustrated by Fig. 2A. This figure shows the travel of the roll plotted against time for two screwdown drives, which are geared for the same free running speed, as shown by the fact that the curves are parallel at the upper ends. The curve of motor No. 2 shows a case where the motor does not have sufficient torque to accelerate itself and the load as rapidly as is desired. Since all the movements except the return travel when the bloom is finished are short, it is evident that the curve of motor No. 1 shows the better operation.

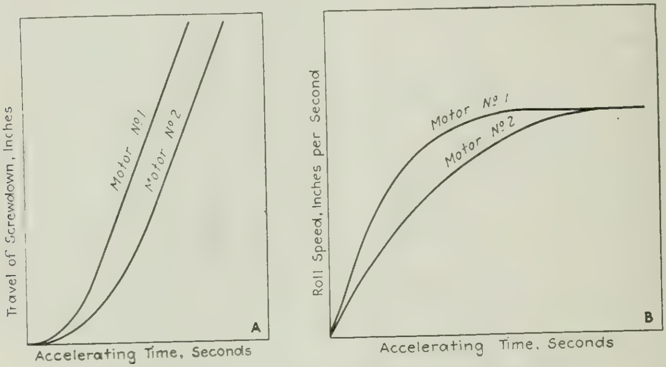


FIG. 2—CHOICE OF EACH MILL MOTOR DEPENDS UPON PARTICULAR CHARACTERISTICS REQUIRED

A—Time-distance curves of a screwdown, showing motion of top roll of a blooming mill. B—Speed-time curves of two motors, showing speed of motion of top roll of blooming mill.

The speed-time characteristics of the two drives are shown in Fig. 2B. This brings out the fact that the speed-time characteristic of a motor for a given application is very important in instances where the time for each operation is short. The rate of acceleration depends upon the torque of the motor and the inertia of the motor, pinion, brake and load. In many cases the inertia of the motor, pinion and brake make up the greater portion of the total inertia. For such drives as lift tables the time available for each up or down motion is usually between two and three seconds. The load torque is high, which means that the starting current must be heavy if the motor is to accelerate rapidly. For such an application it is often better practice to force a small motor to the limit of its capacity than to go to a larger size. The next larger size motor may require a larger brake with larger inertia, and the inertia of the armature will also be considerably increased. Unless the torque of the larger motor will compensate for the increased inertia and leave a good margin of torque for faster acceleration, it will not pay to use a larger motor. The heating of the motor is greatly increased by forcing it to the limit of its ability to commutate. By providing a small motor-driven blower to give forced ventilation the continuous capacity of the motor can usually be increased by about 50 per cent, so that the temperature can be kept within safe limits.

It is obvious that in selecting the proper motors for mill auxiliary drives there is no single method of procedure which will fit all cases. The calculations range from the most elementary to complicated calculations involving inertia of rotating parts, friction load torque, selection of proper gear ratio, ohmic value of starting resistor steps, interval between closing of accelerating contactors, frequency of operation and heating of the motor after repeated operation. For all but the more simple drives it is usually necessary to employ a cut-and-try process, going far enough with each caculation to show the limitations of the motor for the application or that it is satisfactory.

On account of the wide variation in the friction of mill machinery and variations in the over-all efficiency due to wearing of the working parts, it is always advisable to have some margin of capacity. Whenever possible the drive being studied should be compared with similar drives which are in operation. Oscillograms and high-speed graphic meter charts are of great assistance in studying existing drives. **R. H. Wright,**

General Engineer.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

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Underfeed Stoker Most Favorable for Burning Lignite

OF THE devices for burning lignite, the underfeed stoker proved to be the best adapted and showed the most favorable results in experiments made by the Texas Power & Light Company. This type of stoker demonstrated its ability to burn crushed run-of-mine lignite with good economy and to develop high overloads. Excellent flexibility in operation was shown as well as low fuel consumption for banking periods. Allowing for the lower efficiencies obtained in daily operation as compared with that obtained on tests, one barrel of fuel oil having a heating value of approximately 19,000 B.t.u. per lb. is equivalent to about 0 5 ton of lignite of 7,000 B.t.u. per lb. This ratio, however, does not take into account the cost of coal and ash handling or extra boiler-room labor required with solid fuel.

One of the most difficult problems in burning lignite is to obtain successful ignition of the incoming fuel. The large moisture content of the fuel must be quickly evaporated on entering the furnace, and to do this the furnace design should be such as to develop a high furnace temperature and to concentrate the radiant heat both from the walls and from the luminous flame upon the incoming fuel.

The tests conducted on the underfeed stoker included evaporation, quick steaming and banking. Five evaporative tests are given in the accompanying table. The test shown in the second column was conducted

EXTRACTS FROM RESULTS OF TESTS BURNING TEXAS LIGNITE ON AN UNDERFEED STOKER

Dimensions: Kind of stoker, underfeed; width of grate surface, seven-retort; length of grate surface, twenty two tuyéres: water-heating surface, 5,184 sq ft ; superheating surface, 883 sq ft.; volume combustion space, 6,067 cu ft.; minimum distance grate to heating surface, 7 ft. 3 in

Character of fuel	Lignite	Lignite	Lignite	Lignite	Lignite
Point of origin of fuel	Tredlow	Hoyt	Hoyt	Hoyt	Hoyt
Average pressures, temperatures, etc.:					
Steam pressure by gage, lb per square inch	207.8	212.3	206.5	204.8	206.1
Temperature of steam, deg Fahr.	535.1	556.4	512.0	509.1	540.7
Superheat, deg. Fahr	145.1	163.4	121.6	119.4	150.5
Temperature of feed water, deg. Fahr	85.9	84.4	77.0	70.5	65.4
Temperature of escaping gases, deg. Fahr	586.9	670.5	496.3	492.3	564.1
Percentage of rated capacity developed	193.7	247.5	99.68	97.0	151.1
Economy and efficiency:					
Water fed per pound of fuel as fired, lb.	3.40	3.29	3.94	3.62	3.35
Calorific value per pound, fuel as fired, B.t.u.	6,845	7,206	7,058	7,026	6,925
Efficiency of boiler, furnace and grate, per cent	61.05	56.61	68.44	63.47	60.51
Proximate coal (as fired):					
Moisture, per cent	35.95	34.30	34.76	36.13	33.38
Volatile matter, per cent	31.05	30.61	28.34	27.72	27.35
Fixed carbon, per cent	22.92	26.20	27.81	26.72	25.86
Ash, per cent	10.08	8.89	9.09	9.43	13.41
Sulphur, per cent	.....	.....	0.48	0.41	0.86

to determine the highest rating that could be obtained, and this proved to be 247.5 per cent of the rated capacity for the particular boiler used. Prior to each test the stoker was operated for a period of about fifteen hours at the rating at which the test was to be made, using the test fuel to insure that the setting would be thoroughly heated.

In burning lignite the best results were obtained with thin fuel beds, usually from 8 in. to 10 in. deep over the tuyères. With the thin fuel beds correspondingly low air pressures were carried in the tuyère boxes, the pressure ranging from 0.9 in. to 1.9 in. of water according to the rate of combustion. The principal operating difficulty while burning this fuel was the tendency, particularly at high ratings, to form large clinkers of a saddle shape on the lower tuyères, bridging across adjacent rows of tuyères. If these clinkers were not removed, the fuel bed at these parts would become heavy and the green fuel would drift over the clinkers.

Results of the banking and quick-steaming tests are of particular interest. The quick-steaming test was made after a dead-bank of forty-five hours, from which condition the boiler was brought on the line and the safety valve lifted in thirty-four minutes after starting the fan and stoker engine. Five minutes later the flow meter showed the boiler to be developing 200 per cent rating.

A live banking test covering a period of seventy-three hours showed that pressure could be maintained on the boiler between the limits of 175 lb. and 200 lb. by the consumption of 0.4 lb. of lignite per boiler horsepower per hour. This figure compares very favorably with results obtained with bituminous coals. Upon the conclusion of this test the fan and stoker engine was started, and in five minutes the boiler was on the line and developing over 200 per cent rating.

This information is taken from the report of E. T. Keck of the Texas Power & Light Company, which was prepared for the prime movers' committee of the N. E. L. A. and was included in the annual report of this committee presented at this year's convention at Atlantic City.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

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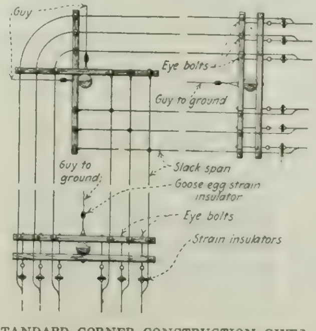
Better Line Corners

DIAGONAL guying on corner poles and elimination of double arms are objectionable when the strain is above normal. It is practically impossible to place a head guy splitting the angle and have the pole stand up straight, owing to the unequal tension when stringing the line. It is also difficult with this method of guying to sag the conductors evenly. Better construction results by placing two line head guys as shown. On the adjacen poles strain insulators should be used as indicated, omitting the pin-type insulators on the first arm. When the loading is heavy it i more practical to double-arm the corner pole rather than use a special cross-arm of heavier cross-section as this would be an undesirable departure from standard.



STANDARD CORNER CONSTRUCTION GIVES BEST RESULTS

P. P. ASHWORTH,
Distribution Engineer.
Utah Power & Light Company,
Salt Lake City, Utah

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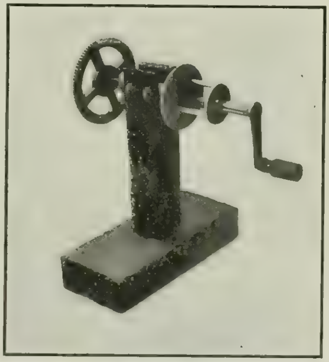
Graphic Meter Chart Winder Easily Constructed

AFTER editing any length of tape taken from a graphic meter, it is a tedious process to rewind by hand and was overcome in one case by the winder shown in the accompanying illustration. This consists of a wooden standard slotted at the top to receive a sleeve, made from a wire connector, which is fastened by screws. In the winder shown a magneto crank with removable handle was placed in the sleeve upon which the graphic chart spool holder is held by the threaded crank handle pushing it against a collar on the shaft. This collar bears against the end of the connector.



SIMPLE WINDER THAT HELPS IN EDITING GRAPHIC CHARTS

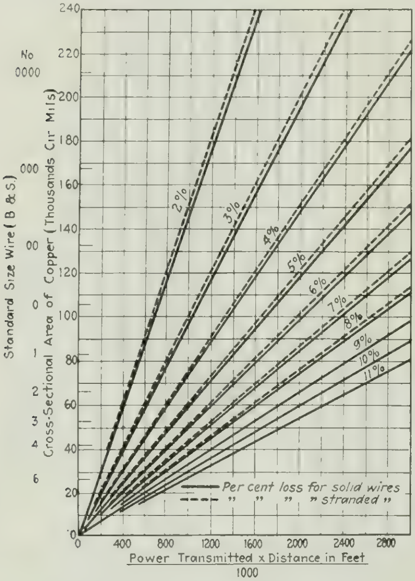
To take up the extra length of shaft from the end of the sleeve to the gear wire was wound on like a closely wound spring. Washers were then placed on the shaft at both ends of the sleeve in order that the shaft and spool might turn freely.

To wind the tape an empty spool is slipped onto the holder, the end of the tape fastened to it in the regular way and the tape guided by hand against the larger disk. If the base is heavy or solidly fastened the tape can be wound on rapidly and evenly without tearing. The paper is also much cleaner than when wound by hand.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

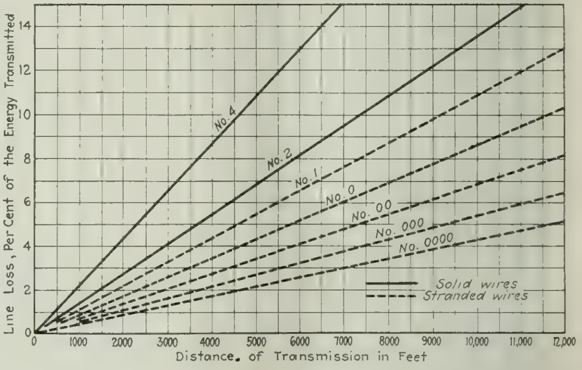
Easily Made Charts Assist in Line Calculations

TO ASSIST in making line-constant calculations for a three-phase, 2,200-volt distribution system, the writer drew the following charts with an assumed constant power factor. No account was taken of the reactive voltage drop since in a number of instances it may be neglected. In such cases these charts offer a rapid and easy means of line calculation when the size of the copper required to transmit a given amount of power with a given percentage power loss is desired.



LINE DROP CHARTS

A—Size of copper necessary to transmit power at a given line loss. B—Line loss calculated on a basis of 300 kw.



These charts are easily constructed and require little time for calculation since the graph consists of straight lines pasing through zero so that a series of charts for different power factors can readily be laid out. Chart A gives the cross-sectional area of copper required as a function of the kilowatt-feet and the percentage power loss obtained from the formula:

$$\text{C.M.} = WL\rho/E^2 n \cos^2\theta, \quad (1)$$

where

C.M. = cross-sectional area of wire (circular mils),

W = watts to be transmitted,

L = distance of transmission in feet,

ρ = specific resistance of copper (10.37 ohms per mil-foot at 20 deg. C., solid conductor, and 10.57 ohms per mil-foot at 20 deg. C., stranded conductor),

E = receiver line voltage (2,200),

n = percentage power loss, also percentage resistance voltage drop, and

$\cos\theta$ = receiver power factor (85 per cent).

Equation (1) is obtained as follows:

$$I = W/\sqrt{3}\,E\cos\theta \quad (2)$$

where I = current per wire of the three-phase circuit.

Now, to allow a power loss of n per cent, the loss per wire is $nW/3$ watts; therefore

$$I^2R = nW/3, \quad (3)$$

and so $R = Wn/3\,I^2$, where R = resistance per wire.

However $R = L\rho/\text{C.M.}$, and, substituting in (3):

$$\text{C.M.} = L\rho\,3\,I^2/Wn. \quad (4)$$

But

$$I^2 = W^2\;3\,E^2\cos^2\theta, \quad (5)$$

and, substituting (5) in (4):

$$\text{C.M.} = (3\,L\rho/Wn)\;(W^2/3\,E^2\cos^2\theta)$$
$$= WL\rho/E^2 n\cos^2\theta. \quad (6)$$

Substituting the known values in (6):

$$\text{C.M.} = WL\;10.37/n\;(2{,}200)^2(0.85)^2$$
$$= WL\;2.96(10^{-6})/n.$$

Changing WL to kw.L, multiplying by 1,000, we get:

$$\text{C.M.} = \text{kw.}L\;2.96(10^{-3})/n$$
$$= 2.96\;\text{kw.}L/1{,}000\;n.$$

Since there is no constant term and no second degree term, this equation is a straight line passing through zero. So, choosing an abscissa of 1,000 (kw.-ft. × 10^{-3}) as a factor K, we plot points on that vertical line for different values of power losses. For example, to locate the 10 per cent power loss line:

$$\text{C.M.} = K\,2.96/0.10$$

$$\text{C.M.} = (1{,}000)\,(29.6) = 29{,}600,$$

and we plot the point 29,600 on the 1,000-kw.-ft. line and, drawing a line through zero, obtain the line representing a power loss of 10 per cent. Continuing to plot points for new values of losses, we get the corresponding ordinates of circular mils and secure the positions of these lines.

To illustrate the use of this chart, assume that it is desired to find the size of copper required to transmit 500 kw. 3,000 ft. with a power loss of 5 per cent. The kw.-ft. × 10^{-3} = 500 × 3 = 1,500. Locating this abscissa and following it to its intersection with the 5 per cent loss line, we read across to the ordinate to find that the size of copper required is approximately 90,000 circ.mil. The nearest standard size is No. 1 B. & S. gage, which has a cross-sectional area of 83,690 circ.mil. This size will increase the power loss slightly.

Chart B has been constructed in a similar way, but for 300 kw. only, using the transmission distance as abscissa and the line loss as ordinate. If 500 kw. is to be transmitted 3,000 ft., it will be necessary to reduce it to a 300-kw. basis; e.g., 500 × 3,000 ÷ 300 = 5,000 ft.

The percentage power loss is the same. Locating the abscissa of 5,000 ft. and following it up to the intersection with 5 per cent, we find our wire size somewhere between No. 0 and No. 1, B. & S. If No. 1 is chosen, we get a power loss of 5.4 per cent.

Irwin J. Campbell.

Johnstown, Pa.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Texas Company Adopts Standardized Electrical Store

Interesting Development in a Central Station's Policy to Build Up Its Merchandising Business

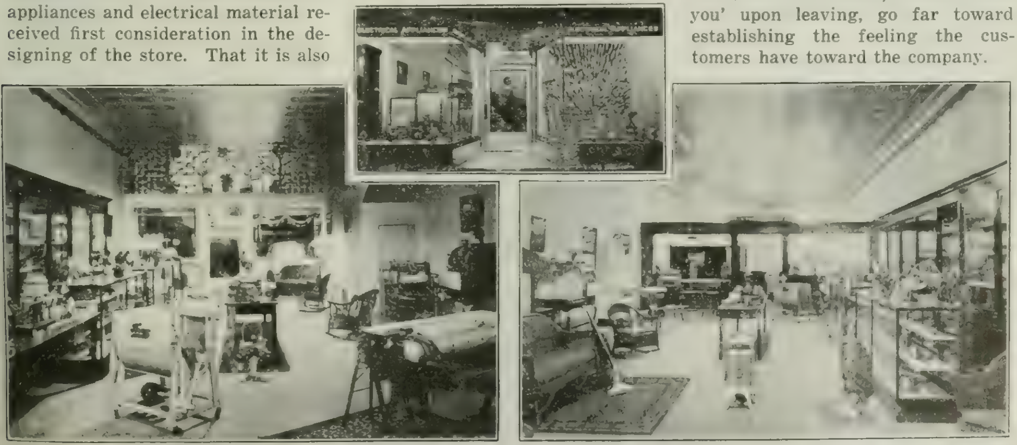
THE opening of this new electric store and office in Sherman, Tex., marks another step in the broad commercial policy of the Texas Power & Light Company to push aggressively the sale of electrical goods in all the cities and towns where it supplies energy. This store represents the type which the company has adopted as standard for its entire property.

J. C. Carpenter of Dallas, vice-president and general manager of the Texas Power & Light Company, who is largely responsible for this movement, plans to employ these modern and attractive stores, with efficient and courteous clerks to sell merchandise, in a campaign to make Texas the leading state in the use of electricity and electrical devices in the home. The sale of electrical appliances will now be made of chief importance in the company's activities.

As will be seen from the accompanying cuts the proper display of appliances and electrical material received first consideration in the designing of the store. That it is also an office is scarcely apparent. Another feature of the new store that has attracted favorable public comment is the manager's office in the rear, which is entirely open. The manager is thus at all times accessible to visitors to the store, and is not hidden in a private office where it seems necessary to run the gantlet of an office boy and a stenographer to get to see him.

Electrical men who visited the new store on opening day were unanimous in the opinion that its attractive and convenient arrangement is particularly adapted to meet the merchandising requirements of the central station company.

The Sherman store is the first of a series of electrical stores of standard design which will be opened by the company wherever it maintains an office. The company believes that it can build up its appliance business only by rendering a complete merchandising service to its customers, and accordingly plans are now being made to establish stores in the following Texas cities and towns reached by its lines: Bonham, Brownwood, Cleburne, Commerce, Denison, Ennis, Gainesville, Hillsboro, McKinney, Palestine, Paris, Taylor, Temple, Tyler, Waco and Waxahachie.



VIEWS OF TEXAS POWER & LIGHT COMPANY'S NEW ELECTRICAL STORE

Top—Display window. Bottom, left—Interior looking toward front of store. Bottom, right—Interior looking toward rear and manager's office.

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The Meter Reader as a Good Will Builder

THE public's attitude toward a central station is influenced to a great degree by personal contact with the company's employees, and the meter reader probably has more opportunities to make friends for the company than any other employee. W. J. Read, in charge of meter reading and collecting for the Central Power Company, Grand Island, Neb., points out the importance of the meter reader's duties as follows:

"The opinion of the company held by about nine-tenths of the customers of any utility company is made by the meterman. The greeting the meterman gives the customer when the latter answers the knock on the door, the pleasantness of his smile, the politeness with which he asks to read the meter, and his 'thank you' upon leaving, go far toward establishing the feeling the customers have toward the company.

"The meterman's job is not an easy one. He must be a diplomat and a gentleman; he must have tact and patience and an easy working smile; he must make the customers feel that it is a pleasure to call, not just to read the meter, but to keep in closer touch with them and find out if the service has been good—if the iron or washing machine is giving any trouble—and to take notes relative to any improper condition.

"The average meterman will say that he does not have time to bother with such matters, but he should always remember that his company is in the same position as a merchant selling goods and that satisfied customers are the best advertisement in the world. The customer has every right to expect courteous treatment and cordial interest in his requirements, and every effort made along this line will be rewarded with more pleasant public relations.

"If you cannot meet and care for the public in this spirit, if you cannot or will not be courteous and helpful and gracious and pleasant every step of your way with the public and your fellow employees, don't try to be a meterman."

What the Public Thinks of Government Ownership

REFRESHING indication of the growing sentiment against government ownership and operation of public utilities is found in the testimony recently presented before the Massachusetts Legislature's joint committee on power and light. Petitions had been made for the appointment of a special commission on the advisability of the acquisition by the state of public and private gas plants, and at the hearing E. W. Burnstead, representing the Massachusetts Civic Alliance, arraigned the failure of government operation in the following manner:

"A move for government ownership means not only that the government shall step into the business being run by private enterprise, but it means that private enterprise shall step out of this business and be excluded, and if that is done in the case of one line of industry, why not in other lines of industry?

"There is one argument usually put forward on this proposition, that of better service at less cost. That is based solely upon an assumption that government operation is less costly and more efficient than private control, but that assumption has never been proved.

"Government business is less efficient, for generally those who manage it are started in at the top and not from the bottom up, while in private business the managers are developed from office boys running up to the top. The heads of a government enterprise are frequently changed through elections and by appointment. If they develop a special ability, their heads may go off at any moment, and the department suffers loss and the government business becomes a failure. It is not necessary to remind you of the failures of government operation of the steam roads, the express service, steamships, the telephone, telegraph and airplane industry. Every man's pocketbook has been taxed and will be for years because of the gross extravagance, waste and profligacy of those services."

This testimony before the Massachusetts Legislature was given by a lay citizen not an employee or an officer of any public utility company. It indicates, however, the trend of public sentiment with regard to government ownership or operation, of which there have been so many sorry examples during the past few years. People do not soon forget the waste and extravagance of government operation, particularly when the after effects continue to be felt in higher taxes and poorer service.

Increasing Use of Higher-Wattage Lamps

UNDER the recently established residential lighting rate of the Hartford (Conn.) Electric Light Company a 60-watt lamp can be burned at a cost 10 per cent below that formerly charged for service with a 40-watt lamp. In various ways the company has advertised this rate change advantageously, but there is a particularly effective display, illustrated herewith, at the lamp exchange and sales windows in the company's main office. As a result of placing a printed notice calling attention to the economies of the new rate beside the window, about 1,500 additional watts per week has been sold in place of renewals or purchases of the smaller size named.

THIS NOTICE INCREASED THE SALES OF LARGER SIZE LAMPS

What Other Companies Are Doing

Chicago, Ill.—The Public Service Company of Northern Illinois between Jan. 1 and July 15 obtained 1,424 contracts for house wiring, which is 100 per cent more than during the same period in 1921 and even exceeds the contracts taken during the first six months of 1920. Power contracts were also greater, as the new 1922 business was equivalent to 75 per cent of the load involved for all new contracts in 1921. Electric ranges numbering 75 per cent of those connected in 1921 were installed during the past six months.

New Hampshire. — The Twin State Gas & Electric Company is building 55 miles of 33,000-volt transmission line between Gorham, N. H., and St. Johnsbury, Vt. This line will connect the Gorham hydro-electric station and the one steam station and four hydro plants in the company's St. Johnsbury division. It is estimated that the cost of the line will be saved in three years through elimination of steam operation and by affording an outlet for secondary hydro-electric energy developed in the St. Johnsbury division.

Providence, R. I.—In two issues of stock employees of the Narragansett Electric Lighting Company purchased 2,261 shares, of which only 314 shares have since been sold. In other words, of all stock purchased by employees, 86 per cent is still held by them. A third opportunity to purchase has now been announced, and each employee of one year's standing or more may subscribe in the ratio of one share for each $300 of his or her annual wages, not to exceed twelve shares to any one employee. The company offers a bonus of $1 per share per year for five years beginning Sept. 1 to subscribers remaining in its employ and keeping the stock.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Beaumont - Monteux Hydro - Electric Plant.—J. REYVAL and J. SUET.—Situated near the junction of the Isère with the Rhone, an adjustable dam has been erected across the former river, which creates a useful head of from 10 m. to 11 m. with an average water flow of 328 cu. m. per second. At present seven vertical-shaft Francis spiral turbines of 6,400 hp. each, at a speed of 107 r.p.m., are installed. Three-phase, umbrella-type generators, wound for 6,200 volts and 50 cycles, are mounted above the turbines. An 80-kw., 250-volt exciter is keyed to the end of the vertical shaft. An outdoor step-up station contains five banks of three single-phase transformers each, rated per bank at 10,000 kva., 6,200 volts delta to 120,000 volts star. An outdoor switching station contains steel-aluminum busbars, suspended on eight-disk Hewlett chains, thirty-six single-pole, 120,000-volt oil switches, twenty-three three-phase, 6,000-volt oil switches, a set of electrolytic aluminum arresters and the necessary measuring transformers.—*Revue Générale de l'Electricité*, May 27 and June 3, 1922.

The Quality of Hydro-Electric Service.—ALEX. E. BAUHAN.—An article relating to quality of service that is to be expected from a properly equipped and well-operated hydro-electric plant, showing how by indefatigable effort such service now compares very favorably with and in many cases is better than that rendered by the metropolitan steam plant.—*General Electric Review*, June, 1922.

Generation, Control and Switching

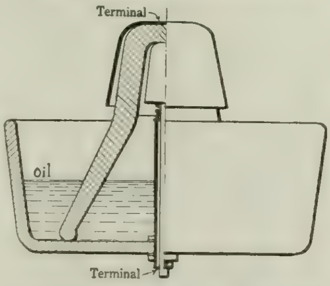
New Switching Stations for 100,000 *Volts and* 125,000 *Volts.*—H. PROBST.—All the different stations described in this interesting paper are of the indoor type, which, with the present situation and labor cost in Germany, results in a less expensive layout. However, there seems to be also another factor which very forcibly leads the way to the indoor type, and that is the general use of paper-made high-voltage insulators, which can be utilized only under roof. Porcelains for very high voltages are at present almost unobtainable in Germany. The first 100-kv. switching stations were built four stories high. Later the two-story station came into general use. As long as horn-gap lightning arresters were employed, the upper story had to be made very high to provide the necessary head room for the safe operation of the horns. Since the advent of the Petersen coil, obviating any other overvoltage protection, the two-story stations are being built with a much lower upper story, which now serves only to house the buses. The author shows on actual station layouts various favorable arrangements of transformers, switches and buses. In all earlier plants great attention was paid to the fireproof separation of all oil-containing apparatus. Based upon the German experiences, statistics seem to indicate that this expensive precaution is not essential.—*A. E. G. Mitteilungen*, June, 1922.

Transmission, Substations and Distribution

Mechanical Characteristics of Aluminum-Steel Conductor. — M. SUZUKI. — The topics covered in this paper are the distribution of tensile load between the two metal components of aluminum-steel cable, with stress-strain diagram of such a cable, and the effects of temperature upon mechanical stress in aluminum-steel cable.—*Journal of the Institute of Electrical Engineers of Japan*, June, 1922.

Units, Measurements and Instruments

Overpotential Test for Insulators.—G. W. LAPP.—Factors met in the design of insulators and characteristics of routine electrical tests are discussed.



PUNCTURE TESTS THAT GIVE PURCHASER DEFINITE BASIS FOR SPECIFICATIONS

A new overpotential test is described, with its application and effects. Results of this test make possible a higher standard of practice in the manufacture and use of transmission-line insulators. In the test the insulator is placed in an insulating dish, as shown in the accompanying illustration, which holds a sufficient depth of oil to form an electrical flashover seal at the rim of the insulator and at the same time leave the head and central part of the shell exposed to the air. The inside terminal is connected with a conductor passing up through the center of the dish. In this way flashover is prevented at the chosen testing voltage.—*Journal of the A. I. E. E.*, July, 1922.

Electric Flashover of Porcelain.—A. SCHWEIGER.—The results of a great many tests to determine the flashover strength of porcelain are reported. The author comes to the conclusion that the dry flashover in air is nothing else but the breakdown of a path of air and that all laws governing the air breakdown apply alike to the air flashover of a porcelain insulator.—*Elektrotechnische Zeitschrift*, June 29, 1922.

Illumination

Highway Lighting Units That Eliminate Glassware for Street Lighting.—SAMUEL G. HIBBEN.—Standard nomenclature and classification of street-lighting globes is necessary if the specifications and contracts are to be intelligently written. This article discusses the progress of the work, showing how the setting of limits for weight, brightness or diffusion and transmission efficiency is going forward. When the standardization of sizes and dimensions is more fully accomplished, much of the unnecessary cost of street-lighting glassware will be obviated.—*Electric Journal*, May, 1922.

Good Lighting an Essential in the Efficient Conduct of Business.—J. H. O'HARA.—In factory lighting each lamp should be so placed that the eye does not see it in the ordinary course of work and so shaded or covered that brilliant reflections are avoided. The effects of good illumination are reduction of accidents, greater accuracy in workmanship, increased production, less eye strain, better working and living conditions and greater ease in the supervision of men. The factors discussed are type of reflectors, indirect lighting, spacing of units, yard lighting, flood lighting and maintenance. The securing of expert assistance in dealing with problems in illumination is emphasized.—*Electrical News*, July 1, 1922.

Motors and Control

The Use of Dielectrics in Condensers.—C. F. GUILBERT.—In the design of condensers for the correction of the power factor of motors and lines a number of electrical details have to be considered very carefully to insure a lasting product. Among important points that should have careful attention are the maximum field density safely permissible, the density near the edge of the conductor, heat losses due to the discharge, heat losses due to dielectric hysteresis, and the physical and chemical fatigue of the dielectric. The author deals in the paper mainly with the effect of entrapped air, the intensity of the dielectric field and the border effect on power condensers.—*Revue Générale de l'Electricité*, June 3, 1922.

Safety Precaution in Paper Mill.—GEORGE E. WALLIS.—Several examples of machines provided with various safety devices in paper mills are given, and various methods of procuring the proper protection of the machines are pointed out.—*National Safety News*, July, 1922.

Improvements on Centrifugal Slip-Ring Short-Circuiting Devices. — P. SUTER.—This paper gives descriptions, drawings and photographs of the latest developments of such centrifugal switches for use on motors up to 2,200 kw. and 3,600 r.p.m. According to the size and the speed of the motor, the contacts of these switches can be safely designed for current densities as high as 0.4 amp. per square millimeter contact surface.—*Brown-Boveri Mitteilungen*, July, 1922.

Heat Applications and Material Handling

Heating of Hydro-Electric Plants.—G. SULZER.—Five per cent of the water-turbine energy transformed into electric power in the generator is, on an average, converted into heat and imparted to the air. In two Swiss plants this heat is being utilized by a carefully laid out hot-air-heating system which keeps all the rooms of the entire power station at a satisfactory temperature during the winter months. The generator capacities of these two plants are 25,000 kw. and 50,000 kw. respectively. Specially installed blowers force the circulation of the heated air through an elaborate system of air ducts, ending in registers in the different rooms.—*Bulletin of the Schweizer Elektrotechnischer Verein*, June, 1922.

Electric Pig Iron Furnace. — L. FAHNRICH.—A furnace is described for reducing iron ore into pig iron that is coming in general use in Austria. This is an arc furnace, suitable for single-phase or three-phase as well as direct current, using a number of electrodes, the number depending upon the size of the furnace. As a rule 600 kw. per electrode of 650-mm. diameter gives best results. The voltage may be 50 to 100, with about eight regulating positions. Depending upon the size, these furnaces operate at from 0.85 to 0.90 per cent power factor. For 1,000 kg. of pig iron 2,600-kw.-hr. of energy and 6 kg. of electrodes are required as an average. At the same time about 500 cu. m. of gas are generated, with a caloric value of some 2,250 heat units, equivalent to 230 kg. of anthracite coal.—*Elektrotechnik and Maschinenbau*, July 2, 1922.

Electrophysics, Electrochemistry and Batteries

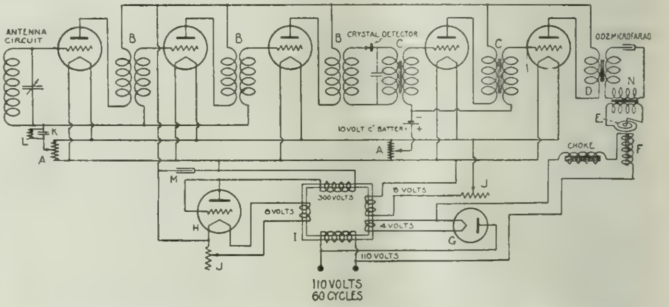
Raw Materials for Electrode Manufacture.—CHARLES L. MANTELL.—The physical and chemical properties of the carbonaceous substances and binding materials are reviewed from the standpoint of electrode requirements. Petroleum coke and pitch are the principal raw materials in the manufacture of electrodes. A satisfactory electrode for electrothermic purposes may be high in ash, since its resistivity is either unimportant or else can be sacrificed if a cheaper electrode may be employed. On the other hand, in electrolytic work electrodes must have a low resistivity and be as free as possible from contamination.—*Chemical and Metallurgical. Engineering*, July 26, 1922.

Traction

Operation of Single-Phase Interurban Railway—C. N. WILCOXON.—The 100 miles of electrified track of the Chicago, Lake Shore & South Bend Railway has shown exceptional performance and reliability in high-speed service. The present service and operation of both the passenger and freight traffic are reviewed. The system operates on 25-cycle, single-phase alternating current with trolley potential of 6,600 volts, which is stepped down from the transmission system of 33,000 volts. Special features discussed are schedules and traffic, handling of peak loads, trailer-car service, rolling stock, high-tension apparatus and the development of freight traffic.—*Electric Traction*, June, 1922.

Telegraphy, Telephony, Radio and Signals

Development of an Electron-Tube Amplifier.—P. D. LOWELL.—The paper describes a five-stage amplifier which operates satisfactorily on 60-cycle supply for both filaments and plates. This amplifier has three radio-frequency stages and two audio-frequency stages and uses a crystal detector. The interference from the 60-cycle supply is practically eliminated by balancing resistances, grid condensers and special grid leaks of comparatively low resistance, a telephone transformer in the output circuit and a crystal detector instead of an electron-tube detector. The paper gives circuit diagrams, the final complete circuits for the five stages being reproduced, and states the values of the condensers, resistances and inductances used.—*Journal of the A. I. E. E.*, July, 1922.



THIS FIVE-STAGE AMPLIFIER USES CRYSTAL DETECTOR AND IS SUPPLIED WITH 60-CYCLE ALTERNATING CURRENT TO FILAMENTS AND PLATES

A—Balancing resistances.
B—Radio-frequency transformers.
C—Audio-frequency transformers.
D—Telephone transformer.
E—Armature of loud speaker.
F—Field of loud speaker.
G—Tungar rectifier.
H—Plate voltage rectifier.
I—Power transformer.
J—Filament rheostats.
K—Condenser, 1 mfd.
L—Leak resistance, 2 megohms
M—Smoothing condenser, 10 mfd.
N—Step-down transformer for loud speaker.

Electric Switch and Signal Setting Apparatus. — L. PAHIN. — A motor-operated block system is described which has been installed recently on the French northern lines. Semaphores and switches are set with 110-volt direct-current motors operated over battery-energized relays. The usual interlocking system renders the apparatus safe from the railway standpoint. All motors operate in both directions to open or to close the signal or the switch and are connected to the control tower with four-conductor cables. To set a switch requires 3½ amp. for three and one-half seconds; to set a signal takes 2 amp. for one and one-half seconds. The relays consume permanently 0.05 amp. The article is eight and a half pages long and is well illustrated.—*Revue Générale de l'Electricité*, July 8, 1922.

Miscellaneous

The Microstructure of Babbitt Metal. —A. MCARTHUR JOHNSTON and R. W. IRWIN.—A microstructure investigation shows that the rigid control of temperature is the most important consideration in manufacturing babbitt, as its physical properties can be changed almost at will by the alteration of the mixing and pouring temperatures. The results of research in the manufacture of babbitt are ably covered in this article with line drawings and several microscopic photographs.—*Journal of the South African Institution of Engineers*, May, 1922.

Integral Equation for Skin Effect in Parallel Conductors.—CHARLES MANNEBACK.—A general set of integral equations is calculated giving the theoretical solutions of the current distribution in parallel conductors. It is shown that current losses in a conductor at low frequency vary as the square of the frequency, while at high frequency they vary as the square root of the frequency.— *Publication No. 30 of the Institute of Technology.*

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Arc-Light Projector for Taking Moving Pictures.

The positive carbon is fed automatically by a small shunt motor connected across the arc. Changes in the length of the arc are immediately reflected in the motor voltage, causing the motor to take a proper corrective measure. In addition to being fed forward, the positive carbon is rotated, which insures the burning of a large and even crater.—*Electrical Apparatus Committee of the N. E. L. A.*

Controller, Magnetic.

A very important development in magnetic control equipment has been perfected and put on the market during 1921. This consists of a new design of contactor which makes it possible to obtain a steel mill controller with contacts and arc chutes having a life from fifteen to twenty times greater than formerly. Instead of castings, the parts are made, as far as possible, of pressed steel or punchings, which are light in weight and very uniform. The result is a quicker operating switch of greater reliability. These contactors are used in a line of magnetic controllers utilizing the voltage drop relay scheme of current limit acceleration. — *Electrical Apparatus Committee of the N. E. L. A.*

Regulator, Potential, Reversing-Switch Type of.

This regulator is sensitive only to the maximum permissible variations of potential, say ±5 per cent from normal. The potential is brought back to normal by means of a transformer whose primary may be either short-circuited or excited in either direction according to the position of a three-way switch. The magnets operating the latter are controlled by contact-making relays which respond to the potential variations. The switch may also be used with a regulator of the variable-ratio type. In the three-phase form a single potential circuit will take care of the regulation in all phases simultaneously. The advantages claimed are simplicity, reliability and low cost.—*Angelo Bianchi, Milan, Italy.*

Oscillograph, Cathode-Ray Type.

A cathode-ray oscillograph has been developed which operates on 300 volts instead of the 10,000 to 50,000 volts required with the older forms of Braun tube. The low-voltage operation is secured by using a thermionic cathode as the source of the cathode rays. The tube has a high sensitivity, the deflection being 1 mm. per volt applied between the deflector plates, or 1 mm. per ampere-turn in suitable deflector coils. The simplicity of the auxiliary apparatus and the sensitivity promise to make this oscillograph an inexpensive and useful instrument for low frequency as well as for high-frequency work.—*J. P. Johnson, Western Electric Company, New York City.*

Underground Temperature Surveys in Duct Banks.

Extensive underground temperature surveys have been made in duct banks by means of gang cables of thermocouples, approximately 350 ft. long. These gang cables are built up beginning with a ⅜-in. steel-wire rope to which the thermocouples are attached. The thermocouples are spaced every 30 ft. and the pair of leads to each one brought back to one end of the cable. Four layers of tape are used to protect the cable from abrasion and moisture.—*E. J. Rutan, in the A. I. E. E. Journal, June,* 1922.

Oil, Transformer, Moisture Test of.

Freshly cut sodium dropped into the oil to be tested is a convenient and sensitive means of detecting traces of moisture. Evolution of gas bubbles is produced by smaller quantities of moisture than can be detected by the usual test of rubbing the oil with eosin. — *C. C. Kiplinger, Mount Union College, Alliance, Ohio.*

Steam Apparatus, Supervision of, with a Graphic Ohmmeter.

In many industries an abnormal condition is indicated by a change in the ohmic resistance. The device, as developed, will indicate, for example, when a tube in a surface condenser begins to leak, the boilers prime, or what the concentration of salts in a boiler is. With suitable electrodes this instrument will record changes in resistance continuously.—*J. W. Esterline, Indianapolis, Ind.*

Dielectrics, Molded, Tests at Radio Frequencies.

A standard test has been developed for non-vitreous solid insulating materials formed in molds by the application of pressure. The phase difference is measured at a known frequency by determining the effective resistance and capacitance of a condenser made of the material under test. The dielectric constant is calculated from the measured capacitance and the dimensions. The dielectric power loss is proportional to the product of the dielectric constant and the phase difference.—*Committee on Electrical Insulating Materials, American Society for Testing Materials,* 1315 *Spruce Street, Philadelphia, Pa.*

Turbines, Steam, Vibration Test, Dynamic.

The wheel disks are caused to vibrate while revolving at various speeds until a point is reached at which the wave of disk vibration—traveling against the direction of rotation—attains the same speed as the wheel. This results in a stationary wave which may ultimately result in fracture. It is possible to test wheels in place in the field, and their sensitiveness to vibration at operating speeds can be definitely determined. Wheels which are subject to certain kinds of vibration at or near the normal operating speed are considered dangerous, and their replacement by wheels with a different cross-section is recommended.—*General Electric Company, Schenectady, N. Y.*

Heating, Electric, of Water for Residences.

Tests have been made on a 30-gal. storage tank, with water temperature about 100 deg. F. above that of the room. The tank was lined with hairfelt of different thickness and radiation losses were measured. The importance of thorough insulation in reducing the losses has been amply demonstrated. A thickness of hairfelt of about 2 in. is sufficient, and the reduction in the losses beyond this limit does not warrant a further increase in the thickness of insulation.—*Hydro-Electric Power Commission, Toronto, Ontario.*

Thermometers, Total Versus Partial Immersion.

A study has been made of the errors involved when a thermometer calibrated for total immersion is only partly immersed in a bath, and vice versa. In one case at 210 deg. C. the error was 3.2 deg. C. and at 355 deg. C. the error was 15.6 deg. C. The committee recommends three standard types of thermometers for general use, all of the partial-immersion type (76 mm. immersion), to cover the following ranges on the centigrade scale: —20 deg. to +150 deg.; —5 deg. to +300 deg.; —5 deg. to +400 deg. Detailed specifications have been prepared for such thermometers in co-operation with the manufacturers and users of thermometers, and with the United States Bureau of Standards.—*Committee on Thermometers, American Society for Testing Materials,* 1315 *Spruce Street, Philadelphia*

Gloves, Rubber, for Electrical Workers.

Changes and additions have been made in standard specifications and in prescribed tests.—*Rubber Products Committee of the American Society for Testing Materials.*

Research in Progress

Switchboard Matting.

A request has been received from the accident prevention committee of the N. E. L. A. to prepare specifications for matting to be used about electrical switchboards and in similar situations where an electrical hazard is involved. The subcommittee on protection of persons from electric shock has undertaken the development of such specifications.—*Rubber Product Committee of the American Society for Testing Materials.*

Suggestions for Research

Temperature Regulation, Automatic.

With the increasing use of electric furnaces and ovens in various industries, it becomes highly desirable to develop an automatic temperature regulator with which the time-temperature curve could follow any desired program. The principle of such a device was shown by the Foster Instrument Company at a recent exhibition of the Physical and Optical Societies in London, England.

Insulation, Textile, X-Ray Examination of.

The control of textile operations is facilitated by a periodic X-ray examination after each important operation. Certain chemicals have been found with which the fiber can be impregnated for such tests without injuring it. It is thought that similar tests may be applied to the study of electrical insulating materials having a textile basis.—*See Textile Institute Journal, Vol.* 12, 1921, page 1.

Rectifier, Vibrating-Contact Type.

In small sizes such a rectifier is quite efficient for charging storage batteries, provided that the contact is made and broken when the a.c. voltage is equal to that of the battery. Recently L. Schüler has given the fundamentals of motion of such vibrating contacts and described a stroboscopic method of experimental observation of their motion (*E. T. Z.*, Vol. 42, page 481). It is hoped that this work will be used by other investigators for a further practical improvement of existing rectifiers of this type.

Grounding Portable Devices.

The grounding of portable devices is not always easy, as there is a hazard introduced in grounding through the grounded circuit wire. If an additional ground wire is supplied in portable cord, what is a feasible arrangement at the attachment plug and receptacle for insuring a ground connection for the extra conductor?—*M. G. Lloyd, Bureau of Standards, Washington, D. C.*

Receiver, Telephone, Efficiency of.

Various measurements indicate a very low efficiency of the telephone receiver, considering it from the point of view of the transformation of the incoming electrical energy into that of air vibrations. See, for example, Shepardson, "Telephone Apparatus," page 81. With the increasing importance of loud-speaking telephones, the matter of increased efficiency of the receiver acquires a particular importance, and further accurate investigations are desired with the view of analyzing the causes of the principal losses and finding suitable remedies.—*Editorial Suggestion.*

Cables, Study of Paper and Petrolatum for.

The paper by Del Mar and Hanson, *A. I. E. E. Journal,* 1922, page 139, opens a new and fruitful field of investigation of the electrostatic stresses, dielectric displacement currents and conduction currents in a composite insulation consisting of paper and mineral oil. Further and more extensive studies with more delicate apparatus should lead to important practical results.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Federal Courts Upheld

American Bar Association Is Opposed to the Bacharach Bill and Similar Radical Legislation

AT SESSIONS of the American Bar Association held in San Francisco on Aug. 7 to 11 discussion on the Bacharach bill and similar legislation resulted in the adoption of resolutions placing the association definitely on record as opposing that type of legislation. At a meeting of the Public Utility Section of the association Aug. 8 the following resolution was adopted:

"Resolved, That the Section on Public Utility Law of the American Bar Association hereby expresses the emphatic opposition of its membership to the Bacharach bill now pending in Congress (H.R. 10,212) and to any similar legislation designed to limit or destroy, as to any particular class of litigants or rights, the present equitable powers of the federal courts to enforce the guaranties of the federal Constitution for the protection of persons and property.

"Resolved, further, That the section asks its chairman in his report to the association to present at least in outline the considerations which have been developed in the discussions before the section as demonstrating the extreme unwisdom of any such radical curtailment of the federal judicial power.

"Resolved, further, That the chairman of this section and the special committee created at today's session are authorized in behalf of the section to take such further steps as in their judgment may be advisable to bring about an indorsement by the association of the action of its committee on jurisprudence and law reform in actively opposing the Bacharach bill at the present session of the Congress, and also to support before the association any suitable resolutions which may be offered in condemnation of that or similar legislation."

JURISPRUDENCE COMMITTEE'S REPORT

At a general session of the association Thursday, Aug. 10, the committee on jurisprudence and law reform, Henry W. Taft, chairman, presented its report. It included as a part of the report the resolution adopted by the Public Utility Section and expressed definite opposition to the Bacharach bill as follows:

"Three hearings have been had upon this bill. At one of these a member of this committee, Mr. Harriman, attended and pointed out the objections to it upon the grounds referred to in these previous reports. The chairman also presented a similar statement. After considering the subject carefully this committee unanimously voted that it disapproved the bill. Information as to this vote has been presented to the judiciary committee of the House, which has had the matter under consideration."

The committee report was unanimously adopted by the association.

◆

Crude Petroleum and Poles on Free List

An effort made in the United States Senate on Wednesday to impose a duty of 35 cents a barrel on refined and 25 cents a barrel on crude petroleum was defeated by a vote of forty-five to nine, the mover of the resolution—Senator Harreld of Oklahoma—coming in for attack as personally interested in the proposed duty because of a part interest in an oil well.

Telegraph, telephone, electric light and other poles were, by amendment, put on the free list.

◆

New York Utilities Ask Their Customers to Save

Over the signature of "The Gas and Electric Companies of Greater New York," the newspapers of New York City carried this week an advertisement headed "Important Notice" and addressed "to the consumers of gas and electricity in the city of New York" which in the following terms urged the public to economize in the use of these commodities:

"On recommendation of the Governor's State Fuel Commission and of the Public Service Commission of the State of New York you are earnestly requested to give careful consideration to the following suggestions in connection with the utilization of the services supplied by the gas and electric companies of New York City.

"It is absolutely necessary during the present scarcity of fuel that the consumers of the public utilities co-operate in every practical way in the saving of fuel and the elimination of waste.

"*Burn fewer lights.*—Save gas and electric current.

"*Turn them off when not needed.*—Do this when leaving a room or office whether you are paying for it or not.

"*Conserve all heat and power.*—Remember that the waste of light, heat or power is a loss of coal. Keep in mind daily the necessity during the present emergency for the utmost economy in the use of facilities requiring the consumption of fuel."

Coal Strike Virtually Ended

Agreement Being Reached in All of the Producing Centers and Speedy Resumption Indicated

BY THE agreement reached in Cleveland this week between the union representatives of the striking miners and the operators the long-drawn-out coal strike has been virtually terminated. Although up to the present not all of the districts have signed the agreement, it is expected that acquiescence in it by all operators will follow soon. The anthracite-coal operators will probably also come to an agreement with the hard-coal miners within a very short time. Inasmuch as the old wage scale remains, hope for cheaper coal vanishes.

The operators are confident that soft coal can be produced at a rate considerably larger than normal, so that within a few months depleted bins may be completely replenished. There are no indications, however, that the regulations with reference to the distribution of coal by the President's coal committee can be abrogated until next spring. Electric light and power companies in various sections have sent out requests to customers to be frugal in the use of electricity so that their diminishing coal supplies may last until shipments begin to arrive again.

The railroad strike is causing most concern, but men who are in close contact with the situation expect the lowering clouds to disappear within a very short time. Until the railroad strike is settled on the coal-bearing railroads at least, there is no possibility of moving any considerable amount of fuel. A conference between railroad executives and union officials was held in New York the latter part of this week. Out of this conference it is expected an agreement will come which will bring the railroad strike to a speedy end.

◆

Fuel Situation in the Middle West

Although no large electric plants in Iowa have curtailed service from lack of coal, several municipal plants have suffered. Report sfrom Rex H. Fowler, secretary of the Iowa Section of the National Electric Light Association, indicate that the coal situation is serious but that with the aid of fuel oil operation will be continued until coal is available.

A meeting of Ohio central-station men was held in Cleveland on Wednesday to discuss procedure in case actual curtailment of service becomes necessary. No immediate shortage in Cleveland is feared.

The Wisconsin Traction, Light, Heat & Power Company has only a ten days' supply available.

Boston Coal and Percentage Charges Sustained

Four appeals to the Massachusetts Department of Public Utilities against the coal clause and so-called percentage charges of the Edison Electric Illuminating Company of Boston were ordered dismissed in a twenty-four-page finding of the commission issued last week, pending the adjudication before the board of the existing rate inquiries involving the company. Three mercantile establishments and the city of Boston sought to escape fuel and percentage payments, and the municipality sought to recover money thus paid by it to the company and described by its counsel as "reparations." The petitioners cited recent reductions under the coal and percentage clauses to so-called Schedule A customers (comprising the great mass of consumers) and evidenced as discrimination the existence of certain long-term contracts made some years ago with consumers who up to now have not been required to pay these additional charges.

The pendency of the exhaustive rate inquiry before the commission contributed in large measure to the board's action in dismissing the four petitions, although the petitioners are allowed sixty days in which to request that their prayers stand until the adjudication of the main case. The company claimed that all four of the petitioners are paying less per kilowatt-hour than the Schedule A customers, and if this is so the finding declares the alleged discrimination is more one of form than of substance. The board questions whether under these circumstances the existing lower charges paid by these petitioners should be reduced still lower in comparison with those made to the vast majority of customers, particularly in view of the main contention of the complainants in the rate inquiry, viz., that the customers under Schedule A, including these very four complainants, are paying more than they ought in proportion to other classes of consumers.

The petitioners and the company were unable to agree upon any reasonable basis for suspending payments under the coal and percentage clauses until the ultimate determination of the main inquiry. The petitioners argued that unless repayments or so-called reparations by the company to the city can be granted by the board they cannot be had through the courts under a recent decision of the Massachusetts Supreme Court against the city of Boston, and that as a consequence no redress can be obtained by those who may be injured in case of excessive or discriminatory rates. The commission points out that the statutes contain nothing which would seem to indicate an intention to give the board the power to order reparations. The commission calls attention to the desirability of legally requiring all gas, electric and water rates to be filed with it before taking effect as a means of making it difficult for any company to put into use rates either excessive or discriminatory.

Competitive Situation in Indianapolis

The protests of the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company of Indianapolis against granting a certificate of convenience and necessity to the Terre Haute, Indianapolis & Eastern Traction Company for the installation of electric power lines in Indianapolis have been overruled by the Public Service Commission of Indiana. The effect of granting the proposed certificate, it was said, would be to permit the railway companies to compete with the two companies now providing electric service for Indianapolis. The commission expressed doubt whether the certificate should be granted, but was convinced of the necessity of relief being granted the petitioning company, which has won the approval of the city for its proposal.

Further reductions in rates of the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company applicable to larger consumers have been requested in a petition filed by attorneys for a number of business concerns and industries. The present rates went into effect July 1.

Indiana Cities Are to Unite in Opposing Rate Increases

An organization to oppose increases in utility rates and to bring about amendments to the Public Service Commission law and other legislation was agreed on by mayors and city attorneys of several Indiana cities at a meeting held recently at the invitation of Mayor John C. Quick of Muncie. The cities represented at the meeting were Indianapolis, South Bend, Hammond, Gary, Anderson, Newcastle, Elwood, Crawfordsville, Vincennes, Muncie, Whiting and East Chicago. Other places are expected to join the movement.

Vigorous attacks on the Public Service Commission law were made, especially by Mayor R. O. Johnson of Gary, who argued that it should be repealed and rate making and control of utilities should revert to city councils. Most of the city attorneys present, it is said, opposed repeal of the basic law, but urged the need of amendments designed to open the way to a stronger presentation of the "case of the people" than under the present operation of the law.

With the next Legislature about five months distant, sentiment against the Public Service Commission is being encouraged actively in some districts.

Ontario Hydro's Rebuttal

The "Murray Report" to N. E. L. A. Is Declared Unjust and a Vigorous Attack Made on Its Author

UNDER the unabridged heading "Refutation of Unjust Statements Contained in a Report Published by the National Electric Light Association Entitled 'Government Owned and Controlled Compared with Privately Owned and Regulated Electric Utilities in Canada and the United States' Respecting the Hydro-Electric Power Commission of Ontario," the body last named has issued a fifty-three-page pamphlet which assails with great vigor the statements made in the report referred to, of which W. S. Murray and Henry Flood, Jr., were the authors. A "foreword" to this pamphlet is contributed by Sir Adam Beck, the chairman of the Ontario commission, in which he says:

"Mr. Murray has made definite statements purporting to be true but which are at absolute variance with well-known facts. He has misquoted statements, even replacing significant words therein with others. He has employed partial and misleading data, thereby arriving at conclusions which cannot for a moment be supported if the correct data be employed. He has presented grossly misleading statements respecting even physical facts within his knowledge, and he has made comparisons between entities radically different, when even a proper recognition of the real differences would have created an impression entirely at variance with what he has represented. He has inflated costs in a manner which falsifies the conclusions. Such procedure is characteristic of the use made of much of the essential material embodied in the premises which Mr. Murray has adduced and upon which he has based his conclusions. This accounts for the worthless nature of such conclusions."

Many Instances of Alleged Inaccuracy Are Cited

In support of these serious allegations Sir Adam Beck makes the following statements:

That the very title of Mr. Murray's report is misleading inasmuch as the phrase "government owned and controlled," in its usually accepted meaning, conveys a significance radically different from any which can be attached to the operations of the Hydro-Electric Power Commission of Ontario, which, Sir Adam says, "is co-operative, municipal ownership working through the agency of independent commission control and administration and is entirely removed from political interference."

That Mr. Murray's report is not "based on an impartial and exhaustive study," such as he says the N. E. L. A. requested, being neither exhaustive nor impartial and embodying fallacious methods that render its conclusions necessarily unsound.

That Mr. Murray asserts, "The commission cannot be sued without fiat from the Attorney-General, and to date no fiat has ever been granted," whereas within the period from 1912 to date more than twenty-five such fiats have been granted.

That Mr. Murray misquotes the power commission amending act by altering the phrase "in respect of which authority is by this act conferred upon it" to read "in respect of that authority as by act conferred upon it," thus, in Sir Adam's opinion, creating the false impression that the jurisdiction conferred by the particular portion of the act cited relates to the operations of the commission as a whole instead of relating, as it does, only to comparatively unimportant features covered by the provision in question.

That Mr. Murray states that in 1920 the street-lighting cost per capita in Buffalo was 60 cents as compared with 67 cents per capita in Toronto, leaving out of account the fact that in Buffalo more than one-half the total number of street lamps are gas or gasoline, whereas in Toronto all the street lamps are electric. The correct figures for total lighting, Sir Adam says, are $1.15 for Buffalo against 67 cents for Toronto.

NIPIGON-KAMINISTIKWIA CONTROVERSY

That Mr. Murray asserts that the Nipigon development "lacks a storage equal to that available to the Kaministikwia plant," whereas the potential storage on the Nipigon watershed is more than nine times that on the Kaministikwia, and that his failure to direct attention to the "very special features distinguishing the water power of the Nipigon River" is an "unpardonable breach of professional integrity."

That throughout his report Mr. Murray "effects comparisons between data and circumstances which are often inherently and radically different." Sir Adam Beck instances as an unfair comparison that drawn in the Murray report between California and the Ontario hydro systems "other than the Niagara." These, says Sir Adam, represent only one-seventh of the Ontario Hydro system's load, and the only possible comparison would be between California and the system supplied from Niagara Falls.

That in dealing with hypothetical factors involving future circumstances Mr. Murray, "by inflation and other devices," overestimates the cost of the Niagara system by 75 per cent, even granting his own assumptions as to the amount of water available.

That so far from Mr. Murray's declaration that electrical energy is dearer in Hydro municipalities than in other territories to which he refers being true, the rates throughout the system are cheaper than for like service elsewhere in the world. For instance, Sir Adam says, average energy costs in Buffalo are 35 per cent higher than in Toronto, not 20 per cent lower, as Mr. Murray estimates.

More than 300 municipalities now served by the Hydro-Electric Power Commission of Ontario have, declares Sir Adam, saved through reduction of rates approximately $60,000,000 as compared with what would have been the cost under rates prevailing before the undertaking was begun.

The main portion of the pamphlet under notice is an amplification of the assertions made by Sir Adam Beck in the "foreword." It concludes with another arraignment of Mr. Murray, who is accused of employing "methods demonstrably reprehensible and unprofessional."

Bill to Reorganize Georgia Commission

A bill has passed the Georgia House of Representatives by which the name of the state commission has been changed from "Railroad Commission" to "Public Service Commission" and the membership of the body reduced from five to three. The bill provides an appropriation of $70,000 to pay the operating expenses of the commission, this sum to be collected from the public utilities on a pro rata basis, according to the ad valorem taxes they pay.

The commission is required by the terms of the bill to hold hearings in the local community of the utility in every contested rate case. The attorney for the commission is to act as a representative of the public in all contested rate cases and shall conduct or assist in conducting the case for the public.

Suit Against Southern Power Results in Mistrial

A suit brought by twenty-two cotton-mill companies against the Southern Power Company in an effort to upset advanced rates granted to the power company by the North Carolina Corporation Commission came to an end on Aug. 5 at Shelby, N. C., when the jury announced its inability to agree and the judge declared a mistrial. The trial had lasted two weeks, and the jury had been out twenty-seven hours. It stood from the first seven to five in favor of sustaining the existing rates as established by the commission. A very wide degree of public interest had been aroused by the action of the cotton mills in taking their contentions into court. They will now seek to carry the case to the North Carolina Supreme Court.

Two questions were put before the jury for decision: (1) whether the rates fixed for the company are unreasonable and unjust; (2) whether the regulations prescribed by the commission are unfair and unjust. A decision against the commission would have sent the case back to it for a rehearing. The increase granted by the commission was about half what the company asked for. All consumers were put on the same footing, in accordance with a decision of the Supreme Court of the state, and all existing contracts were abrogated. The new rates were accepted by 250 consumers, but the contending mills refused to abide by them, claiming that they were higher than those embodied in contracts with the Southern Power Company only a few months before.

A. I. E. E. Announces Committee Appointments

At the first meeting of the board of directors of the American Institute of Electrical Engineers for the administrative year beginning Aug. 1, 1922, held in New York on Tuesday, Aug. 8, President Jewett announced the committee appointments for the coming year. The chairmen are as follows:

Standing committees: Board of examiners, H. H. Norris, New York; code of principles of professional conduct, Schuyler Skaats Wheeler, Ampere, N. J.; co-ordination of Institute activities, W. I. Slichter, New York; Edison medal, Edward D. Adams, New York; executive, Frank B. Jewett, New York; finance, L. F. Morehouse, New York; headquarters, E. B. Craft, New York; law, H. H. Barnes, Jr., New York; meetings and papers, E. E. F. Creighton, Schenectady, N. Y.; membership, R. B. Howland, New York; publication, Donald McNicol, New York; public policy, H. W. Buck, New York; research, J. B. Whitehead, Baltimore; safety codes, H. B. Gear, Chicago; sections, A. W. Berresford, Milwaukee; student branches, C. F. Harding, Lafayette, Ind.; standards, Harold Pender, Philadelphia.

Technical committees: Educational, C. E. Magnusson, Seattle; electrical machinery, B. A. Behrend, Boston; electrochemistry and electrometallurgy, J. L. Yardley, Pittsburgh; electrophysics, F. W. Peek, Jr., Pittsfield, Mass.; industrial and domestic power, H. B. Reed, Milwaukee; instruments and measurements, P. A. Borden, Toronto; iron and steel industry, E. S. Jefferies, Hamilton, Ont.; lighting and illumination, G. H. Stickney, Harrison, N. J.; marine, G. A. Pierce, Jr., Philadelphia; mines, Graham Bright, Pittsburgh; power stations, R. F. Schuchardt, Chicago; protective devices, H. R. Woodrow, New York; telegraphy and telephony, R. E. Chetwood, New York; transmission and distribution, Edward B. Meyer, Newark, N. J.

EDISON MEDAL COMMITTEE

In accordance with the bylaws of the Edison medal committee, the board of directors confirmed the appointment by President Jewett of new members to serve on that committee, as follows: Gano Dunn, New York; F. A. Scheffler, New York, and W. R. Whitney, Schenectady, for terms of five years each. The board also elected three of its membership as members of the Edison medal committee for terms of two years each, namely, E. B. Craft, New York; G. Faccioli, Pittsfield, Mass., and William McClellan, New York.

American Engineering Council Has Water-Power Plan

With the whole federal water-power situation in what is called a critical condition, involving vast economic consequences, Dean Mortimer E. Cooley of the University of Michigan, president of the American Engineering Council of the Federated American Engineering Societies, and John R. Freeman, president of the American Society of Civil Engineers, will, it is announced, appear before a sub-committee of the Senate committee on commerce the latter part of this month to advocate the establishment of a national hydraulic laboratory. A bill to create such a laboratory is now before the Senate.

This action, it is stated, was prompted by "the Federal Power Commission's lack of effective and permanent personnel." The water-power plan coincides with the American Engineering Council's reforestation movement, in which the engineers are co-operating with the United States Forestry Service and other bodies. The executive board of the American Engineering Council, which is to meet in Boston on Sept. 8 and 9, has adopted a resolution declaring that stream-flow conditions in many sections of the country vitally affect the welfare of the people in many ways. Among these it instances the loss of life and damage to property resulting from floods, the economic significance of water-power developments and the importance of their industrial utilization.

Accounting Regulation Conference to Meet Sept. 18

The conference with Federal Power Commission officials on the accounting regulation has been fixed for Sept. 18. It had been the intention to have the meeting at an earlier date, but it was found that the date fixed would allow the representatives of the National Electric Light Association time to return from the Salt Lake City meeting and at the same time be a convenience to the representatives of the National Association of Railway and Utility Commissioners, who will be in the East just prior to that date, attending their Detroit convention.

Senate Formulates a Proviso Affecting All New Dams

In giving its consent recently to the construction of a dam across the Mahoning River at Warren, Ohio, the United States Senate not only provided that the dam must not be used to develop water power or generate electricity or be commenced until the plans have been approved by the Chief of Engineers, but also added another proviso which is likely to be a part of all future permits to construct dams for other than power purposes. This standardized clause reads as follows:

"That the consent hereby given shall terminate and be at an end from and after thirty days' notice from the Federal Power Commission or other authorized agency of the United States to said company or its successors that desirable water-power development will be interfered with by the existence of said dam; and any grantee or licensee of the United States proposing to develop a power project at or near said dam shall have authority to remove, submerge or utilize said dam under such conditions as said commission or other agency may determine, but such conditions shall not include compensation for the removal, submergence or utilization of said dam if the water level to be maintained in said power project is higher than the level of the crest of said dam."

Major Bennion Sees Western Power-Project Sites

Utah and Oregon must develop additional water power in the near future if the rapidly growing market in those states is to be kept supplied. This opinion was expressed by Major Howard S. Bennion, assistant chief engineer of the Federal Power Commission. Major Bennion has just returned from an inspection trip which included visits to the Flaming Gorge and the Bear River projects, those between American Falls and the Seven Devils country on Snake River, the proposed development of the Pacific Power & Light Company above Lewiston, and the developments at Flathead Lake. In addition he visited Butte and Great Falls to study the manner in which the copper companies make use of their power.

Major Bennion was surprised at the rapid rate of increase in the load being carried by the Utah companies. He states that the Utah Power & Light Company is planning to proceed with its four projects on the Bear River in the near future.

The situation in Idaho, Major Bennion states, is going to be unsatisfactory until a larger market is found for firm power. At present a large part of the market is for pumping enterprises. Irrigation demands cheap power, but before low rates can be put into effect some use for the power must be found to enable plants large enough to handle the summer peak to utilize their equipment at other seasons of the year.

In Montana the power market is reviving owing to increased activities in the copper industry. The existing installation at Butte and Great Falls, however, is sufficient to take care of the natural expansion at those points for some time to come. Throughout the entire Intermountain region Major Bennion found evidences of intelligent efforts to devise means whereby industries could be established to utilize the large amount of potential power available in that section. Since that power must be developed in large blocks to be profitable, the preliminary investigation necessarily must be slow and painstaking. He believes that industrial uses will be found for increasing amounts of this power, but the greatest immediate promise is the electrification of sections of the transcontinental railroads. He thinks there are sections of each of the transcontinental lines where it is feasible to begin electrification and points out that this use of power carries with it much promise of expansion because, once installed, the tendency always is to add to the mileage over which electrification extends. The tendency at this time, Major Bennion asserts, is for the railroads to plan the development of their own power.

Major Bennion was impressed with the bearing the Flaming Gorge and Kremmling projects will have on flood control in the Colorado River. The Federal Power Commission is withholding action pending a report by the Colorado River Commission. Major Bennion found that there is decided sentiment in the West that the projects should be put through as early as possible because of their effect on the flood situation.

United States Building for Brazil's Fair

Architect's drawing of the official United States government building now being constructed at Rio de Janeiro for the Brazilian Centennial Exposition, which opens in September. The building is of permanent construction and will serve as the American Embassy after the close of the exposition. Frank L. Packard of Columbus is the architect and Dwight P. Robinson & Company, Inc., are the constructors. The photograph is reproduced by courtesy of Dwight P. Robinson & Company, Inc.

Electric Utilities' Daily Fuel Consumption Increases

Figures just issued by the Geological Survey show a small increase in the average daily consumption of fuels of all kinds by the electric public utility plants of the United States as compared with 1921, though the figures for coal are behind those for 1920 and 1919 and in January and February were behind last year. The tables for the three and a half years ended June 30 last follow:

Month	1919	1920	1921	1922
COAL (net tons):				
Jan.	104,000	115,600	95,900	95,300
Feb.	102,000	111,500	93,900	92,600
March	93,900	105,000	85,200	87,900
April	88,100	97,200	80,600	81,900
May	85,300	91,100	77,900	79,900
June	88,300	95,000	81,360	83,000
July	85,700	94,800	79,400	.....
Aug.	86,700	97,100	83,200	.....
Sept.	92,200	100,100	86,300	.....
Oct.	98,400	101,800	89,000	.....
Nov.	112,500	105,200	92,600	.....
Dec.	116,800	103,200	93,700	.....
Year	96,200	101,400	86,500	.....
OIL (barrels):				
Jan.	21,900	41,600	28,900	35,700
Feb.	21,900	40,300	27,900	35,600
March	20,400	34,200	27,400	30,600
April	19,400	30,400	28,100	27,500
May	23,300	29,800	27,500	27,600
June	29,000	35,900	30,500	30,400
July	32,100	38,400	33,200	.....
Aug.	34,600	38,700	37,600	.....
Sept.	37,100	40,700	39,700	.....
Oct.	39,000	37,700	38,100	.....
Nov.	41,700	32,000	38,200	.....
Dec.	40,800	30,600	38,400	.....
Year	30,300	35,900	33,000	.....
GAS (1,000 cu.ft.):				
Jan.	35,500	46,100	55,300	52,700
Feb.	47,100	45,300	52,000	57,100
March	57,000	50,800	50,100	51,600
April	62,000	60,100	62,000	61,700
May	62,100	68,400	64,300	71,400
June	66,200	75,200	69,000	78,400
July	66,400	83,700	62,400	.....
Aug.	64,500	87,400	74,700	.....
Sept.	63,400	90,500	78,900	.....
Oct.	64,400	77,600	73,600	.....
Nov.	60,700	63,600	73,800	.....
Dec.	51,000	60,490	63,300	.....
Year	58,600	67,500	65,000	.....

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New York Chamber of Technology Again Suggested

A circular letter issued to the members of the New York Section of the American Institute of Electrical Engineers by Calvert Townley, its chairman, brings up again the question of forming a body in New York City which would embrace engineers of all descriptions in a common membership. Mr. Townley says:

"Many of you will recall that beginning about two years ago, a number of conferences were held between representatives of the New York Section and of other allied engineering and technical bodies in the metropolitan district at which the formation of the New York Chamber of Technology was discussed. The object of this movement was to bring together the technically trained professional men of the district in the same way that they have been brought together under organizations having various titles in other cities, namely, Philadelphia, Baltimore, St. Louis, Pittsburgh, Boston, Detroit, et al. As I recall it, the organizations represented in the metropolitan conferences some two years ago total about 15,000 members, and it is obvious that there are many opportunities for co-operation, unity of action, avoidance of duplication of work, etc., that are even more worth while in and about New York than in any other city. At the present time aside from holding joint meetings between two or more different societies there is no vehicle through which the New York professional men can act, and it would be interesting and helpful to know if the membership of the A. I. E. E. favor a revival of the effort referred to."

An expression of opinion as to the number and character of the meetings of the section is also solicited by Mr. Townley.

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New Brunswick Commission for Public Ownership

The Electric Commission of the Province of New Brunswick, which is under the control of the provincial government and which built the new hydro-electric station on the Musquash River, has declared itself in favor of the principle of public ownership of public utilities and will refuse to sell the power generated at Musquash to private companies for resale at a profit. Through Dr. E. A. Smith, the chairman, and C. O. Foss, the chief engineer, the commission asserts that it is committed to this principle and stands for development and sale of power to municipalities and individuals at cost. When communities other than municipalities desire electric service and have satisfied the commission that a sufficient revenue has been pledged to pay the interest and cost of administration, the commission will undertake the necessary construction, taking the bonds of the community or district, which shall be duly authorized by act of the New Brunswick Legislature, to cover such capital cost.

The commission, while it did not build the hydro-electric station at Great Falls on the Nepisiguit River, has arranged for the extension of service into the cities of Chatham and Newcastle as well as other centers of the north shore section of New Brunswick. Part of the Province of Quebec will also be served by the Great Falls station.

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Slogan Sought for Electric Trucks

At a meeting held on Aug. 9 by the automobile bureau of the New York Edison Company to consider the electric vehicle exhibit at the coming electrical show in New York City it was determined to hold a prize letter contest for the purpose of obtaining the "best slogan for electric trucks to adopt." The prizes decided on will aggregate $1,000, including a first prize of $500, a second prize of $200, a third prize of $100 and forty prizes of $5 each. It was also decided to hold an electric truck parade on Oct. 10 in connection with the electrical exposition.

Higher Costs of Underground Service Recognized

Beginning Oct. 1, the city of Providence, R. I., will pay the Narragansett Electric Lighting Company a base price of $87.69 a year for each underground-connected 6.6-amp. inverted-type series magnetite-arc lamp burning all night and every night and $65.43 for each similar aërially connected arc lamp, according to a recently signed contract for street-lighting service. Series tungsten incandescent lamps of 100 cp. will be supplied at $38.03 per year each for all-night service if fed from the underground system and at $15 per lamp when served from aërial lines. The contract term is four years with provision for indefinite continuance. The negotiations which led to this agreement have been under way for several months and have been based upon a comprehensive estimate by the company of the costs of supplying various types of lamps from overhead and underground lines and the discussion of these estimates by the city.

Departure from Normal Agreement

In its recognition of the greater expense of supplying lamps from underground service the contract is an interesting departure from the ordinary agreement lumping lamps into an average price per unit. The company estimated that the investment required for each underground arc was $298.28 and for aërially supplied arcs $134.20 each. Incandescent lamps supplied from the underground system represented an estimated outlay of $222 per lamp and when fed from aërial lines $39.88 per lamp. Upon these investment costs were determined in large measure the final prices agreed upon, although the city authorities did not accept the company's figures *in toto*. In arriving at the street-lighting investment the company's engineers segregated all equipment required for this class of service. At the generating station the street-lighting pro rata was determined on the basis of demand. In substations it was computed on the basis of relative area required by this equipment in that portion of the substation occupied by distributing apparatus plus the demand ratio of the street-lighting service applied to transmission cables, lines and portions of substations common to all classes of service. A thorough study of the costs of underground and aërial lines per foot and per lamp was also undertaken to facilitate computations of the investment between the lamps and the substations. The major items in the price list include 907 underground-connected arcs and 661 aërially connected arcs, 428 underground-connected incandescents and 7,181 aërially connected incandescents. The contract includes a fuel clause, an arrangement for pricing new types of lamps, compensation for varying hours of burning, limitation of discontinuances and other features designed to facilitate the practical handling of matters between the parties under various conditions.

Rocky Mountain Tentative Program Ready

For the combined convention of the Rocky Mountain Geographic Division of the National Electric Light Association and the Colorado Electric Light, Power and Railway Association, to be held at Glenwood Springs, Col., on Sept. 11-13, this tentative program has been issued:

MONDAY, SEPT. 11

Morning.—Welcoming address, W. G. McDonald, Mayor Glenwood Springs; address, Fred Norcross, president Colorado Electric Light, Power and Railway Association; "Timely Topics," C. N. Standard, vice-president and general manager Denver Gas & Electric Light Company; "Transportation," E. C. Stenger, receiver Denver Tramway Company; committee formation report, A. Prager.

Afternoon.—"The Banker's Relation to the Public Utilities," James C. Burger, president Hamilton National Bank of Denver; "Illumination Ancient and Modern," W. D'A. Ryan, General Electric Company; "Development of the Commercial Lighting Load," W. T. Blackwell, Westinghouse Electric & Manufacturing Company (presented by L. A. S. Wood); report of activities of the Rocky Mountain Committee on Public Utility Information, George E. Lewis, executive manager; question box and general discussion.

TUESDAY, SEPT. 12

Morning.—Address, E. P. Bacon, president Rocky Mountain Division, N. E. L. A.; "Symposium on Lighting Business Development," S. E. Doane, National Lamp Works of General Electric Company, and others; "Building Public Confidence," P. L. Thomson, advertising manager Western Electric Company; "Communication," Ben S. Read, Mountain States Telephone & Telegraph Company; general discussion.

Afternoon.—"'More and Better Business' Program and General Activities of the N. E. L. A.," J. E. Davidson, vice-president N. E. L. A.; "The Future of the Artificial Gas Industry," H. O. Lobell, Henry L. Doherty & Company; "Adequate Rates," H. B. Dwight, Colorado Public Utilities Commission; "Budgeting a Management Aid," O. A. Weller, Denver Gas & Electric Light Company; question box and general discussion.

WEDNESDAY, SEPT. 13

Morning.—"The Newspaper and the Public Utility," E. A. Bemis, president Colorado Editorial Association; Address, Rodney J. Bardwell.

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New England N. E. L. A. Has Varied Program

Commercial, public relations and technical problems occupy the major portion of the program of the fourteenth annual convention of the New England Geographic Division, N. E. L. A., to be held at the Hotel Griswold, New London, Conn., Sept. 5-8. On Wednesday, Sept. 6, at 10 a. m., President C. L. Edgar will open the convention. J. B. Groce, director New England Bureau of Public Service Information, Boston, will speak upon "The Public Utilities and the Public," and the reports of the standing committees on accident prevention, customer ownership, membership, purchasing agents and taxation will be presented. Sports will occupy the afternoon, and at the evening session F. J. Stanwood will present the report of the Accounting Section, followed by an address by W. A. Jones, vice-chairman National Accounting Section, New York. The film "A Day with Thomas A. Edison" will then be shown.

Technical committees will hold a round-table discussion of their year's work on Thursday, and H. M. Parsons, chairman, will discuss the work of the rural lines extension committee. "Western Red Cedar Poles and Butt Preservation Treatments" will be the subject of a talk in the afternoon by E. L. Clark, Spokane, Wash., followed by a discussion of "Radio and Its Relation to the Central Station." This year's convention will depart from previous custom by holding the election of officers at an executive session in the evening in connection with a dinner-dance and meeting of the Public Relations Section, at which addresses will be made by Chairman W. C. Bliss of the Rhode Island Public Utilities Commission, President Frank W. Smith of the N. E. L. A. and H. T. Sands, chairman Public Relations National Section.

On Friday the morning session will be occupied by reports of the Power, Lighting and Wiring Bureaus, and the afternoon will include a talk on "How to Merchandise and Sell Electric Ranges," by P. L. Miles, Chicago, and the reports of the Rate and Electric Vehicle Bureaus. In the afternoon E. W. Lloyd, Chicago, will speak, his topic being "Electrify."

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Great Lakes N. E. L. A. Program

The second annual convention of the Great Lakes Geographic Division of the National Electric Light Association, in joint meeting with the fourteenth annual convention of the Indiana Electric Light Association, will be held at the French Lick Springs Hotel, French Lick, Ind., from Sept. 27 to 30. Subjects of both technical and commercial character will be considered at this convention. Special entertainment features have been arranged for the ladies and a handicap golf tournament for the men. The Central Passenger Association has made the rate for the round trip one and a half fare. The tentative program is as follows:

Report of rural-lines committee, Eugene Holcomb, chairman Great Lakes Division, N. E. L. A.; "Merchandise Sales and Co-operation with Contractors and Dealers," John F. Gilchrist, vice-president Commonwealth Edison Company; "Desirability of Uniformity of Rate Systems," Alex Dow, president Detroit Edison Company; "Public Utilities as a National Institution," E. Hill Leith, Halsey, Stuart Company, Chicago; "The Inductive Co-ordination Situation," R. F. Pack, Northern States Power Company, and B. Gherardi, American Telephone & Telegraph Company; "Selling the N. E. L. A.," R. F. Schuchardt, chairman Technical Section, N. E. L. A.; "How the Great Lakes Division Can Help the N. E. L. A. Joint Committee on Business Development," E. W. Lloyd, Commonwealth Edison Company; "Safe Wiring" (illustrated), J. C. Langdell, Hodenpyl, Hardy & Company; "Power," Morse Dell Plain, vice-president Northern Indiana Gas & Electric Company; "Transforming Public Opinion," S. M. Kennedy, Pacific Gas & Electric Company; "Overhead Line Construction with Reference to Safety and the Safety Code" (illustrated), M. G. Lloyd, Bureau of Standards; report of women's public information committee, Miss R. E. McKee, Middle West Utilities Company; "Uniform Classification of Accounts," W. J. Myers; report of public relations committee, B. F. Lyons; round-table discussion, "Customers' Records and Billing Methods," led by J. H. Thomas of Peoria, C. H. Hansberger of Grand Rapids, P. A. Erlach of Springfield, Ill., B. F. McGuire of Chicago, and H. C. Mitchell of Indianapolis; "Store-Lighting Survey," Oliver R. Hogue and J. J. Kirk, Commonwealth Edison Company; report of educational committee, John H. Mitchell, East St. Louis Light & Power Company.

Frank W. Smith, president of the N. E. L. A., will address the association at the annual evening banquet on Sept. 28.

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Scheduled N. E. L. A. Committee Meetings

The first meeting of the public policy committee of the National Electric Light Association during the present administrative year will be held at national headquarters Thursday, Sept. 21. Martin J. Insull, chairman, will preside.

The second meeting of the national executive committee will be held at headquarters Wednesday, Sept. 20, and will be presided over by Frank W. Smith. At this meeting all budgets will be passed upon and the definite program of activities for the association already under way and partially outlined at the first meeting of the executive committee will be finally approved.

Meetings of the several committees of the Public Relations Section will be held at national headquarters beginning Tuesday morning, Sept. 19, and a meeting of the executive committee of the Public Relations Section will be held at headquarters Tuesday afternoon, Sept. 19.

Brief News Notes

Niangua River Development.—A tunnel through a hill on the Niangua River, 9 miles above Hahatonka, Mo., has just been completed, and concrete work on the dam being constructed there by the Missouri Water Power Company will start immediately. This dam is the first of four which are to be constructed by the company, which expects to generate 40,000 hp. The company will furnish power to Lebanon and twenty other towns, and it is said that Jefferson City will eventually be one of the cities supplied.

Empire District Company Has Big Dam Project.—The Empire District Electric Company of Joplin, Mo., has filed with the Federal Power Commission an application for a preliminary permit for a water-power development, consisting of a dam on White River and a power house in Taney County, Mo. This dam, which will be 175 ft. high and 2,500 ft. long, will cost $10,000,000 and will take 500 men two years to build, will generate 60,000 hp., according to C. L. Proctor, vice-president of the Empire company. Transmission lines will be built to Joplin and other cities in that section of the state.

Utah Power & Light's Green River Project.—Application has been filed with the State Engineer by the Utah Power & Light Company for permission to use 5,000 sec.-ft. and to develop by storage 300,000 acre-ft. on the Green River in Daggett County. With this water it is proposed to develop 188,000 hp. of electrical energy for use in Utah, Idaho and Wyoming. It is proposed to build a dam in the river near the Wyoming boundary and extend a pressure tunnel 19,800 ft. long southeasterly to empty into the Green River again in Red Canyon. This tunnel is to deliver water to five wheels capable of producing 37,600 hp. each under a head of 350 ft. to 415 ft.

Arkansas Valley Company Changes Name.—The name of the Arkansas Valley Railway, Light & Power Company, with headquarters at Pueblo, Col., has been changed to the Southern Colorado Power Company.

Switzerland's Coal Saving. — On account of electrification, Switzerland's consumption of coal is 800,000 tons less than before the war. From 1914 to 1920 no less than 425,000 hp. of new water power was fully utilized.

Senate Passes Salt River Bill.—The United States Senate has passed without debate, on report from its irrigation committee, the bill previously approved by the House authorizing fifty-year leases for surplus power developed by the Salt River reclamation project in Arizona.

Radio for Plant Communication.—Radio is being used to tie the main office of the San Joaquin Light & Power Company to the scattered generating plants. At present only a one-way conversation is contemplated for dispatcher service to the stations. The company also gives a radio broadcasting service at stated periods.

"White Coal" in New York.—Hydroelectric energy is saving the people of the Empire State $62,500 a day on their coal bills, according to the New York State Committee on Public Utility Information, which estimates the reduction in coal consumption due to water-power development at 12,500 tons daily and the average cost at $5 a ton.

Memphis Utility to Be Sold at Auction.—The Memphis (Tenn.) Gas & Electric Company will be sold at public auction on Aug. 28 under a federal decree, according to formal notice given by the company receivers at Memphis. The minimum price for the sale is fixed at $5,385,000. The company has been in receivers' hands since January, 1920.

"Doherty News" Reappears. — The *Doherty News*, the house organ formerly issued monthly for the benefit of the employees of Henry L. Doherty & Company and the Cities Service Company, New York, which was discontinued last year, has been revived as a semi-monthly paper, and the first number of the new series has been issued. Frank LeRoy Blanchard is editor.

Iowa Meter Committee Actively at Work.—The meter committee of the Iowa Section of the National Electric Light Association met at Keokuk recently to complete plans for districting the state and the better education of the men engaged in meter work. The committee is working in close co-operation with the engineering school at Ames to further the interests of the next short course, which has been set definitely for March 12-16, inclusive, 1923.

Tennessee Electric Power Company Plan Declared Operative.—The plan for organization of the Tennessee Electric Power Company to acquire the properties and securities of the Tennessee Power Company, Chattanooga Railway & Light Company, Nashville Railway & Light Company and Chattanooga and Tennessee River Power Company has been declared operative as of July 26.

Wapanucka Votes for Central-Station Service.—By a vote of 270 to 8 the people of Wapanucka, Oklahoma, have voted a franchise to the Public Service Company of Oklahoma to supply it with power and lighting. A municipally owned plant has been operating for several years, but has failed to give adequate service, and hence the town has turned to the central-station company for relief.

Iowa's Electric Utilities to Spend $6,750,000.—The public utilities of Iowa are spending, according to figures compiled by a state committee on public improvements, nearly $14,000,000 for enlargements and improvements. Of this amount the electric light and power companies are responsible for $6,750,000, which is to be expended for increased power-station facilities, new distributing systems and other equipment.

Pennsylvania Power & Light Now Serves Wilkes-Barre.—By the construction of a 66,000-volt transmission line from Harwood, Pa., to Wilkes-Barre the latter city has been added to the communities served directly by the Pennsylvania Power & Light Company. The new line went into service on July 24, connecting with the Ashley substation at Wilkes-Barre. It has 157 steel towers, which average about 80 ft. in height.

Long Island Utilities to Merge.—Negotiations have been concluded for the consolidation of the Nassau Light & Power Company with the Long Island Lighting Company, a combination which will give the new organization practically all the electric light and power and gas business of Long Island, N. Y., up to the New York City line in Queens County. Application to authorize the consolidation is to be made soon to the Public Service Commission.

Rural Electrification in France.—Success which has attended the operation of farmers' co-operative associations in France has led an association of farmers and peasants in the region of Saint-Martin de Londres to undertake the construction of a hydro-electric project in the gorge of the Hérault, from which thirty-seven rural districts will obtain their light and power. The development will cost 3,000,000 francs. The electricity commission of the General Council of the Department of the Seine is making a study of electrification in rural districts, but this project is the first actual effort to electrify rural areas in France.

Associations and Societies

Steinmetz and Lamme to Participate in Program of A. I. and S. E. E.—A tentative program of subjects to be discussed at the Cleveland convention of the Association of Iron and Steel Electrical Engineers on Sept. 11-15 was printed in the *Electrical World* for Aug. 12, page 343. A later announcement gives the names of those who will contribute papers. These include Dr. C. P. Steinmetz, whose subject is to be "Improvement in Efficiency of Electric Power Supply," and B. G. Lamme, who will give a "Review of Steel-Mill Electrification." Others contributing will be A. G. Witting, F. C. Watson, D. M. Petty, L. W. Heller, R. B. Gerhardt, D. B. Rushmore, F. W. Cramer, A. R. Leavitt, E. T. Moore, R. H. Bauer, F. A. Wiley, L. F. Galbraith and R. S. Shoemaker.

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Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Michigan Electric Light Association — Ottawa Beach, Aug. 21-23. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

International Association of Municipal Electricians, New Bedford, Mass., Aug. 22-25. C. R. George, Houston, Tex.

Conference of Local Electrical Leagues—Association Island, N. Y., Sept. 5-7.

New York Electrical League—Association Island, Sept. 5-7.

N. E. L. A. Geographic Divisions — New England, New London, Conn., Sept. 5-8; Rocky Mountain, Glenwood Springs, Col., Sept. 11-13; Southeastern, Atlanta, Sept. 12-15; Great Lakes, French Lick Springs, Ind., Sept. 27-30.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 6-9. H. M. Stine, 212 Locust St., Harrisburg, Pa.

Colorado Electric Light, Power and Railway Association—Glenwood Springs, Col., Sept. 11-13.

Association of Iron and Steel Electrical Engineers—Cleveland, Sept. 11-15. J. F. Kelly, Empire Bldg., Pittsburgh, Pa.

American Electrochemical Society — Montreal, Sept. 21-23. A. D. Spillman, Columbia University, New York City.

Illuminating Engineering Society—Swampscott, Mass., Sept. 25-28. Samuel G. Hibben, 29 West 39th Street, New York.

American Institute of Mining and Metallurgical Engineers—San Francisco, Sept. 25-28. F. F. Sharpless, 29 West 39th Street, New York.

National Association of Railway and Utilities Commissioners — Detroit, Sept. 26 J. B. Walker, New York Transit Commission, New York.

Indiana Electric Light Association—French Lick Springs, Ind., Sept. 28-30. Thomas Donohue, Lafayette, Ind.

American Electric Railway Association — Chicago, Oct. 2-6. J. W. Welsh, 8 West 40th Street, New York.

Empire State Gas and Electric Association —Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.

Association of Edison Illuminating Companies — White Sulphur Springs, W. Va., Oct. 11-14. Preston S. Millar, 80th St. and East End Ave., New York.

National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St.

Electric Power Club—Asheville, N. C., Oct. 30. S. N. Clarkson, 506 Laclede Gas Bldg., St. Louis.

Ontario Association of Electrical Contractors and Dealers—Toronto, Nov. 13-14. J. A. McKay, 24 Adelaide Street West, Toronto.

Commission Rulings

Municipality Acquiring Electric Plant Must Take Entire Property.—The Indiana Public Service Commission has ruled that the town of Brookville in acquiring the property of the Brookville Electric Company must pay for 9 miles of transmission line which will not be needed because of connection with another supply company. The municipality has also been compelled to assume the obligations of a contract providing that in case of sale the utility company would purchase another section of line.

Emergency Rate Reduction Justified.—A commission, the Utah Public Utilities Commission asserted in adjusting a complaint of the Utah Lake Distributing Company against the Utah Power & Light Company, is justified in ordering, as an emergency measure, an electric service company temporarily to change, modify and reduce rates and regulations affecting irrigation service when it is shown that buyers of this service are faced with an emergency rendering financial relief imperative. Rules to cover such a contingency were formulated by the commission for 1922.

Unprofitableness of Consumer's Business and His High Load Factor as Elements in Rate Making.—Dismissing a complaint made by the American Phosphorus Company against the electric rates of the York Haven Water & Power Company, the Pennsylvania Public Service Commission dwelt on the petitioner's contention that it had been compelled to close down its plant and might be forced out of business entirely. The commission ascribed this misfortune to foreign competition and prevailing economic conditions. "We are not convinced," the commission said, "that complainant's shutdown has been caused solely by increased rates for power, nor that such fact, even if established, would be sufficient in and of itself to establish a prima-facie case of unreasonableness." A claim of high load factor was answered by the assertion that the tariff complained against automatically benefited such consumers.

Commission's Power to Modify Certificate of Necessity Issued and in Force.—Establishing the principle that a certificate of public convenience and necessity granted a utility may be modified to meet changed conditions, the California Railroad Commission has ordered a division of territory between the Vallejo Electric Light & Power Company and the Great Western Power Company of California in Vallejo and vicinity. The matter came before the commission upon a complaint of the Vallejo company charging the Great Western with invasion of its territory. Certificates had been granted authorizing the two utilities to supply electricity in the same territory. The question involved was whether the commission had power to prohibit unnecessary competition or duplication of lines within such district by limiting the rights of the companies under their certificates. Admitting that the limitation of the rights of either to make extensions will result in a virtual revocation of its certificate as to part of the territory, the commission held that it has power to modify a previous order or decision at any time and that a certificate of public convenience and necessity is not a right which passes beyond all regulation or control. The Great Western company was therefore directed to make no further extensions of its lines and to construct no more distribution lines in the general territory of the Vallejo company.

Difference Between Depreciation Fund and Depreciation Reserve.—The distinction between a depreciation fund and a depreciation reserve was defined as follows by the Wisconsin Railroad Commission in proceedings affecting the Wisconsin Telephone Company: "A depreciation reserve represents the accumulated amount which the utility has reserved, generally out of its earnings, to meet the loss on retirement of property when that loss occurs. It appears as a liability account on the balance sheet of the company and is offset by whatever form of asset the reserve earnings may have been converted into. The depreciation fund represents cash or its equivalent in securities, and although the wording of the public utility law contemplates the establishment of a fund, it permits its diversion to other legitimate uses, so that there is nothing in the law which seems to contemplate that the accrued depreciation shall be offset by cash or securities."

Existence of Adjacent Underground Service Not a Bar to Lateral Extension.—Service to petitioners against the Edison Electric Illuminating Company of Boston is recommended by the Massachusetts Department of Public Utilities in a finding covering a proposed lateral extension from the company's underground lines in one of the main thoroughfares of Roslindale. The company protested against making the extension on the ground that the lateral street (Lee Hill Road) is abutted on by only three dwellings and that the cost of reaching these would be abnormal on account of the existing underground construction and permanent paving upon the intersecting main thoroughfare. The commission conceded that the expense of reaching the petitioners is somewhat excessive for the immediate revenue to be derived, but pointed out that the section of the city in question is more or less built up and that additional residences will undoubtedly be constructed in the near future upon the road. In the board's opinion, the immediate revenue expected would justify an extension under ordinary conditions, and it is held that the presence of the adjacent underground service should not debar the prospective customers on the lateral street from use of the company's facilities.

Recent Court Decisions

Ownership of Lots on Canal Implies No Right to Water for Power.—In Stebbins vs. Frisbie & Stansfield Knitting Company the Supreme Court of New York, Appellate Division, has held that the mere ownership of lots extending between a canal and a river which it parallels confers upon the lot owner no right to take water therefrom for power, nor has the lessee of a certain amount of water from a canal the prescriptive right to more. Owners of a canal for development of water power may recover as damages the value of excess power used by a lessee, but the owner of a power canal must have it of such size as to supply the amount of power therefrom which it has leased. (194 N. Y. S. 559.)*

Commission Authorized to Order Issuance of Securities to Discharge Debt Incurred in Development of Plant.—When moneys were advanced as loans to a public utility for the purpose of discharging, and were used to discharge, indebtedness incurred in the acquisition and construction of the utility's plant, the Ohio Public Utilities Commission had, by the decision of the Supreme Court of Ohio in Trumbull & Mahoning Water Company vs. Commission, authority to order the issue of stocks and bonds for the discharge or refunding of the obligations so incurred, whether incurred during or prior to the five-year period fixed in the statute. Moneys thus obtained, owing and unpaid, are not "moneys in the treasury of the public utility" (135 N. E. 449).

City Contracts Are Subject to State Police Power.—A city cannot assert, as against the state, that its contracts are protected by the inhibition of the federal constitution against impairment of contract obligations, the Supreme Court of Montana declared in City of Helena vs. Helena Light & Railway Company. While a state may preclude itself from exercise of its restrictive power over the contracts of a municipality by authorizing it to contract with a public utility for a given service for a definite period, the courts will not recognize such surrender of power unless unmistakably expressed by legislative act or necessarily to be implied from powers expressly granted. The Supreme Court, however, reversed a finding for the company, which sought to discontinue a certain railway line, declaring that the contract with the city remained valid until upset by the state, and that the agency established by the state in such proceedings was the Public Service Commission. (207 Pac. 337.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

J. F. Owens Heads Chamber of Commerce

The election of James F. Owens, vice-president and general manager of the Oklahoma Gas & Electric Company, to the presidency of the newly organized Oklahoma State Chamber of Commerce brings to the organization as its chief executive a man well qualified by nature and experience to fill the office. Mr. Owens was born in Aurora, Ill., in 1878 and was graduated from Kansas State University in 1901. He entered the service of the Baldwin (Kan.) Gas Company in 1905 and soon was advanced to the position of manager. Later he went to Wagoner, Okla., as local manager of the gas company, but in 1910 resigned to join the Muskogee Gas & Electric Company. After seven years he became head of this company, and in January, 1918, was selected as vice-president and general manager of the Oklahoma Gas & Electric Company, the position he now holds. Mr. Owens was not long established in Oklahoma before his public spirit was recognized, and as a result he has been called upon to serve in every civic campaign of importance. He has an unusually wide acquaintance among representative business men of the state.

J. F. OWENS

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H. F. Shearer, manager of the Smith's Falls (Ont.) Hydro-Electric System, has resigned and assumed a similar position with the city of Welland, Ontario.

B. F. Boynton, claim agent of the Portland Railway Light & Power Company, was elected secretary-treasurer of the Pacific Claim Agents' Association at the annual convention held in Los Angeles recently.

Col. William Kelly, the chief engineer of the Federal Power Commission, is in California making a personal inspection of water-power projects.

E. Sammann, formerly chief electrician on the Board of Public Works of the city of Sturgis, Mich., is now connected with the Indiana & Michigan Electric Company as maintenance electrician of the steam plant at South Bend, Ind.

C. H. Birdseye, chief topographer of United States Geological Survey, is making an inspection trip through the Western States. On Sept. 1 he will join the party being formed by E. C. La Rue for a trip along the Colorado River. During Colonel Birdseye's absence E. M. Douglas will be acting chief topographic engineer.

A. L. Lewis, formerly vice-president and general sales manager of the Lux Manufacturing Company of Newark, N. J., has established himself in Canton, Ohio, as a manufacturer of fuse plugs.

E. D. Knight, formerly chief electrician with the Cabin Creek Consolidated Coal Company, Rayford, W. Va., is now chief engineer of the Virginia Electric, Inc.

Valere A. Fynn, well-known designing and consulting engineer, recently succeeded in climbing Mount Victoria, Alberta, Canada. This was the first time the feat had been accomplished, and his success adds new laurels to Mr. Fynn's renown as a mountain climber. The mountain is near Lake Louise and is 11,600 ft. high. Because of its steepness and ice-covered slopes it had baffled Mr. Fynn on three previous attempts to reach the summit.

E. C. Rutz has recently been appointed superintendent of power and maintenance of the Bryant Paper Company of Kalamazoo, Mich. Mr. Rutz has had experience with the Chicago Edison Company and with the Stanley Electric & Manufacturing Company. For many years he was field engineer with the Woodmansee-Davidson Engineering Company and was appointed director of the public utilities of Kalamazoo in 1921.

R. A. Lundquist, chief of the electrical equipment division, Department of Commerce, sailed on Aug. 10 from New York for a short trip through England, Sweden and Germany to study electrical development in those countries. He is especially interested in the superpower schemes in Sweden and England and is to give close attention to the rural development in the former country. He also will study the domestic-appliance market for American manufacturers in England. This survey will cover a period of about three months.

Dr. M. E. de Margerie, director of the geological service of France, will succeed Prof. J. Cavalier, who recently returned to France, as the French exchange professor in America, lecturing at Columbia, Cornell, Harvard, Johns Hopkins, Massachusetts Institute of Technology, Pennsylvania and Yale.

Eugene Vinet, who is now associated with the Middle West Utilities Company of Chicago, was formerly connected with the Shawinigan Water & Power Company, Montreal, where for sixteen years he engaged in various engineering and organization work, including construction, designing, operation, inspection and standardization. In his present position Mr. Vinet assists G. W. Hamilton, supervising engineer over all companies controlled by the Middle West Utilities Company and manager of several of these properties.

EUGENE VINET

E. G. Newton is to be chief engineer of the new plant which the West Missouri Power Company is building in Clinton, Mo. At the present time Mr. Newton is in charge of construction.

Arch Robison, who has been in Florida for the past year with the Southern Utilities Company, is now in charge of construction work under way for the Virginia Western Power Company at Ronceverte, W. Va.

Gordon Kribs, formerly assistant engineer with the Hydro-Electric Power Commission of Ontario and latterly engaged in the manufacture of the Kribs electric washing machine, has been appointed chief electrical engineer to the New Brunswick Power Commission.

W. Paxton Little, for many years associated with the Niagara Falls Power Company and the Canadian Niagara Power Company, has recently been appointed chairman of the Accounting Section of the Canadian Electrical Association.

Francis H. Achard, formerly associated with the Angus Company, Ltd., Calcutta, India, has joined the inspection department of the Stone & Webster Engineering Corporation at Pittsburgh, Pa.

G. P. Baldwin Is Manager G. E. Merchandising Department

G. P. Baldwin, who was recently appointed manager of the newly organized merchandising department of the General Electric Company, was made manager of the Pittsburgh office of that company about thirteen years ago. From there he was transferred to Philadelphia as district manager. Before his connection with the General Electric Company Mr. Baldwin had been engaged in the street-railway business in the capacity of road engineer of one of the large Western traction companies. Later he joined the Stanley Electric Manufacturing Company as one of its representatives on the Pacific Coast. He was born in California and was graduated from Stanford University in 1896. During the war Mr. Baldwin was on the staff of Gen. George W. Goethals at Washington.

G. P. BALDWIN

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Major H. S. Bannion, assistant chief engineer for the Federal Power Commission, has returned from a tour of inspection of power sites in Idaho and the Pacific Northwest.

H. D. Titus, formerly with McDonald & Kahn, building contractors and architects of Los Angeles, has recently been appointed district representative in the Southwest of the Square D Company, manufacturer of safety switches.

Irving M. Popkin, Detroit, has been appointed agent in Michigan for the Killark Electric Manufacturing Company, St. Louis. Until recently he was connected with the Great Lakes Electric Company, an electric jobbing firm in Detroit. Mr. Popkin is going into business for himself as a manufacturers' agent.

Boyd Candlish has been appointed manager of the Detroit branch of Herbert Morris, Inc. He was formerly chief engineer of the Herbert Morris Crane & Hoist Company, Niagara Falls, Ont., and is still acting in a consulting capacity for both companies on the design of special hoisting motors, magnetic brakes and controllers.

J. C. Foster has severed his connection with the Utica (N. Y.) Gas & Electric Company and is now with the Adirondack Power & Light Corporation, Amsterdam, N. Y.

Ernest Jones, formerly of Camaguey, Cuba, has been appointed assistant superintendent of the Butler district of the West Penn Power Company, Butler, Pa.

D. C. Green, vice-president and general manager of the Fort Smith Light & Traction Company, has been re-elected to the presidency of the Fort Smith Federated Welfare Association.

William W. Van Sant, formerly construction foreman with the Westinghouse Electric & Manufacturing Company, is now connected with the Brooklyn Edison Company in the same capacity.

R. S. Thomas, formerly assistant to the superintendent of the Water and Light Department, Blackwell, Okla., is now associated with the Benham Engineering Company, Kansas City, Mo., in the capacity of electrical engineer.

F. R. Whittlesey, former secretary of the Oregon Association of Electrical Contractors and Dealers and more recently field man for the Northwest Electrical Service League in Oregon, has left the services of the league and is now in the range sales division of the Portland Railway, Light & Power Company.

E. A. Robertson, who has been associated for the past year with the Moloney Electric Company, St. Louis, has been appointed district manager of the Chicago office of that company. Previous to his connection with the Moloney Electric Company Mr. Robertson was associated with the Westinghouse company and also with the Laclede Steel Company of St. Louis.

Joseph Paulson has recently assumed his new duties as representative of the A. G. Manufacturing Company, with headquarters in Los Angeles, succeeding A. B. Martin, resigned. Mr. Paulson has been with the Illinois Electric Company for the last seven years as purchasing agent and office manager. Prior to that time he had spent five years with the Western Electric Company in the Atlantic and Seattle districts. Mr. Paulson is a graduate of the Oregon Agricultural College and completed his training at the Westinghouse Electric & Manufacturing Company's works at East Pittsburgh, where he remained in the engineering department for a year and a half before going to the company's Atlanta office, where he was chief correspondent.

Anson H. Rees, formerly city salesman, has been made stores manager of the Illinois Electric Company in Los Angeles. Mr. Rees takes over the duties of this position after fifteen years of varied experience in the electrical industry. His first connection was with the Laclede Power Company of St. Louis, after which he completed his studies as an electrical engineer in the Missouri State University. Upon his arrival in California in 1898 he became purchasing agent for the Ventura Power Company and soon afterward was made general contract agent in charge of new business and advertising in the northern division of the San Joaquin Light & Power Corporation. For a number of years he was city salesman for the Illinois Electric Company. He will now have charge of the general offices, purchasing and service departments of the company.

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W. H. Burleson Joins Ohio Brass Company

W. H. Burleson has joined the Ohio Brass Company and will give his time to sales work in the high-tension transmission department of the business. Mr. Burleson is a native of Texas and was graduated in 1913 from the Agricultural and Mechanical College of that state. Since that time he has been connected with the Texas Power & Light Company, Dallas.

W. H. BURLESON

Obituary

John L. Swayze, general counsel for the New York Telephone Company and consulting counsel for the Bell Telephone Company of Pennsylvania, died suddenly of heart disease in a sanitarium in Watkins, N. Y. Mr. Swayze was fifty-four years old.

Albert Sechrist, president and general manager of the Albert Sechrist Manufacturing Company of Denver, Col., died suddenly last month after a nervous breakdown. Mr. Sechrist was a resident of Denver for more than fifty years and was considered a pioneer of the electrical industry in that city. After graduation from the University of Denver he settled at Greeley. Later he returned to Denver, where he purchased the fixture department of the Denver Gas & Electric Light Company, from which the present company is the outgrowth.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Restoring Radio to Health

The Order-Taking Period Now Over and Salesmanship Will Be a Factor—Broadcasting Here to Stay

BY DAVID SARNOFF
General Manager Radio Corporation of America

UNTIL very recently the demand for radio apparatus has exceeded the available supply, and this condition of affairs caused an unbalancing in the market and created conditions which were undesirable from every one's standpoint. At present, however, I think it may fairly be said that the supply of radio devices and material is not only equal to but greater than the immediate demand, and I feel that this change of circumstances marks the first real "milestone" in the progress of events since the beginning of the present year.

There has been a marked decrease in the volume of new business. This was not unexpected, particularly during the summer months when outdoor life holds more attraction than indoor activities and when a great many people are away from home enjoying their vacations. But there is already tangible evidence of increased business. The curve is again climbing upward, this time in a saner and healthier manner, for the wild rush and pyramiding of orders that formerly prevailed are not part of the present activities of the distributor and dealer. I feel sure that this curve will continue to rise until in the fall of this year it will reach a position which should satisfy every legitimate manufacturer, distributor and dealer whose interest in radio is not confined to "making hay while the sun shines," but whose efforts and concern are directed toward stabilizing the radio equipment market.

PRODUCTION MEETS DEMAND

Now that we have turned the corner in the matter of production and we are able fully to meet the demands of the market, distributors of radio apparatus should, in my judgment, proceed with the marketing of their devices with the understanding that radio, like other articles of merchandise, requires intelligent selling effort. The builders of apparatus have done and are doing their part in providing the necessary equipment. The "builders of business" must now prepare to take their share of the load. If the electrical supply jobbers and dealers are to be the business builders of the radio industry, they should not view with alarm or even regret the fact that the supply of equipment begins to offset the volume of orders which came without sales effort.

DAVID SARNOFF

A large percentage of the early demand for radio equipment came from amateurs and young enthusiasts who did much to stimulate the interest of their elders in this fascinating art. Evidence is at hand showing that present sales are not confined to the younger element but are extending to men and women in all walks of life. This fact in itself gives promise of a market which can be made large with proper sales effort and service. A reasonable stock should be built up during these months so as properly to take care of the fall trade and to avoid the uncertainties and undesirable conditions resulting from unpreparedness.

I have been told by a number of distributors and dealers that where they found a slackening in business they installed radio sets on a "trial basis" and that in the majority, if not in all, cases the sets were purchased after the period of trial. The dealer might well follow this lead and endeavor to arouse and sustain interest; for every satisfied customer in radio represents another selling agent when he talks to his neighbor about "radio" and his "set."

Moreover, radio affords the opportunity to establish a relationship between the dealer and the customer's home, and this fact should be of special significance to the electrical dealer, to whom contact with the customer's home means increased opportunities for sales not only in radio sets, radio parts and radio renewals but in the other electrical merchandise sold to the home.

BROADCASTING PERMANENT

A practically untouched radio market lies in the small towns and rural districts. Entertainments enjoyed in cities only are now through the agency of "radio" available to the country home, the small village and the hamlet. Contact with this market can be established through the small-town electrical dealers, hardware and general merchandise stores and by installing sets in the homes of leading citizens, thereby creating interest and building up trade in the community.

Despite the many problems inherent in the situation, some of which press for an early solution, and despite the difficulties which at the moment may appear to those associated with the radio market, my faith in radio broadcasting has not been shaken in the slightest. I hold the definite conviction that radio broadcasting is here to stay and will continue to grow and that its growth will be in proportion to the service it renders to the public. This is as it should be.

But the "order-taking" period is over. Work and intelligent sales effort should now be the aim of the radio distributor. The real radio business builder will find a market for his apparatus and his selling and service activities will be factors which will make for permanently stabilizing the radio equipment market in this second period of its development. It will be the tonic which the radio market, like all other markets, requires in order to enjoy a healthy growth.

Large Stocks Cut Profits

Dealers and Jobbers Must Not Be Tricked by Quantity Discounts —Danger of More Pyramiding

By G. W. Johnston

President and Treasurer
Mid West Electric Company
Omaha, Neb., and Des Moines, Iowa

VIRTUALLY every electrical jobber and dealer in the country is overstocked on one or more items. It would seem that they have forgotten or never known the relation of turnover to profit. There is not one of us who has not suffered within recent memory. Our last experience, of course, we blamed upon the war.

After the war the manufacturers, jobbers and dealers indulged in a wild orgy of buying. Orders were pyramided. The same article was ordered by the dealer from several jobbers, and each jobber placed orders for it with several manufacturers, hoping for early delivery from some one of them and not thinking of the possibility of receiving a surplus. When these articles finally became available and deliveries commenced depleted stocks were first built up and then became large. The cancellations that followed are now an old story.

But this is only part of the cause of overstocks. Quantity purchases earn the best discounts. The dealer ordering from the jobber or the jobber ordering from the manufacturer needs, for his immediate and logical stock requirements, say, ten pieces of a certain kind. He finds, however, that if he buys twenty or twenty-five pieces he will receive an additional 10 per cent discount. So, because people are not in business for their health nor from altruistic motives, this 10 per cent cries louder than turnover, and he buys the twenty or twenty-five articles where he needed only ten, and the rest go to frozen stock.

The amount of money tied up in stock grows; the interest on that money increases the overhead expense, and as an immediate consequence the profit is lessened not alone on this one article but on every other item in stock. The ultimate result is either a profitless business or higher selling prices.

G. W. JOHNSTON

Those who sell in wholesale quantities establish a differential scale of discounts to induce a larger volume of business. But the buyer, unless he has a very good reason for buying an unusually large quantity, should be extremely careful about taking advantage of greater discounts for the sake of a better price only. For rapid turnover means profit, while frozen stocks mean loss. In the matter of discounts, the legal maxim "Let the purchaser beware" may well be paraphrased. Let no one be cajoled into making foolishly large purchases by the attractive bait of higher discounts.

We approach now on a smaller scale the possibility of another period of pyramiding orders. The demand in some localities for materials to supply the present extensive building operations are exceeding the ability of local jobbers to meet it from stock. This is producing an increasing demand on certain manufacturers, and these supplies are falling behind in their deliveries.

This we have already found to be a dangerous practice, and the industry should not permit the tendency to grow. Better far to lose the profit on an order than to tie up in overstock an amount ten times as great as the profit made. Our memory of the war-time pyramiding debauch is still green, and we should not forget. For the practice will inevitably lead again to the wastes and disappointments of cancellation and of overstocking, which in turn will mean clogged turnover and loss of profits.

Survey of Business Conditions

Watt-Hour-Meter Stocks Are Ample for Present Needs

Watt-hour-meter stocks for residence use are reported ample to supply existing needs in the principal districts, despite the increasing demand brought about by completion of new homes.

Unlike the year 1920 and part of 1921, when central stations were generally out of house meters and factories were away behind in orders, supplies take better care of the demand. One authority in the meter market, however, said that he was not sure supply and demand would balance so satisfactorily one month from now, when the greater part of the past summer's construction would terminate.

The outlook in the meter market is reported promising. The increased capacity in the last year gives ample possibilities for increased production. Canadian demand provides a good export market, and even with the unfavorable conditions of exchange, the other export fields present a good demand. An improvement in exchange would open this market to a large extent.

Flexible Armored Conductor Prices May Be Increased

Flexible armored conductor prices are to undergo an upward revision—this is the well-founded opinion of certain jobbers in the East. Rumors to this effect have been current for some time, and it is known that manufacturers, too, are preparing for the higher prices.

Some jobbers in the New York territory are stocking all the armored cable that they can obtain, an *Electrical World* correspondent was informed by one of them last week.

Manufacturers are selling at present prices only for immediate shipments, they being reluctant to quote more than one month ahead.

During the earlier part of the summer many small shops, some in rooms of tenement homes, started turning out a cheap and unsatisfactory product.

Some of these "fly-by-night" manufacturers, as they are called in the market, are known to have held jobs in the textile district during the day and, with the help of their wives and children, to have operated machines in the manufacture of flexible armored conductor into the early hours of the morning.

Because of this faulty material, several fires in Brooklyn caused heavy damage to property. Contractors, who were none too careful, are now most discriminating in their selection. However, the situation is bettered, most of these shops are out of the competitive field, and dependable manufacturers hold sway.

Questioned regarding the possibility of a higher price going into effect in the near future, several leading producers said that the matter had been under consideration for some days. The amount of increase, of course, is unknown, but there are indications that it will be larger than 5 per cent. Production at present prices brings little profit, one manufacturer said.

Farm-Lighting-Plant Sales Prospects Are Good

Farm-lighting-plant sales prospects are brighter than they were two weeks ago. There has been quite a slump in the sale of these plants all over the country. Announcement of a bountiful crop last week makes the situation even brighter, as the farmer is in a cheerful state of mind and is more easily approached. Coming farm fairs are expected to stimulate business. Some companies are reported as sending out sales agents in expectation of closing many orders after the harvests are sold.

Pole-Top Lightning Arresters Are in Greater Demand

Lightning arresters of the pole-top variety are in greater demand than a month ago. They are reported responding to a good movement in the Middle West. Other good orders have been reported on the Pacific Coast and in the East, too. From the volume of inquiries coming to manufacturers, fair buying is in prospect.

No price changes have been reported up to date. It is known that many lines have been allowed to remain without lightning protection in the last few years, and some have been erected without it.

Lamp Buying in Fall Is Expected to Be Active

The fall buying movement in lamps promises to be extraordinarily good. Supplies in all types and sizes are reported sufficient to meet the heaviest demand except perhaps on some of the large-size lamps in certain sections.

In the East prospects for good fall sales are excellent. Jobbers in the New York district are finding an increasingly strong demand.

Consumer Demands Efficient Radio

Cincinnati Sales Manager Says Lessons Have Been Learned—Believes Prices of Standard Equipment Will Not Be Revised Downward for Some Time

THAT the consumer of radio apparatus has learned his lesson through buying apparatus of poor quality and that he has been educated to demand reliable products is the outstanding feature of an answer by an important radio manufacturer in Cincinnati to a questionnaire sent out by *Electrical World*. The company's sales manager writes as follows:

"The outlook for fall and winter business is, I believe, exceptionally good for efficient radio apparatus. The consumer has had his eyeteeth cut and has been educated to demand well designed and engineered apparatus that is efficient in performance. He will not be stung with sets of unknown quality or 'orphan' outfits manufactured prior to the slump. New developments and refined models are rendering the earlier types of receiving sets obsolete, and the industry is rapidly settling down to a stable and dependable foundation.

SATURATION POINT IS FAR AWAY

"There are, roughly speaking, 5,000,000 homes in this country the heads of which are paying income taxes and are potential buyers of radio equipment of the better grade. This vast potential market is far from being saturated, and from my experience in the automotive field, I know that it will be many years before the saturation point can be reached if it ever is.

"Current sales have fallen off approximately 65 per cent since June 1. This is due, in my opinion, to a combination of circumstances. Radio is, after all, a seasonable article. It is in its present-day form a source of entertainment and entertainment is in turn the basic reason for the popularity of radio with the layman. Vacations, outdoor sports, static and a general acceptance by the entire radio industry, manufacturers, jobbers and retail dealers alike, of the idea that summer months mean the death of radio sales, have all contributed to the slump that has been experienced in the past five months.

HAVE TAKEN ADVANTAGE OF LULL

"Deliveries are good. Many dealers are now receiving the goods that were ordered months ago, and to make it worse, there are no sales to move the stocks. As a result, no incentive exists for the dealer to order more. The better class of manufacturers, however, have taken advantage of the lull to increase manufacturing facilities and are preparing for the fall business that is sure to come. A number of 'fly-by-night' manufacturers invaded the field since spring and have been caught with limited capital and considerable stock (finished products) which they have been compelled to dispose of with no ready market to absorb the goods. This resulted in a price-cutting war between this class of manufacturers, and shoddy goods were unloaded on the trade at any prices that could be extracted from the merchants. Many dealers are now loaded with unsalable radio apparatus, and this fact alone is responsible in a great measure for the dealer's lack of interest today."

American Tariff Restraints on Japanese Wire Exports

Owing to the increase of the import tariff on American copper, Japan has found it almost impossible to export wire for electrical purposes. Except to China and Manchuria, Japanese exports of copper wire have fallen off considerably. The domestic demand, on the other hand, has increased, since most of the industrial factories in Japan are using electric power. The quotations for copper from Japan have, therefore, shown no remarkable change, according to reports to the Department of Commerce.

Foreign-Made Heating Devices Being Imported

Reports coming from various sources in the electrical industry indicate that there are a considerable number of foreign-made heating devices being brought into this country. Actual figures on the numbers being brought in are not available, some authorities frankly stating that they have no idea what they are, while others are positive the numbers are very great. Most of these devices, it is reported, are coming in from Germany.

Bill Would Compel Electrical Companies to Merge

A bill has been passed by the French Chamber of Deputies, and after slight changes by the Senate, authorizing the government to compel electrical generating and distributing companies to merge their interests and interconnect their lines through high-tension networks whenever the Minister of Public Works decides that this will result in better utilization of the energy, whether produced by hydro-electricity or steam. If the government does not wish to undertake the construction of the necessary lines, it can grant subsidies and compel the companies to build them.

This is the first step in the practical realization of the project for a nation-wide "superpower" system in France. Before going into effect, the bills must return to the Chamber of Deputies in its modified form. There is, however, little doubt that it will be accepted and become a law very shortly.

Report that Fans Had Very Satisfactory Season

Although unfavorable conditions during the past two months have caused poor fan sales, notably in the New York district, jobbers and manufacturers are of the opinion that the season just passed has been on the whole a very successful one.

Extreme optimism prevails among the manufacturers over prospects for next season's sales. One of the leading manufacturers states that he is planning to meet a 25 per cent increase over the 1922 demand, and producers, generally, expect to increase production. The basis of this optimism is said to be the ever-increasing use of fans in households. This business has nowhere near reached its peak. Plans are on foot to increase sales further by promoting the use of fans in cold weather for heating purposes.

Manufacturers' stocks vary. A certain representative producer has 25 per cent of this season's output on hand, but others report that they are entirely cleaned out. Ceiling fan stocks are very scarce.

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Urges Wider Use of Essential Business Statistics

Electrical companies are being urged by the Fabricated Production Department of the United States Chamber of Commerce to employ a wider collection of essential business statistics.

As a means of encouraging a more general employment of statistics this department announces that it is preparing to set up a service for chambers of commerce and trade associations for the purpose of informing them as to how statistical bureaus may be established and operated.

"During our last period of inflation the lack of accurate figures on production, consumption and stocks on hand was the prime cause of the runaway markets of that time," says the department in a bulletin which it is putting out. "The hue and cry of shortage in many lines was founded not on facts, but the lack of facts." Later the release of large volumes of goods brought demoralization and loss.

◆

New School Buildings to Aid Lighting Fixture Market

One of the most promising markets appears to be that of lighting fixtures for school buildings. Reports have been received from several sections of the country showing activity in that direction. The field seems to be fitted for the application of unit lighting fixtures, and certain manufacturers have been putting the situation squarely up to local contractors to go out and sell the equipment.

At the same time additional advantages are being offered for night school work through organizations not directly connected with educational institutions, and this is requiring the use of more room for night periods. In addition, unused portions of buildings are being put to use for educational classes.

With the coming of shorter days and the increasing use of educational buildings during periods when artificial illumination is necessary, it would seem that manufacturers and distributors of suitable lighting equipment should bend additional efforts in this direction through local electrical contractors.

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Prevailing Conditions Affecting Cost and Volume

Failures Increase. — This week all four sections of the United States showed increase in failures, resulting in a total almost equal to that of two weeks ago. Defaults reported to R. G. Dun & Company this week aggregate 402, compared with 347 last week and 407 the week before that.

Bank Clearings Gain. — Margin of gain in bank clearings over last year's figures narrowed further this week, the total of $5,825,393,000 at twenty cities in the United States, as reported to *Dun's Review*, being 9.9 per cent in excess of $5,299,557,014 of a year ago. Last week the increase was 12.1 per cent.

Price Level Practically Stationary.— Wide price fluctuations in some leading markets were witnessed last month, but Dun's index number for Aug. 1 discloses practically no alteration. While certain commodities advanced appreciably, there were offsetting movements in other quarters, and index number shows a decline of 0.1 per cent.

Steel Ingot Production Decreases.— Steel ingot production continues to decrease and is now in neighborhood of 30,000,000 tons a year, against average rates of 27,000,000 tons in the first quarter of the year and 35,500,000 tons in second quarter.

Business Volume Drops $1,000,000,000.—Volume of business for week ended Aug. 9 was $7,811,000,000, marking recession of $1,005,000,000 from total of $8,816,000,000 reported for preceding week, which was swelled by end-of-the-month transactions.

Bond Market Without Feature.—The bond market was dull and devoid of interesting features last week. Prices of corporation bonds remained firm, while Liberty loans fluctuated within narrow limits at level slightly under the high for year. Foreign government loans were still under influence of strained relations between Germany and France, and most issues traded in on the Stock Exchange lost ground. Railroad issues continued in great demand and bonds of gas and electric companies showed marked strength.

Foreign Exchange a Dull Affair.— The foreign exchange market last week was a dull affair as business was considerably restricted on account of interruption of cable service with northern Europe. Bankers practically gave up doing business and only undertook urgent transactions.

Small-Motor Supplies Are Becoming Shorter Each Day

Supplies of small motors are reported as becoming shorter each day. This condition has been brought on by the steadily increasing demand during the last five weeks. Fractional-horsepower motors are not being called for as they were in the earlier part of the summer.

Extensions of plants of small and large industries are responsible for much of the demand for motors. Among these industries are textile mills of New England and the Southern States, small manufacturers all over the country and irrigation companies and canneries in the West.

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Metal Market Situation

Copper Is Without Feature—Domestic Buying Mainly by Larger Electrical Companies

The copper market was without feature last week. The usual amount of copper is being sold for export, mainly in small individual lots. Inquiry is good in the domestic trade, and certain companies are trying to buy into the first quarter. They, however, are not willing to pay producers' prices, which are slightly better than 14 cents, delivered, on shipments which are far ahead.

Recently domestic buying seems to have been mainly by larger electrical companies and such wire and brass companies as have their plants situated within trucking distance of most of their customers and depend upon oil or hydro-electric service for power or else have ample coal supplies on hand.

July copper sales, foreign and domestic, are estimated by competent authorities in the trade to have been 125,000,000 lb., compared with 140,000,000 lb. for June and 210,000,000 lb. for May.

ELECTROLYTIC COPPER PRICES

Average prices in New York

	1922	1921	1920	1919	1918
Jan.	13.60	12.85	19.02	20.00	23.50
Feb.	12.97	12.79	18.61	16.91	23.50
Mar.	12.84	12.23	18.36	15.01	23.50
April	12.71	12.54	18.54	15.40	23.50
May	13.29	12.83	18.28	16.01	23.50
June	13.71	12.76	17.97	17.65	23.50
July	13.90	12.35	18.61	21.71	25.89
Aug.	......	11.76	18.44	22.22	26.00
Sept.		12.10	18.04	21.95	26.00
Oct.		12.75	16.30	21.50	26.00
Nov.	...	13.16	14.39	19.96	26.00
Dec.		13.67	13.48	18.48	25.29
Average		12.65	17.50	18.90	24.68

NEW YORK METAL MARKET PRICES

	Aug. 9, 1922	Aug. 16, 1922
Copper	Cents per Pound	Cents per Pound
Prime Lake	14.00 14.25	14.00 14.25
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	5.75	5.75
Antimony	5.25	5.25
Nickel, ingot	36.00	36.00
Zinc, spot	6.60	6.50
Tin, Straits	32.37½	32.20
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	10.50 11.00	11.00-11.25
Brass, heavy	5.75 6.25	5.75 6.25
Brass, light	5.25 5.50	5.25 5.50
Lead, heavy	4.62½ 4.75	4.62½-4.75
Zinc, old scrap	3.00 3.37½	3.00 3.37½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

BUSINESS in electrical materials is restrained severely by the railroad strike, reports from important centers indicate. Deliveries in conduit become smaller each day, some jobbers stating that they can no longer fill orders for smaller sizes which are in much demand. Increased activity in lamps is expected because of the coming longer days. Greater interest is being taken in radio apparatus, and batteries for receiving sets are reported to be selling in larger volume. Motors are selling especially well in the smaller sizes. Fixtures, in the better grades, are attracting added interest. Appliances, particularly flat irons and toasters, are gaining attention.

New York

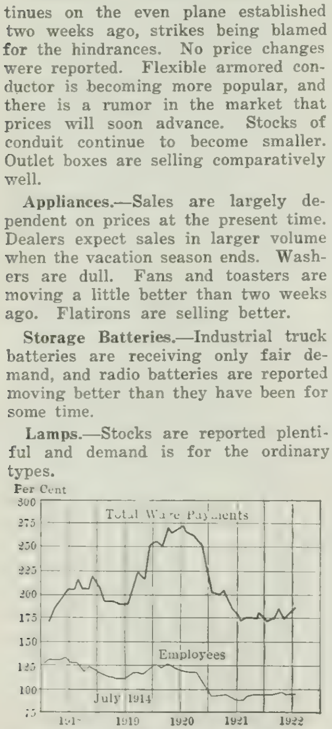
Appliance Sales Dependent on Prices—Lower Conduit Stocks—Flexible Armored Conductor Active

Demand for electrical materials continues on the even plane established two weeks ago, strikes being blamed for the hindrances. No price changes were reported. Flexible armored conductor is becoming more popular, and there is a rumor in the market that prices will soon advance. Stocks of conduit continue to become smaller. Outlet boxes are selling comparatively well.

Appliances.—Sales are largely dependent on prices at the present time. Dealers expect sales in larger volume when the vacation season ends. Washers are dull. Fans and toasters are moving a little better than two weeks ago. Flatirons are selling better.

Storage Batteries.—Industrial truck batteries are receiving only fair demand, and radio batteries are reported moving better than they have been for some time.

Lamps.—Stocks are reported plentiful and demand is for the ordinary types.



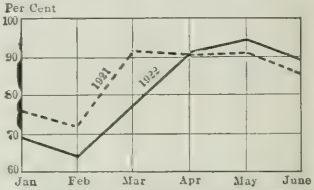
WAGE PAYMENTS IN NEW YORK STATE FACTORIES COMPARED WITH NUMBER OF WORKERS EMPLOYED. FROM MONTHLY REVIEW OF SECOND FEDERAL RESERVE DISTRICT

Fixtures.—Demand is for the better grades. Dealers are preparing for large sales in the early autumn.

Chicago

Wiring Materials Demand Steady—High Tension Manufacturers Active—Lamps Are Moving Well

Electrical trade is back to its normal stride again after termination of the street railway strike. Call for wiring materials is steady, but prices are firm owing to uncertainties involving the coal and rail strikes. Supply of smaller sizes of conduit is spotted since shipments from manufacturers are quickly disposed of to the trade. High-tension manufacturers are active. Lamps for home lighting are moving well. Radio has not started any action as yet, but jobbers look forward to a brisk fall trade.



RETAIL TRADE IN THE CHICAGO DISTRICT BASED ON REPORTS TO THE SEVENTH FEDERAL RESERVE DISTRICT.

Wire.—Normal active flow of rubber-covered wire was again resumed after settlement of the car strike. Prices are firm and No. 14 is available in 5,000-ft. lots at $6.35 per 1,000 ft. Stocks are normal. Bare and weatherproof wire prices are stiffening along with the rise in copper. The call for this material is spotted.

Conduit.—Variations in supply with most jobbers are chiefly restricted to smaller sizes. Shipments from manufacturers are distributed rapidly since demand is still strong.

Flexible Armored Conductor.—The market has been riding along with few changes. No. 14, two-wire, single-strip, is quoted at $44 per 1,000 ft. and stocks are in fair shape.

Lamps.—Movement is normal, the most active field at the present time being that of home lighting. The mill type for industrial purposes is gaining in popularity, although jobbers state that industrial buying has not started its full swing. Active business is expected in the fall.

Dry Cells.—Uniform, steady demand is reported by most jobbers.

Radio.—Although there has been no evidence as yet of the return in popularity for radio, jobbers are wisely looking over their stocks, replacing and adding to them so as to prepare for the fall demand, which they feel will be active.

Boston

Wire Trade Extremely Brisk—Tape Sales Fair—Flexible Armored Conductor More Popular

Tone of business continues strong despite strikes. Demand for wiring materials is well sustained and rigid conduit is running low in supply. Railroad buying continues good in jobbing circles. Building contracts in New England for the week ended Aug. 8 totaled $4,700,100, or slightly below last year's corresponding week. Electrical supplies are moving less actively in Maine than earlier in the summer.

Wire.—No. 14, in 1,000-ft. lots, sells at $6.25 per 1,000 ft., and prices are open at 5,000 ft. and above. Trade is extremely brisk and the supply excellent. Weatherproof is moving slowly at 15 to 15.5 cents base. Little demand for bare copper wire is reported, and there has been little resumption of last spring's call for radio aërials to date.

Tape.—Fair sales reported, ¾-in. black in 100-lb. lots moving around 40 cents per pound according to quality. House wiring is absorbing a good deal of this material.

Flexible Armored Conductor.—In 1,000-ft. lots, No. 14 sells at $43.20 per 1,000 ft., with good supplies and very active demand.

Atlanta

Jobbers Report Fair Telephone Equipment Market—Considerable Interest Given to Refrigerators

Steady and general improvement in business is reported, despite rail and coal strikes. So far the coal strike has caused no shutdowns, although the situation will become serious if the strike continues thirty days longer. Last week's cool snap caused a falling off in volume of fan sales.

Telephone Equipment.—Jobbers report business fair to good with a brisker market expected in early fall. Stocks and shipments are satisfactory and prices are steady.

Portable Drills.—Slow at present, but orders are being placed for fall stocks. Jobbers are expecting an excellent season, owing to extensive home building and to the fact that prices on this specialty will be from 20 to 25 per cent under those of last year.

Refrigerating Equipment.—Considerable interest is being displayed, and while no sales of moment have materialized, prospects are being followed up closely. Prices are steady.

Electric Ranges.—Only fair demand is reported although the field is being worked intensively and jobbers anticipate a much improved market in the near future. One of the largest central stations in this section has recently

Market Conditions for Four Weeks Ended Aug. 12

	New York	Chicago	Boston	Atlanta	St. Louis	San Francisco	Salt Lake City-Denver	Portland-Seattle
Conduit	Active	Active	Active	Active	Active	Steady	Steady	Active
Armored cable	Active	Steady	Steady	Active	Active	Active	Steady	Active
Wire	Steady	Steady	Active	Active	Slow	Steady	Active	Steady
Sockets	Active	Steady	Steady	Steady	Slow	Steady	Slow	Active
Knobs	Steady	Steady	Steady	Steady	Active	Active	Steady	Active
Switches	Active	Active	Steady	Active	Steady	Steady	Slow	Steady
Hollow ware	Steady	Steady	Steady	Steady	Steady	Active	Active	Active
Lamps	Steady	Active	Active	Steady	Active	Steady	Active	Steady
Motors	Active	Steady	Steady	Slow	Steady	Active	Steady	Steady
Refrigerators	Steady	Steady	Slow	Active	Active	Active	Active	Steady
Soldering sets	Steady	Steady	Steady	Active	Steady	Steady	Steady	Steady
Washing machines	Steady	Steady	Active	Active	Active	Active	Active	Active
Vacuum cleaners	Steady	Slow	Active	Steady	Steady	Active	Active	Steady
Fans	Slow	Steady	Active	Steady	Steady	Steady	Slow	Slow
Trend of prices	Up	Up	Up	Up	Up	Firm	Up	Firm

reduced its rate for this class of service, which should help to boost the volume of sales.

Electric Churns.—This line is slow at present, but jobbers have good stocks on hand to take care of demand, which is expected to pick up in the early fall. Prices are steady.

Porcelain.—Dullness, reported a few weeks ago, continues. Representative prices are: "Nail-it" knobs, $15.50 per 1,000; split knobs, $15.80 per 1,000; unglazed cleats, $15.90 per 1,000: tubes, $\frac{5}{16}$-in. x 3-in., $5.50 per 1,000—all in barrel lots.

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St. Louis

Schedule Material Stocks Sufficient to Meet Increasing Demand—Wire Demand Improves

Jobbers report little change in volume of business this week. Coal and railroad conditions are holding back progress principally because they are developing a mental attitude of caution on the part of industries and the general public until future conditions can be better foretold. Conditions otherwise are favorable for considerable expansion of electrical sales.

Money is easier, and long-standing obligations are being liquidated. Jobbers' stocks are in good condition except for conduit, which is very short, and wire, which is apt to be short if slow deliveries continue.

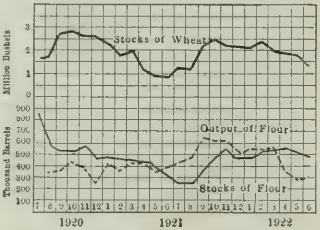
Schedule Material.—Stocks are in good shape to meet increasing demand, and sales this week were especially good. Representative socket prices are as follows, per 100 pieces in standard package lots: Key, $18.15; keyless, $16.50; pull, $33; mica weatherproof, $9; composition weatherproof, $9.65; porcelain weatherproof, $9.90. Similarly, two-piece rosettes are quoted at $10 and one-piece at $5.50. Single-pole non-indicating snap switches sell for $15.40 and single-pole indicating snap switches for $17.60.

Wire.—Demand for rubber-covered in sizes of No. 10 and smaller showed improvement during the week and deliveries are becoming more uncertain. Stocks are declining. The following prices obtain: No. 14, $6.50 per 1,000 ft.; No. 12, $9.50 per 1,000 ft.; No. 10, $12.50 per 1,000 ft.; No. 8, $15.74 per 1,000 ft.; No. 6, stranded, $32.46 per 1,000 ft.—all in lots of 5,000 ft. or more.

San Francisco

Vacuum Cleaner Sales Drop 30 per Cent—Fuse Market Is Reported Active

The freight situation is exceedingly critical owing to refusal of railway-operating unions to move freight through points protected by armed guards. This action has closed the main gateways out of the state, 2,000 carloads of perishable freight being stalled. Unless the acute situation is relieved immediately, many interior cities will be absolutely deprived of purchasing ability.



FLOUR OUTPUT AND STOCKS AT END OF MONTH IN THE SAN FRANCISCO DISTRICT. COMPILED BY TWELFTH FEDERAL RESERVE DISTRICT.

The feature of the past month has been the increase in Oakland building permits. In 1921 the total was nearly $16,000,000; 1922 will probably run 50 per cent more.

Vacuum Cleaners.—Sales have dropped about 30 per cent. Vigorous selling is necessary for any showing.

Washers.—Sales improving, mainly because of revised models. Local stocks are good.

Sewing Machines.—Dealers report added interest in this line. Dishwashers and ironers are slow movers.

Fuses.—Increase of industrial plants and completion of large buildings is bringing on excellent fuse opportunities.

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Salt Lake City–Denver

Strike Seriously Interrupts Business—Considerable Fan Stocks Held Over—Heaters Gain Interest

The rail strike has seriously interrupted freight traffic, delaying movement of shipments from factories to jobbers. All kinds of construction work is impeded on account of being unable to secure materials. Highway building in some cases has been temporarily suspended. Electrical jobbers report stocks generally in fair condition. Dealers are still trading from hand to mouth, ordering barely enough merchandise to tide them over from week to week.

Unless the strike clears up soon, fruit growers will sustain heavy losses.

Considerable fan stocks will be held over to another season.

Interest is centering in lines that will be seasonable during early fall, air heaters commanding attention. Dealers are replenishing stocks of lamps in anticipation of a pick-up in trade when the longer evenings are here.

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Portland–Seattle

Jobbers Report Good Business—Rubber-Covered Wire in Demand—Lamp Cord Advances

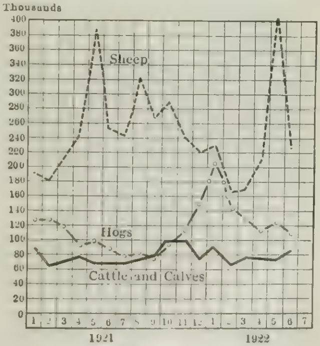
The unusually long dry spell throughout the Northwest, said in many sections to be the longest on record, was broken the latter part of the week by heavy rains. As a result the forest fire hazard has been almost entirely eliminated and much valuable timber has been saved from destruction.

Electrical jobbers report business good. Prices generally are stable with only slight adjustments taking place here and there. Thus far the railway situation has not caused any serious shortages in supplies.

Wire.—Rubber-covered is in good demand and prices remain steady. No. 14 is selling at $6.75 per 1,000 ft. in 5,000-ft. lots. No. 12 is quoted at $9.10 per 1,000 ft. in similar lots. Weatherproof is moving very well at prices which are somewhat higher.

Lamp Cord.—Advanced about 8 per cent in some sections. No. 18 cotton-covered is now quoted at from $13.40 to $15.45 per 1,000 ft. in lots of 1,000 ft. and 250 ft., respectively.

Lamp Sockets.—Movement is very good and stocks are in good shape. Prices are steady at the following approximate figures for the various types, per 100, in carton lots: Pull chain, $25, key, $24.75; keyless, $22.



RECEIPTS OF LIVE STOCK. (LOS ANGELES PORTLAND, SALT LAKE CITY, SEATTLE, AND TACOMA INCLUDED.)

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Keen Interest Shown in Radio Merchandising

Form Firm to Wholesale to Department Stores—Centralized Exhibition Scheduled for Sept. 1

ANNOUNCEMENT of the formation of a new radio merchandising firm to wholesale radio equipment to department stores was made last week. The new firm will be known as the Fourar Radio Corporation. The officers are: Alfred Fantl, president; William Dubilier, president of the Dubilier Condenser & Radio Corporation, first vice-president; Frederick Dietrich, president of C. Brandes, Inc., manufacturer of the Brandes telephone receivers, second vice-president; and Arthur Weisenberger, former director of research for the National Dry Goods Association, secretary and treasurer.

The new concern's purpose is to help conditions in the industry brought on by lack of standards, trade discounts, etc. It will handle only standard apparatus, and, according to the announcment, "will endeavor to maintain a standard which will render service to the public, to sell at prices which will enable manufacturers to guarantee deliveries, to provide a discount for the retailer that will permit profitable merchandising, and to remove complications now besetting the sale of radio so that its sale to the public shall be established on a sound, profitable basis."

President Fantl has given a definition of the significance of the corporation's title:

"The four 'R's' that stand back of Fourar Radio," he remarked, "are the initial letters of the motto and the spirit of this organization—'Reliable Radio for Representative Retailers.' As its sales force your mission is to sell merchandise having the unequivocal indorsement and backing of such manufacturing plants as the Radio Corporation of America, the Dubilier Condenser & Radio Corporation, C. Brandes, Inc., and the National Carbon Company. You are to sell this reliable, dependable radio merchandise to department stores which, in their turn, are as rich in resources and as high in repute with the American public."

To Open Radio Fair

Because New York City is the largest buying center in the United States there has been a growing need for a centralized exhibition of radio apparatus where merchants and purchasers could go to view representative apparatus. Such an exhibition, to be known as the Radio Fair, will be opened in the "Red Room" of the Hotel Imperial, New York, on Sept. 1, 1922, it is announced.

A large number of glass wallcases have been arranged in the room, and these will be rented out for a small sum to manufacturers of reliable radio apparatus.

The Radio Fair will be open to buyers only during the morning, and business cards will be accepted for admission. An expert radio engineer will be in attendance to explain and demonstrate apparatus to buyers. In the afternoon and evening the room will be open to the general public.

Arrangements have been made with Raymond Francis Yates, radio editor of the *Evening Mail*, to direct and manage the show. Only apparatus that is approved by Mr. Yates will be accepted for display.

The Radio Fair is being organized as a convenience to the many buyers who make the Hotel Imperial their headquarters while in New York. For a number of years past toy, automobile accessories and ready-to-wear shows have been held at the Hotel Imperial with great success. More than $8,000,000 in orders were placed at a recent toy fair.

◆

H. N. Blanchard Establishes Portland (Me.) Company

The H. N. Blanchard Electrical Company, Inc., has been established in Portland, Me., by Harry N. Blanchard, formerly of the Hay-Blanchard Electrical Company of the same city.

The new concern will have its headquarters in a building at 25 and 27 Casco Street, which was purchased at a cost of approximately $40,000.

The new company is incorporated with $50,000 capital stock and will engage in a general electrical and construction business and manufacture and deal in electrical supplies. Mr. Blanchard is president, and the other officers are George H. Mountford and Eugene L. Bodge, both of Portland.

◆

Refractory Company to Have Twelve Plants

Plans have been completed whereby the General Refractories Company, incorporated in Pennsylvania, is to acquire the entire stock ownership, assets and business of the General Refractories Company of West Virginia and other companies, the earliest incorporation of which dates back to 1900.

The new company will have twelve manufacturing plants with a capacity to produce 247,000,000 refractory bricks a year. It is one of the largest companies of its kind in the United States.

Award Contracts for Mills' Electrification

Lockwood, Greene & Company awarded contracts last week for the installation of electrical equipment in the Moore cotton mill at Valmead, N. C.; the Whitnell mill at Whitnell, N. C.; the Hudson mill at Hudson, N. C., and the Lenoir mill at Lenoir, N. C.

These mills are changing their motive power from steam to electricity and have arranged with the Southern Power Company to supply the current.

The Westinghouse Electric & Manufacturing Company received the contract for motors. Whitted & Hayward of Charlotte, N. C., representing the Movies Machine Company, received the contract for the fire pumps. Electric wiring will be done by Michael & Bivens of Gastonia, N. C.

◆

Trade Bulletin Warns Against Use of Cheap German Irons

Cheap foreign-made electrical devices are declared to be a fire menace by Chief T. A. Clancy of the Milwaukee fire department in a statement published by the Milwaukee *Journal*. Chief Clancy referred specifically to a quantity of electric flatirons made in Germany and recently imported into New York City.

"Recently a shipment of 180,000 German-made electric flatirons was unloaded at New York," said Chief Clancy. "These irons are being retailed at about $1 each, but are so constucted as to constitute a serious fire hazard. In addition, their life is short and they are a poor 'buy' at any price. They come without a stand, and with flexible cords and attachments that do not conform to United States standards. I wish to warn the public to shun these German devices and stick to approved makes of American irons."

Last week's bulletin of an important manufacturer of battery switches warned customers as follows:

"The iron had no stand; the heating element broke under test in from three to thirty-five minutes; no replacement parts were available; the attachment plug was of wood, one-piece type; the cord had less than $\frac{1}{32}$ in. rubber, with no 'braid covering of asbestos'; the cord was secured to the leads of the heating element in the base of the handle by brass bolts, poorly insulated, and the assembling was very bad and immediately developed short circuits on test.

"These points cover only a part of the rottenness of these German irons. Very few electrical men were fooled, but the cheap 'skin-'em-quick' crowd abounding in New York City as in other cities pushed them out to the poorer folks who thought to get a great 'buy' for a dollar and doubtless went away extolling German efficiency and deploring American robbers, etc.—that is, until they woke up with a sting. Then things looked different, and they were wiser beings.

"American goods are good enough for us!"

Ratify Wagner Electric Reorganization Plan

Stockholders Authorize 7 per Cent Cumulative Preferred Stock to Amount of $3,000,000—Property of Missouri Corporation to Be Turned Over

STOCKHOLDERS of the Wagner Electric Manufacturing Company ratified the proposed plan of reorganization of that company at a meeting held Aug. 4 by a vote exceeding 90 per cent of the total outstanding stock.

The financial program is as follows:

Authorization of 7 per cent cumulative stock to the amount of $3,000,000; bonds bearing interest at a rate not to exceed 7 per cent to the amount of $2,500,000; no-par-value common shares to the amount of 80,000 shares, of which approximately 58,270 are to be exchanged, share for share, with the holders of the present common stock, 20,000 shares to be used to accomplish the reorganization and refinancing of the company, and the balance to remain in the treasury for future use.

The $1,500,000 of preferred shares are offered to the stockholders at par, or $100 per share, with a bonus of two-thirds of one share of no-par common with each share of preferred stock taken.

By virtue of a requirement of the Missouri state law, preferred stocks cannot be issued without the consent of all common stock outstanding. This made it necessary for the company to go out of Missouri in this reorganization plan. Therefore the company has organized the Wagner Electric Corporation of Delaware, and all of the property of the Missouri corporation will be turned over to the new company.

At an organization meeting held a few days ago the board of the new company was elected as follows: V. W. Bergenthal, James M. Buick, Guilford Duncan, James H. Grover, W. A. Layman, John F. Lee, Joseph W. Lewis, Stewart McDonald, E. J. Miller, J. Herndon Smith and Harry J. Steinbreder.

Officers of the new company were elected as follows: W. A. Layman, president; A. H. Timmerman, vice-president; J. W. Westcott, secretary; V. W. Bergenthal, treasurer, and G. L. Evans, auditor.

◆

Kimball to Continue as Manager of G. E. Small Motor Sales

Fred M. Kimball, who has been announced as manager of motor sales division of the new merchandise department of the General Electric Company, will continue to act as manager of the G. E. small motor department with headquarters at Lynn, Mass., in which capacity Mr. Kimball has been serving for many years.

The business appertaining to manufacturers who purchase motors for combination with and sale as part of their machines and machinery remains with the small motor department under Mr. Kimball's direction as heretofore.

◆

National Carbon Company Extends Emergency Department

In order to reduce the time required for handling small and other emergency requirements of carbon brushes and to give better service to its customers, the National Carbon Company, Inc., has established two finishing plants, one at 337 East Forty-first Street, New York City, and the other at 560 West Congress Street, Chicago. These supplement the emergency department maintained for some time at the Cleveland factory.

Both of these plants carry complete stocks of all leading grades of Columbia carbon, graphite and metal-graphite brushes and are prepared to furnish all sizes equipped with standard types of shunt connections or other special methods of finishing.

Necessarily the capacity of these plants is limited, and it is the desire of the company that where delivery conditions will permit, orders for material of this kind be forwarded to Cleveland, as in the past. However, on breakdown jobs and other requirements of an emergency nature the users of brushes in the surrounding territories should avail themselves of the special facilities at New York, Cleveland and Chicago and should send their orders to the nearest plant.

◆

Westinghouse Continues Steady Increase in Business

The Westinghouse Electric & Manufacturing Company continues the steady increase in the current year's business. Despite strikes, interrupted coal movement and temporary let-up in certain of the industries, Westinghouse, reflecting the situation in the electrical field, booked twice as much business in the first days of August as in the corresponding period of July.

The company is running ahead of schedule on manufacture of apparatus to fill the seven-million dollar contract for the electrification of the Chilean state railways. Arrangements have been made for shipping this apparatus from points where ample boat capacity is assured.

A contract has been awarded to the company at $250,000 for switching equipment for the new switch house of the Westport station of the Consolidated Gas, Electric Light & Power Company of Baltimore.

The recent increase in the demand for power in the district near Pittsburgh has made it necessary for the West Penn Power Company to increase the capacity of its Windsor plant, and orders for three large transformers and a number of high-voltage circuit breakers and electrolytic lightning arresters have been placed with the Westinghouse Company.

A new high-voltage transmission line will be run to Washington, Pa., and Charleroi, Pa. This line will be supplied by three new transformers, which are oil-insulated, water-cooled, rated at 12,000 kva., single-phase, 60-cycle, and have high voltages of 132,000 and 66,000 and a low voltage of 11,000. The new equipment which will be installed in the Washington and Charleroi stations includes at each station two 132,000-volt type G-2 oil circuit breakers and one 132,000-volt type AK electrolytic lightning arrester.

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Canadian Brandes, Ltd., Reports Very Active Demand for Radio

C. Brandes, Inc., manufacturer of radio head sets, 237 Lafayette Street, New York City, has announced the establishment of its Canadian plant in Toronto, Ont. Edga Rypinski, formerly of the sales staff of the New York company, has been placed in charge of the Canadian plant. He assumed his duties Aug. 1.

The company states that since the Canadian plant has been established work has been rushed to complete the manufacturing facilities as there is a great demand for the firm's product in Canada and England. Soon after the establishment of the Canadian factory the entire output for six months was sold to Canadian customers. C. Perkins, Ltd., of Montreal, has been appointed representative of Canadian Brandes, Ltd.

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The Horn & Brannen Company, 427 North Broad Street, Philadelphia, manufacturer of gas and electric fixtures, has acquired property 84 ft. x 208 ft., at 1814 Spring Garden Street for approximately $100,000. The building will be improved and an addition erected at the rear.

The Concrete Steel Company, 42 Broadway, New York City, manufacturer of steel and wire products, will commence the erection of a one-story addition to its plant at Seventeenth and Federal Streets, Camden, N. J., in the near future.

The W. R. Ostrander Company, Inc., Brooklyn, N. Y., manufacturer of electrical supplies, has taken title to the six-story factory building at 83 Clifton Place, between Grand and Classon Avenues.

The Electric Supply & Equipment Company, Hartford, Conn., will take bids at once for the construction of a four-story factory branch, 42 ft. x 60 ft., at Broadway and Church Streets, Albany, N. Y. It will cost approximately $50,000.

The General Railway Signal Company, Rochester, N. Y., has closed a contract with the Great Northern Railroad for the complete installation of automatic block signals on 165 miles of track in Montana, Idaho, Washington.

Foreign Trade Notes

PROPOSED TELEPHONE DEVELOPMENT IN SOUTH AFRICA.—The South African government, it is stated, will appropriate £500,000 for telephone development in the Union during the coming year.

RAILWAY ELECTRIFICATION IN DUTCH EAST INDIES.—The government of the Dutch East Indies, according to the *Electrical Review*, has decided to equip all the railways in Java for electrical operation. Two power stations are to be erected to supply energy for this purpose at distances of 39 miles and 27 miles respectively from Batavia. The line between Meester-Cornelis and Tandjong-Priok will be the first to be reconstructed.

MARKET FOR ELECTRIC HEATERS IN CAPE TOWN, SOUTH AFRICA.—Owing to the fact that houses and office buildings in Cape Town are not equipped with central heating facilities and in many cases have no heating facilities at all, *Commerce Reports* states there is a good demand for electric heaters.

RADIO TELEPHONY IN ARGENTINA.—No laws as yet have been passed to govern wireless telephony in Argentina, but a bill is being drafted, according to *Commerce Reports,* to regulate the use of radio sets. At present no regulations in effect prevent the sale of broadcasting and receiving sets. The latter are being manufactured locally, but are of very inferior quality and sell at from 200 to 700 pesos. French tubes are used.

PROPOSED WATER-POWER DEVELOPMENT IN CZECHOSLOVAKIA.—The construction of a new power plant at Huszt in Russinia (Ruthenia) has been planned in addition to two hydro-electric plants now under construction in Bohemia, according to *Commerce Reports.* The project calls for a canal to connect the Tereblje (Talabor) and Velka Reka (Magyag) Rivers, both of which have their source in Russinia. It is estimated that 45,000 hp. can be developed.

SWEDISH POWER PLANTS.—A late report giving a general description of the state power plants in Sweden, published in English by the Royal Board of Waterfalls, has been received by the Bureau of Foreign and Domestic Commerce, Washington. Interesting data are given, particularly as to the Trollhattan-Vasteras line. Copies of the report are available for loan from the electrical equipment division or through any of the district or co-operative offices by referring to File No. 62,857.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A **Danish** (No. 3216) engineering firm desires to secure connection with manufacturers of wireless telephones with a view of importing to Denmark.

A merchant in Italy (No. 3,220) desires to secure an agency for the sale of railway material and all kinds of electrical and technical goods.

PROPOSED NEW POWER STATION FOR WELLINGTON, NEW ZEALAND.—The City Council of Wellington, the *Electrical Review* states, contemplates the construction of a power station at Shag Point.

NEW ELECTRIC PLANT IN PERUGIA, ITALY.—A new electric power plant, *Commerce Reports* states, is to be built in the district of Branca, Province of Perugia, Italy. The concession will be granted to the Società Lignitifera Umbra, which will be subsidized by the government for a period of twenty years. The new plant will utilize the national supply of lignite. The station will be equipped with three units of 5,000 kw. capacity each, one of which will be held for reserve use.

EQUIPMENT FOR MANGAHAO POWER SCHEME, NEW ZEALAND.—Tenders will be received by the Public Works Department, Wellington, New Zealand, according to the *Electrical Review,* for equipment for the Mangahao power scheme as follows: Until Oct. 24 for copper wire; Nov. 21, for battery booster-transformer.

ELECTRIC EQUIPMENT FOR ELECTRIC PLANT, WELLINGTON, NEW ZEALAND.—Tenders will be received by the Public Works Department, Wellington, New Zealand, according to the *Electrical Times,* until Oct. 3 for power-house and substation transformers, electric cranes, ventilating fans, lift and 11,000-volt insulators. Particulars may be obtained at the Department of Overseas Trade, 35 Old Queen Street, S. W., London.

PROPOSED IMPROVEMENTS TO ELECTRIC PLANT IN COROWA, AUSTRALIA.—The Municipal Council of Corowa, New South Wales, Australia, the *Electrical Review* states, has decided to change the municipal electric plant from a direct-current to an alternating-current system. The cost is estimated at about £30,000.

New Apparatus and Publications

ELECTRICAL HEATING REFERENCE DATA.—The Electrical Alloy Company, Morristown, N. J., announces the publication of a bulletin entitled "Electrical Heating Reference Data," embodying the experience and suggestions of an expert on electrical heating. It covers the subject exhaustively, from the method of determining the material adapted to certain specific conditions and the proper size and length of resistance wire to be used to suggestions for the actual designing of the heating element. In this bulletin the current-carrying capacity of resistance ribbon and strip is published for the first time. These charts will be available only in this publication. To make the bulletin complete as a reference work, the publishers have included numerous reference tables for which the engineer or designer has daily need.

RADIAL ARM DRILL.—The Van Dorn Electric Tool Company, Cleveland, has recently developed a radial arm drill for millwright work, known as the "Millwright Special."

RECORDS AND REPORTS FOR INDUSTRIAL PLANTS.—"Forms, Records and Reports in Personnel Administration" is the title of a handbook edited by C. N. Hitchcock which gives a collection of representative records and reports designed to give the personnel managers of industries the kind of information which will enable them to determine policies wisely and administer them effectively. The book is published by the University of Chicago Press, Chicago.

INSTRUCTIONS FOR LIGHTING.—"Five Home Lighting Recipes" is the title of a booklet issued by the National Lamp Works of General Electric Company, Nela Park, Cleveland, which gives instructions for lighting residences.

TOOL-HANDLE SWITCHES.—Two new types of electric tool and appliance switches have been developed by the Cutler-Hammer Manufacturing Company, Milwaukee. One switch, No. 7,037, is for installation in the handles of drills, etc., and the other, No. 7,039, is designed for use in vacuum cleaners and similar appliances.

REFRIGERATED WATER SYSTEM.—"A Neglected Source of Economy" is the title of a leaflet distributed by the Armstrong Cork & Insulation Company, Pittsburgh, dealing with the use of refrigerated drinking systems in manufacturing plants.

DYNAMOMETER CHASSIS TEST SYSTEM.—The Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York City, is distributing bulletin No. 48,718, describing the Sprague electric dynamometer chassis test system for car manufacturers, service stations and public garages.

New Incorporations

THE AUTLER ELECTRIC COMPANY, New York City, has been incorporated by L. and A. and B. Autler with a capital stock of $30,000 to sell electrical energy and appliances. B. B. Greller, 299 Broadway, is attorney.

THE CONTINENTAL ELECTRIC COMPANY, Newark, N. J., has been incorporated by Mauritz Larsen, North Arlington, Eric H. Anderson, Wallford A. Petersen, Belleville, and John Aauensen, Arlington.

THE WESTSIDE RURAL LIGHT & POWER COMPANY, Olympia, Wash., has been incorporated by L. E. Duval and Queen Young.

THE MARION COUNTY LIGHT & POWER COMPANY, Hannibal, Mo., has been incorporated by J. E. Weatherly, Dr. A. B. Blue, J. T. Ray and P. M. Fisher. The company is capitalized at $5,100 and proposes to erect electric transmission lines and distribute electricity.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MACHIAS, ME.—The property of the Washington County Light & Power Company has been purchased by the Bangor (Me.) Railway & Electric Company, subject to confirmation by the courts. The sale includes a water privilege on Saco Falls on Pleasant River in the town of Columbia, where a concrete dam is about 75 per cent completed. It is planned to complete the dam, which, it is estimated, will develop about 6,000 hp. It is also proposed to extend the lines to other territory.

MANCHESTER, N. H.—The boiler house of the Gale Shoe Manufacturing Company is being remodeled so as to furnish light and power as well as heat for the plant. New equipment, including a boiler and engine, will be installed. An 80-ft. smokestack will also be erected.

GLOUCESTER, MASS.—The Gloucester Electric Company has applied to the Department of Public Utilities for permission to issue $91,600, in capital stock, part of the proceeds to be used for extensions and improvements.

DEVON, CONN.—The Connecticut Light & Power Company, Waterbury, will begin work immediately on its proposed steam-operated electric power plant at Devon, to cost about $4,000,000.

North Atlantic States

BUFFALO, N. Y.—Application has been made to the State Water Power Commission by T. Kennard Thomson and Peter A. Porter, Marine Bank Building, for permission to construct a hydro-electric plant at Foster Flats, Lower Niagara River. The cost of entire project is estimated at about $25,000,000.

BUFFALO, N. Y.—Extensions are under consideration by the Niagara, Lockport & Ontario Power Company, including the construction of a power plant, the erection of a 20-mile transmission line from Athol Springs to Dunkirk, a 50-mile double-circuit transmission line from Dunkirk to Falconer and a 30-mile line from Athol Springs to Westfield. The cost of the work is estimated at $942,620.

JAMESTOWN, N. Y.—The Western New York Electric Company contemplates increasing the capacity of the Washington Street substation and the transformer and frequency station at Falconer, a suburb of Jamestown, and erection of high-tension lines throughout Chautauqua County, at a cost of about $453,880.

LONG ISLAND CITY, N. Y.—A power plant will be built by Ridley's, Inc., 345 West Fortieth Street, New York, in connection with its new candy factory at Queens Boulevard and Moore Street, to cost about $300,000.

MEDINA, N. Y.—The Western New York Utilities Company, Inc., has issued $200,000, in bonds, part of the proceeds to be used for extensions and improvements.

NEWBURGH, N. Y.—Plans are under consideration by City Manager McKay for the installation of a new ornamental lighting system on Broadway between Mill and West Streets. It is proposed to use single-lamp standards.

NEW YORK, N. Y.—Bids will be received by the Board of Purchase, Municipal Building, until Aug. 25 for furnishing electrical material and wire to the Department of Street Cleaning. Grover A. Whalen is chairman of board of purchase.

NEW YORK, N. Y.—Bids will be received by the Board of Health of the Department of Health, 505 Pearl Street, until Aug. 23 for the construction of a transformer building on the grounds of the Riverside Hospital, North Brother Island. Royal S. Copeland is president board of health.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, board of education, Flatbush Avenue Extension and Concord

Street, Brooklyn, until Aug. 22, for furnishing materials for use of mechanics, electrical division, in various schools in the various boroughs of the city of New York.

NEW YORK, N. Y. — Bids will be received by R. W. Rodman, superintendent of plant operation, board of education, Flatbush Avenue Extension and Concord Street, Brooklyn, until Aug. 21, for installing electric ash hoists in Public Schools 6, 33, 42, and 47, borough of Brooklyn, and electric forced draft equipment in Public Schools 28 and 46, borough of Bronx.

POTSDAM, N. Y.—The St. Lawrence Transmission Company is securing the right-of-way for a transmission line from its power plant at Higley Falls to Port Howe, a distance of 25 miles, to furnish electricity to the proposed new mill of the Wayne Lumber Company.

HACKENSACK, N. J.—An electrically operated pumping plant will be installed in connection with the proposed sewage-disposal works, to cost about $485,000.

BATH, PA.—A bond issue has been approved for the installation of an electric lighting system.

CLEONA, PA.—The Worth Chocolato Company, Hershey, will build a one-story power house in connection with its new local plant.

GRANVILLE, PA.—A two-story power house, 26 ft. x 60 ft., will be erected at the local home of the Knights of Malta. Harvey T. Hauer, Lebanon, Pa., is architect.

GREENVILLE, PA. — The Greenville Steel & Iron Company, recently organized, contemplates the construction of a 15,000-hp. power plant in connection with its proposed local steel works, to cost about $2,000,000. Colonel H. P. Bope, Pittsburgh, formerly connected with the Carnegie Steel Company, heads the organization.

HAMBURG, PA.—The Hamburg Gas & Electric Company has issued $35,000 in capital stock, the proceeds to be used for extensions and improvements.

NORRISTOWN, PA. — The Merchants' Association is considering the installation of an ornamental (cluster) lighting system on Main Street, from Green to Marley Street.

NORTH WALES, PA.—The Philadelphia Suburban Gas & Electric Company will build a transmission line from Quamby to North Wales.

PHILADELPHIA, PA.—The Philadelphia Brewing Company, Fairhill and Clearfield Streets, has completed plans for the construction of a one-story power house at its plant.

PITTSBURGH, PA.—Bids are being received by the Duquesne University, Bluff Street, for a three-story school, gymnasium and power house, to cost about $150,000. A. F. Link, 407 North Craig Street, is architect.

READING, PA.—The Reading Hardware Company will build a four-story power house 50 ft. x 96 ft., in connection with an addition to its plant.

ROWENNA, PA.—The Pennsylvania Railroad Company will extend its 2250-volt transmission line to Rowenna to supply energy for a new electrically operated pumping plant.

WARREN, PA.—The Warren Light & Power Company contemplates the erection of a 33,000-volt transmission line from Warren to Tidioute, a distance of 21 miles, to cost about $50,000. A. H. Stack is manager.

WELLSVILLE, PA.—The Edison Light & Power Company is reported to be planning the construction of a transmission line to Wellsville and vicinity.

WILKES-BARRE, PA.—The villages of Conyngham, St. Johns and Beisle's are reported to be making arrangements to secure electrical service from the high-tension lines of the Pennsylvania Power & Light Company to be erected from Harwood to Wilkes-Barre.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company plans to rebuild its coal-handling tower at its Spring Garden power plant, recently destroyed by fire with loss of about $25,000.

DENTON, MD.—The Eastern Shore Gas & Electric Company is erecting a transmission line from Greenwood, Del., to Denton (14 miles long), to furnish electricity in Denton, Greensboro, Ridgely and Hillsboro from its plant at Laurel, Del.

OAKLAND, MD.—The Town Council has given the West Penn Power Company, Pittsburgh, an option on the municipal electric light plant. A fifty-year franchise is also offered the company.

TERRA ALTA, W. VA.—Arrangements have been completed by the West Virginia & Maryland Power Company, a subsidiary of the West Penn Power Company, for acquiring the property of the Home Light Company. It is proposed to erect a high-tension transmission line from Cheat Haven through Kingwood to Terra Alta.

North Central States

BAY CITY, MICH.—The Michigan Central Railroad Company contemplates building a power house in connection with its proposed car shops at Bay City.

CLEVELAND, OHIO—Bids will be received at the office of purchases and supplies, City Hall, until Sept. 1, for economizers, forced and induced draft fans.

TOLEDO, OHIO — Plans for the proposed local glass manufacturing works to be erected by the Toledo-Libbey Owens Sheet Glass Company at a cost of $4,000,000, including machinery, provide for a power plant.

YOUNGSTOWN, OHIO—Plans are being prepared by the Penn-Ohio Power & Light Company to build a substation of 8,000 hp. capacity on Market Street Extension.

WINCHESTER, KY.—The Winchester Water Works Company has applied to the Federal Power Commission for permission to build a hydro-electric plant at the United States Lock and Dam, Kentucky River near Winchester.

AZALIA, IND.—The Interstate Public Service Company will build a new 500-kw. automatic substation in Azalia, to cost about $30,000. Extensions and improvements will also be made to the substation at Southport.

COLUMBUS, IND.—The Indiana Oil Refining Company will install a new electric power plant at its local refinery.

INDIANAPOLIS, IND.—The Silk Hosiery Company, North Noble Street, has filed plans for a one-story power house.

INDIANAPOLIS, IND.—Extensive improvements are contemplated by the Interstate Public Service Company to its power distributing system between Indianapolis and Louisville.

CHICAGO, ILL.—Bids will be received by W. J. Sadler, secretary of the Board of Local Improvements, until Aug. 21 for the installation of a new street-lighting system, consisting of 251 lighting units mounted on concrete standards. Shepherd & Hovey, 1623 Monadnock Block, Chicago, are consulting engineers.

SPRINGFIELD, ILL.—The Public Service Commision has granted the Central Illinois Public Service Company, Mattoon, permission to erect a 33,000-volt transmission line from Pawnee to Springfield for the interchange of power with the Illinois Power Company and has also given its approval of a contract for an interchange of power.

BIRCHWOOD, WIS.—The local plant of the Wisconsin-Minnesota Light & Power Company will be closed down and electricity will be supplied from the transmission line extending from Birchwood to Rice Lake.

SHULLSBURG, WIS.—The installation of an ornamental street lighting system, to cost about $25,000, is under consideration. W. F. Richardt, Watertown, is engineer.

FULTON, MO.—Arrangements are being made by the board of managers of the Missouri School for the Deaf for the installation of two boilers and other equipment in the power plant at the institution, for which bids have been received.

JOPLIN, MO.—The Empire District Electric Company has petitioned the Federal Water Power Commission for a preliminary permit for a water-power development on the White River, consisting of a dam, 175 ft. high and 2,500 ft. long and a power house. A transmission line will be erected to Joplin and other cities in this section of the state. The plans call for a development of 60,000 hp., at a cost of about $10,000,000.

KANSAS CITY, MO.—Bids will be received by the Fire Commissioners until Sept. 5 for fire-alarm system, including 130,000 ft. underground cable, 150 fire boxes, 29 fire stations, central exchange building, and also complete telephone and telegraph system.

LEBANON, MO.—Work will begin at once by the Missouri Water Power Company on the construction of a dam on the Niangua River, 9 miles above Hahatonka. This is the first of four dams to be built by the company in connection with a 40,000-hp. hydro-electric power development. The company plans to furnish electricity in Lebanon and to twenty other cities. Jefferson City, it is said, will eventually be one of the cities supplied. Arthur T. Nelson is president.

LYMAN, NEB.—A bond issue of $10,000 has been voted for the installation of an electric lighting system.

NEBRASKA CITY, NEB.—Work will soon begin on the erection of the transmission lines of the Nebraska City Utilities Company from Dunbar to Lorton and Otoe. The company also contemplates extending its line to Palmyra and Unadilla.

OTOE, NEB.—Bonds to the amount of $8,000 have been authorized for improvements to the electric lighting system. A transmission line will be erected from Dunbar to Otoe.

PLATTSMOUTH, NEB.—The Chicago, Burlington & Quincy Railroad Company, Omaha, will build a new power plant here, to cost about $50,000.

CANEY, KAN.—The Tri-State Electric Company, it is reported, will build a transmission line from Caney to Copan, Okla.

Southern States

ASHBORO, N. C.—The Reding Gold Mining Company, Danville, Va., plans the construction of a power house at its local properties.

SPARTANBURG, S. C.—Henry M. Earle, representing bondholders, has acquired the property of the South Carolina Light, Power & Railway Company at a receiver's sale. The company will be reorganized and extensions and improvements made.

SAVANNAH, GA.—The West Broad Street Merchants' Association has approved plans submitted by R. C. Brooks, manager of the Savannah Electric Company, for the installation of an ornamental lighting system on that thoroughfare. The plans call for eighty-three single-lamp standards, mounted with 600-cp. lamps, to cost about $12,500.

APALACHICOLA, FLA.—Bids will be received by the City Commission until Sept. 12 for equipment for a two-unit electric generating plant of 200-kw. capacity, to be operated in conjunction with the municipal waterworks system. The motive power will consist of one 100-hp. and one 150-hp. engine directly connected to generators. All communications to be addressed to F. B. Wakefield, city clerk and cashier.

JACKSONVILLE, FLA.—The City Council is considering the installation of a lighting system in Memorial Park.

JACKSONVILLE, FLA.—Bids will be received by the City Commission until Aug. 24, for a 600-kw. transformer, etc., and for a number of smaller oil-cooled transformers. R. N. Ellis is purchasing agent.

BROOKHAVEN, MISS.—Bids will be received by the Mayor and Board of Aldermen until Sept. 5 for improvements to the waterworks system, including well and pumping equipment, electric motors, control apparatus, etc. The Kramer Engineering Company, Magnolia, is consulting engineer.

COTTER, ARK.—The Dixie Power Company, which has been granted a permit by the Federal Water Power Commission to construct a hydro-electric plant on White River above Cotter, is seeking a permit to build a dam on North Fork River, east of Mountain Home.

RUSSELLVILLE, ARK.—The City Council is considering establishing a municipal electric light plant and waterworks. The cost is estimated at about $300,000.

RUSSELLVILLE, ARK.—The Arkansas Light & Power Company, Pine Bluff, is planning to build a hydro-electric plant on the Illinois River, to cost about $60,000. The project includes a power dam.

HAMMOND, LA.—The installation of an ornamental lighting system is under consideration by the Commission Council.

MADILL, OKLA.—The Madill Grain & Elevator Company plans to rebuild its power house, recently destroyed by fire with loss of about $25,000.

DALLAS, TEX.—A power house will be erected by the Allied Chemical Company in connection with its new chemical plant at Alma Street and Santa Fe Avenue.

SAN ANTONIO, TEX.—Bids will be received by the State Board of Control, Austin, until Aug. 26, for the construction of a power house at the Southwestern Insane Asylum. Phelps & Dewes, San Antonio, are architects.

Pacific and Mountain States

ABERDEEN, WASH.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system on Heron Street.

AUBURN, CAL.—The Bear River Water & Power Company, care of J. L. Reynolds, P. O. Box 22, plans the construction of a hydro-electric plant in Lake Valley, with initial capacity of about 3,000 hp.

LA PORTE, CAL.—William H. Spencer has applied to the State Water Commission for permission to construct and operate a hydro-electric plant on Nelson Creek, near La Porte, for power service at his gold mining plant.

LOS ANGELES, CAL.—The Little Power & Water Company has been granted permission by the State Water Commission to construct and operate a hydro-electric power plant on Rock Creek, to cost about $350,000.

OAKDALE, CAL.—Preliminary plans are under way by the Pacific Asbestos Corporation for the erection of a new asbestos mining and manufacturing plant to include machine shop, power house, etc. W. A. Sutherland, Fresno, is interested in the company.

OAKLAND, CAL.—Plans are being prepared by G. B. McDougall, state architect, Forum Building, Sacramento, for a one-story recreation building, two-story employees' building, one-story women's shop and a power house to be erected at the Oakland State Blind Asylum on Telegraph Avenue, to cost about $70,000.

RICHMOND, CAL.—The Western States Gas & Electric Company contemplates extending its transmission lines into the Rio Dell section.

SAN BERNARDINO, CAL.—The Santa Fe Railroad Company will build a power plant at its local shops, to cost about $100,000.

SAN FRANCISCO, CAL.—The Yosemite Power Company has applied to the Federal Power Commission for permission to build a hydro-electric project in the south fork of the Tuolumne River. The company proposes to build two reservoirs, a 17-mile conduit and a power house at Ward's Ferry.

GRANGEVILLE, IDAHO—The Standard Mining Company, Warrens, Ida., contemplates the construction of a hydro-electric plant on the Salmon River, near Grangeville, for commercial light and power service and for mine operation.

WEISER, IDAHO — The Mutual Power Association has applied to the Federal Power Commission for permission to build a hydro-electric plant on Crane Creek, about 20 miles from Weiser. The plans provide for using the water for irrigation purposes after passing through the power station. It is estimated that 2,800 hp. can be developed.

SALT LAKE CITY, UTAH—The Utah Power & Light Company has applied to State Engineer for permission to use 5,000 sec.-ft. and to develop by storage 300,000 acre ft. in the Green River in Daggett County. The plans provide for a development of 188,000 hp. for distribution in Utah, Idaho and Wyoming.

ARTESIA, N. M.—The electric plant of the Pecos Valley Gas & Electric Company has been put out of commission owing to the breakdown of the engine. The City Council is considering purchasing the plant and installing a new engine.

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Canada

CHARLESWOOD, MAN.—The ratepayers have voted to appropriate between $8.-000 and $12,000 for the erection of an electric distributing system to supply the municipality with electricity for lighting purposes. The service will be furnished by the Winnipeg Street Railway Company.

WESTVILLE, N. S.—A petition has been presented to the Town Council asking that action be taken to secure hydro-electric power from Malay Falls.

STAMFORD TOWNSHIP, ONT.—A bylaw authorizing an issue of $30,000 in debentures for extensions and improvements to the hydro-electric system of the township has been authorized by the rate payers. T. R. Stokes, Niagara Falls, Ont., is clerk.

TORONTO, ONT.—The Ontario Hydro-Electric Power Commission, it is stated, has under consideration a new 80-ft. power canal from Chippawa to Queenston, to cost about $100,000,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 1, 1922)

1,424,164. Electric Motor; Howard E. Hoover, Chicago, Ill. App. filed Sept. 16, 1918. Light motor for suction sweepers.

1,424,185. Device for Simultaneously Starting a Plurality of Internal-Combustion Engines; Max Schafer, Stuttgart, Germany. App. filed Dec. 12, 1912. Facilitates starting engines having dual ignition system.

1,424,201. Flywheel Magneto; August Kazenmaier, Stuttgart, Germany. App. filed March 12, 1920. Enables use of smaller-diameter flywheel.

1,424,219. Wire-Clamping Terminal for Low-Voltage Installations; Gottlieb Steiner and Jacques Bohli, Solothurn, Switzerland. App. filed July 6, 1921. Bifurcated clamp with jaw swiveled on pin.

1,424,256. Electric - Current - Changing Means; Clyde J. Myers, Indianapolis, Ind. App. filed April 4, 1918. Two slip rings added to direct-current machine for producing alternating current.

1,424,259. Cooling System; John F. Peters, Edgewood Park, Pa. App. filed July 30, 1920. Circulation of cooling medium through core of transformers, reactors, etc.

1,424,290. Contact Terminal; Frank F. Forshee, Flint, Mich. App. filed June 25, 1921. Strap-clamp contact for heating elements.

1,424,294. Signaling Unit for Wireless Telegraphy; Sydney G. Frost, Twickenham, England. App. filed May 11, 1922. Emergency hand-driven high-tension generator.

1,424,300. Control System for Single-Phase Motors; Rudolf E. Hellmund, Swissvale, Pa. App. filed Feb. 13, 1917. Current-limiting reactor also used as auto-transformer for starting.

1,424,326. Brush Holder; John E. Trostle, Wilkinsburg, Pa. App. filed July 7, 1920. Adjustable bracket surrounding armature for inclosed motor.

1,424,340. Electric Heating Apparatus; John C. Cavitt, Weirton, W. Va. App. filed April 27, 1921. Consists of water as element with automatic control.

1,424,346. Relay; John Erickson, Chicago, Ill. App. filed March 14, 1919. Circuit-closing device for alternating or direct current.

1,424,365. Radio Signaling; Edward H. Loftin, Washington, D. C. App. filed April 5, 1920. Horizontal antennas from which various combinations may be selected.

1,424,368. Substation Telephone Circuits; Talbot G. Martin, Chicago, Ill. App. filed Jan. 21, 1921. Connection of impulse sender in battery telephone circuit.

1,424,404. Power System; Frank O. Hartman, Mansfield, Ohio. App. filed Aug. 19, 1918. Engine-generator set for charging batteries.

1,424,443. Extension for Conduit Outlet Boxes; Carl H. Bissell, Syracuse, N. Y. App. filed June 21, 1918.

1,424,449. Rotary Advertising Device; Lucius H. Cammack and Henry A. Brown, Huntington, W. Va. App. filed Jan. 4, 1922. Machine for moving advertising display cards into position at predetermined intervals.

1,424,515. Rheostat; John Parkin, Jr., San Rafael, Cal. App. filed April 25, 1921. Variable resistance of the dial type.

1,424,567. Warming Device for Carburetors; Charles D. Higgins, Berkeley, Cal. App. filed March 14, 1921. Electric heater placed in manifold.

1,424,637. Electric Gage; Edson F. Galaudet, Providence, R. I. App. filed Sept. 26, 1917. Variable resistance controlled by float for gasoline tanks.

1,424,644. Automatic and Semi-Automatic Telephone System; Henry J. Herink, London, England. App. filed Nov. 10, 1916. Same connecting apparatus and junction lines used for connection between two subscribers and between subscriber and operator.

1,424,658. Molding; Edward S. Lidstone, Providence, R. I. App. filed Dec. 21, 1920. Two-conductor ornamental metal molding.

1,424,702. Electrical Control Apparatus; Max Wissinger, Essen, Germany. App. filed Sept. 8, 1920. Accelerating of direct-current motor.

1,424,716. Trolley Harp; Charles J. Dorrance, Chicago, Ill. App. filed Dec. 20, 1920. Cushioning arrangement to prevent dislodgment of wire.

1,424,717. Flexible Trolley Harp; Charles J. Dorrance, Chicago, Ill. App. filed Oct. 17, 1921. Shock-absorbing device.

1,424,726. Electrical Coil; Kenneth S. Johnson, Jersey City, N. J. App. filed Dec. 22, 1920. Transformer and balancing network combined in anti-side-tone telephone circuit.

1,424,731. Battery-Temperature Controller; Charles E. Linebarger, Chicago, Ill. App. filed March 17, 1919. Electric circuit in battery closed by thermostat.

(Issued Aug. 8, 1922)

15,429 (reissue). Flanged Article; Edgar C. George, Norwood, Ohio. App. filed July 15, 1921. Flanged insulating bushing.

1,424,752. Adjusting Integrating Electricity Meters; O. T. Blathy, Budapest, Hungary. App. filed Nov. 6, 1920. By means of a comparison with lamps fed from alternating-current source.

1,424,769. Hysteresis Power Transmitter and Brake for Phonograph Motor Mechanisms; Montford Morrison, Chicago, Ill. App. filed Sept. 5, 1916. Drives rotor at constant speed independent of motor.

1,424,805. Subterranean Signaling System; Lee de Forest, New York, N. Y. App. filed June 16, 1917. Pair of overhead base lines widely separated, each line formed between plates buried in earth and transmitting and receiving system associated with each line.

1,424,821. Apparatus for Incubating; Charles M. Heck, Raleigh, N. C. App. filed Nov. 19, 1914. Automatic heating with device for producing moisture.

1,424,860. Transmission System for Automobiles; Harry L. Tanner, Brooklyn, N. Y. App. filed Aug. 18, 1916. Electrically and mechanically interconnected dynamo-electric machines coupled to engine and load.

1,424,863. Key-Control Telephone Switch; Don C. Walker and Bonzano Weeks, Memphis, Tenn. App. filed Sept. 26, 1921. For isolated stations along railway track,

1,424,866. Method and Means for Relaying Modulated Carrier Waves; Peter I. Wold, East Orange, N. J. App. filed Feb. 17, 1917. Receiving modulated high-frequency oscillations and impressing them on a thermionic vacuum-tube modulator.

1,424,898. Gas Heater and Vaporizer; Thomas W. Gorman, Spokane, Wash. App. filed Feb. 23, 1921. Heating element between carburetor and intake manifold.

1,424,899. Meter-Testing Device; John L. Grayson, Morgantown, W. Va. App. filed Jan. 17, 1921. Test block installed with polyphase meters.

1,424,954. Spool or Holder for Commutators; Charles A. Van Dusen, Toledo, Ohio. App. filed Sept. 20, 1920. One-piece spool provided at ends with segment clamping flanges.

1,424,979. Electric Humidor; John E. Blount, Louisville, Ky. App. filed March 13,, 1922. Electrodes in water well, water acting as element.

1,424,993. Auto Theft Alarm; John I. Crosser, Tulsa, Okla. App. filed May 8, 1920. Alarm sounded if ignition switch is closed without proper key.

1,425,001. Ignition System; Valère A. Flynn, St. Louis, Mo. App. filed March 7, 1918. Battery ignition system operated in conjunction with generator.

1,425,003. Switch; Adolph A. Gazda, Chicago, Ill. App. filed Sept. 20, 1920. For preventing noisy operation of dashpots.

1,425,011. Joint for Electrical Conduits; James C. Herron, Chicago, Ill. App. filed May 12, 1920. May be angularly adjusted without danger of wearing the insulation of wire.

1,425,034. Portable Electric Liquid Heater; Oran W. Montgomery, Lakewood, Ohio. App. filed May 21, 1921. Water between carbon plates as element.

1,425,040. Electric Heating Iron; Nels A. Nelson, Bode, Iowa. App. filed May 24, 1919. Carbon-arc soldering iron.

1,425,047. Receiver Earpiece; Herman G. Pape, New York, N. Y. App. filed April 15, 1921. Diaphragm clamping element of greater pliability than main body.

1,425,049. Electrical Attachment Plug; Johann G. Peterson, Hartford, Conn. App. filed June 12, 1919. Fixed polarity plug.

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Too Much Tax Exemption

"A BETTER day is in store for the world," prophesied Chief Justice William Howard Taft at one of the sessions of the American Bar Association meeting recently held in San Francisco. Much of the time of this association was taken up in providing the machinery to promote the unification of law in the commonwealths of the nation and to make the laws on the statute books more easily accessible. Great concern was expressed over the increasing cost of government.

It is quite evident, however, that if the "better day" foreseen by Mr. Taft is to become a reality, the lessening of the tax burden must bulk more largely in the purposes of legislative bodies and in the daily thought of citizens. Something more than concern is needed. Action is the demand of the hour.

THE portion of the tax burden imposed on the few is increasing by leaps and bounds, while the tax-exempt class grows. It is estimated that there are approximately thirty billion dollars' worth of tax-exempt or semi-tax-exempt public improvement or government bonds outstanding. This means that the income derived from such securities escapes the burden of taxation, and that taxable industry and property must make up the deficit.

Figuring that the thirty billion dollars is yielding the holders of the bonds a return of 4 per cent, the government is losing the tax on income that it should receive from the greater part of the $1,200,000,000 these bonds return the holders annually in interest. Industrial or agricultural undertakings which produced $1,200,000,000 annually would be paying a large part of this return to city, county, state or federal government through taxes of various forms.

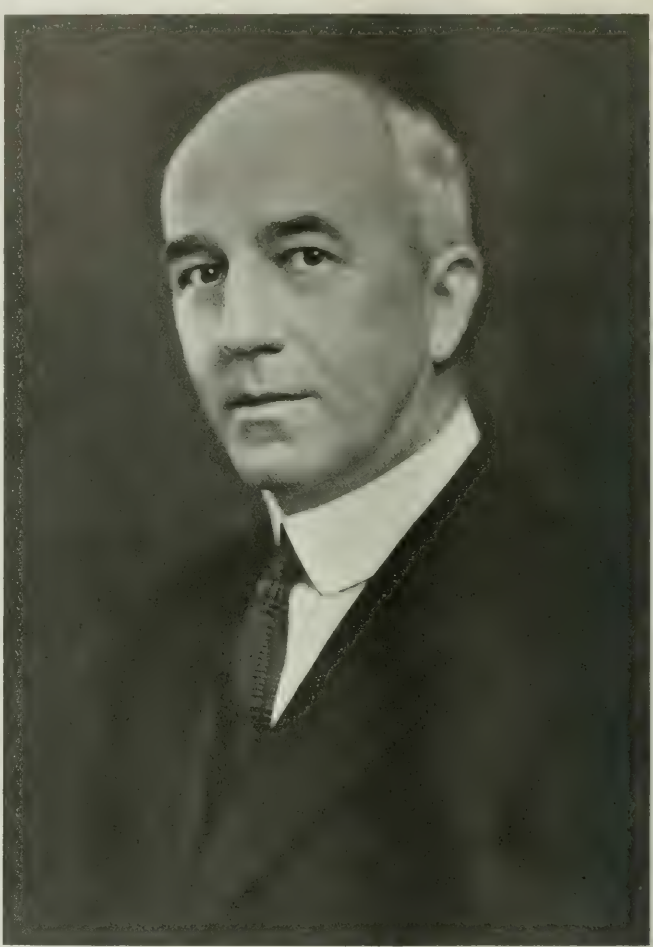
Nor has the movement toward tax-exempt securities yet been abated. Consider the case of California, where the so-called California water and power act to be voted upon by the citizens at the elections in November proposes to add $500,000,000 more to the already huge total of tax-free bonds and tax-free property in the state. Should this bill carry, California will have an indebtedness equal to 43 per cent of the combined indebtedness of all the states of the Union. It is already losing approximately $20,000,000 per annum in taxes because of tax-exempt federal, state and local bonds.

All attempts to prohibit the issuance of tax-exempt securities have so far failed. Our present system admittedly discriminates between taxpayers, impedes private financing and discourages investment in new enterprises. Unchecked, it may lead to social unrest.

HERE is something worthy of the thoughtful consideration of every citizen of the nation. At the present time 90 per cent of the taxable property carries the burden of government. Where is this going to end? Shall we wait until the percentage is seventy, sixty, forty, or until the last lone farm carries the entire load?

Preston S. Arkwright

An energetic utility executive, famous for his ability to establish good public relations.



IT IS of interest to contrast the good relations existing between capital, labor and the public in the central-station industry with different conditions in other industrial fields. For many years no better co-operation has existed between conflicting elements anywhere than is found in the electric light and power business. In this industry both the employers and the employees found the real meaning of the word service years ago, and strikes in a central-station organization are as extinct as the dodo. Central-station executives have learned that their organizations are composed of human beings, and the employees have learned that their duty is to serve other human beings.

No one has had a greater influence in establishing ideals of service than Preston S. Arkwright, president of the Georgia Railway & Power Company. His brilliant legal attainments and his sound executive abilities enabled him to take a disorganized and troubled utility situation in Atlanta and change it into one that is now in many respects a model for other localities.

In a very few years he mastered the utility business and built up a consolidated and co-ordinated system in Atlanta that stands for service, efficiency and financial integrity. On this work his ability to make and win the friendship and support of his associates was a decided asset.

Through straightforward dealings with the employees and the public Mr. Arkwright made his company famed for the civility and kindness of the employees and for its conception of service to its customers. He was born in the city of Savannah, Ga., Feb. 24, 1871. He moved to Atlanta immediately after his graduation from the University of Georgia in 1891 and, without powerful connections or the advantage of financial strength, found himself president of the biggest public utility corporation in the Southeast in little more than ten years.

When he became president of the Georgia Railway & Power Company in 1912 hydro-electric power development was practically unknown in the South. As president he has seen the company acquire the Bull Sluice development and plunge into the wilderness of north Georgia to harness the waters of the Tallulah and Tugalo Rivers, one of the biggest hydro-electric projects undertaken in the southern part of this country.

Mr. Arkwright's time has been thoroughly taken up in the past twenty years. He is now a member of the executive committees of both the National Electric Light Association and the American Electric Railway Association. He has been vice-president of the Southern Banking & Trust Company, vice-president of the Title Guarantee & Trust Company, vice-president of the Union Pinopolis Sawmills and vice-president of the Aripeka Sawmills.

In all Mr. Arkwright's association with big business he has never lost sight of the viewpoint of the other fellow, gained while he was fighting for the ground he now holds. A few months ago the Atlanta Federation of Trades adopted resolutions commending his broad-gaged attitude toward organized labor, and when the Amalgamated Association of Street and Electric Railway Employees of America met in Atlanta last year he received the signal honor of being the only employing executive ever invited to address that body. He is a member of several clubs and a frequent and popular speaker at Rotary Club activities throughout the country.

Editorial Comment

Electrical World, August 26, 1922
Volume 80 Number 9

Electric Utilities Over the Hump

IT IS very gratifying to observe the splendid operating and financial conditions in the electric light and power industry. Very largely this situation has arisen through recognition by the utilities that the public is entitled to know the facts in the industry. The public has real information and acts with confidence in dealing with the light and power companies.

This condition was brought about by hard work and co-operative effort on the part of utility managers and commissions. The embryo and incompetent regulatory bodies are gone just as the wildcat stock promoter has gone, and today good public and governmental relations are recognized assets in the utility business. Economic waste is less in the light and power business than in any other industry because financial, labor and operating conditions have been worked out on a basis of fact and because the public and the operator have been educated to appreciate the value of mutual confidence.

More than a quarter of all corporate securities issued in this country during the year have been those of electric public utilities—a total in excess of $400,000,000. Despite unsettled labor conditions and stagnant industries, the production of electric power has not varied in amount by more than 6 per cent since 1918, and the investors of the country have responded to this stabilized condition of the industry. New capital for electric utilities has been obtained at a rate which gives an average yield of above 6 per cent for long-term bonds and about a 7 per cent yield for short-term bonds.

Now is the time to secure new capital, to expand the light and power industry and to build for the future. The farms, the unwired houses and the many appliances are ready for electrical energy. The industrial depression is about over, and every electrical utility should now anticipate and prepare for its future load, so building its business that it will not be dependent on any one class for its profit.

"An Engineer's Civilization and a Lawyer's Government"

THIS apt characterization of the way in which our national government has frequently failed to respond to the genius of the American people fell recently from the lips of Edwin Ludlow, retiring president of the American Institute of Mining and Metallurgical Engineers. If, like most pithy sayings, it cannot be taken with absolute literalness—indeed, Mr. Ludlow's expansion of his thesis showed that he did not intend it to be so taken—yet it contains no small degree of truth. Engineering is dynamic; the law is static. Engineering is in haste to get on the job; the law's delay was ancient in the time of Hamlet. Engineering is for tearing down obstacles; the law is prone to erect them. Engineering tunnels the mountain; the law follows a tortuous path around its base. Engineering is mathematical and is founded on the exact symbols of arithmetic; the law is literary and dwells fondly on commas and diacritical marks.

This is a government of laws and not of men, as we are frequently reminded. The law is and must always be supreme. Lawyers, however, are men, and to their hairsplittings and professional hesitations an undue amount of political reverence has sometimes been accorded. Perhaps engineers, as their influence in government increases, will, with their shorter-cut methods, their more practical outlook, their bolder attack and their greater concern for general interests when these clash with particular ones, make the science of government express more fully the national delight in accomplishment as contrasted with debate than the preponderance of legal minds in Congress and Cabinet has made possible in the past.

Value of Conference in Revising Engineering Education

EDUCATION for the profession of engineering is a topic of unfailing interest to both educators and practical engineers. This is probably due to the difficulty of testing in application new methods for differences in points of view. The results of any new plan can only be observed over a period of years, during which conditions may change, and they are especially subject to error due to the wide difference in the natural characteristics and earlier preparation of the student body. Variations in the quality of raw material will affect the product of any process, and these variations are so wide in the case of the material coming to engineering schools as seriously to mask the probable value of any modification of method which may be introduced. Discussions on this topic are of particular value when engineers and educators meet. They have not always agreed. Not so very long ago a well-known industrial manufacturer seriously and publicly announced that for the needs of industry, as he saw them, he preferred a young man without, rather than with, technical collegiate training. Happily this extreme attitude is apparently limited to this solitary case.

There are now many evidences of the desire on the part of both industry and education to come together for discussion as to how they can mutually help each other for the betterment of the product of our engineering schools. Particularly interesting from this point of view was the meeting at the recent convention of the American Institute of Electrical Engineers devoted to engineering education. While the several papers prepared with obvious care by engineers were not without their radical suggestions, they were nevertheless offered with such obvious intent of helpful comment and were answered by the educators in such a temperate vein in discussing their value and practicability as to set at once a new standard of mutual understanding. Present opinion seems to agree that formal engineering training should be directed away from, rather than toward, those aims of early engineering educators to bring the student into intimate contact with the materials and machinery of the profession. These methods are better left to purely vocational schools. Premium is now put on the development of qualities of character, such as clear thinking, persistence, observation, etc., and on instruction in the subjects making up a general education, confining instruction in technical subjects to the later years, and insisting on principles rather than the enumeration of various applications. It is recognized also that probably the most important factors bearing on the quality of the product of our engineering schools are the character of the raw material entering and the personal teaching ability of the instructors. The opportunities offered by improvement in either of these particulars are far greater than those pertaining to the introduction of this or that new subject.

Dubious Factors in Illumination

WE SINCERELY wish that the Illuminating Engineering Society would take up through some of its committees the still mooted point of the relation of color to effective illumination. Somehow or other it seems almost impossible to have a real investigation of this matter unmixed with irrelevant psychological and physiological data from which it is difficult to separate the facts. For instance, there are available for purposes of illumination lights of different color, ranging, let us say, all the way from the neon tube at one end of the spectrum to north skylight, so called, at the other, together with mixtures of all the intervening colors in various proportions. Now, the unfortunate fact is that up to the present we do not know definitely whether light of one color or that blended of several, including perhaps all, is really the more desirable for practical purposes. This difficulty exists because most of those who undertake so-called practical investigations in matters of this kind have not had sufficiently wide experience and lack the broad knowledge necessary to determine the facts. In particular, there has been a constant mixing up of physical with physiological and psychological conditions which renders the results extremely uncertain.

For illustration, perhaps no experiments have been more striking than those correlating speed of perception with illumination. Yet the data on speed perception are actually very closely connected with the fatigue effects on the ocular muscles, which in turn depend on the kind and rate of movement implied in the hasty observations. Color effects observed under such circumstances would in all probability bear no simple relation to static acuity tests or to the still more uncertain reaction time tests, which hopelessly mix up two probably quite independent variables. It is not even quite clear yet whether daylight in the raw, so to speak, is preferable to more nearly monochromatic illumination either from specialized sources or obtained by screening out some of the colors of daylight. All these things are of considerable practical importance in illumination and ought to be determined with something like final precision. The job is distinctly one for collaboration of the physicist, the psychologist and the ophthalmologist, a combination hardly to be expected in any one individual, but entirely feasible in a committee of a body enrolling a diversity of experts. Many another topic in illumination can be advantageously handled in such a way, but we know of none which needs at the present time more concentrated effort.

The Electrification of Soviet Russia

SURPRISING testimony as to the value of electricity to civilization is borne by Nicholas Lenin. At the last All-Russian Congress of Soviets he referred most glowingly to the electrification of Russia and reduced the complexity of Communism to the following simple formula: Soviet power + electricity = Communism. Lenin visualizes imperative and immediate work of tremendous scope and importance through the agency of electricity, which he proposes to employ for the economic construction and enrichment of Soviet Russia. For the purpose in hand the whole of Russia will be supplied with energy from superpower stations. Her naphtha, coal and peat will be utilized in this way for the production of electricity, and the country's water powers will be developed for the same purpose. A complete scheme for the electrification of the nation, her railways, farms and industries, has been prepared by an engineer named Krzyzanowski. Whatever else people may think of Lenin and his doctrines, it is evident that his scheme for the electrification of Russia is sane and far-reaching in its effect. It may fail utterly for a thousand and one reasons, or it may be brought to function. Good and lasting things grew out of the destruction wrought by the French Revolution, and who knows but that an electrified Russia may arise in the future due in part to the visions of the Moscow dictator?

Concerning a Station of Mystery

DURING the world war we heard much of the British "mystery ships," so thoroughly veiled in secrecy and mendacity that not even the most industrious Teuton spy could find out what they were and what might be their intended use. Just now, too, we hear of a mystery airship which may, if something does not happen to the engines, cross the Atlantic with a considerable passenger list in twenty-four hours—more or less—or some other comparatively brief period. In default of the necessities of war, secrecy must here be charged up to possible elements in construction for which patents have not yet been granted. However this may be, an electric station for public service already in operation would hardly seem to be a natural or proper subject of concealment, and we have been rather surprised to note the difficulties that several well-known engineers have experienced in trying to get a look at the North Tees development of the Newcastle-on-Tyne Electric Supply Company. Their difficulties, in fact, have extended to complete failure in the attempt to get permission for even a cursory inspection of these particular works, engineered, by the way, by one of the most distinguished English firms.

In the absence of a knowledge of all the circumstances severe judgment on the owners or engineers is uncalled for, especially as few Americans who have not been instructed in the conservative British methods of doing business instinctively adopt the strategic line of approach. Here, if one wishes to visit a power station and is a person of standing in the profession whose motives are not suspected, he can usually walk straight up to the permit-issuing authority and in a few minutes obtain the necessary pass. This is not exactly the English way of doing business of any kind. The Englishman's office is his castle, defended by moat, portcullis, drawbridge and divers outworks to prevent the too sudden access of persons to him comparatively unknown on business which has not been been previously explained. Consequently one cannot often catch him offhand. If, however, the intending visitor drops a polite line several days in advance, asking for an appointment at earliest convenience, he is very likely to receive a prompt reply and to get a particularly courteous and friendly reception.

Whether the American engineers who tried to see the North Tees station thus approached it by regular siege, so to speak, we do not know. They certainly would have failed in carrying the works by assault. Further, the English are a conservative folk who would consider warily the granting of permissions which would here be a matter of course, and particularly no subordinate official of an English concern would be likely to transgress a hair's breadth beyond the letter of his instructions regarding such matters.

There must be some specific reason for the secretiveness of the owners of this particular station, a reason which probably has nothing to do with the nationality of those who might wish to see it. Now and then, if things are not going in quite the way in which they were expected to go, too much publicity causes unfavorable criticism or may even prove embarrassing in connection with the financial upholding of the undertaking. For that matter, not a few accidents of a very serious character have been hushed up in large plants in our own country, without even the technical public being allowed to get at the exact facts. If a plant like the North Tees undertaking finds it necessary and desirable to keep technical observers away, that very fact rouses perhaps unjustifiable suspicion that all is not well within the well-guarded walls. It certainly would be desirable to have the facts regarding the operation of this station set forth without undue delay and with something of the frankness that generally characterizes the successful inauguration of important public works.

Power Loops Improve Service

TWO vitally important aspects of electric service confront the transmission and distribution engineer —reliability and efficiency. In serving important loads distributed over considerable areas both are attained to a marked degree through the use of the modern power loop. Loads are increasing on many systems to a point demanding drastic handling of the problem occasioned by expansion of equipment. The pressure upon engineering departments to economize in both first and operating costs is properly heavy. Interconnection is doing its part in increasing both the reliability and the efficiency of service, but there are many cases where the transmitting capabilities of lines must be increased locally without reference to neighboring systems. Every case must, of course, be studied on its own merits. Whether interconnection is feasible or not, the possibilities of loop construction should be carefully weighed.

By departing from the purely radial system of transmission through the tying together of former dead ends, so to speak, of lines and feeder layouts, remarkable gains in regulation may be realized through the equivalent increase in carrying capacity resulting from looping. Often a comparatively small additional investment will yield a heavy increase in average line cross-section by this means. Reduced losses of energy follow, as a matter of course, for a given power total transmitted and distributed. This means a great deal to the operating company or companies concerned, but to the consumers, industrial or otherwise, it means still more in service quality. Improved sectionalization, better prospects of applying regional relay protection effectively, and in general the more reliable delivery of energy in both large and small blocks, are the reward of loop development along sound engineering lines.

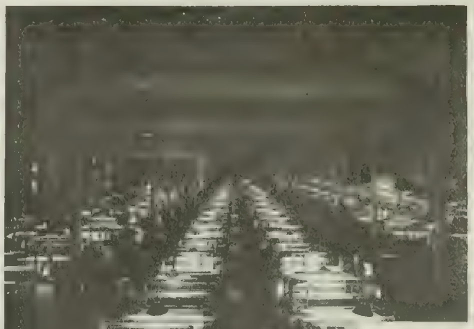
Application of Common Sense to Obtaining Private Rights-of-Way

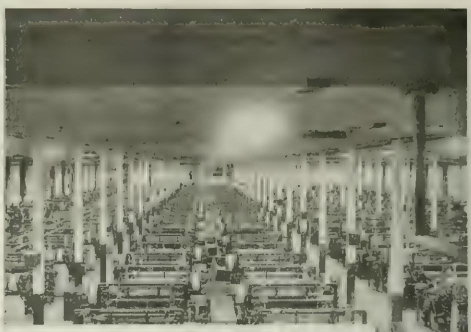
THERE is a strong tendency in many quarters toward obtaining signed agreements for all right-of-way permits, whether they involve large or small undertakings. However, it would seem advisable to divide these permits into two classes. The first one should include the building or operating of through lines, either for transmission or distribution, which involve serving a large number of customers and would necessitate a large expenditure for rerouting. In such cases a registered agreement obtained from the owners by the company upon the payment of a consideration seems logical. It is not so much a matter of either party to the transaction questioning the good faith of the other as an indication of the realization by both parties of the importance of the transaction.

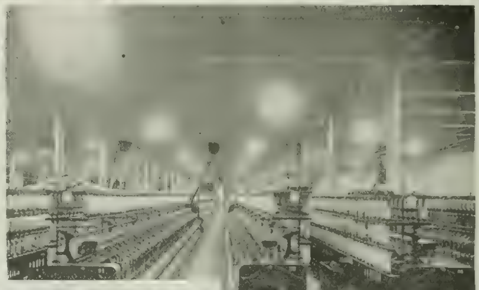
The second class would include distribution lines, such as primary or secondary extensions with poles or conduits on private property, which involve a relatively small number of customers and could be rerouted at a comparatively low cost. In this class also should be placed attachments on buildings for service wires. In such cases oral permits are sufficient, with some convenient means of indicating definitely by stakes or markings the exact location to be used, as arranged at the time the oral agreement is made.

Such a method emphasizes the partnership that should exist between the public and the company that is trying to serve its needs and certainly leads toward better will on the part of the public. It must be recognized that most people are reluctant to sign their names to any paper, fearing that they may not understand all to which they are committing themselves. Suspicion may be aroused as to the ultimate intent. Furthermore, the value of such papers is very questionable so far as actual rights are concerned. In cases of conflict between the interests or wishes of the two parties the papers are of no practical value in arriving at a satisfactory adjustment because to insure co-operation willingness on both sides is necessary. Besides, it is worth while to save the cost of maintaining an organization for drawing up and executing these signed permits and to avoid delay in installing the equipment.

Central-station companies should look into this matter carefully and disregard the purely legal aspect of the situation in favor of better co-operation with the public. We feel that companies that content themselves with oral permits for all minor rights-of-way are not only saving money but improving public relations.

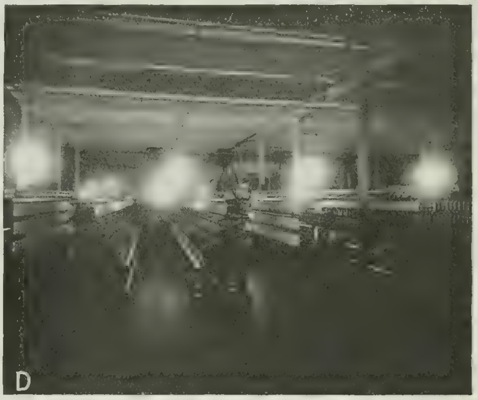


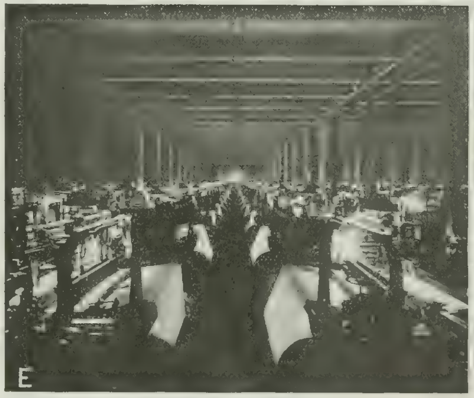


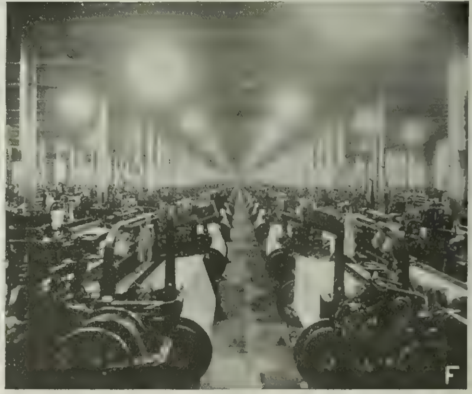


"Before" and "After" Taking Illuminating Engineering Advice

INSTEAD of an installation illuminated by incandescent lamps suspended by drop cords over the individual machines, one designed for adequate general distribution of light throughout the entire working spaces—this is the notable change at the factories of the Boston Manufacturing Company, Waltham, Mass. The camera tells an interesting story in comparative exposures at stop f-16. The darker views were exposed from fifteen to twenty minutes, whereas the brighter photographs showing the improved lighting were exposed only from seven to four minutes. No satisfactory foot-candle data were obtainable in the older installations in view of the range between the maximum intensity on the working plane and the dimness of the aisle spaces, but in the new installations uniform distribution was secured, the foot-candles on the working plane being 8, 7 and 7 respectively. A and B show the weave room, where 280 15-watt lamps have been replaced by 90 200-watt lamps with RLM reflectors; C and D show the spinning room, where 300 15-watt lamps without reflectors have been replaced by 148 200-watt lamps with RLM reflectors; E and F show another weave room, in which 684 15-watt lamps have been discarded and 148 300-watt lamps with RLM reflectors installed.







Meter Panelboards for Large Consumers

Theft-proof and Fool-proof Method of Measuring Simultaneous Demands of Primary Customers at Several Substations and of Metering Power Factor of Two Customers at Same Place

By VERNON I. E. WIEGAND
Union Gas & Electric Company, Cincinnati

THE majority of large power consumers in Cincinnati are metered on the primary circuits, and in several cases simultaneous demands must be measured at different substations. Furthermore, some of the customers have two separate feeders, and in some cases it is an advantage to meter two customers from the same place. To meet these requirements the Union Gas & Electric Company has developed several types of panelboards which have the feature of being fool-proof and theft-proof and besides use synchronous motors for operating the timing mechanisms. The panels are wired and built complete in the meter department, where they are also tested. Then they are crated and sent to the place where they are to be installed. All that is required to install them is to set the panels in place and run the leads from the instrument transformers to the terminal board on the back of the panel.

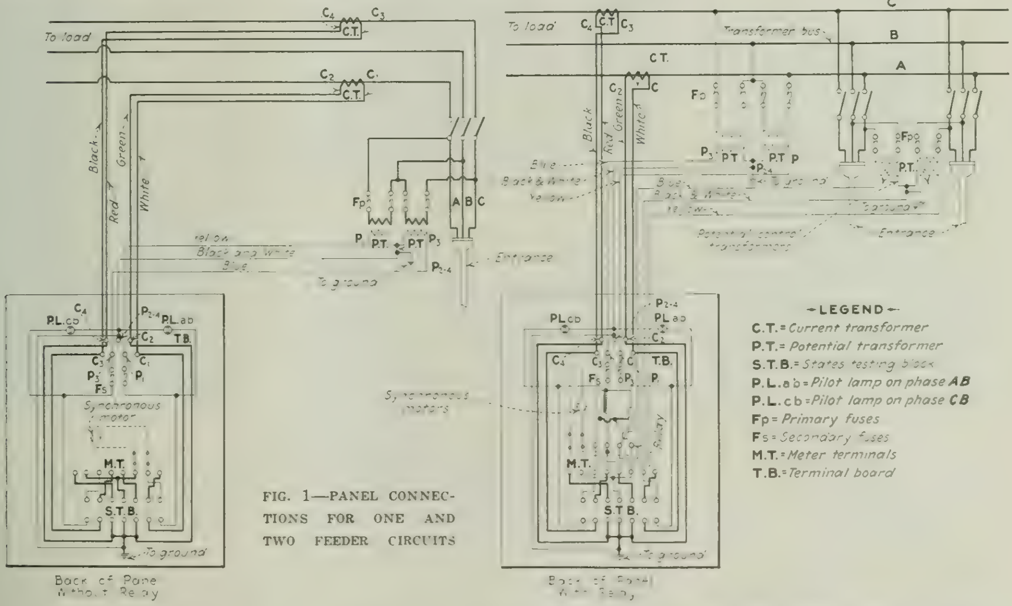


FIG. 1—PANEL CONNECTIONS FOR ONE AND TWO FEEDER CIRCUITS

The panelboard developed for a single graphic demand meter is made of ebony-asbestos board, 24 in. wide by 36 in. long by 1½ in. thick, and is mounted on a vertical frame built of 1¼-in. pipe braced by angles. Back and front views are shown in Figs. 5 A and B. The wiring on the back of the panel (see Fig. 2) is covered by a No. 14 gage sheet-iron box which can be entirely removed from the panel. This box is hung from an angle-iron brace across the top of the back of the panel, being held in place by two iron pins projecting up from this angle into holes in the top of box. Attached to the bottom of the box is a slotted L-shaped piece through which a staple passes. Into this may be inserted a lock which will securely fasten the box to the panel. The locks on all the boxes can be opened by the same key.

Secondary leads from the current and potential transformers are run into the box through a conduit which is securely fastened to the angle-iron brace by a pipe strap. The meter frame and the load lines of both current and potential transformers are grounded to the angle and strap-iron braces, the panel frame being grounded with a No. 6 wire. Hence, with the iron box in place, a theft-proof as well as fool-proof installation is assured. All wiring on the panel is made of No. 12 copper wire covered with asbestos insulation.

To drive the timing mechanism a single-phase synchronous motor is used. This motor has a constant speed, dependent, of course, upon the frequency at the generating station. More satisfactory service is expected than with a spring-wound clock. Besides, the motor makes possible the exact synchronism of charts on meters at different substations, thus allowing a simultaneous demand peak to be obtained. The wiring diagrams for these panels, a copy of which is shown in Fig. 1, is pasted on the inside of the box covering the wiring. Where the station is supplied by only one feeder, the synchronous motor is connected across one shunt-coil element on the inside of the meter. The potential transformers must be connected ahead of the disconnecting switch and potential left on the feeder at all times in order to keep the synchronous motor running when the load in the station is disconnected.

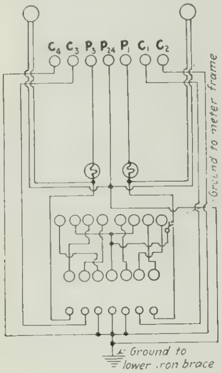


FIG. 2—BACK-OF-BOARD WIRING FOR GRAPHIC-DEMAND-METER PANEL SHOWN IN FIG. 5 A AND B.

The secondary potential circuit is fused with a 3-amp. glass-tube fuse, not of standard size and mounted on the rear of the panel. A standard 3-amp. to 30-amp. size is not used, to prevent a fuse of greater capacity than 3 amp. being thoughtlessly put into the circuit. In case of short circuits or overloads in testing, the secondary fuse will blow before the primary potential fuses. The synchronous motor is also fused with 1-amp. glass-tube fuses placed in a fuse block mounted on the front of the meter. This affords protection against short circuits in the coil of the motor. Two ruby pilot lamps are connected back of the secondary fuses to indicate whether the potential circuit is alive or not.

A terminal board is provided at the top of the panel to which the secondary leads from the transformers are connected. The terminals are lettered so that if the wiring diagram in the back of the box is followed no mistake should be made in connecting the meter. To eliminate the necessity of "ringing out" wires run in conduit and to prevent mistakes in connecting the meter in the circuit, a standard color scheme has been adopted. Corresponding colors are marked on the wiring diagram. A four-conductor colored cable is used for the current circuit and a three-conductor colored cable is used for the potential circuit. Two separate cables are used because in certain installations the current and potential transformers are in widely separated positions.

A testing block placed on the back of the panel facilitates the testing of the meter. When making tests the current transformer leads can be easily short-circuited by loosening thumb screws, and one of the potential lines can be disconnected in the same manner. To connect the meter in series with the phantom load and rotating standard a testing comb is inserted under studs provided for the purpose. After the test is completed the comb is removed and the thumb screws are screwed down, thereby automatically connecting the meter to the station load again.

In stations which have two separate distribution feeders supplying one load, a relay is required to transfer the connections of the synchronous motor instantly from one feeder to the other in case either is cut out or "goes dead."

The relay is mounted on the back of the panel, as may be seen in Fig. 4 B. Leads from the synchronous motor are run through the back of the meter frame and panelboard and connected to the relay. The latter is connected across one phase of each feeder, and the secondardies are connected in open delta. The synchronous motor is in series with a hinged contact arm actuated by an electromagnet connected across one transformer. When energized, it pulls the contact arm against the upper stationary contact, completing the circuit through the motor. When the feeder to which the relay is connected is de-energized, a spring pulls the contact arm against the lower stationary contact connecting the motor to the live feeder. Thus potential is assured on the motor at all times.

This panel requires a floor space of about 2½ x 3 ft. and is 6 ft. high.

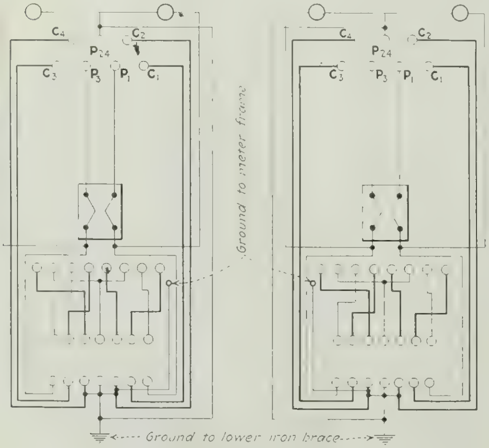


FIG. 3—BACK-OF-BOARD WIRING FOR REACTIVE-METERING PANEL SHOWN IN FIG. 5 C AND D, ADAPTED TO METER TWO CUSTOMERS AT ONE PLACE

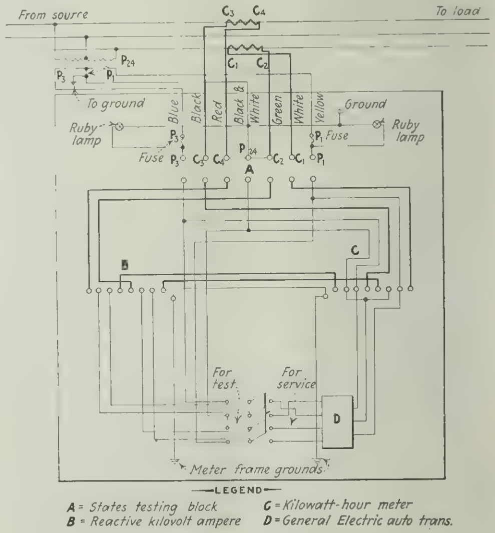


FIG. 4—BACK-OF-BOARD WIRING FOR REACTIVE-METERING PANEL WHICH IS USED AT THE UNIVERSITY OF CINCINNATI

To obtain data on customers' power factor for future billing purposes another panel was developed which is shown in Fig. 5 C and D. This board includes an auto-transformer, a testing block and a four-pole, double-throw switch. The panel is built along the same general lines as the single-meter panel which was previously described. The wiring diagram of a panel which was designed for metering two customers where the two meters could be installed at the same place is shown in Fig. 3. Except for a few features, the size and details, are the same as for the panel with the reactive and in-phase component meters. Type RA graphic-demand meters equipped with synchronous motors are used. One meter measures kilowatts and kilowatt-hours, and the other reactive kilovolt-amperes and reactive kilovolt-ampere-hours. Since the charts are exactly synchronized the power factor or kilovolt-amperes of any interval may be determined. The average monthly power factor may be obtained from the kilowatt-hour and reactive kilovolt-ampere-hour registration.

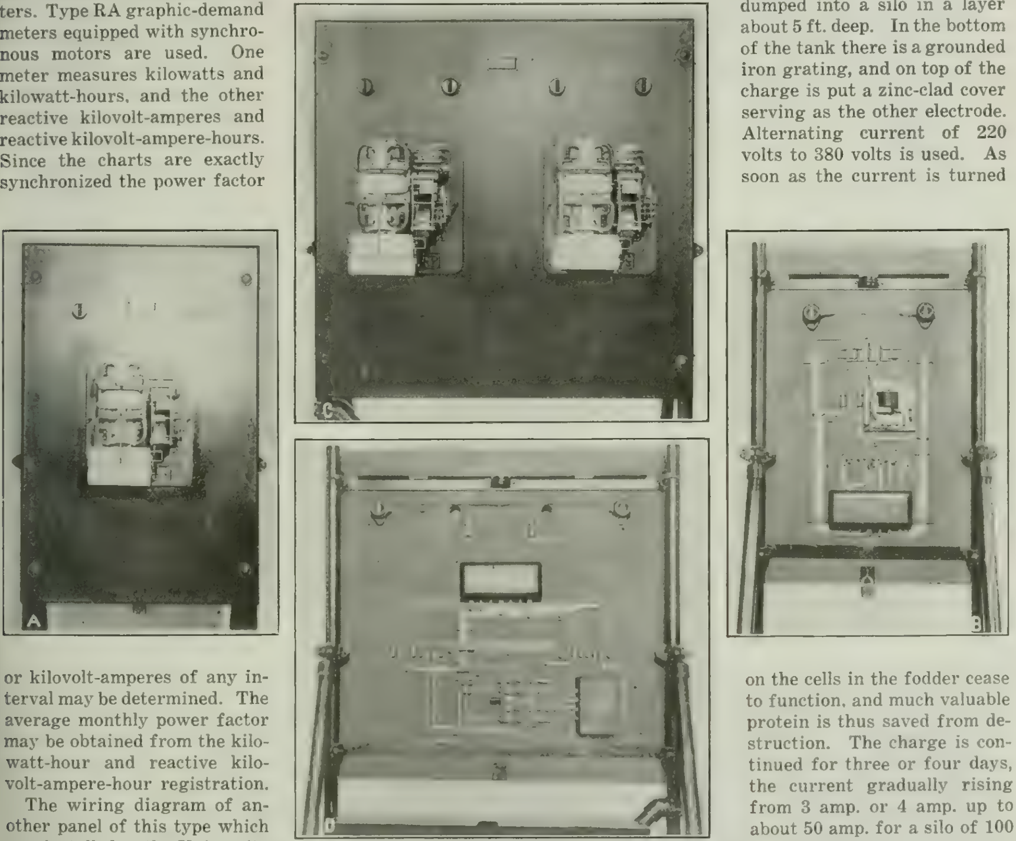


FIG. 5—FRONT AND REAR VIEWS OF TWO PANELBOARDS ADAPTED TO METER LARGE CUSTOMERS

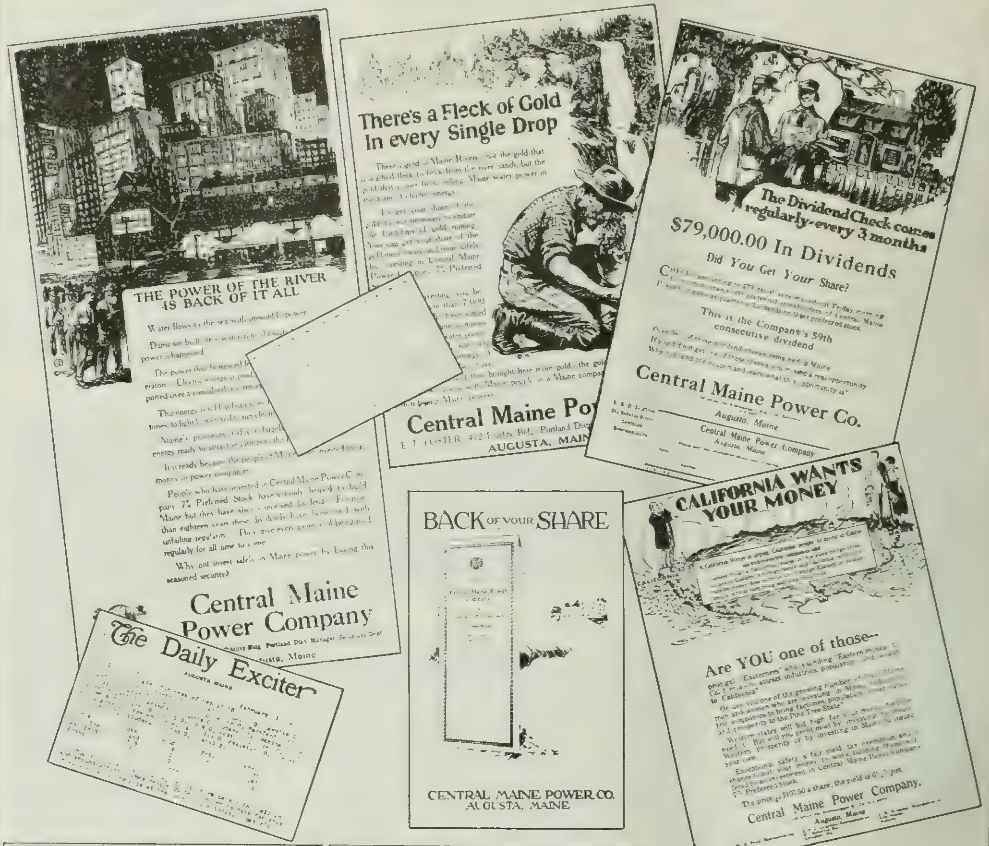
A and B—Graphic demand meter panel. C and D—Reactive metering panel for determining power factor.

The wiring diagram of another panel of this type which was installed at the University of Cincinnati is shown in Fig. 4. The field coils of the meters are connected in series, and the potential for the meter measuring reactive kilovolt-amperes is taken from an auto-transformer. To throw the potential of the reactive-kilovolt-ampere meter from the auto-transformer directly onto the line back of the testing block a form-pole, double-throw switch is used. With this arrangement the two meters can be tested at the same time with the ordinary phantom load and rotating standard. After the test is completed the switch is thrown back into the position marked for service. This panel requires a floor space of about 2½ ft. x 3½ ft. and is 6 ft. high.

Conserving Fodder by Electricity

AN INTERESTING method for conserving green fodder by means of electric current, developed by T. Schweizer, has attracted much attention in agricultural circles in Germany, where it is claimed that the method will be of considerable importance in rural electrification, since it greatly increases the yearly energy consumption per unit area of cultivated land, being at the same time highly economical and making the farmer virtually independent of rain during the harvest. The green fodder is dumped into a silo in a layer about 5 ft. deep. In the bottom of the tank there is a grounded iron grating, and on top of the charge is put a zinc-clad cover serving as the other electrode. Alternating current of 220 volts to 380 volts is used. As soon as the current is turned on the cells in the fodder cease to function, and much valuable protein is thus saved from destruction. The charge is continued for three or four days, the current gradually rising from 3 amp. or 4 amp. up to about 50 amp. for a silo of 100 cu.m. (3,500 cu.ft.). During the treatment the temperature of the mass rises to about 50 deg. C., so that most of the destructive bacteria are killed. After this process the fodder will, it is asserted, keep fresh for months. Three electro-silos are used, one for each phase, and in each a new layer is put in every day on top of the fodder already being treated till the whole tank is full. The energy consumption is about 20 kw.-hr. to 25 kw.-hr. per ton of green fodder, and it is estimated that the use of electro-silos on German dairy farms will raise the yearly energy consumption per unit area of cultivated land to four times its ordinary value, the latter averaging 21 kw.-hr. per hectare-year (8.4 kw.-hr. per acre-year).

Advertising Copy in Customer-Ownership Sales Must Be Written by an Expert



THE POWER OF THE RIVER IS BACK OF IT ALL

Why not invest safely in Maine power by buying this seasoned security?

Central Maine Power Company

Augusta, Maine

There's a Fleck of Gold In every Single Drop

Central Maine Power

AUGUSTA, MAINE

The Dividend Check comes regularly-every 3 months

$79,000.00 In Dividends

Did You Get Your Share?

This is the Company's 59th consecutive dividend

Central Maine Power Co.

Augusta, Maine

Central Maine Power Company

Augusta, Maine

CALIFORNIA WANTS YOUR MONEY

Are YOU one of those--

Central Maine Power Company,

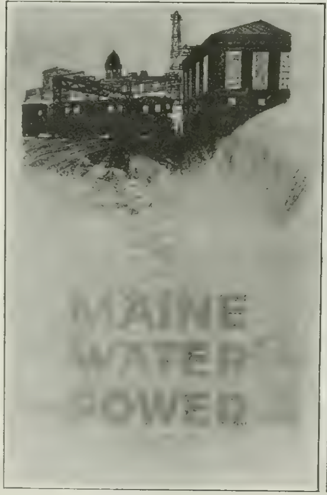
Augusta, Maine

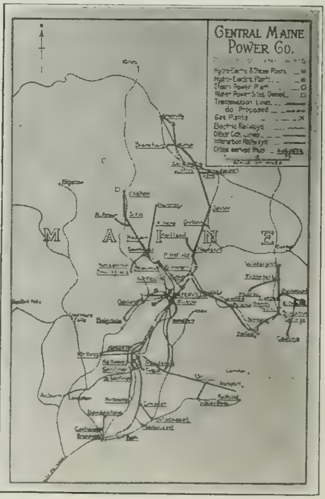
BACK OF YOUR SHARE

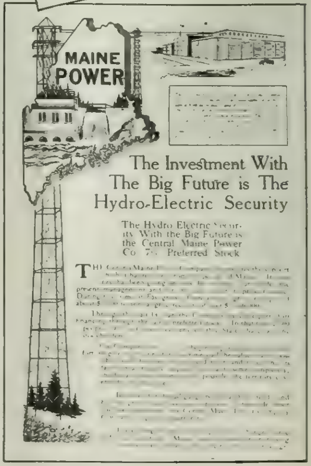
CENTRAL MAINE POWER CO.
AUGUSTA, MAINE

The Daily Exciter

AUGUSTA, MAINE







MAINE
POWER

The Investment With The Big Future is The Hydro-Electric Security

The Hydro Electric Security With the Big Future is the Central Maine Power Co 7% Preferred Stock

Stock Selling by a Permanent Staff

How to Recruit the Sales Force—Hiring, Paying, Training and Supporting the Salesmen—Selecting the "Prospects"—Conducting the Sale

By PERCY H. WHITING

Manager Securities Department, Central Maine Power Company

ANY power company that experiences a rapid development and consequently a steady demand for capital and is able to sell all the stock which its market will absorb is likely to pass through at least three stages: (1) Easy selling by employees; (2) intensive selling through employees; (3) selling through regular security salesmen.

In two former articles Mr. Whiting has given a graphic picture of the way to organize the initial stock-selling campaign and how to sustain stock selling by employees after the enthusiasm of the first campaign has died. In this final article of the series he gives some very practical advice on permanent security selling by regular stock salesmen. It is a phase of the problem which central-station companies are already facing and many of them must ultimately meet.

Mr. Whiting speaks with the authority of a very broad experience. His company has sold a 7 per cent preferred stock for four years at $107.50 a share. It has marketed $4,000,000 worth in Maine to 8,000 stockholders. It has secured an average of better than one stockholder to every seven customers and is still selling successfully. This campaign has been under Mr. Whiting's direction, and he has assisted in a number of successful campaigns in other cities.

SELLING central-station junior securities through regular stock salesmen should never be attempted until employee selling has slowed down below your needs. For selling by full-time salesmen is admittedly more expensive and calls for closer supervision. It presents no insurmountable difficulties, however, and is a vastly cheaper and more satisfactory method than the old way of turning the issue over to a bond house.

The first step in selling through salesmen is to recruit your sales force. Do not hurry this. Put on new men no faster than you can train them. We have dug up men ordinarily through advertisements, using either good-sized classified space or small display. You will never get the kind of salesmen you want by running an advertisement which says "Salesmen wanted" and little else.

Buy enough advertising space to give the facts and to explain the good and bad points of the position offered. Make the reader understand that you are offering him no refined bond selling job, but rather an opportunity to take on real hard work through long hours with a chance to gain good pay. The sort of advertisement we have used, in a space of two columns by seven inches, is shown on page 421.

The kind of men you do *not* want to hire are bond salesmen. I never yet knew a bond salesman who succeeded in selling preferred stock for a power company to its customers. But I have known many who failed.

Our best salesmen have usually been men who have sold something intangible, such as insurance, correspondence courses, religion, politics. Ministers, politicians, carpenters; shoe-factory operatives, head waiters, purchasing agents, farmers, stone-cutters, hotel-keepers, school teachers, merchants, house-wiring solicitors and accountants have all succeeded with us as salesmen. It does not matter so much what a man has previously done if he has energy and enthusiasm and if he is truthful, honest, determined and willing to learn about securities and about the company.

When a man answers an advertisement for salesmen we have him fill out an application blank which contains many questions. The ones we consider of especial importance are:

1. How many dependents? *(Responsibility makes for reliability.)*
2. List every job you ever held, with name and address of employer. *(Check the answers over very carefully for gaps. The man who leaves out one or more jobs usually does so for a reason.)*
3. How much time have you lost from work because of accident or injury through the past five years? Give particulars.
4. Have you any means of support besides what you earn yourself? *(Don't hire the "idle rich.")*
5. How much do you make per week from your present work?
6. What correspondence courses have you started? Finished?
7. Have you saved any money? How much?
8. How have you invested the money which you have saved?
9. Do you own a home?
10. Can you give a surety bond? *(A good question, whether or not you expect to bond your salesmen.)*
11. Did you do any work as a boy? What kind was it? *(The man who worked as a boy is likely to be used to it.)*
12. Do you *over*-indulge in cigarettes? Liquor? Gambling? Anything else?
13. How much insurance do you carry?
14. What class or trade magazines do you read regularly?
15. What books relating to your work have you read in the past year?
16. Give the names and addresses of ten people of some standing in business or in your home town as character references. We shall write these people and ask if your reputation for truthfulness and honesty is good. *(It is surprising how many we have weeded out by this test. Incidentally, we write also to every concern for which the applicant has worked.)*
17. Why do you want a position as salesman with this company. Please answer fully.

Naturally the answers to some of these questions are valuable only for what you can read between the lines. But when a man has filled out his application blank he is interviewed, and we have a rule that no salesman is to be hired unless he has been passed on favorably by at least two, or preferably three, executives. We try to have one of these executives see the candidate at least twice.

In interviewing a man we do not depend on random impressions, but use a three-sheet form which contains a list of the points we try to determine about the man. Here are a few of them:

1. Does he "sell himself" well? *(If he can't "sell himself," it is fair to suppose he can't sell anything. The man*

who sits down and waits for you to "hire" him will never sell much stock.)

2. Is he the kind of man you would be willing to invite to spend a few days in your home? (*If you would not like him in your home, is it reasonable to believe any one else would like him in theirs?*)

3. Does he get to the point in his conversation or does he wander?

4. Can he answer objections? (*Try him on some. This is important. If a man quits on objections, he will never sell much.*)

5. Is he easily discouraged? (*Tell him the difficulties of the job and see how he reacts.*)

6. Is he willing to undergo a course of study and training before he starts on the work?

7. Grade him on:

   Physical Qualities—Size, "pep," health, carriage.

   Appearance—Clothing, neatness.

   Character—Stability (*How often has he changed jobs? Why?*). Loyalty (*Ask him about his former employees—give him his chance to tell his tale of woe. If he has never been satisfied on any other job, is it likely he will be satisfied on yours?*). Veracity (*See if he tangles himself up in his own story*). Sincerity (*Does his story of himself appear to ring true?*).

   Address — Grammar good, bad or medium? Voice pleasing or otherwise? Forcefulness of speech? Does his talk carry conviction? Is he positive in his statements? Has he self-confidence? Does he state things enthusiastically?

   Determination—What is he trying to become? Has he a rudder or is he drifting? (*I am indebted to various writers on sales subjects for many of these questions and would give them credit if I could remember their names. The questions have been modified considerably to suit our needs.*)

I have no apologies for going exhaustively into this matter of selecting salesmen. You can save yourself thousands of dollars if you can learn to head off incompetent salesmen at the gate.

The question of how to pay your salesmen is too abstruse to discuss here, for books have been written about payment plans. The writer's experience has been with a salary-expense-quota-and-bonus plan, which has worked satisfactorily, despite several obvious faults. The straight commission basis has much to recommend it—with the one glaring weakness that your salesmen are then working for themselves instead of for you.

Traveling and hotel expenses are another puzzle, and how to solve it depends on many conditions. But I believe it a good plan, if expenses are paid, to limit them to so much per week.

Training the Salesman

With your salesman hired and on the pay roll you face the task of training him. Our own method is crude. We allow the new man to spend two to four days in the office, during which time he goes over our advertisements, printed matter, bulletins, rules and so on. He is then turned over to a field manager who takes him out and shows him how to sell.

The field manager usually works with the new man a while in the hotel room, polishing up his sales talk. He then takes him out and begins calls. At first the field manager makes the talks and then he lets the salesman try. After each attempt by the beginner the field manager points out faults and suggests improvements. And so the new man is launched on the stormy seas of selling.

The plan we are working toward is this:

1. Prepare a manual which will contain (a) Every fact about the company that has any bearing on stock selling; (b) every talking point in favor of the stock; (c) a sales talk (we do not expect a salesman to repeat a "parrot canvass," but we do want him to have a standard sales talk to fall back on when it is necessary); (d) answers to objections.

2. Start a new salesman with a couple of days in the office, at which time he will learn the sales talk and study the manual.

3. Turn the candidate over to a field manager.

4. Give the new man two or three months' trial. If he makes good, bring him to the home office for two or three weeks' intensive study and training.

5. Keep the salesmen studying by means of correspondence course, frequent questions and the like. (We keep a library of books on selling, financing, securities, etc., which we constantly influence the salesmen to use.)

6. Send salesmen daily bulletins, with very little "inspirational matter" and a great many useful facts about selling.

7. Hold a sales school each summer.

This costs money, but it comes back fast in sales.

Supporting the Salesman

As your sales force grows your office and executive forces will have to grow with them. When you have as many as six or seven salesmen select the best as a field manager. When you have another six or seven select another field manager. If you are working a big city, where the men can come to the home office virtually every day, you will not need, proportionately, so many field managers. If the men are scattered, however, a field manager to every six or seven salesmen works best.

After you have secured and trained your salesmen you will also need some "prospects" for them to call on. If you are working among your own customers, as you naturally would at first, select your prospects from them. Have the name of your customers in the town, city or section of a city which you are going to work run off on 3-in. x 5-in. cards. If the community is not too big, the local superintendent or one of his men can go through the list and throw out most of the impossible names.

Explain carefully to the men who are selecting prospects the kind of names you want. If you do not, they will pick out a few rich men and stop there—which is the poorest list possible. We generally say to the men who select our prospects: "We want the names of every man and woman in the community who in your judgment has money to invest, or who has $500 or more in the savings bank, or who can save and invest $10 or more per month."

A compilation of figures from several campaigns I have handled in various parts of the East shows that the most sales were made in the following order, to (1) housewives, (2) merchants, (3) mill hands, (4) clerks (retail), (5) retired persons, (6) farmers, (7) teachers, (8) carpenters, (9) clergymen, (10) laborers, (11) manufacturers, (12) physicians, (13) stenographers, (14) engineers, (15) printers.

In any fairly good farming section farmers prove excellent prospects—and the farther away from civilization they live the better prospects they are, because few if any salesmen have bothered to call on them.

When we are working towns which are not located in our territory we ordinarily use as a basis for our prospect list either the tax collector's books or a voting list. If a voting list is used, it is well to get some one to add to this list the names of women with money who have neglected to register. You are likely to find many of them.

We plan to call on from 10 to 20 per cent of the inhabitants of any town we serve and on from 2 to 10 per cent in towns we do not serve.

After you have listed your prospects plan to interest them in your stock by at least two forms of advertising—newspaper and direct-by-mail. Of the volumes that could be written about newspaper advertising, we have space for only these points:

1. Plan to spend from 25 cents to $1 per share on newspaper advertising. It is money well invested, and part of the cost can justly be charged to "good will," because your preferred-stock story is necessarily a "good-will" story as well. If your customers are scattered through many towns, study the field in which your newspapers circulate in mapping out a campaign. For example, in our state the Augusta paper dominates Augusta, Hallowell, Gardiner and Winthrop. So we work these four towns at once, aided by a brisk advertising campaign in the Augusta paper. Then we start advertising in another paper and work the towns it dominates. This means that we are buying advertising only in the town where we are working.

HIGH GRADE MEN WANTED
AS SECURITY SALESMEN

On our security selling force we can use two or three salesmen.

A man, to make good at this work, must be able to meet on equal terms the very best people of our communities. Yet he must not be too proud to call on **any one** or too elegant to work hard and steadily at all hours, under all weather conditions, over all kinds of roads, in big towns and small. He may have to travel afoot through mud and slush, will often stop at bad hotels and will generally have to work nights.

> Knowledge of securities not required. Selling experience desirable but not absolutely essential. The candidate must have a clean record and must have proved on previous jobs that he is a WORKER!

If you are this sort of a man and you want a position that entails plenty of hard work, but pays expenses, a small salary and liberal commissions, and has a real future—write us, giving full facts about yourself.

Remember—to succeed on this job the man must be high-grade and willing to punish himself with work. The position offers not only good pay but a chance for advancement.

Send your application to the Securities Department.

CENTRAL MAINE POWER COMPANY,
Augusta, Me.

2. Make your advertisements different in appearance from the "issue" advertisements and the stiff and formal "cards" of the bond houses. If you do not know how a good financial advertisement looks, study the live ones—there are only a few, but they stand out—in the New York *Times*, Philadelphia *Public Ledger* or Chicago *Tribune*.

3. Do not under any circumstances run your preferred-stock advertising on the financial page. Most of the people you want to reach never even glance at the financial page.

4. Use big space and brief "copy."

5. Use illustrations if you can secure them. The N. E. L. A. may be able to help you. If you have a monogram or company insignia, have it made up in various sizes, as sort of a glorified "dingbat" to liven up the composition of your advertisements.

6. Do not try to cover more than one point in an advertisement. That is, devote one entire advertisement to "safety," another to "freedom from care," another to your "resale plan."

7. If you know of objections that are going to be raised, answer them in a positive way in your advertisements. For example, last summer we knew that the bond houses would work on our prospects with the argument that our bonds netted more than our stock—which was true. To offset this line of talk we advertised very strongly that our stock was tax-exempt, that it was never likely to be called, and that the company would handle all resales. Nothing was said about the bonds, but advantages that the preferred stock had over bonds were brought out. In consequence of answering these objections before they were raised we sold our stock briskly in competition with our own bonds, which were netting nearly a point more than the stock.

The newspaper advertising should be started in any town you are going to work perhaps a week before the sale begins. A couple of days before your salesmen start working send to the prospects a letter and a circular. Preparing this circular is a job that should be carefully done.

Avoid the stilted, frigid and unreadable style of the conventional bond circular. Turn the job of writing the circular over to some advertising man, with instructions to make it look as different from a bond circular as possible. Be sure he uses type that is large enough, that he uses illustrations, and that the circular not only gives the facts about the security but that it arouses a desire to buy. This desire to buy will come if you bring the prospect into the picture and show him how he profits by the transaction.

As soon as your mailing pieces go to your prospects the sale can begin. If your men are all working in or from the same town, start each day with a brief sales meeting. Polish up sales talks, rehearse answers to objections, swap "openings" and "closings," and make the meetings practical helps in selling.

Sort out your prospect cards by streets and sections to save the salesmen unnecessary pedestrianism. Watch out, however, that you don't keep any salesman too long in one section, which may be unusually bad or unusually good. Change your men around frequently.

Be sure that every salesman calls and reports on every prospect whose name is given to him. For this purpose we use the card shown on page 418. These report cards are filed and used the next time that the community is worked. By this method we build up a wonderful prospect list.

Impress particularly on salesmen the fact that each prospect they call on should yield them other prospects. In other words, somewhere in each sales talk they should say, in effect: "You believe that this stock is a good investment. Can you not give me the names of some of your family or friends who might like to buy?" Prospects secured on this basis are worth materially more than ordinary prospects. Require your salesmen to keep and send you a record of all calls made and sales talks delivered.

As the sale progresses some of your salesmen will do well, while others will slip. Keep your field managers busy helping the men who need help and watch them to see that they do it. A field manager much prefers to work with the men who are going strong—which is a poor practice. If the salesmen are working away from home, personal letters of commendation, advice and stimulation from the home office are also useful.

It was our plan when we started to work a city or a group of towns and then to "close" that territory and award it to a salesman, who would have the exclusive right to sell there as long as he produced. We found that an average "territory" numbered from 20,000 to 30,000 people. The "closed territory" plan has advantages and also drawbacks for the territory man is less expensive, but he is apt to slip into a rut.

We have changed several times from the campaign method to "closed territory" and back again. My present belief is that the "closed territory" plan is best, provided you keep at the home office a permanent list of the prospects in every town and provided you give each salesman each week a list of the people he is to call on—and see that he does it. In other words, the salesman's activities have to be directed almost altogether by the home office.

If you find that "closed territory" selling is fading, try to freshen it up by campaigning again through the entire territory, and then go back to closed territories again.

The selling plan here outlined can be used successfully for indefinite periods at a reasonable cost. Its continued success depends on good advertising, careful training of salesmen, good field management and intelligent direction. The system has faults, but with all its faults selling by salesmen produces large amounts of preferred-stock money over long periods at low cost—which is about all that could be asked of any system of financing.

◆

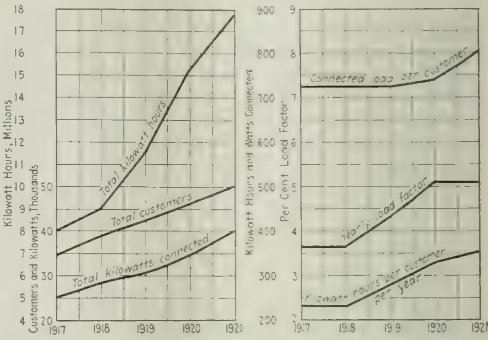
What Is Residence Load Factor?*

Is It Improving? Some Curves on the Domestic Load and Some Considerations that Should Be Kept in Mind

By J. A. Rockwood
Portland Railway, Light & Power Company

It is not practicable to determine with accuracy the load-factor of residence business because of the difficulty of determining what the connected load is. Ordinarily appliances are not counted in determining the connected load of a customer, although the kilowatt-hours used by these appliances constitute quite a proportion of the total used by residences. The smaller residences are taken at a flat figure, as a minimum, regardless of how many lamps are actually installed. The sizes of lamps and other installations in any given residence are to a greater or less extent being changed, and it is impracticable for a company to keep in touch with the changes that take place. The result is that while most companies keep records of the kilowatts installed for residence customers, it is very evident that these figures may be in error to a considerable extent. However, while it may not be possible to get the exact ratio of average load to connected load, it can be approximated and the trend of the changes that are taking place can be measured.

In the accompanying charts are given some data that illustrate the changes that are taking place in the residence business. One of the charts gives some statistics of the gross growth of the residence business. On this chart are platted the kilowatts connected, the total number of customers and the total kilowatt-hours consumed of the residence class. It shows that while the customers have increased approximately one-half, the kilowatt-hours consumed have more than doubled in the five-year period for 1917 to 1921. It is evident from this that the consumption is growing at a much faster rate than the customers. The other chart gives the same information on a unit basis. The connected load per customer shows comparatively little change in the five-year period, although the last year or two shows the effect of the increasing number of ranges.



THE NUMBER OF CUSTOMERS INCREASES ONE-HALF AS RAPIDLY AS THE KILOWATT-HOUR CONSUMPTION

The interesting curves are those of the load factor and kilowatt-hours per customer. The load factor increased from about 3.6 in 1917 and 1918 to about 5.1 in 1920 and 1921. This is an increase of about 40 per cent in that period. The kilowatt-hours per customer increased from about 232 in 1917 to about 356 in 1921. This is an increase of 124 in the period or more than 50 per cent.

The earnings per kilowatt-hour in this same period decreased between 20 and 25 per cent, while the total earnings per customer increased less than 20 per cent. All these facts together prove without question that there has been a very decided increase in the use of electrical energy in residences in the past five years.

This increase in residence business may be laid to a number of causes: Range load; appliances, especially small heaters; more outlets and increased size of lamps; increased use of light and appliances. The increase in the consumption began the month after the armistice was signed and has been increasing ever since. The rate of increase, however, was not as great in 1921 as it was in 1919 and 1920. When these unit figures are plotted month by month, the remarkable changes that have taken place are all the more noticeable.

In conclusion, it is evident that in this specific case there has been an improvement of about 40 per cent in the load factor and about 50 per cent in the average consumption per residence customer. This indicates the possibilities of residence business if developed to a reasonable extent. The increased use of electricity in the home offers an opportunity to smooth out the load curve and to offset the effect of industrial depressions.

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*Paper presented before the Northwest Electric Light and Power Association, Boise, Idaho.

VANCOUVER CONVENTION
American Institute of Electrical Engineers

Papers on Transmission and Insulator Developments Form the Basis of an Interesting Discussion—Electrical Precipitation Processes and an Educational Symposium Also Arouse Comment

THE eleventh annual Pacific Coast convention of the American Institute of Electrical Engineers was held at the Hotel Vancouver, Vancouver, B. C., Aug. 8 to 11 inclusive, the attendance reaching about 225. The convention program was filled with interesting technical features, with which were interspersed valuable entertainment and inspection trips. The subject which called forth greatest discussion was that of high-tension insulators coupled with long-distance transmission and the features of the forthcoming 220-kv. transmission schemes in California. As reported in the issue of Aug. 12, retiring President William McClellan, in whose administrative year the present convention was held, was present during the first half of the convention and made the principal address at the dinner on Wednesday evening.

Transmission the Keynote

CALIFORNIA has had a very rapid growth in the demand for electric power, and this condition has resulted in a rapid increase of load on the transmission lines and generating stations of the various electric companies supplying this power. The hydro-electric developments in California are in the mountains quite a distance from the load, with the result that the question of transmission becomes very important. R. J. C. Wood described the 220-kv. transmission system of the Southern California Edison Company. This company at present has two single-circuit power lines, 241 miles long, from its Big Creek development to Los Angeles. In order to take care of the power demand the company had the alternative of either duplicating these lines or of raising the voltage upon them and decided upon the latter procedure as being the more economical. The existing lines are at 150 kv., so that a doubling of capacity will result by raising the voltage to 220 kv.

In order to take care of the existing generating stations, etc., built for the lower voltage, auto-transformers are used, transforming from 150 kv. to 220 kv. Six sectionalizing switching stations will be built in the new line so that the rebuilding may be possible with a minimum amount of trouble, and this amount of sectionalization permits tests to be made very readily on the different sections of the line. A future plan is to use automatic oil switches to secure sectionalization in place of some of the air-break cross-over switches now used. A 30-mile extension of the Big Creek line will be built from the Eagle Rock substation to a new substation which will lie east of Los Angeles and deliver power to a section of that city. Upon the completion of this line there will be 270 miles of 220-volt transmission.

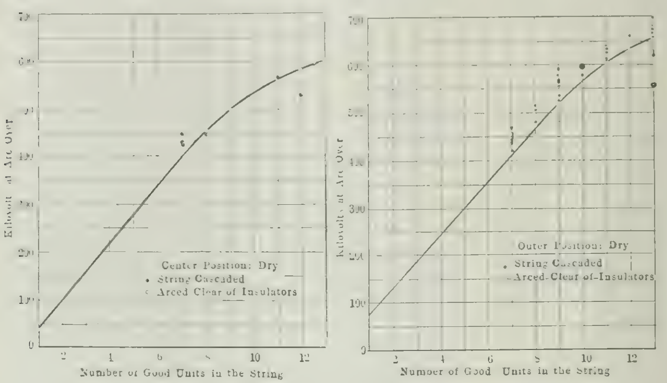
Preliminary to the installation a considerable amount of investigation and research was carried on, both in the factory and in the field. The insulator question was one of the largest problems to solve, and after tests were made it was determined to use suspension insulators in preference to any other design, while in order to obtain better voltage distribution between the different units in the string ring shields were used. All the suspension strings will have a ring shield, 28 in. outside diameter, around the first unit. At the outer positions on the tower the arcing horns with which the top insulators are now equipped will be left in position. The center suspension will have the arcing horns removed and a ring substituted.

In connections with the field tests one section of the line was energized to 280 kv. for one month and to 241 kv. for about five months, extending through the greater part of the rainy season. Considerable care was taken to obtain reliable measurements of voltage current and corona losses, and the results of these tests are pretty largely described in the issue of the *Electrical World* of Feb. 11, 1922, with a corrected table of coefficients in the May 6 number.

CONDENSERS USED FOR REGULATION

It is thought that a total condenser capacity of 180,000 kva. would be required to regulate for 240,000 kw. transmitted over two lines with zero regulations from generator to substation, the power factor of the load being taken at 0.85 lagging and economic limitations will determine the amount to be used on the system. The 220-kv. oil switches will have a rupturing capacity of not less than 1,200,000 kva. Disconnecting switches for station use will be mounted upon separable post-type insulators. The existing clearance to ground is 25 ft., and on the reconstruction for 220 kv. a great percentage of the towers will have to be increased in height to afford a minimum clearance of 30 ft. to ground in all country susceptible of cultivation. The towers will be raised bodily without interference with conductors or ground wire, and a structural-steel, vertical-sided extension frame will be bolted between them and their old foundation anchors. No lighting arresters are to be installed on the new 220-kv. line, although the existing 60-kv. arresters now in service will remain in operation. The method now used of breaking arcovers is to lower the fields of generators and synchronous condensers until the arc breaks, and upon building up the field once more the generators pull into step if they have fallen out of synchronism. Service is resumed in about one minute on an average. Plans are under way to make this operation automatic and thus insure a great saving in time. The author felt that transmission at 220 kv. and the equipment required for this voltage is standardized and can be used with great confidence in its reliability.

In presenting his paper Mr. Wood stated that he had made some tests at 280 kv. and that reports came to him from real-estate agents that the line was sounding like the hissing of "venomous serpents" and people were being scared away from the community. As a matter of fact, as far away as a thousand feet from the line it did sound somewhat like frying eggs. When the voltage was reduced to 240 kv., however, there was no indication of any higher voltage than that now used in operation, namely, 150 kv.



A SUMMARY OF THE ARC-OVER TESTS MADE AT PITTSFIELD AT 60 CYCLES ON INSULATORS WITH AND WITHOUT SHIELD RINGS

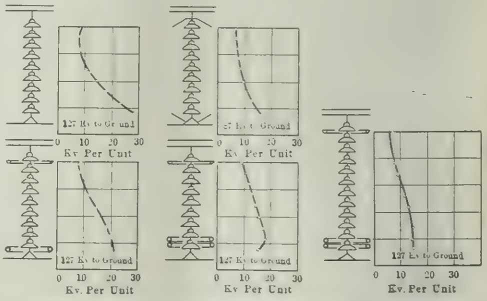
William McClellan, New York, pointed out that the developments discussed by Mr. Wood constitute engineering of the highest type in that it is breaking into new fields. There is plenty of routine engineering, he said, but this is real engineering in that it tackles the problem of looking keenly into the future.

W. A. Hillebrand, San Francisco, asked if any experiments had been made on the disconnecting switch to control the direction of flashover. Mr. Wood said that the only attempt which had been made was to mount a galvanized iron pipe at the outer contact end of the switch in such a way as to try to induce a horn-gap action, but that the flash did not follow this pipe at all, even though the pipe was only three inches away from the end of the switch, but rather formed a large inverted "U" from the end of the knife blade to the outer contact. Mr. Hillebrand also asked if provision had been made for controlling high-frequency discharges in the substation, Mr. Wood replying that they were skeptical of any high-frequency effects but nevertheless were prepared for them.

In reply to a question regarding the charging energy, Mr. Wood said it has been calculated that there will be a charging energy of 50,000 kva. At the lower end of the line synchronous condensers are provided and the generators and synchronous condensers will all start at once. Aside from the magnitude of the quantities involved, he said, no new operating problems are anticipated.

Mr. Wood also discussed a surge recorder which had been devised to get approximate measurements of the value of surge voltages. This surge recorder consists of six points set at varying distances opposite a metal plate. The first gap is set at 10 per cent over voltage, the second at 25 per cent, the third at 50 per cent, the fourth at 100 per cent and the fifth at 200 per cent. A kodak film moves along between the points and the plate, and as surges occur they are recorded on the film. So far the highest surges recorded on the 150-kv. line have been not more than 100 per cent of line voltage, and these highest surges have occurred when the bus was killed in the station in order to change the film. Records were also obtained at the time of opening the line at the other end, but so far no records of 200 or 300 per cent above normal have been secured, and even if they did occur this voltage is probably not enough to flash over. The line has, however, had some unexplained flashovers when, so far as outward observations indicated, the line was under normal operation, with no switching, and in fair weather. All of a sudden a flashover occurs, the voltage lowers, the flash dies, the voltage rises and everything is right again. Mr. Wood said the engineers were bending all their energies to learn what is going on in the line because these flashovers look as if they were the result of the simultaneous happening of three or four out of some eight or ten things which might happen. If the flashover were due to any one thing, one would expect to have a few flashovers every day.

Joseph Mini, Jr., San Francisco, said he had visited the system during the high-voltage tests and while there was visible corona at 280 kv., he would have to be told that the voltage was on the line at 220 kv. or 240 kv. Mr. Mini pointed out that it would not be so easy to break flashovers when both sending and receiving ends of the line are connected star-grounded on the high-tension side. At present the generator end is connected in delta and the receiving end in star. Mr. Mini suggested that the way to break a flashover is to set the relay system light for ground trouble and heavy for trouble between phases, though naturally there must be duplicate lines in order to make use of this principle. Carrying his discussion of duplicate lines into method of operation, he brought out the point that if one line is fully loaded and it is desired to add the second, there is a large phase-angle difference at the receiving end



POTENTIAL GRADIENT ON INSULATORS WITH AND WITHOUT SHIELD RINGS FROM TESTS MADE AT STANFORD which would cause a great disturbance if the two receiving ends were then connected together in parallel. Mr. Mini raised the question whether it would not be best to make the original connection at the receiving end, to use another generator at the generating end and to pull up some of the load on to this new generator until the two lines were in phase at the generating end and then connect the two in parallel there.

A great many engineers have difficulty in using the hyperbolic solution for transmission lines, and for this reason C. H. Holladay presented, in a paper entitled "A Graphic Method for the Exact Solution of Transmission Lines," a scheme whereby charts and graphs can be used to determine a solution on an accurate basis. Starting with the voltage at the generator on open circuit, the receiver voltage is higher, owing to the line capacity drawing a leading current through the inductance. As the line is loaded with a lagging current, this voltage rise is counteracted by the impedance drop. Under load the generator current is made up of the charging current and the load current, and these values are expressed in a vector diagram from which it is possible to read directly power and power factor as well as condenser kva. necessary for voltage regulation.

EFFECT OF TERMINAL APPARATUS

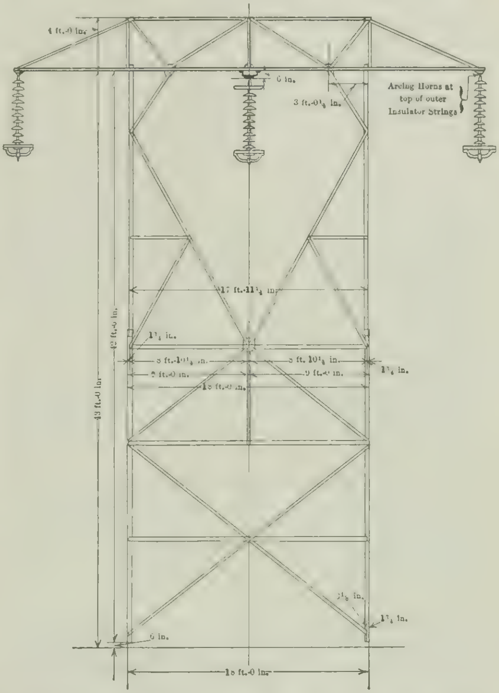
Very frequently it is convenient in making the electrical calculations for a long transmission line to include the effect of the transformers and other terminal apparatus. Herbert Bristol Dwight, in a paper entitled the "Electrical Characteristics of Transmission Systems," gave a method for doing this on constant-voltage lines, which are the type of line commonly used, especially for high-voltage and high-power systems, since synchronous condensers are generally part of the equipment. The necessity of using the hyperbolic theory in calculating the lines is pointed out, and specific examples of papers and problems solved without the use of this theory are discussed and errors indicated. The method of determining the size of conductor and the features of loading and controlling a constant-voltage transmission line proposed by Mr. Dwight is to draw a circle diagram for the line in question. This shows the operation of the condensers under all conditions of load and gives the amount of load which can be carried by the line at the voltages considered; in addition, the efficiency of transmission and power factor at the generators for various loads may be conveniently plotted above the diagram.

The paper by Shungo Furui scheduled could not be presented, as Mr. Furui, who had intended to present it in person, had unexpectedly been called to Japan.

C. E. Magnusson, in discussing transmission-line calculations, pointed out that hyperbolic functions take into consideration both length and phase of the quantities under consideration, whereas circular functions neglect the variations of length. The whole question then is whether the particular case in question at any time is such that the errors resulting from the use of circular functions are negligible.

Sven Barfoed, San Francisco, showed from diagrams which he placed on the blackboard the great variation in kilovolt-ampere capacity in synchronous condensers necessary for power-factor correction as the power factor varies and the consequent lack of necessity for absolute accuracy in its determination.

Ivar Herlitz deprecated the debate over method. If complete accuracy is necessary, he held, naturally the hyperbolic method is the only one to use; but for any line it is possible to learn exactly how much error the use of circular functions introduces and, knowing this error, one can use circular functions or not as he deems necessary.



STANDARD BIG CREEK TOWER WITH INSULATORS AND SHIELD RINGS AS FINALLY ADOPTED

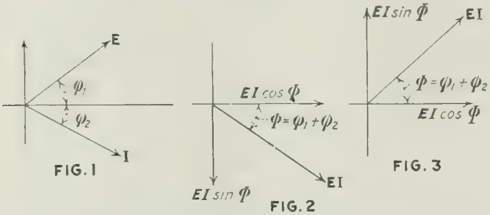
H. L. Melvin, Spokane, said that each operator probably makes his calculations in his own pet way, depending upon the requirements of his own system, using hyperbolic, circular, diagrammatic or other graphical means to fit the case, and that most operators can use any of these methods as needed. But, in any case, Mr. Melvin thought, an engineer was helped by the use of vector diagrams. He personally liked the Perrine-Baum diagram. Mr. Melvin would not minimize the importance of exact solutions. These, he said, must be known in order that a person may intelligently use less accurate methods.

John R. Dunbar, Hamilton, Ontario, brought up the question of a standard rule for the drawing of a vector diagram showing kva., pointing out that while the A.I.E.E. Standardization Rules, following the recommendation of the International Electrotechnical Commission at Turin, Italy, in 1911, provide that a leading current shall be plotted counter-clockwise to the electromotive force in the zero position—in other words, that impedance shall be represented by the formula $Z = R + jX$—there is no provision for the kva. diagram. Expressed mathematically, shall one use the conjugate of E or the conjugate of I in working out the vector expression for kva.? Thus, if I is multiplied by E, it gives:

$$\begin{aligned} & I(\cos\phi_2 - j\sin\phi_2) \times E(\cos\phi_1 + j\sin\phi_1) \\ & = EI[\cos(\phi_1 + \phi_2) - j\sin(\phi_1 + \phi_2)] \\ & = EI\ (\cos\phi - j\sin\phi). \\ & = EI\cos\phi - j\,EI\sin\phi. \end{aligned}$$

But if E is multiplied by I, it is:

$$\begin{aligned} & E(\cos\phi_1 + j\sin\phi_1) \times I(\cos\phi_2 - j\sin\phi_2) \\ & = EI[\cos(\phi_1 + \phi_2) + j\sin(\phi_1 + \phi_2)] \\ & = EI\ (\cos\phi + j\sin\phi.) \\ & = EI\cos\phi + j\,EI\sin\phi. \end{aligned} \tag{2}$$



FIGS. 1, 2 AND 3—E-I VECTOR DIAGRAM "LAGGING" CURRENT; KVA. VECTOR DIAGRAM "LAGGING" WATTLESS KVA. AS INDICATED BY FIG. 1 AND EQUATION 1; KVA. VECTOR DIAGRAM "LEADING" WATTLESS KVA. AS INDICATED BY EQUATION 2, BUT NOT BY FIG. 1

This latter makes a diagram which shows "leading" kva. with "lagging" current. The standards committee should, therefore, add a rule defining kva. as a quantity capable of vector representation in transmission line diagrams, etc.

Insulators Show Improvement

ACCURATE information showing the actual operating performance of insulators during a period of years was presented in a paper entitled "Failure of Disk Insulators on High-Tension Transmission Line," by Harrison D. Panton. The tabulated results, given in three tables, are based on the operation of a 100-kv. double-circuit steel-tower line, 97 miles long, during the period from March, 1912, to October, 1921. A principal feature of this transmission line are double-circuit steel towers, 73 ft. high, which support two three-phase circuits of No. 1/0 six-strand copper wire. The three conductors of each circuit are on the same side of the tower. The vertical spacing between these conductors is 9 ft., and the horizontal spacing of the two circuits is 15 ft. for the bottom and the top conductors and 21 ft. for the middle conductors. As built originally, the horizontal spacing of the two circuits was the same for all three conductors, but in 1916 the spacing between the middle conductors was increased to 21 ft. by putting a 3-ft. extension on each end of the middle arm. The average span length is 680 ft. The disk insulators used are of the cap-and-pin type, being the No. 1113 Thomas type manufactured in 1911. These were replaced on tension assemblies in 1915 with General Electric Hewlett disks, and the number of Thomas disks used in all suspension assemblies was increased from six to seven. This insulation is used at present. Tables I, II and III refer only to the Thomas No. 1113 disks used on suspension assemblies, there being on this line a total of 4,452, such assemblies consisting of a total of 31,164 disks. The remarkable thing about these tables is that instead of No. 1 disk showing the greatest tendency to failure, No. 7, or the one nearest the tower, shows the greatest tendency to failure. If these results are corroborated by other experiences, this will tend to show that the use of the shield ring or graded disks on the lower side of the insulator is misdirected work.

Insulation in New Zealand

"Test and Investigations on Extra High-Tension Insulators" was the title of a paper by C. Coleridge Farr and Henry E. R. Philpott of New Zealand. This paper took up tests made for the Public Works Department of New Zealand on insulators on the Lake Coleridge electric power supply system. A complete description of the tests made was given. These tests were inaugurated very largely because on this transmission system with over 5,000 insulators more than 800, or 16 per cent, had to be replaced in six years owing to failure. The experience of the authors indicated that failure was due mainly to initially poor insulators coupled with mechanical weakness. The authors suggested that insulators for extra high-tension work should, before they are put into service, be subjected, individually in the case of suspension units and on each shell in the case of pin insulators, to flashover pressure for a definite period at both high and low frequency; also that a percentage of each shipment of insulators should be subjected to a hydrostatic pressure of 2,000 lb. per square inch, with the insulator placed in a solution of fuchin for about a week.

In the design of insulators it is desirable to obtain

TABLE III—FAILURES LOCATED ON TEST FROM 1912-1921

Arranged according to years and location of disks in the assembly, disk No. 1 being adjacent to the conductor. Total number Thomas disks on suspension assemblies 31,164; prior to 1916, 26,712

Disk No.	1913	1914	1915	1916	1917	1918	1919	1920	1921	Total
1	14	26	30	54	51	41	42	36	100	294
2	8	22	11	21	20	44	22	69	111	217
3	8	22	16	20	48	63	40	124	237	341
4	9	23	10	26	44	85	60	127	254	384
5	5	14	19	30	55	88	67	116	272	394
6	3	23	24	21	52	88	40	160	295	411
7	...	...	...	43	71	103	42	170	303	429
Total	47	130	110	215	341	512	313	802	1,572	2,470
Per cent total No. disks ..	0.2	0.5	0.4	0.7	1.1	1.6	1.0	2.6	5.1	

TABLE I—FAILURES LOCATED ON TEST FROM 1912-1915, SIX-DISK ASSEMBLY

Arranged according to location of disks in the assembly, disk No. 1 being adjacent to the conductor

Disk No.	Top Wire	Middle Wire	Bottom Wire	Total
1	15	18	37	70
2	6	10	25	41
3	11	14	21	46
4	13	13	16	42
5	10	11	17	38
6	24	14	02	50
Total	79	80	128	287

TABLE II—FAILURES LOCATED ON TEST 1916-1921, SEVEN-DISK ASSEMBLY

Arranged according to location of disk in the assembly, disk No. 1 being adjacent to the conductor.

Disk No.	Top Wire	Middle Wire	Bottom Wire	Total
1	112	112	100	324
2	101	96	90	287
3	193	204	135	532
4	246	203	147	596
5	237	210	181	628
6	259	211	186	656
7	281	239	212	732
Total..	1,429	1,275	1,051	3,755

good dielectric strength, and in that respect flashover voltage, shell thickness and impulse ratio must also be considered. In a paper entitled "An Overpotential Test for Insulators" G. W. Lapp stated that the ratio of puncture voltage to the product of flashover voltage times impulse ratio may be taken as the electrical factor of safety in service.

To make it possible to test insulators at any definite voltage desired from flashover to high puncture, an overpotential test was devised and used in which the insulator is placed in an insulating dish which holds a sufficient depth of oil to form an electrical flashover seal at the rim of the insulator, at the same time leaving the head and center part of the shell exposed to the air. The inside terminal is connected with a conductor passing up through the center of the dish. In effect the dish becomes part of the insulator, which temporarily, for testing purposes, acquires an extended flashover distance sufficiently long to prevent flashover at the chosen testing voltage.

From records of puncture under oil of 1 per cent of several thousand suspension insulators, representative of six months' production, minimum and average puncture values were increased about 20 per cent and 15 per cent respectively above previous values on similar units tested by liberal flashover with impact. Maximum values of puncture were fully as high after applying the overpotential test. In no case was an oil puncture value below the overpotential used on the test. The distribution of punctures throughout the five minutes of test showed that two-thirds of the failures occurred in the first and second minutes and failures diminished in succeeding minutes, indicating that at the voltage of test no evidence of dielectric fatigue had appeared.

Thus this test applies to an insulator a definite chosen potential in excess of its highest normal flashover voltage, eliminates doubtful material and so increases the factor of safety.

TEST TOO EXPENSIVE

In discussing the insulator papers, C. E. Skinner, East Pittsburgh, Pa., pointed out that porcelain is essentially a conglomerate of elements, each individual unit having its own personal character due to its manufacturing history, and it is therefore necessary to test each individual unit and not depend upon batch testing. What the industry is looking for is a test to eliminate those insulators which will give trouble if used. No test has been, and none probably will be, devised to equal service conditions, and there must be an economic balance between the number of insulators eliminated by test and the number used. Certain conditions might make the Lapp test useful if it would eliminate the right ones, but these extra ones must be paid for some way and the entire conclusions would have to be based upon the assumption that the factory procedure was absolutely uniform. It is, of course, absolutely impossible for any test to eliminate insulators which would become defective later owing to their mechanical history while in use. Every one will welcome any test that helps give better insulators, Mr. Skinner said, and the Lapp test appears to afford a method which will be particularly useful to designers and manufacturers in developmental work, but he expressed his doubt as to its ever being useful as a routine test.

E. E. F. Creighton, Schenectady, N. Y., pointed out that the Lapp test meant a more severe test, that it would cost more, and that it would take out of service more insulators which the operating companies in the end would have to pay for.

C. Fortescue, East Pittsburgh, Pa., in a written discussion called attention to some errors, as he called them, in Mr. Lapp's suggestions and to some of the special features of the test. Mr. Fortescue said that the actual frequency of the test may be many times the 100,000 to 200,000 cycles mentioned by Mr. Lapp owing to the damped oscillations induced by the flashover itself. Mr. Fortescue argued for the greater dependability of the 60-cycle test for routine work and pointed to the fact that the potentials to which insulators are subjected under routine tests now used are several times more severe than any surge they are likely to meet in service.

Mr. Fortescue also deduced points in favor of the Lapp test—that the insulators are not flashed over, that the testing equipment does not have such severe service as in case of flashover, and that there is absence of deafening noises and the usual headache-causing ozone. Another good feature is that the value at which the test is made is under control so that any economic test value may be used. But Mr. Fortescue emphasized that the purchaser of special insulators would have to pay a special price or else the purchaser of standard insulators would have to bear part of the cost of losses sustained in selecting insulators for the more exacting service.

QUARTZ LENSES RECOMMENDED

Allen W. Eshelby, Seattle, called attention to the incomplete information which photographs of flashovers taken through ordinary glass lenses present. Mr. Eshelby mentioned some flashover pictures taken with quartz lenses, which are not opaque to ultra-violet rays as are glass lenses, and said that these flashover pictures give much more complete information as to the actual behavior of the flashovers than do those pictures which show only the visible part of the spectrum. Mr. Eshelby said he thought that the greater use of quartz lenses would show much that is not now known.

R. J. C. Wood, Los Angeles, in discussing Mr. Panton's paper, referred to the figures which showed that in early years, 1913 to 1917, No. 1 disk seemed to fail the most, whereas since 1917 No. 7 disk, that nearest the point of support, has taken first place. It is common knowledge that in the years 1913 to 1917 insulators were different from those of today. Mr. Wood wondered if the explanation were not that the earlier failures were due to electrical causes, whereas the latter-day failures are due to mechanical causes.

W. A. Hillebrand, San Francisco, said he thought the record of failures over the period of seven years was one of the lowest known. There is, however, a comparatively high rate in the dead-end position, but this was accounted for by the heavy sleet which had caused an average of about one break per mile so that the dead-end had been placed under heavy mechanical strain. Mr. Hillebrand pointed out in addition that perfect results in porcelain were never to be expected, and Mr. Skinner said that if porcelain manufacture ever became uniform, it would probably be uniformly bad.

E. E. F. Creighton discussed some of the manufacturing reasons for non-uniformity in porcelain, asserting that a perfect piece of porcelain was perhaps an accident. He referred to tests which have already been recorded in which dye was sucked into porcelain by the use of a vacuum and the porcelain later broken in the attempt to find faults of manufacture and also his

"Ferris wheel" tests for deterioration under hot and cold variations.

Ivar Herlitz, Riverside, Cal., whose experience has been principally in Sweden, quoted from a paper by W. Borgquist, director of the Bureau of Power, Board of Water Falls, Sweden, telling something of Swedish experience with insulator development. He made the following points:

Swedish Precautions to Reduce Failures

1. That in the years preceding 1914 an extensive study of the mechanical and electrical aspects of the insulator problem was made, this investigation resulting in the design of a suspension insulator with the following characteristics: (a) The porcelain was, as far as possible, made free from tensile and shearing stresses. (b) The cap was corrugated at its lower edge and the pin at its top only, giving the metal greater freedom to expand axially under variations of temperature. (c) The joints between metal, cement and porcelain were provided with elastic cushions. (d) Sharp corners in the porcelain were eliminated as far as possible in order to reduce possibilities for concentration of electric field. (e) The string was graded by varying the capacity of the units so as to make the voltage distribution as even as possible. (f) The cement was electrically short-circuited by means of a conducting film on the porcelain, which film was connected with a cap or pin. For later insulators the grading has been replaced by shielding accomplished by arcing horns of a special design.

2. That of these insulators 70,000 have been in operation during the past six or seven years without any aging phenomena. Fifteen or twenty units have been replaced on account of damage from arcs, otherwise no replacements have been necessary. Experience has shown that electrical phenomena in the cement are probably of little importance.

3. That experience from certain insulators has strongly brought out the detrimental effects of expanding cement.

H. V. Carpenter, Pullman, Wash., thought that while perhaps better porcelain is being produced, this better porcelain introduces some new characteristics which must be learned.

Megger Not a Conclusive Test

H. H. Schoolfield, Portland, Ore., recently tested a 66-kv. line with a Johnson "buzz stick," which was the first test the line had received since 1912, the date of installation. This line is near The Dalles, in a dry part of Oregon. About 3 per cent of the insulators were found bad by this method, which Mr. Schoolfield considered a good record for insulators bought in 1912. The line is somewhat underinsulated, there being three units in suspension strings and four units in strain strings. A large percentage of the failures took place at the point of support. Upon checking with a megger the insulators which failed under the "buzz stick" the results obtained indicated that the megger does not show all the bad insulators.

R. J. C. Wood was somewhat surprised at the temerity of Mr. Schoolfield in his use of the "buzz stick" under these conditions and mentioned his own electroscope testing apparatus, made from a Bakelite tube, which avoided the possibility of short-circuiting a string in case two insulators out of three were bad.

H. L. Melvin, Spokane, Wash., asserted that while the operating engineer was not a designer and while he depended upon the manufacturer for design and test, still the operator was at fault for not keeping an adequate record of failures from which more conclusive data could be obtained.

D. I. Cone, San Francisco, approaching the subject from a different angle, said that telephone engineers note with pleasure the increase in freedom from insulator failure and from the consequent telephone disturbance.

R. M. Boykin, Portland, Ore., wanted to know about the standard test for insulators which the executive committee of the N.E.L.A. Technical Section had requested from the A.I.E.E. standards committee. C. E. Skinner stated that no standard test had been reached and that one of the reasons was that new tests such as those suggested by Mr. Lapp were being introduced into the industry and were making it impracticable to reach any definite conclusion as to a standard.

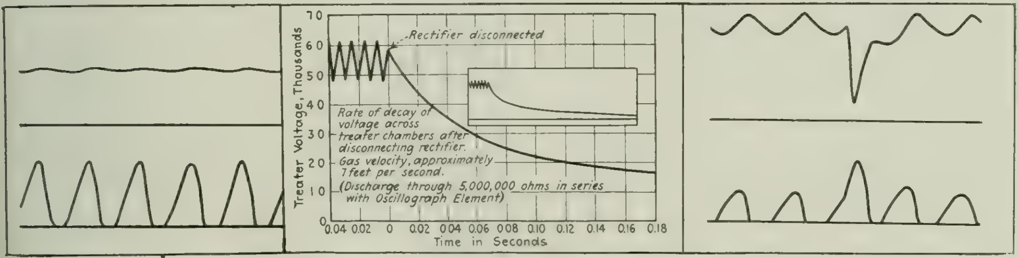
Symposium on Electrical Precipitation

INVESTIGATIONS in regard to the electrical precipitation of solids from gases during recent years have resulted in some important conclusions, which were presented by Walter A. Schmidt in a paper entitled "Recent Conclusions Pertaining to Electrical Precipitation."

It was early recognized that percentage of precipitation increased as the voltage approached the arcing points, and that the electrical discharge or current flow increased simultaneously and in a more or less definitely related manner. Later, in certain commercial problems, however, the poorest results were obtained with the highest current flow, that is, with the most intense corona discharge, making it imperative that the subject should be investigated.

In practice a precipitator consists of a multiplicity of opposing electrode units, one group being of such shape as to facilitate corona discharge, the other group being of such form as to minimize or prevent discharge. The former are usually referred to as discharge electrodes, the latter as collecting electrodes. Discharge electrodes may consist of wire, chains, edged strips, serrated edges, or any other form of conductor that will establish a sufficiently high potential gradient at or near its surface to cause corona discharge. Collecting electrodes may consist of plates, pipes, screens, closely grouped wires, or any other form or arrangement of conductors that will establish low field concentration and thus minimize or prevent corona discharge. Usually the collecting electrode system is of much greater weight than the discharge electrode system and consequently is electrically grounded. The potential difference maintained between electrodes depends on the spacing and other circumstances and ranges in different installations from 20,000 volts to 100,000 volts. Unidirectional current is supplied by rectifying high-tension alternating current. The precipitator has received the name of treater, and the type of collecting electrodes designates the type of treater, as, for example, pipe, plate or screen treater.

When discharge is raised above the critical potential a corona discharge is established, the gas immediately around the wire becomes ionized, and the resultant ions travel either to the collecting electrode or to the discharge electrode, depending on whether they are negative or positive. Should the gas in its tubes carry suspended liquid or solid particles, such as come within the zone of ionization, it may become either negatively or positively charged and thus be either repelled from or drawn to the discharge electrodes. Load particles which remain outside of the zone of ionization become negatively charged and are forced over to the collecting electrodes. In practice it is found that a certain amount of the precipitated material is always collected upon the discharge electrode, but by far the greater part is collected on the grounded collecting electrodes. As soon as material commences to collect on electrodes conditions in the precipitator change. The deposit forms a series of minute particles separated by equally minute gas pockets, and as the solid particles in the gas will have different dielectric properties the electric field will be concentrated at the points of contact or approximate contact of the solid particles. As the charge accumulated at the surface increases the field increases, and the parts of local concentration will rise to field intensity sufficient to cause ionization of the gas within the deposit. When this condition is established the deposit becomes an ionizer or source of discharge, with most disastrous results. This can be prevented by keeping the collecting electrode at all times conducting.



ELECTRICAL CHARACTERISTICS OF TREATER CIRCUITS

Left—Treater voltage with a peak of 57,000 and treater current of 1 amp. applied to a large unidirectional treater installation. Middle—The rate of treater discharge is slow as the result of low velocity of the charged particles. Right—Rapid recovery of treater voltage following breakdown between electrodes during the precipitation process.

"The Electrical Precipitation of Solids from Smelter Gases" formed the title of a paper presented by Ross B. Rathbun. The author set forth the fundamental principles of a precipitation process as developed by Cottrell and described the various types of treaters in common use, showing that gas is ionized more efficiently for a given power consumption and the construction simplified and reduced by arranging the electrodes in a flue so that their dielectric fields are in series with each other. By this means the gas flow is parallel to the electrostatic lines instead of at right angles to them. The physical rather than the chemical structure of the dust in suspension is a very important item, and metallurgical factors which control the amount of sulphuric acid and water vapor in the gases also have an important bearing on the operation. Several theories were given regarding the fact that dust is much easier to precipitate than fume, and some photographs illustrated the difference in structure between the fume and dust. Selective absorption was given as an explanation of how aqueous vapor added to the gas stream functions to permit electric charge to leak through a dry precipitated coating to the electrode. The author also discussed the theory of back ionization and phenomena of discontinuous dielectric and pointed out that these electrical matters are secondary to treater design and the conditioning of the gases.

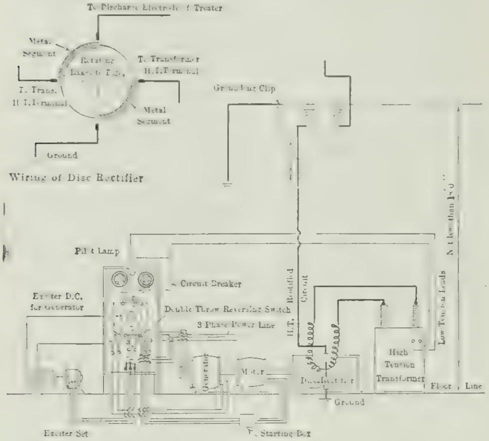
The "Electrical Engineering Features of the Electrical Precipitation Process" was the title of a paper by G. H. Horne in which he described in detail the common sources of power for precipitation work. In the commercial plant today the low-tension current is supplied to the transformer either through a synchronous motor or motor-generator, and the transformers are standardized at a voltage ratio of 220 or 440 to 100,000 volts, with taps in the low tension to give 50, 62½, 75, 87½ and 100 kv., the capacities being 10, 15 and 25 kva. As it is necessary to supply the discharge electrode system with unidirectional current to obtain maximum precipitation efficiency, a mechanical rectifier is used which consists of a bakelite disk to the periphery of which are attached two quadrant metal strips opposite each other, constituting the moving conductors. The four stationary shoes are so mounted that they may be rotated about the disk through 90 deg. by means of a hand wheel, pinion and gear segment. The length of the stationary shoes and the length of the moving conductors determine the length of contact on the wave, and the position of the shoes about the disk, as adjusted by the handwheel, determines the portion of the wave rectified. These mechanical rectifiers so far are the only type that have proved successful.

The power consumption of a precipitator having clean electrodes and ordinary air as the dielectric medium appears to follow the laws of dielectric phenomena developed by F. W. Peck, Jr. On the other hand, the power consumption in a normally operating precipitator having the electrodes covered with deposits of fume or dust and having furnace gases as the dielectric is influenced by a number of factors which have not yet been fully investigated. Ionization of the gases and high

NEW VOLTAGE DATA ON DIFFERENT MATERIALS WHICH CAN BE PRECIPITATED

Material on Plate		Arcing Voltage, Kv. Peak
Plate clean	Point negative	120
Mica	Point negative	50
Sulphur	Point negative	50
Glass wool	Point negative	50
Varnished cambric	Point negative	70
Filter paper	Point negative	90
Writing paper	Point negative	118
Writing paper crumpled	Point negative	90
Edge of glass plate	Point negative	65
Asbestos	Point negative	100
Plate clean	Point positive	45

temperature also may cause variation over and above those which would be expected from the corresponding reduction in the gas density. The two curves shown indicate the power used by a pipe precipitator, one having air and the other mist-laden gas. The power for the air curve is greater than for the gas curve up to a voltage of approximately 60 kv., where the curves intersect. The general conclusion is that Peek's expression for corona loss may be used, subject to correction, as a means of interpreting electrical precipitation power data.



ELECTRICAL PRECIPITATION REQUIRES THE PRODUCTION OF A UNIDIRECTIONAL ELECTROSTATIC FIELD IN WHICH A CORONA DISCHARGE IS MAINTAINED

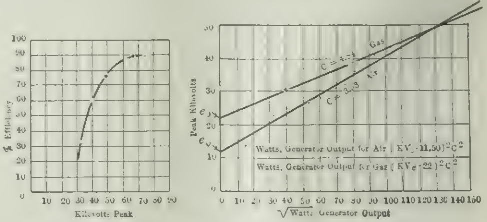
In presenting his paper Mr. Schmidt remarked that it was peculiar that this electrical precipitation process had not been developed by electrical engineers, but rather by chemists, electrophysicists and electrometallurgists. The art has advanced, however, until it is possible to treat as high as 2,000,000 cu.ft. to 3,000,000 cu.ft. of gas per second.

O. H. Eschholz, East Pittsburgh, Pa., in a written discussion, pointed out that electrostatic precipitation is actually the successful utilization of the corona phenomenon, which usually results in an energy waste or impending failure, but in this case is the essential operating agency. Because of the importance of the corona phenomenon involved, interest is frequently centered on the character of the treater voltage wave. In the three figures presented herewith, which were a part of Mr. Eschholz's discussion, he showed first an oscillograph record of treater voltage and currents. The peak voltage was 57,000, the effective voltage 97 per cent of the peak. The effective mechanical rectifier ground current was approximately 1 amp. This quite flat character of the voltage wave is doubtless responsible for Mr. Horne's observation that the substitution of a high-voltage direct-current generator (Girven) for the mechanical rectifier does not give a substantial increase in precipitation of frequency.

With reference to the low velocity of the heavy ions, Fig. 2 shows the comparatively slow rate of treater discharge upon disconnecting the supply circuit as a result of this low ion velocity. As a result of the low ionic drift, considerable energy is stored between electrodes. This is useful in maintaining treatér voltage or serves quickly to re-establish such voltage in the event of a short circuit caused by breakdown between electrodes. This latter effect is well illustrated in the unusual record shown in Fig. 3. This shows the treater voltage and current before, during and after a breakdown between treater electrodes. Only those particles in the immediate path of the arc were discharged, thus permitting the immediate re-establishment of treater voltage when the arc had been ruptured at the contacts of the rectifier. It is important to note that because of this low ionic drift and the breaker-like action of the mechanical rectifier, the precipitation time lost due to treater short circuits is negligible, and hence it is practicable to operate treaters very close to their critical breakdown voltage. Mr. Eschholz also pointed out that treater circuits may serve as a source of high-frequency radiation and hence cause wireless interference. Apparently the energy stored in the treater proper is radiated from the transmission line at the latter's natural frequency.

E. P. Dillon, New York, also in a written discussion, said that lack of knowledge of the phenomena now explained by Mr. Schmidt had for many years been an obstacle to precipitation engineers in their efforts successfully to handle certain kinds and conditions of gases that do not lend themselves readily to effective clean-up in Cottrell precipitation treaters. Mr. Dillon also voiced his keen appreciation of the excellence and value of the Anderson and Horne work, which has established mathematically very important conclusions with reference to precipitation phenomena. The result of this is that engineers are now better equipped to design treaters for practically any problem of cleaning gas and to predetermine the percentage of recovery or clean-up. In other words, engineers are now equipped with information permitting them to take cognizance of the economic elements in designing a treater for a given problem.

J. C. Hale, New York, said in a written discussion that the relative advantages of the synchronous motor and the motor-generator set depend largely upon the characteristics of the power supply circuit to which they are to be connected. With poor regulation on this circuit the motor generator is perhaps better; however, sufficiently close voltage regulation to permit satisfactory operation of synchronous motors is usually found. Another disadvantage of the motor-generator is the voltage distortion from a 5-kva. or even a 15-kva. generator due to oscillations from the rectifier circuit. These could not occur on a large system as the oscilla-



LEFT—THE PRECIPITATION EFFICIENCY DOES NOT INCREASE INDEFINITELY WITH THE PEAK KILOVOLTS. RIGHT—UP TO ABOUT 50 KV. THE POWER REQUIRED FOR PRECIPITATION IN AIR EXCEEDS THAT FOR MIST-LADEN GASES tions would be too small to react. What the effects of these are is not yet definitely known.

Mr. Dillon also complimented Mr. Rathbun for his development of the wire-type treater, and Mr. Schmidt and C. N. Beebe, Vancouver, both called attention to the fact that the Rathbun treater requires a smaller cubical volume, Mr. Schmidt further pointing out that in order to get the greater precipitation in the same cubical volume, a much greater length of discharge electrode is used by Mr. Rathbun, but that the Anderson-Horne law still holds.

From the economic standpoint, Mr. Beebe asserted that modern smelting companies do not hesitate to spend a million dollars if necessary on precipitation installations and that the Rathbun research had done much to keep such figures low.

Education Attracts Attention

IN THE United States today empirical, shop and laboratory practices in educational institutions, from the kindergarten to the university, are overdone. This is the opinion of Taliaferro Milton as expressed in a paper entitled "Training to Think Versus Gathering Information." The author averred his belief that there should be no fundamental difference between the general methods of engineering education and education in any other profession. The chief element of education is to teach the student to think and give him just such facts as are necessary to make him think. One of the main troubles with modern colleges, especially the large one, is the lack of democratic spirit. As a result of observations throughout the country Mr. Milton concluded that graduates from the smaller colleges are more democratic in spirit because their time is not so largely spent on other things than college work.

The colleges of the country should change their courses and take cognizance of the fact that industry today needs men who will take charge of the business side of the work, L. A. Ferguson declared in his paper on "Engineering Graduates in Business." The training of the students of the future, said Mr. Ferguson, should make provision for the type of men who, though they may not shine in technical work, will nevertheless take places of importance in the industrial world, where leadership, salesmanship and executive ability are in great demand.

COLLEGES RUN INEFFICIENTLY

There is a very great waste of good material in the educational institutions of this country, in the opinion of J. W. Upp, who presented a paper entitled "Conservation or Waste of Material in Educational Institutions." Mr. Upp compared the colleges with an up-to-date business institution and said that such a loss of material as occurred in colleges would never be countenanced by any progressive business. He thought that a college or university should be run according to the best modern business principles; that is, the administrator should be able to show a satisfactory return on the investment. In his opinion the number of students who have failed to complete their work or who have dropped out of college is the best criterion regarding the college's efficiency as an educational institution.

The selecting and training of teachers is probably the most important phase of college administration, and teaching calls for leaders of the highest type, who should be properly remunerated and properly trained.

E. E. F. Creighton in opening the discussion on the educational papers said that this was a continuation of the educational symposium started as a result of the educational committee's activities during the past two years and that the principal purpose of the committee's survey and of this symposium was really to get the engineer in practice interested in what the university is doing so that he will assist the university to produce the right sort of material. Referring to the older engineering manufacturing organizations, Mr. Creighton said that the chief engineer knew all of the organization's engineers, assistants and foremen and even most of the workers and really was the czar in the organization. Salesmen then were untechnical and under the thumb of the engineer. Finally, however, the management realized that salesmen must not be mere gingham-counter clerks, and salaried places as salesmen were offered to technical graduates until the pendulum swung to the point where salesmen came to speak of "our engineers."

C. E. Magnusson, Seattle, said that whether it appreciates the university output or not, the profession cannot get along without the university. As to selection of material entering the university, Professor Magnusson said he would like to see the man who can go to the high school and pick out the executives of twenty years hence. While psychologists can help, Professor Magnusson pointed to a nationally advertised psychological wonder who is now in his classes and for whom the professor is trying to find a means of earning his bread and butter. Referring to Mr. Ferguson's analogy with the pine and the maple, Professor Magnusson wondered if possibly the result of trying to segregate the maple would not be to produce a bird's-eye maple, more decorative than useful.

Since this discussion was a continuation of the discussion at Niagara Falls, Professor Magnusson referred to Mr. Doane's paper and said that although universities would welcome the placing of instructors in industries for a year, they would welcome even more the absorption of engineers from industry into university work for a year at a time. If he could have only one or two such per year, "they would come out different men" with reference to their attitude toward universities.

William McClellan, New York, said that of course men must be trained as citizens and engineers as engineers and that the two things must not be confused. A man to design a bridge must be familiar with all kinds of reinforced concrete, all kinds of structural steel, all types of bridges, he must be up to date on all recent bridges built, on technical ways of doing things, etc. If he has taken the time to keep up on all this, can be also have the time to be a business man and a lawyer as well? Naturally he must broaden in order to take his place as a citizen in his club circle and in his talks with other men, but even if he does not he may still be a big engineer.

F. D. Weber, Portland, Ore., a member of the Oregon Rating Board for the Registration of Engineers in Oregon, said he thought useful information could be obtained from the records of the various boards operating under the new licensing laws in different states. In Oregon, with a population of something like 700,000, 1,240 have registered as professional engineers. In the examination of these men the most striking characteristic is the lack of ability to attack new problems out of the line of the specialty of the man in question.

Professor Matthewson of the department of civil engineering, University of British Columbia, discussing the relation of the university to the engineering profession said that it must not be forgotten that all so-called self-educated engineers actually draw upon university work or its equivalent or they would not be successful.

J. B. Fisken, Spokane, Wash., referred, as did many others, to the insufficient emolument of university professors as limiting the supply of high-grade men for the training of future engineers.

Walter A. Schmidt, Los Angeles, said he thought that an attempt was being made to make "super-engineers" in numbers out of harmony with the possibility.

W. A. Hillebrand said that there are perhaps thirty qualifications necessary to success. Of these a college has a contact with not more than two or three, and this ought to be made clear to college students. A college can train men to think but it can have an effect only upon those who will submit to the training.

Miscellaneous Papers

INSTABILITY as applied to an exciter has many meanings, including any change in voltage for a small change in load, a creeping of the voltage without apparent cause, temporary loss or reversal of excitation accompanying sudden short circuit of the alternator, and grabbing of the load when in parallel with other exciters. R. E. Doherty, in a paper entitled "Exciter Instability," held that experience has shown that most of these phenomena occur when the exciter is operating at low magnetic densities. The author made a study of circuits, assuming the exciter to be operating within the range of the straight portion of the saturation curve, and checked the results by an experimental study. He concluded that the conditions of instability are low magnetic densities in combination with one or more other things, such as low residual voltage, a large drop in the armature, a relatively large inductance in the load circuit, and alternator transient of greater duration than exciter transient, or excessive series field strength. His conclusions were based on an equation which is the same form as that given for an electric circuit containing resistance, inductance and capacity, the only difference being that the duration of oscillations and transients is much longer. Mr. Doherty said that an exciter can be stabilized against voltage creeping by special design, or by the use of a few batteries connected in series with shunt field, or by using automatic regulators or rheostats in the alternator field.

R. J. C. Wood, Los Angeles, said that Mr. Doherty's paper was a good argument for the directly connected exciter on the generator shaft. This, of course, is the direction in which the industry is going, but from the standpoint of stability it is possible and easier to design a directly connected exciter so as to avoid operation on a low saturation point of the curve. J. Brown, however, pointed out that when a voltage regulator is used and a broad range needed, it is necessary to operate low on a saturation curve. Some of the points made by Mr. Doherty, he said, mean that more attention must be paid to the application of exciters.

O. C. Merril's paper was presented by G. F. Brown of Schenectady, but called forth no discussion.

Colorado and power development on the Colorado River have attracted the attention of hydraulic engineers very much during the last year, and a paper was prepared on this subject by O. C. Merrill.

Picture Telegraphy

Picture telegraphy is as yet far from the zenith of its possibilities, in the opinion of D. W. Isakson, who presented a paper entitled "Developments in telephotography." The art of transmitting an optical image to a distance by means of an electric circuit has beginnings which reach back more than seventy years, but as yet it has had no results which warrant its commercial application. The problem has been discussed and worked on by modern scientists, such as Korn and Belin, and in addition the Leishman systems have been developed, all along lines leading to ultimate solution. A broad field for investigation and experimentation in the application of new and untried laws and the phenomena of physics, chemistry and electricity is unfolded to the engineer in developing this phase of engineering. Mr. Isakson anticipated a great advance in the art during the next decade.

The only discussion on Mr. Isakson's paper, which was conceded to give a clear exposition of modern developments in this line, was to question the term used. "Telephotography" has long been used as a term in the photographic arts to indicate a photograph of a distant object taken through a telescope or "telephoto" lens to make it appear as if the picture were taken at close hand. Some other term should be adopted by electrical science to indicate the transmission of pictures by telegraph or telephone or radio.

Miscellaneous Features

ON TUESDAY evening G. Faccioli entertained the convention delegates with an interesting, informal illustrated discussion on the reduction of engineering problems to their simple elements. This talk was filled with examples pertinent to the discussion.

On Thursday evening R. J. C. Wood, Los Angeles, and Joseph Mini, Jr., San Francisco, gave extended talks illustrated by stereopticon describing graphically developments and plants of the Southern California Edison Company and the Pacific Gas & Electric Company.

On Thursday afternoon C. E. Skinner, East Pittsburgh, Pa., addressed the convention on the present status of standardization both in America and internationally, showing the development of the American Engineering Standards Committee. He also gave an illustrated talk on the new 1,000,000-volt testing laboratory of the Westinghouse company at East Pittsburgh.

On the same afternoon Lieut.-Commander A. M. Charlton, U. S. S. *Tennessee*, gave a complete description of the electrical equipment of the *Tennessee*, which was visited by several of the convention delegates on Saturday, Aug. 12, at Bellingham.

On Friday afternoon all of the delegates and guests were entertained by the British Columbia Electric Railway Company, Ltd., going by boat to Lake Buntzen for a complete inspection of the two hydro-electric plants of the company at that place.

The location of the next Pacific Coast convention was left undetermined, with the probability that it will be held in San Francisco in August, 1923.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Conductivity of Creosoted Poles

To the Editors of the Electrical World:

On page 674 of the June 12 issue of *Commerce Reports* is an interesting article, "Creosoted Poles Used in Southern France." The methods of treatment used in France and the durability obtained cannot be compared with the standards in use in the United States, where a greater penetration of the preservative and hence longer service are secured; but the statement about the electrical resistance is of interest.

Accompanying this letter is a copy of the statement to which I have just made reference. This may be of especial value at this time to the readers of the *Electrical World* on account of the increased use of pressure-creosoted pine poles. The results of these experiments on conductivity of creosoted poles compare very favorably with the results of tests made in this country on the relative conductivity of treated and untreated ties.

P. R. HICKS,
Secretary-Manager.
Service Bureau American Wood Preservers' Association,
Chicago, Ill.

[The inclosure referred to by Mr. Hicks follows:

Recent experiments conducted by the faculty of science of the University of Toulouse, in co-operation with the Société Méridionale de Transport de Force of Carcassonne, indicate that creosoted poles have a much lower conductivity than ordinary wooden poles. It appears that there is only about one-fourth the loss of electrical energy through creosoted poles which occurs through uncreosoted poles. It cannot be claimed that the former are non-conductors, but their conductivity is so low that on certain lines the transmission wires have been affixed directly to them without the use of insulators, with results quite satisfactory during dry weather, so long as the periods of transmission were confined to actual working hours.]

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Heat-Recovery Apparatus in the Gennevilliers Power Station

To the Editors of the Electrical World:

I have just read with a great deal of interest the article appearing in the *Electrical World* describing the Gennevilliers power station near Paris.

The principal feature which stands out in this station is the application of practically every form of heat-recovery apparatus which has been developed up to the present time. This, of course, may be warranted by the price of coal existing in France. However, it has occurred to me that if high-grade English coal can be delivered to the United States at a price not very much higher than our own coal, the price of coal in France is not so excessive. In other words, I question the use of some of the heat-recovery equipment in this station in face of the fact that in this country, for instance, there seems to be a diversity of opinion as to the use of economizers. For example, economizers were not installed in the Hell Gate power station of the United Electric Light & Power Company of New York City.

The most radical departure in the Gennevilliers station is the use of air heaters in addition to economizers. In reviewing the history of various heat-recovery apparatus I cannot help wondering whether or not air heaters will not go through a temporary wave of popularity.

I think the operators of the Gennevilliers power station can render a great service to the engineering world if they subject this station and its individual equipment to exhaustive tests and publish the information thus obtained. If this is done, engineers will be in a better position to judge whether or not air preheaters, for instance, are desirable for a particular station.

Another feature which stands out is the position of the superheaters. It will be noticed that they are apparently entirely outside the boiler setting and receive the gases after they have passed through not only the first pass but the circulating tubes as well. This is contrary to practice in this country, where the tendency is to place the superheaters as near the fire as possible. With the superheaters installed as in the Paris station, an area of approximately 50 per cent of the boiler-heating surface is required in order to obtain a superheat of 250 deg.

An interesting feature is the fact that the amount of surface employed in the various heat recovery apparatus is more than twice that in the boilers proper.

Another outstanding feature in this station is the simplicity of the turbines, which employ only ten stages as compared with the twenty stages used in this country for the same size of unit. The economy of these units is also very much better than that obtained in this country, the water rate being about 10 per cent lower than the best water rate obtained in the United States, after correcting for difference in steam conditions.

Among other features the actual performance of which will be of great interest are the generator air coolers and the Venturi stacks.

HERBERT B. REYNOLDS,
New York, N. Y. Consulting Mechanical Engineer

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"A Question of Copper"

To the Editors of the Electrical World:

The letter of L. H. B. Sandwell appearing in the July 29 issue of the *Electrical World* seems to me to be in error. The statement with regard to transformers that a 220-volt secondary would require less copper than a 110-volt secondary is, of course, wrong. A 220-volt secondary transformer requires just half the cross-section and double the turns of copper, which results in slightly more copper for 220 volts than for 110 volts. It would seem to me that the same thing would apply to rotaries, motors, etc., although I am not so familiar with other apparatus as with transformers. In addition, the smaller wire costs more than does the larger wire.

Regarding lamps Mr. Sandwell admits that these would be more expensive on account of the shorter life. There is no doubt that the troubles with short circuits and the destruction of heating devices would be far greater, and the burning out of small motors would also be increased.

Another distinct disadvantage would be that shocks to customers would be more frequent and more perceptible to them.

In short, I think that the only saving in using 220 volts would be on the secondary network, and it hardly seems likely that this saving would be enough to offset the disadvantages.

R. V. BINGAY.
Pittsburgh Transformer Company, Pittsburgh, Pa.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Rugged Dead-End Assembly for 1,700-Ft. Span

FOR dead-ending a long 63,000-volt transmission span an assembly consisting of four strings of insulators fastened to steel seats in the manner shown in the accompanying illustration is used at the High Bridge substation of the Northern States Power Company at St. Paul. Steel towers, 125 ft. high, form the supports for the 1,700-ft. span over the Mississippi River at this point, one of the towers being used as the framework of a 3,000-kva. outdoor substation. This substation, with a photograph of the tower, was described on page 136 of the Jan. 21 issue of the *Electrical World.*

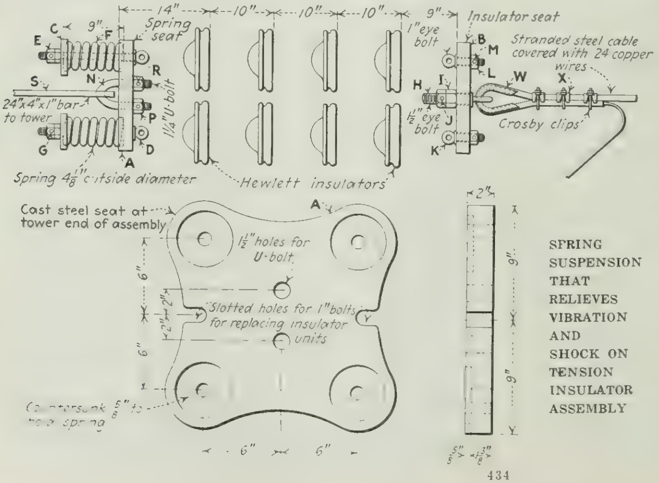
A feature of the insulator assembly is the springs, normally under compression, which are designed to protect the insulators from the effects of vibration or shock. There are four insulator strings, and in place of the usual yoke and equalizer arrangement, a cast-steel plate is used, a spring being provided at the tower end for each insulator string while eye-bolts only are used at the other end. The plates are notched on opposite sides so that bolts can be inserted and the nuts drawn up to release the tension and allow the removal of one or all of the insulator strings for maintenance purposes.

MATERIAL REQUIRED FOR ASSEMBLY OF ONE DEAD-END

Material	Index to Chart
One cast-steel seat, tower end	A
One cast-steel seat, line end	B
Four spring caps	C
Four 1-in. eye-bolts	D
Eight hexagon nuts for 1-in. bolts	E
Four springs	F
Four ¾-in. split cotter pins	G
One 1½-in. eye-bolt	H
Two hexagon nuts for 1½-in. bolts	I
One ¾-in. split cotter pin	J
Four 1-in. eye-bolts	K
Four hexagon nuts for 1-in. bolts	L
Four ¾-in. split cotter pins	M
One 1¼-in. U-bolt	N
Two hexagon nuts for 1¼-in. bolts	P
Two ¾-in. split cotter pins	R
One 4-in. x 1-in. bar	S
One 1½-in. bolt	T
One hexagon nut for 1½-in. bolt	U
One ½-in. split cotter pin	V
One ⅝-in. thimble for ⅝-in. cable	W
Three ⅝-in. Crosby clips	X
Six 1-in. x 5-ft. 6-in. rods	Y
Six hexagon nuts for 1-in. rods	Z
Six washers for 1-in. rods	A-A

The tension on the insulator strings in each assembly is equalized by tightening or loosening the nuts on the end of the eye-bolts running through the springs. Minor adjustments of sag in each conductor can be made by use of the closely spaced holes in the bar which connects the assembly to the tower.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.


14"
10"
10"
10"
9"
9"
C
E
F
Spring seat
R
S
N
24"x4"x1" bar to tower
P
1¼" U-bolt
G
D
A
Spring 4⅛" outside diameter
Hewlett insulators
Insulator seat
1" eye bolt
B
M
L
Stranded steel cable covered with 24 copper wires
W
X
H
I
1½" eye bolt
J
K
Crosby clips
Cast steel seat at tower end of assembly
A
1½" holes for U-bolt
6"
2"
2"
Slotted holes for 1" bolts for replacing insulator units
Y
Y
6"
Countersunk ⅝" to hold spring
6"
6"
2"
9"
9"
5/8"
1⅜"

SPRING SUSPENSION THAT RELIEVES VIBRATION AND SHOCK ON TENSION INSULATOR ASSEMBLY

Auxiliaries of 2,300-Volt Rating Reduce Losses

RELIABILITY, flexibility and simplicity are the underlying requirements for station auxiliary drive. The outstanding features of the increasing use of electrically driven auxiliaries have been the extensive application of the alternating-current motor, and particularly the use of 2,300-volt motors in sizes of 50 hp. and above. Direct current was used in many plants in the past for those auxiliaries which were motor-driven, but, as in the industrial field, the improvement in alternating-current motors has led to their general adoption for station auxiliaries also, the remaining exception of importance in most cases being the drive for stokers.

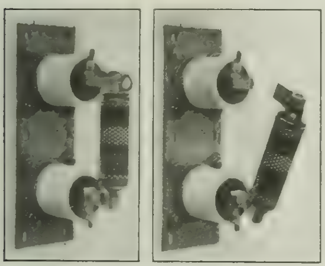
The distribution of either alternating current or direct current at voltages of 600 and below for the auxiliaries in a large plant involves very great investment and heavy losses and is decidedly uneconomical when compared with the distribution where a considerable portion of the load consists of 2,300-volt motors driving the larger auxiliaries. In most of the stations of large capacity built within the last few years 2,300-volt motors are being used quite extensively with entire satisfaction. In the selection of such motors and their control equipment, however, it is important to be assured of ruggedness of construction, ample clearances and simplicity of operation. An indication of the general trend which is of particular interest is that of the Hell Gate station in New York recently placed in operation. In this station all auxiliaries, with the exception of two or three steam reserves, such as emergency boiler-feed pumps, etc., are electrically driven. Moreover, all of the auxiliary motors are alternating current, with all motors above 25 hp. operating on 2,300 volts.

A noteworthy record is the use for the first time in large generating stations of the truck-type switchboard equipment in connection with the 2,300-volt supply to station auxiliary motors in both the Hell Gate station and the South Meadow station in Hartford, Conn.

H. C. ALBRECHT,
Electrical Engineer.
Philadelphia Electric Company,
Philadelphia, Pa.

Protective Resistor Also Disconnects

POTENTIAL taps from circuits operating at 6,600 volts and above, such as those for potential-transformer primaries and ground-detector leads, have in many instances been insufficiently safeguarded against failure of potential fuses to clear the circuit in case of breakdown of equipment. The potential fuses in such cases are called upon to open short-circuit currents many times in excess of their rating, with consequent danger of serious damage to equipment and to the service.



RESISTOR SWITCH USED TO PROTECT POTENTIAL TRANSFORMERS, ETC.

Resistors mounted on porcelain supports and ranging in value from 200 ohms to 500 ohms have in recent installations been inserted in potential leads as close to the point of tapping the main circuit as possible. These resistors have the effect of limiting short-circuit currents to values well within the rupturing ability of the fuses.

Such resistors, with an additional disconnecting feature, were recently installed in a new plant extension for the Queens Borough Gas & Electric Company, at Far Rockaway, Long Island, N. Y. The resistors, as shown in the accompanying illustration, are mounted on porcelain supports and are hinged to provide the disconnecting feature, thus combining the functions of a current-limiting resistor with those of a disconnecting switch. The opening of this device by means of the usual switch-hook makes it certain that the entire fuse mounting, wiring and potential equipment is dead and eliminates the necessity of having to replace or remove potential fuses with special tongs. More important still, it reduces the likelihood of an operator attempting to remove a live fuse by hand because the special tongs are not available at the moment. The illustration shows this equipment as designed for 15,000-volt service.

Similar disconnecting resistors were also used in a recent installation for the Potomac Electric Power Company, Washington, D. C.

C. A. CORNEY,
Electrical Engineer.
Stone & Webster, Inc.,
Boston, Mass.

Furnace Characteristics Determine Economy

AMONG the several factors that determine the choice of an electric furnace for the melting of brass are ability to produce a high-grade metal, good flexibility, simplicity of operation, high thermal efficiency, low renewal and repair cost and good power characteristics. All these have a vital effect on the cost per ton of castings. It may be a simple matter to increase the thermal efficiency of a furnace, but it sometimes can only be done at the expense of good power characteristics, life of furnace linings, adaptability to handle a wide range of alloys and the quality of metal produced. A low power consumption per ton may be meaningless, since the load factor may be so low that the rate per kilowatt-hour would be high, and the power cost per ton may be greater than in a furnace having a low thermal efficiency and consuming more kilowatt-hours but at a good load factor. In this latter case the rate per kilowatt-hour would be low and the cost per ton would also be lower than in the case of a furnace with a high thermal efficiency. Furnace design at best is a compromise.

Comparing the characteristics of the three different types of furnaces now in use—namely, the induction, arc and resistance types—various principles are seen to be utilized in their design and method of operation. If the induction furnace is so designed that the metal itself forms the secondary of a transformer, a high thermal efficiency results, so that the power consumption per ton of metal melted is lower than in any other type. The accompanying table shows that the average monthly load factor ranges from 70 per cent to 75 per cent when operating twenty-four hours per day. For a 60-kw. furnace with a capacity of 600 lb. the average power factor is between 65 per cent and 75 per cent. Some objections to this furnace are that both high-zinc and low-zinc alloys cannot be handled in the same furnace and that it must be preheated to start operation.

The arc type produces its heat from two electrodes placed in a cylindrical shell and then rocked with these electrodes as axes. The thermal efficiency is high, but not so high as the induction type, and the power consumption is low. A wide variety of alloys can be melted. The load factor is the lowest of the group, being 55 per cent with twenty-four-hour operation. With reactance to prevent surges, the power factor on the transformer primary may be as high as 80 per cent.

Resistance furnaces use as a heating medium a resistor material of crushed carbon placed in trenches of refractory material. The heat thus generated is radiated from the trench to the walls of the furnace. The power input is controlled by raising or lowering the electrodes embedded in the resistor material. From a metallurgical standpoint the supply of low temperature makes this furnace the best for melting high-zinc alloys, since the furnace atmosphere is non-oxidizing.

R. F. BENZINGER.
Electric Furnace Company,
Salem, Ohio.

CHARACTERISTICS OF VARIOUS FURNACE TYPES FOR MELTING BRASS

Type	Induction	Arc	Resistance
Monthly load factor:			
24-hour day, per cent..........	70–75	55	85
8-hour day, per cent...........	34	24	54
Average power factor, per cent	65–75	80	95–97
Capacity .	60-90 kw., single-phase	300 kw., single-phase	100 kw., 1-2-3 phase
Thermal efficiency	High	High	Lower than other types
Alloys melted	Unsuited for high or low zinc alloys	Good for wide variety	Good for high zinc alloys
Operating difficulties. .	Must be preheated to start, requires molten metal to operate; must run continuously	Breakage of electrodes requires skilled operators	

Multiple Street Lighting Favored

Advantages and Economies of Multiple System Over Series Circuits Analyzed—Overhead Feeders Along Rear Lot Lines Supply Underground Cables to Lamp Standards

A REDUCTION in the length and a great saving in the cost of circuits were effected by the adoption of a multiple underground street-lighting system in East Cleveland* instead of the standard underground series system along the curb lines. Additional advantages of this system are that special series regulating transformers, panelboards, cut-outs and individual insulating transformers are unnecessary. The system is entirely safe in operation and, furthermore, additions to the system or changes in lamp sizes can be made without the limitations involved in a series circuit.

Another feature of the East Cleveland system is the current supply to residence street lamps, approximately 600 in number and of 150-watt size, from the 115-volt house-lighting secondaries through underground service brought out along the side lot lines. As indicated in Fig. 1, the multiple feeder lines and secondaries of the alternating-current house-lighting distribution system are carried on poles installed along the rear lot lines. Therefore, with a few exceptions, there are no pole lines installed along the residence streets.

An analysis of the cost of installing standard series circuits underground along the curb to supply the lamps on residence streets showed that the cost of this construction would run the expenditure for the system considerably beyond the limit of $90,000 provided in the bond issue to cover the cost of the system. The underground multiple system which was installed, owing to the fact that there were no wooden pole-lines on the streets and therefore a complete new series distribution would have been necessary, did not greatly exceed in cost the estimated expense of a standard overhead series system. The average expenditure of the city for the multiple-lamp standards installed, including underground work and time switches, was $131.53.

With the series system the minimum underground run along the street between lamps would have been 200 ft. This would have involved the crossing of many concrete automobile driveways and the tearing up of pavement to reach the lamps of the staggered system. The alternative, to avoid the opening of street pavements, would have been to run the full 400 ft. between lamps on the same side of the street. The multiple system showed an estimated average run of 130 ft. between the rear lot line and a lamp post at the curb. As actually installed, the average run per lamp was approximately 150 ft. The increase over the estimated run was due to runs along the curb to bring the lamps at exactly equal spacing distances.

The efficiency in lumens per watt of the series lamp is, of course, appreciably greater than that of the 115-volt multiple in the smaller lamp sizes. However, this difference is only about 10 per cent in lamps of the light output used in the East Cleveland system.

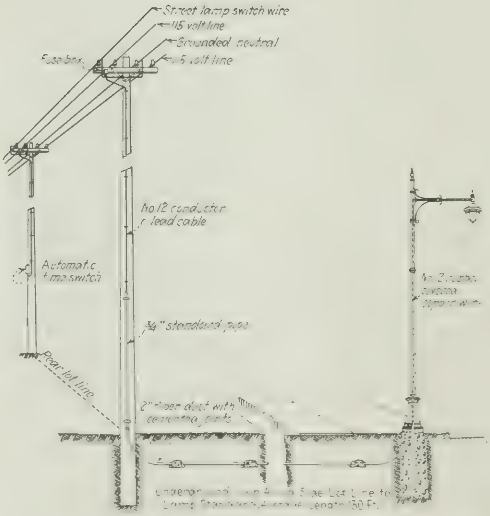


FIG. 1—TYPICAL ARRANGEMENTS OF MULTIPLE STREET-LIGHTING CIRCUITS IN RESIDENCE SECTION

SPECIAL CIRCUITS UNNECESSARY

With the multiple system it was unnecessary to carry special circuits back to the power substation. On the other hand, of course, a switching arrangement was required. Several plans for switching the lamps were proposed and considered.† Time switches were adopted, arranged so that one time switch controls the lamps supplied by the secondary in one block, as shown in Fig. 1. Experimental work is still being carried on, and it is believed that in the future some form of remote-control switch which requires neither periodic setting nor a control wire will be adopted.

The details of a typical multiple underground lamp supply are shown in Fig. 2. The supply wire consists of a two-conductor construction with $\frac{3}{64}$-in. rubber, single-braid cover and $\frac{3}{64}$-in. lead sheath. The underground duct is of 2-in. fiber, placed at a depth of 18 in. to 24 in. below the surface. This duct is in 5-ft. lengths, and each joint is sealed with a collar of Portland cement. At the lamp standard a curved section of duct is used which leads into the base of the pole above the surface of the ground.

The first cost of the lead-wire fiber-duct installation was determined to be slightly greater than the cost of a low-voltage armored cable laid directly in the ground. How-

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*The considerations that led up to the adoption of this system were published on page 221 of the July 29 issue of the *Electrical World*.

†"Multiple Systems of Distribution for Street Lighting," Ward Harrison, *Transactions A. I. E. E.*, 1920.

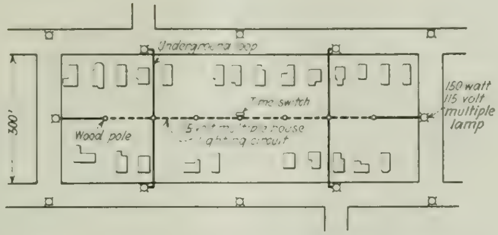


FIG. 2—METHOD OF SUPPLYING UNDERGROUND SERVICE TO STREET LAMPS FROM REAR-LOT-LINE OVERHEAD CIRCUITS

ever, since each individual underground lamp service is brought out along the side lot line through private property by virtue of an easement granted without cost to the city, the fiber-duct installation was chosen because it was considered that should a failure of the wire occur less disturbance in locating and remedying the fault would be involved than in the case of cable without duct laid in the ground. Experimental installations using the same lead-covered wire and other inexpensive types of wire and cable laid directly in the ground are being tried out in the system.

On certain thoroughfares series lines had previously been installed to supply the old arc lamps, and on Euclid Avenue in particular the series circuit was already carried in an underground-duct system. It was obviously a matter of economy to retain the series circuits which were already in place, and this was done An individual insulating series transformer was installed for each of these series lamps so that low-tension leads only are carried into the lamp standards. In the case of Euclid Avenue individual transformers for the 1,000-cp. lamps were not placed in the base of the post according to usual practice, as the pole base did not provide sufficient space. Instead the transformers were grouped in the manholes of the duct system and the secondaries of the individual transformers were branched from these manholes to the nearby lamp standards.

EARL A. ANDERSON,
O. F. HAAS,
National Lamp Works, Illuminating Engrs.,
General Electric Co. Engineering Dept
Nela Park, Cleveland, Ohio.

Changing Waterwheel Runner Increases Efficiency

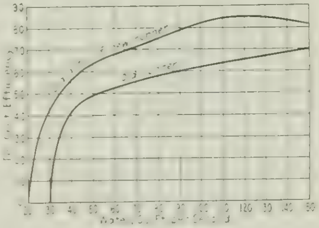
AN INTERESTING case of altering a waterwheel in a simple manner so as to improve its efficiency greatly is to be found in power house No. 2 of the San Joaquin Light & Power Corporation. This plant is near North Fork, Cal., and was completed in 1918. The equipment was chosen and purchased by a construction and engineering company two years before work was actually begun, and the waterwheel was consequently of a rather early design. The plant contains one unit, a 3,000-kva. generator, 35 deg. C. rise, directly connected to a 5,250-hp. reaction turbine opeating at 275 ft. head. The maximum efficiency of the turbine was at 132 cu.ft. per second, when it was guaranteed to develop 3,675 hp.

This unit might have been satisfactory if a large quantity of water, nearly the capacity of the wheel, had been available at all times; but the plant discharges from its tailrace directly into the conduit of another plant below. This conduit is also supplied with water from the South Fork of the North Fork of the San Joaquin River. The flow of this particular stream is not regulated by storage and so varies over a large range during the different seasons of the year. The water used by power house No. 2 comes from the Crane Valley Reservoir, of the San Joaquin Light & Power Corporation, with a capacity of 45,000 acre-ft.

The plant in operation gave very poor efficiency because there was not enough water available to load the waterwheel up to a point where any reasonable efficiency was to be obtained, and for a large portion of the time such low quantities were passed through that even the generator was operating at low efficiencies.

The matter was taken up with the different waterwheel manufacturers and their recommendations were obtained. One suggested a new runner designed according to latest practice and for capacities of water up to 150 cu.ft. per second only, as specified by San Joaquin Light & Power Corporation engineers, and the addition of liner plates and new wicket gates to the turbine. The maker of the wheel, however, proposed only a new runner of late design and high efficiency to fit the hub of the original one, with no liners or changes to the gates. The latter was much the cheaper proposition and was considered better also because the efficiency seemed higher. The accompanying curves show the over-all plant efficiencies based on generator and waterwheel manufacturers' guarantees.

The operation after the change seems very closely to substantiate the estimated figures. The discharge of 109 cu.ft. per second on the old runner gave 1,700 kw. output for the plant. With the new runner 2,100 kw. is obtained from the same quantity of water. The turbine operates much more quietly and at 140 cu.ft. per second delivers 2,600 kw. on the switchboard.



EFFICIENCY INCREASED BY SUBSTITUTING MODERN RUNNER FOR OLD

The entire work of making the change, including the cost of the new runner, was slightly under $3,000, and, as noted above, an incease of about 400 kw. in capacity has been obtained at the higher loads. Under normal operation the plant will deliver slightly more than 1,000,000 kw.-hr. per year over and above its original capacity.

L. J. MOORE,
Executive Engineer.
San Joaquin Light & Power Company,
Fresno, Cal.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

A Sales Force for a Scattered Territory

How a Central-Station Handles Its Commercial Organization and Regulates Stock to Produce Best Returns

By W. E. Prosser
Sales Department Adirondack Power & Light Corporation, Amsterdam, N. Y.

In the present stage of development in the electrical industry the central-station company has little or no reason to sell merchandise at cut prices. On the other hand, it has not been found good policy for companies to retire absolutely from the merchandising business. The electric light and power company enjoys a certain advantage over other merchants in that almost every one of its customers must come in contact with it at least once a month, and this offers the central station an excellent opportunity to provide an additional service to its customers in supplying them with standard appliances and at the same time earn a profit from their sale.

The most serious problem that confronts the company with regard to merchandising is how best to organize and conduct a sales department so that the company's territory will be adequately covered and at the same time the investment in stock and the selling expenses will be kept down and a profit can be made.

This company operates thirteen stores in the Upper Hudson and Mohawk Valleys, where we provide electrical service. In four of these towns we also operate gas plants, and for this reason we sell both electric and gas appliances.

In all of these towns we have salesmen who canvass their districts for certain appliances, and where the town is large enough to support a specialist we have men who specialize on certain articles and appliances. However, we find it necessary and advisable to use as much as possible the co-operation of manufacturers on the larger equipment such as electric refrigerators, heavy-duty cooking equipment, signs and similar appliances which require an engineering experience and a more detailed special knowledge than the average utility salesman would have.

At present we are working toward specialization among our salesmen, as we find that wherever we have put a man to work on one or two articles he not only produces more for the company but we are also able to keep a higher-grade man. This, of course, applies only to the highly specialized articles, and as a result our sales this year of electric domestic refrigerators and electric ranges have exceeded the sales of any previous years.

In order to educate the salesmen and improve their knowledge of specialties we hold a meeting every month and call upon some one of the manufacturers to give them a talk on his particular line. We have found these "get-together" meetings of material benefit in obtaining co-operation throughout the property as they bring the men together where they have an opportunity of exchanging views and solving individual problems which could not be done in any other way.

Centralized Storeroom

A minimum stock is carried in all stores, with a reserve at a central storeroom, which enables us to give the maximum service with the least investment in stock. The smaller towns cannot purchase in sufficient quantities to obtain the best prices, and by stocking the larger towns and transferring goods as needed to meet local conditions we have been able to dispose rapidly of appliances which otherwise might have been carried for a long period. We handle nothing but standard appliances of the best quality, and while some contractor-dealers may from time to time sell a cheaper article, we have found that by advertising, intensive sales effort and good service we are able to sell the better quality goods at the higher prices.

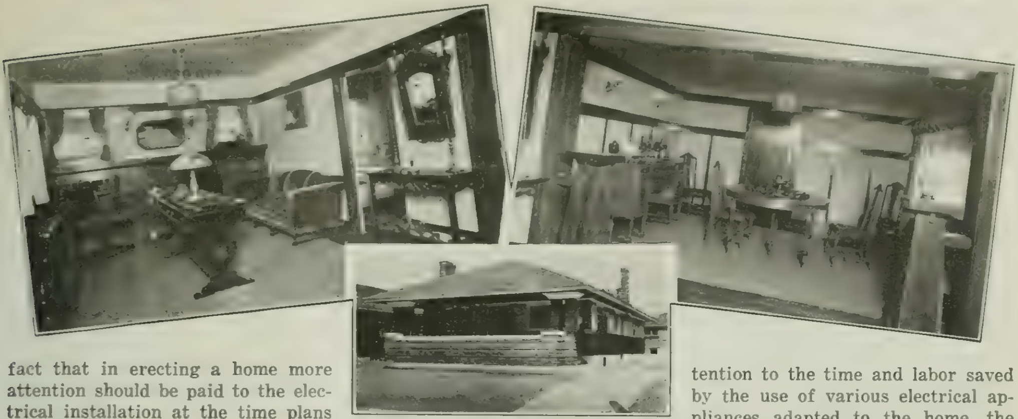
We had a rather large stock of appliances because of the slump of 1921, but with the exception of one or two items it has been closed out, and we are now approaching a point where we turn over our stock four times per year. We expect to improve this and should show a stock turnover of at last six by the end of this year.

Special sales are being outlined for the rest of the year so as to obtain the greatest benefit from general advertising and sales effort. On some articles we will run campaigns simultaneously throughout the property, and on others, with the co-operation of the manufacturers, we will run successive campaigns during the season in an effort to smooth out the sales curve and distribute the cost over the entire period.

Salt Lake Proves Moderate Cost of Electrical Home

In exhibiting Salt Lake City's second electrical home the Rocky Mountain Co-operative Electrical League carried out the idea of featuring the extensive use of electrical equipment in the moderately priced residence. The house, as shown in the accompanying cuts, was a six-room bungalow and cost approximately $6,500 to build. During the two weeks that it was open, from July 25 to Aug. 6, slightly more than 10,000 people passed through and inspected the home.

The purpose of this electrical home, which was successfully carried out, was to demonstrate that a family of moderate means can enjoy the comforts and convenience of electrical appliances to a much greater extent than is usually supposed without the expenditure of a large amount of money. The wiring of the house provided a total of fifty outlets and twenty-two switches, and in conducting visitors through the building particular stress was laid upon the



VIEWS OF SALT LAKE CITY'S SECOND ELECTRICAL HOME, IN WHICH LOW COST WAS FEATURED

fact that in erecting a home more attention should be paid to the electrical installation at the time plans are made.

While this electrical home was not so expensive nor the display so large as the former one in Salt Lake, the appliances shown in each room were entirely appropriate and adequate for the modern electrically equipped residence. From a commercial standpoint this demonstration was considered to be of far more value to the local electrical industry because of its greater appeal to the majority of home builders, as the electrical equipment was representative of what could be easily applied to a house of moderate cost.

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Selling 1,172 Irons in Thirty Days

ONE of the most successful campaigns to bring about a more widespread use of electrical appliances in the home was that carried on by the Utica (N. Y.) Gas & Electric Company in the sale of electric flatirons. This campaign lasted for one month, and during that period 1,172 electric irons were sold, a number far in excess of the mark set by the company.

The sale was handled by the commercial department of the Utica Gas & Electric Company, and the irons were sold to customers of the company under a deferred-payment plan, if desired, of one dollar on date of purchase and the balance in monthly payments of one dollar.

Four special canvassers were employed to call upon the customers of the company, and the men employed in carrying on a house-wiring campaign in the communities served by the Utica Gas & Electric Company were also pressed into service. In addition, employees of the company were interested, and sixty-six of these who became active were successful in selling 457 flatirons. These employees were paid the same commission as that paid the special canvassers—75 cents for each iron sold and an additional 15 cents for delivery to the purchaser.

The company interested fourteen of the electrical dealers in Utica and consignments of electric irons were placed with these dealers, who were paid the same commission for sales made and for deliveries as the special canvassers and company's employees. The newspaper advertisements and the display cards carried the names of all of the dealers participating in the sale. These dealers, in addition to selling 114 irons in a comparatively short time, reported a heavy increase in the sales of all other electrical appliances.

A noticeable feature of the campaign was that revealed by the reports of the special canvassers, who made a house-to-house canvass of the company's customers. These reports showed that an average of twenty-five calls were made in locating a single "prospect"—that is, a company customer not already owning an electric iron, indicating an already widespread use of this particular electrical appliance.

In addition to the immediate benefit accruing to the Utica Gas & Electric Company from the increased number of customers using electric irons, with the consequent increase in the energy consumption, there was the direct good accomplished by the widespread propaganda directing attention to the time and labor saved by the use of various electrical appliances adapted to the home, the benefit of which will be felt in the future increased business of the electrical dealers in the communities served.

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What Other Companies Are Doing

Chicago.—To assist its salesmen in selling gas and electric merchandise, the Public Service Company of Northern Illinois has furnished them with a card file containing the names of all the consumers connected to the lines. This card carries a complete list of appliances with a small space beside each name so that a check can be made for the appliances already in use. A cross indicates that the customer is interested in that certain appliance. On the back of the card is a record of calls made on the customer, and a date is given for a return call. With this method no time is wasted in trying to sell the customer an appliance he already has.

Pawnee, Okla.—This city has voted to abandon its municipal lighting plant and has made a contract with the Oklahoma Gas & Electric Company for electric service to be delivered over a new transmission line in the company's Drumright division. Construction work has been started on this line, and in the meantime the city of Pawnee is making extensive additions and improvements to its local distribution system.

Edgerton, Wis.—This town has 700 homes, of which 674 are now wired. The Janesville Electric Company is now conducting a house-wiring campaign and expects to have the remaining twenty-six homes connected to its lines.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Hydro-Electric Power Plants in Styria, Austria.—R. HOFBAUER.—Plans are being laid out to supply the entire state of Styria (southern part of Austria) with electrical energy for general and railway use. A detailed survey of the power requirements for the next fifteen years showed that a total output of some 250,000 kw. will be necessary, while a hydraulic survey disclosed available water power of about 336,000 kw. Four main generating centers are under consideration, comprising nine new power stations with outputs ranging from 9,500 kw. to 136,000 kw. output each. These plants will feed into a three-phase, 100,000-volt transmission line for industrial load and into a single-phase, 60,000-volt line for traction, delivering a total of about 1,200,000,000 kw.-hr. annually. The realization of this project will require $30,000,000, for the greater part of which foreign capital is being sought.—*Elektrotechnik und Maschinenbau,* June 4, 1922.

Losses in Nozzles of Rectangular Section.—D. S. ANDERSON.—A series of experiments were carried out on nozzles of rectangular shape the results of which are given with a brief résumé of the analytical methods employed. The experiments were carried out using steam sufficiently superheated to insure that the whole expansion took place in the superheated field. A search tube was passed step by step down the axis of the jet, corresponding readings of position and pressure being taken. The supply pressure and temperature were carefully noted, and also the quantity of steam passing through the nozzle in a given time. This provided the necessary data to determine the nozzle performance.—*Engineering,* June 16, 1922.

Generation, Control and Switching

Behavior of Aluminum-Cell Arrester Under Radio-Frequency Electromotive Forces.—H. YAGI and J. OKOCHI.—By means of an oscillograph the behavior of the aluminum-cell arrester under radio-frequency electromotive forces is investigated. The dynamic characteristics and the cyclic current diagrams have been obtained for frequencies varying between 100,000 and 200,000 per second, from which the wave shape of the current and the potential against time are deduced. It is pointed out that the superior quality of the aluminum-cell arrester is that the static capacity of the film is considerably larger than with other apparatus and that the discharge characteristic is non-disruptive. The authors claim that these advantages are not possessed by any other type of arrester.—*Journal of the Institute of Electrical Engineers of Japan,* June, 1922.

The Application of Relays. — L. A. TERVEN.—An investigation showing how the fundamental relations of current and voltage in the electric circuit should be formulated in the study of relay connections, as these connections involve consideration of these values and their relative phase positions with respect to each other. Eight rules are given that should aid in the application of vectors to relay connections.—*Electric Journal,* June, 1922.

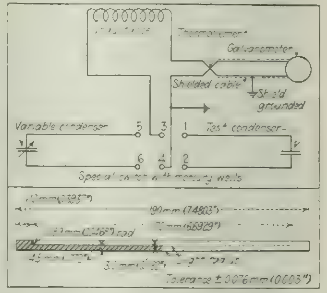
Transmission, Substations and Distribution

Developments in Power-Station Design.—Single and polyphase transformers, current-limiting reactors and rectifiers for railway use are considered in this article. The high cost of building has led many engineers to look into the possibilities of saving money by utilizing outdoor transformers. Various types of transformers of European make are described. Rectifiers up to a capacity of 225 kw. are now being used by many railways in Europe.—*Engineer,* June 9, 1922.

Modern 110,000-Volt Apparatus.—G. STERN.—The characteristic of all modern 110,000-volt electric indoor apparatus in Germany is the total absence of porcelain and the general use of hard-paper insulators. There are several reasons for this important change, which has taken place within the last eight years. Porcelain insulators cannot be manufactured within an accuracy of more than 5 per cent. Paper insulators, on the other hand, can be turned out on the lathe to any desired accuracy. The danger of cracking due to an expansion of the cement used between the porcelain and its metallic armature is eliminated in the paper insulator. In case of a flashover a porcelain is frequently destroyed, whereas paper is usually only charred on the surface and may be refinished. Finally, present conditions in Germany do not permit the building of such high-voltage porcelain insulators, at least not within a reasonable time. A disadvantage of the paper insulator is its restriction to indoor usage. Accordingly a roof or wall entrance bushing is made up of two halves, one of porcelain and the other of paper. All of the new paper insulators have as a special feature a corona ring mounted near the grounded end, which, the author claims, increases its dielectric strength from 50 to 60 per cent. The inner part of these hard-paper insulators is filled with a high flash-point compound. To permit expansion of this compound a special expansion box is provided at the grounded end. The author describes the latest models of 110,000-volt oil switches which have the auxiliary resistance contact restricting the rush of current at the instant of closing. Large rupturing capacity and explosion-proof construction are features of these switches. —*A. E. G. Mitteilungen,* June, 1922.

Units, Measurements and Instruments

Tentative Method of Testing Molded Insulating Materials.—The test applies to non-vitreous solid electrical insulating materials and consists of measuring the phase difference and dielectric constant of this material at radio frequencies. An electron-tube oscillator, the frequency of which can be varied over the range desired, is used as the source of radio-frequency voltage. The measuring apparatus is shown in the accompanying illustration. The test condenser consists of the test specimen, a diagram of which is shown in detail with its dimensions, and two mercury surfaces as the conducting plate. The variable condenser is of special design having negligible phase difference. The frequency meters should have a range corresponding to wave lengths of 3,500 m. to 200 m. and be capable of calibration within 1 per cent accuracy. The phase difference of two specimens is measured by the resistance-variation method at five radio frequencies between 98 kilocycles and 1,200 kilocycles per second. The dielectric constant of a specimen is calculated from the capacity of a condenser in which the specimen is the dielectric and the capacity of which is measured by the resistance variation method. The report of the test should include a description of the material, room temperature and relative humidity, a curve for each specimen showing phase difference and dielectric constant plotted as ordinate values and wave frequencies as abscissas and the phase difference and dielectric constant of each specimen at wave frequencies of 100 kilocycles and 1,000 kilocycles per second. — *Report presented before American Society for Testing Materials,* June 26, 1922.



MEASURING CIRCUIT AND TEST SPECIMEN FOR TESTING MOLDED INSULATING MATERIALS

Illumination

Street Lighting and Public Safety.—EARL A. ANDERSON.—Significant data are presented on the relation of street lighting to traffic accidents and crime, with discussions of illumination systems for business, resident and outlying districts. With the purpose of collecting definite data regarding the values which should be attributed to the proper illumination of streets as a factor in the prevention of traffic accidents, a survey of such accidents in a representative group of cities (thirty-two cities with a combined population of over 7,000,000 people) was conducted. The result of this investigation is given. Types of fixtures, locations and distance apart are recommended for business streets, thoroughfares, resident streets, outlying districts, alleys and highways. Proper maintenance is described in full, as in many cases all that is required to avoid expensive waste of light is a cleaning of the lighting equipment at regular intervals and a prompt renewal of burnt-out or obviously defective lamp bulbs.—*Bulletin No. 46 of the Engineering Department, National Lamp Works of General Electric Company.*

Motors and Control

Parallel Operation of Commutating-Pole Motors and Generators.—C. B. HATHAWAY. — Although direct-current motors and generators have been operated in parallel for years, each time the machines do not parallel successfully many questions as to why they fail are asked. The author has reviewed the subject with the hope that those interested in this work may see the solution from a little different angle.— *Electric Journal,* June, 1922.

Maintenance of Electrical and Associated Mechanical Systems.—L. J. STEWART.—The procedure when handling equipment changes and maintenance of electrical systems, together with the purchasing and stock-keeping routine for the departments of the Western Clock Company, is outlined. This plant has a very complete and up-to-date system and is the result of careful planning by all the departments of the concern. Confusion and loss in the stockroom are avoided by strictly segregating the supplies used by the maintenance department from the raw materials used in production.—*Industrial Engineer,* July, 1922.

Heat Applications and Material Handling

Technology of the Carbon-Electrode Industry.—CHARLES L. MANTELL.—A critical review of the calcination process—why it is necessary and what it accomplishes—is given. The author considers the details of the design and operation of electric and gas-fired calciners, with special reference to their use in American practice. The development of calcining units has been along the lines of continuous furnaces with attention given to the preheating of charges and recovery of the heat of the material as well as the recovery of the combustible gases produced. This is the third of a series of articles in which the first reviewed the history of the industry and the second dealt with the raw material of electrode manufacture. —*Chemical and Metallurgical Engineering,* Aug. 2, 1922.

Standardization Rules for Electric Arc-Welding Apparatus.—Standardization rules approved by the American Bureau of Welding and proposed for adoption by the standards committee of the A. I. E. E. Three classifications of welding apparatus are made, namely, generators and motor-generators, transformers, and rheostats or reactors. Definitions of welding nomenclature are given, as is information relative to the apparatus which it is proposed to supply and conditions under which it is expected to be used. Tests of the apparatus include temperature rise and efficiency, the latter by the input-output method, and also efficiency by the conventional efficiency method.—*Journal of American Welding Society,* June, 1922.

Electrophysics, Electrochemistry and Batteries

Some Recent Conclusions Pertaining to Electrical Precipitation. — W. A. SCHMIDT.—Investigations into the phenomena of electrical precipitation of suspended particles from gases during recent years have resulted in important conclusions. The purpose of this paper is to present these conclusions without entering into a detailed discussion of the actual equations used in designing precipitators and the calculations embodying their use.—*Journal of the A. I. E. E.,* July, 1922.

Traction

Advantages of Railroad Electrification.—R. J. O'BRIEN.—This subject is considered under the headings "Through Trunk-Line Service," "Electrification of Heavy-Grade Sections," "Passenger Terminals," "Suburban Service," "Freight Yards" and "Tunnel Installations." Coal-saving projects of the type where it may be readily shown that the savings per year will carry the investment are also dealt with. In addition to the savings which can be readily calculated, there are usually many additional advantages to which it is impossible to affix a monetary value, but which may be governing factors in determining whether or not electrification is justified. The article considers the inherent characteristics of steam and electric locomotives and the methods of operation with both types of motive power. Every project requires a skill in engineering analysis in order to determine the feasibility of the electrification. The article is nine pages long and covers the subject quite thoroughly. —*Electric Journal,* June, 1922.

The Napa Valley Electrified Route.—A successful 3,300-volt, single-phase electric system is the 46.52 miles of electrified standard-gage track of the San Francisco, Napa & Calistoga Railway between the cities of Vallejo and Calistoga, Cal. Records of power consumption show an average input of 102.4 watt-hours per ton-mile and an average output of 64.8 watt-hours per ton-mile at the station, indicating a station efficiency of 63.3 per cent. The operating revenue per ton-mile for 1920 was 71.19 cents, while the operating expenses per car-mile were 40.1 cents, giving an operating ratio of 56.25 cents.—*Electric Railway Journal,* July 1, 1922.

Telegraphy, Telephony, Radio and Signals

Phantom Telephone Circuits Operated at Audio Frequencies.—J. G. HILL.—The theory of simultaneous telegraph and telephone working on the same circuit is first dealt with, and the limitations of this method of working are stated. The comparative efficiency of side and phantom circuits is calculated, and the principal problems arising from the loading and relaying by amplifiers of phantom circuits are outlined. The derivation of formulas for the calculation of electric wave filters is given in an appendix.—*Journal of Institution of (British) Electrical Engineers, June,* 1922.

Objects That Distort Radio Waves.—L. E. WHITTEMORE.—Tests carried out by the United States Bureau of Standards show that electric wires or cables, steel structures, rivers, trees, trolleys, stone and iron monuments all affect the direction of radio waves. These tests were made to determine the accuracy of the indication of direction finders.—*Radio Broadcast,* June, 1922.

Stationary Frequency Multiplier for Radio Service.—M. LATOUR.—With the use of a newly developed alloy steel which is ductile enough to be rolled into very thin sheets (0.05 mm.) and which has magnetic properties superior to silicon steel as far as the particular service is concerned, a 15-kw. transformer has been built capable of transforming 33,000-cycle current from a high-frequency generator into harmonic frequencies of 165,000, 230,000 or 300,000 cycles per second. The iron core of this transformer weighs only about a pound. Using the same principle of design, it will be possible to build a 150-kw., 100,000-cycle transformer with an over-all diameter of not more than 6 in. These new transformers, the author claims, will become great competitors with the electron tubes and high-frequency arc generators.—*Revue Générale de l'Electricité,* July 1, 1922, and *Radioélectricité,* June, 1922.

Miscellaneous

Varieties of Mica and Their Uses.—OLIVER BOWLES.—Canada, the United States and India produce about 97 per cent of the world output of sheet mica. Of this amount India produces about 65 per cent and the United States 15 per cent. About 90 per cent mined is scrap, most of which consists of material unsuited for sheet mica. The various uses of mica are outlined.—*Serial 2357, Bureau of Mines.*

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

Coal Production Increasing

Disappointment Expressed, However, in Many Sections Over Seriousness of Outlook for Coming Winter

ALTHOUGH the production of bituminous coal has been considerably increased since the agreement between the operators and miners in the various coal-producing centers, the situation is not so satisfactory as some might think. Coal production has not begun to approach anything like normal and is far from what could be wished in some of the large coal-producing states.

While there is little likelihood that electric public utilities will be severely handicapped because of the shortage of production, there is every indication that industry in general will feel the pinch very much. As a result these industries are making every effort to obtain coal to keep them going regardless of price. This naturally has had its effect upon public utilities purchasing spot coal in the open market and has compelled some utilities to pay more than $10 a ton for fuel.

The House of Representatives on Wednesday passed the administration bill for a commission composed entirely of impartial representatives of the public to investigate the coal industry, and it is expected that the bill will pass the Senate within a few days. It is also hoped that a measure establishing a government price-fixing agency for the coal industry will be introduced and acted on quickly and favorably by Congress. The miners and operators in the anthracite region are deadlocked, and little hope is expressed for any production of anthracite coal for winter.

The railroad situation has not improved, but on the contrary settlement of the shopmen's strike is as remote now as ever. Hints have come from Washington that the government will not tolerate a breakdown in the nation's transportation system and that means will be found for speedily terminating the strike if such a breakdown is imminent.

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Friends of Ford Muscle Shoals Plan Seek Vote in House

Advocates of the Ford offer for Muscle Shoals are awaiting an opportunity to have the Detroit manufacturer's proposition brought to a vote on the floor of the House. It will require a special rule to bring this issue up and such a rule admittedly will be difficult to obtain.

Representative Garrett of Tennessee, acting minority leader, as well as a number of Republican members, favors action, and he is seeking a chance to urge the subject upon the rules committee, but inasmuch as the majority of that committee do not appear to be favorable to it and the steering committee has refused to exert pressure in its behalf, the chances of getting a floor vote are slim.

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De Forest Demonstrates His "Phonofilm"

A demonstration was recently given in Berlin to laymen by Lee de Forest of his "phonofilm," a device which is said to have solved the problem of the talking motion picture by making possible perfect synchronization between the reproduction of sound and of action. According to a cable dispatch from the Berlin correspondent of the New York *Times*, the method consists primarily of photographing sounds on a standard motion-picture film and then reproducing the sounds from this film. By a mechanical device it is possible to photograph ten consecutive "sound paths" on one strip of film. A thousand feet of film can, therefore, hold 10,000 ft. of photographed "sound paths," which can be run off continuously.

The ordinary standard motion-picture film is used as well as the standard motion-picture camera and the standard motion-picture projecting machine. Mr. De Forest's basic invention is what he calls the "photion," a glass tube with a bulbous end about 2½ in. long. This "photion" tube is fitted inside of a standard motion-picture camera, above and somewhat to the right of the objective. The secret of the "photion" tube is that without any filaments it generates a sufficiently powerful violet light under electrical excitation to photograph sounds as transferred through a slit only 0.2 mm. wide on a swiftly moving motion-picture film.

The sounds of a voice or voices, instruments or orchestra are picked up by a converter specially invented by Mr. De Forest. It is like the microphone of a telephone, only very much finer. The converter turns the sounds into telephonic currents. From the converter these currents pass into Mr. De Forest's audion amplifier, from which intensive electric currents pass to a high-frequency generator, whence they pass to and excite the "photion." The "photion" thereupon generates the intense violet light, which is controlled by voice or instruments.

Michigan Men Convene

Delegates to Ottawa Beach Meeting Discuss State Regulation, Rural Lines and Tree Trimming

STATE regulation, rural lines and tree trimming were the principal subjects of discussion at the annual convention of the Michigan Electric Light Association at Ottawa Beach on Monday, Tuesday and Wednesday of this week.

Sherman T. Handy, a member of the Michigan Public Utilities Commission, characterized the utility business as a three-party partnership of the company, the public and the state that must work together in harmony. He expressed himself as believing that rates should be commensurate with quality of service rendered and said that he could see no justice in allowing a company giving 100 per cent service no greater return than that allowed a company giving only an indifferent service. Mr. Handy asserted that more harm can come to a utility from its office than from its switchboard. He asked for the development of a service that would begin with the coal and water supply at the plant and end with the receipted bill to a satisfied consumer.

John F. Gilchrist, vice-president of the Commonwealth Edison Company, Chicago, in addressing the convention on public relations advocated careful training of employees in meeting and dealing with the public, taking as the measure of such dealings the way in which the executive would meet the consumer were it possible for him to have personal contact with customers in the way that the business man in the small business concern does.

The report of the rural lines committee emphasized the work being done for rural electric service by a committee composed of utility and farm interests under the supervision of the Public Utilities Commission. The chairman of this committee is David Friday, president of Michigan Agricultural College. Other members are the State Commissioner of Agriculture, the president of the State Farm Bureau and the entire rural lines committee of the Michigan Electric Light Association.

The convention was addressed by President Smith and Executive Manager Aylesworth of the National Electric Light Association.

Officers elected for the coming year are: President, Eugene Holcomb, Alma; first vice-president, S. B. Tuell, Houghton; second vice-president, R. Duncan, Detroit; secretary and treasurer, Herbert Sylvester, Ann Arbor.

New Orleans Utility Properties Sold at Auction

The properties of the New Orleans Railway & Light Company were sold at auction on Aug. 17 by the master in Chancery acting under instructions from United States Judge Rufus Foster. The sale was made in two parts, the first comprising all the real property, rolling stock and stocks and bonds except 958 gold bonds of the denomination of $1,000 and bearing 4½ per cent interest, which constituted the second part. There were only two bidders, who acted on behalf of the reorganization committee, G. H. Dahl, vice-president of the Chase National Bank of New York, bidding $14,500,000 for the first parcel and Charles K. Beekman of New York $620,000 for the gold bonds. The transaction now awaits Judge Foster's approval.

At a meeting of the Commission Council of the city Commissioner of Public Utilities Maloney withdrew the three ordinances that had previously been introduced and substituted three new ones in accordance with the agreement reached with the securities committee. These ordinances give the city an option to purchase the electric light company at $11,048,000, the street railway company at $25,000,000, and the gas property at $8,652,000 plus any additional amount invested in the property subsequent to Dec. 31, 1920. Indeterminate permits are granted in lieu of a franchise for a fixed period, the city to have supervision and control of the operation of the utilities. The city receives the right to levy on the gross receipts of each utility unit after the allowable rate of return is earned. This tax will, it is estimated, net the city about $320,000 annually.

Important Interests Acquire Hortonia Power Company

The Hortonia Power Company, operating an extensive hydro-electric system in central and western Vermont with headquarters at Rutland, has recently passed into the hands of a group of men well known in New England electrical circles and is now undergoing a rapid development. By Nov. 1 a carefully considered program of expansion will have been completed, and plans are now being made for further enlargements of the system next year. New transmission lines more than 50 miles in length and operated at voltages up to 44,000 have been built this year; the first unit of 750-kva. rating has been installed at the Weybridge development, which will have an ultimate rating of 4,000 kva., and various betterments have been made.

The company will shortly complete an additional reservoir in the Sugar Hill section which will double the storage available for the Silver Lake station, and a new 1,000-hp. unit to operate under 690 ft. head is under installation at this point. About 15,000 kw. in generating capacity is now installed on the system, and the company's engineers estimate that an economical development up to 40,000 kw. can be put through without steam installation, owing to the storage sites and water privileges obtained. At Port Henry, N. Y., the affiliated Port Henry Heat, Light & Power Company is facing greatly increased demands for electricity owing to the transformation of this mining community by the addition of plants for treating magnetite ore. George J. Murphy, president of both the electric companies under discussion, said to a representative of the *Electrical World* this week that the demand for electricity at Port Henry is expected to double within two years.

Plans for 1923 development include further enlargement of generating facilities, including 2,000 kw. in machinery for the Port Henry No. 3 station and 3,000 kw. for Weybridge. Vaughan Engineers, Boston, retained by the Hortonia company, are planning for the further development of 7,500 kw.

The officers of the Hortonia and Port Henry companies recently elected are: President, George J. Murphy, treasurer Pettingell-Andrews Company, Boston; treasurer and general manager Hortonia company, E. J. Taveniere, Rutland; Port Henry company, H. A. Barwise, Port Henry; secretary Hortonia company, L. C. Robinson. The directors of both companies are H. O. Phillips, Phillips Wire Company, Pawtucket, R. I.; C. B. Price, chairman directors Pettingell-Andrews Company; Frank S. Price, president Pettingell-Andrews Company; E. J. Taveniere; Major Gilbert R. Hodges, Boston, and I. M. Frost, Rutland.

Ryan Proposed for A. I. E. E. Presidency

Pacific Coast and Other Friends of the Noted Professor and Engineer Seek to Award Him the Highest Honor of the Electrical Engineering Profession

AN OUTCOME of the Vancouver (B. C.) meeting of the American Institute of Electrical Engineers this month is a movement for elevating Prof. Harris J. Ryan to the presidency of the American Institute of Electrical Engineers. Professor Ryan's many friends feel that this honor is due him and have experienced no difficulty in securing the necessary signatures to the petition placing his name in nomination for the presidency next year.

HARRIS J. RYAN

It is contended that there are few men in the engineering fraternity who possess more brilliant attainments or are more beloved than the professor who occupies the chair of electrical engineering at Leland Stanford, Jr., University. Moreover, the claim is made that some recognition is due the Far West, and that in putting forward the name of so distinguished a personage as Harris J. Ryan the West has chosen a man who would lend dignity and distinction to the office and one who, it is confidently expected, will receive the indorsement of all sections of the country.

It is pointed out that a graceful tribute to Professor Ryan's ability and standing in the profession was paid by the board of directors of the A. I. E. E. when they appointed him honorary vice-president of the Institute on the Pacific Coast during the Panama-Pacific Exposition. It was the belief of the board at that time that the importance of the occasion justified the creation of the special honorary office and that this appointment fulfilled a general desire to honor an eminent member and former vice-president.

As is probably well known, Harris J. Ryan, for many years, occupied the chair of electrical engineering at Cornell University, Ithaca, N. Y. In his early days important patents were awarded to him, notably in conjunction with M. E. Thompson for the Thompson-Ryan equipment and for repulsion and interpole motors. Since he has been at Stanford University Professor Ryan has acted in a consulting capacity for many of the great hydro-electric systems on the Pacific Coast. He has done important research work in connection with high-tension insulators. His research work during the war was also notable.

A Seven-Year Construction Program of $125,000,000

In its application to the California Railroad Commission for permission to issue 7 per cent preferred stock to the amount of $9,500,000, the Southern California Edison Company made the following estimate of its construction expenditures for the seven-year period beginning with the present year:

1922	$27,344,300	1926	$16,209,000
1923	18,055,800	1927	15,975,000
1924	13,829,000	1928	11,800,000
1925	22,290,000		
Total			$125,503,100

Senate Reduces Tariff on Electric Light Bulbs

Duty Placed at 20 per Cent ad Valorem—Other Reductions from House Rates on Electrical Goods Are Made—Foreign Valuation Replaces American Plan

A HEAVY reduction in the duty on incandescent electric light bulbs was made by the Senate in the closing days of the tariff debate, the rate standing in the bill as it goes to conference at 20 per cent ad valorem.

The House fixed a rate of 35 per cent on electric light bulbs, based on American valuation. This, roughly, is considered twice the rate based upon foreign valuation, and the Senate finance committee in redrafting the bill placed these bulbs in a paragraph with other illuminating articles—chimneys, globes, shades and prisms—with a recommended duty of 70 per cent. During debate this item came under heavy fire, it being charged that a monopoly exists which permits not only the domestic market but much of the foreign market to be controlled by an American company. As the result of the fight against the electric light bulbs, the committee was over-ruled by the Senate on all illuminating articles and the rate was reduced to 45 per cent.

Returning to the paragraph in the closing days of tariff consideration, the finance committee removed electric bulbs from the other items and restored them to a separate paragraph with a 35 per cent duty, as the House had done, the 35 per cent Senate duty being lower because of the difference in the basis of valuation—foreign as opposed to American. Senator Jones of New Mexico succeeded in having the 35 per cent rate lowered to 20 per cent, asserting that the bulbs can be produced here as cheaply as anywhere in the world. Senator McCumber declared that a committee of American workingmen who had investigated conditions abroad had recommended that a rate of 70 per cent would not be more than sufficient to protect electric bulbs.

OTHER CHANGES IN HOUSE BILL

Subsequently, by an amendment of Senator Sutherland, the Senate restored the 70 per cent duty on other illuminating articles, leaving electric bulbs in the separate paragraph at 20 per cent.

The Senate changed the House rate of 35 per cent on electrical measuring instruments to 50 per cent, which is a reduction, as the House rate was based upon American valuation and the Senate rate is based upon foreign valuation.

As the tariff bill passed the Senate it carries a duty of 45 per cent on carbons and electrodes for producing electric arc light, electrodes of carbon or graphite for electric furnace or electrolytic purposes, brushes for motors and generators, plates and rods for manufacturing brushes and other articles of carbon or graphite for electrical use and not specially provided for. On nickel electrodes a duty of 25 per cent is imposed. Both rates are lower than the duties fixed by the House, although the first one carries a higher figure, the difference being because of the change in the basis of valuation.

The Senate changed from 8 cents per pound to 25 per cent ad valorem the rate on asbestos paper for insulating and other electrical purposes. This effects a material reduction.

The duty on electrical storage batteries, plates and materials was reduced to 40 per cent. The original recommendation of the finance committee was 45 per cent, but the committee reduced this voluntarily. The House rate was 30 per cent upon American valuation, a higher rate.

The bill as it passed the Senate provides that an additional 10 per cent ad valorem shall be imposed upon table, kitchen, household and hospital utensils containing an electrical heating element.

Telephones, telegraph, trolley and electric light poles of cedar or other wood were placed on the free list on motion of Senator Kellogg. A duty of 10 per cent originally was imposed.

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State Government Enjoins Tennessee Merger

An injunction against the merger into the Tennessee Power Company of the various utility companies of which it has acquired control was granted last week by a Nashville court to Attorney-General Frank Thompson, representing the State of Tennessee. The state authorities have filed a bill in the Chancery Court asking forfeiture of the charters of the Nashville Railway & Light Company, the Chattanooga Railway & Light Company, the Chattanooga & Tennessee River Power Company, the Tennessee Power Company, the Tennessee Railway, Light & Power Company and the Tennessee Electrical Power Company on the ground that these companies have violated the statutory law and the common law of the state by entering into an agreement or a series of agreements for organizing and maintaining an illegal combination in restraint of trade.

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Municipal Electricians Widen Contact with Industry

The desirability of closer contact with the electrical industry as a whole was emphasized in the program of the twenty-seventh annual convention of the International Association of Municipal Electricians this week at New Bedford, Mass. In addition to topics of immediate interest to delegates in their daily work of maintaining fire and police telegraph systems, a number of questions of importance to central-station companies were listed for discussion. The convention opened Tuesday morning at the New Bedford Hotel, an address by President W. R. Arbuckle, Bayonne, N. J., being a feature of the program.

The subjects listed for Tuesday afternoon included "Reliable Fire-Alarm Signals as Applied to Automatic Sprinkler Systems," by David Reed, Denver, and "Black Streets Are Back Streets," by L. A. S. Wood, Westinghouse Electric & Manufacturing Company. On Wednesday the program included addresses on "Care and Maintenance of Fire and Police Signal Systems," by G. A. Jackson, Newton Upper Falls, Mass., and "Radio as Applied to Hazards, Rules and Inspections," by R. R. Moore, Westinghouse Electric & Manufacturing Company. Papers on "The Municipal Electrician and the Electric Power Industry," by Dr. Charles P. Steinmetz, Schenectady, and "The Reduction of Fire and Life Hazards at Meter Installations," by G. C. Langdell, Hodenpyl, Hardy & Company, Jackson, Mich., were given on Thursday.

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Public Service Company's Big Waukegan Plant

Ground will be broken Sept. 1 for the new generating station of the Public Service Company of Northern Illinois at Waukegan, 40 miles north of Chicago. The plant will have an ultimate capacity of 250,000 kw. and may cost eventually about $22,000,000. The first unit will contain a 25,000-kw. turbine and three boilers of 1,430 hp. each. Contracts for this equipment have been awarded, and operation of the plant will, it is expected, begin in August, 1923. The building first erected will contain space for two units, the second to be of 30,000 kw. to 35,000 kw. rating. The cost of the first unit and the building, exclusive of the ground, will be approximately $3,000,000.

The site, just north of Waukegan, comprises 87 acres of land in the center of which is a natural pond covering 11 acres. An intake from Lake Michigan will assure ample water supply for the plant. The site is the last one available along the shores of the lake in the Chicago district. The only other available site is at the boundary line between Illinois and Indiana and is owned jointly by the Public Service Company and the Commonwealth Edison Company of Chicago.

A private right-of-way ranging in width from 85 ft. to 150 ft. from the site of the new generating station south to Lake Bluff, a distance of about 10 miles, has been purchased by the Public Service Company. A 33,000-volt transmission line will be built over this right-of-way connecting the Waukegan station with the rest of the Public Service Company's territory, which includes the great industrial district in northeastern Illinois, just outside of Chicago. An industrial district is being developed at Waukegan in the vicinity of the proposed new station, and big power users will be served from 12,000-volt lines.

Million-Volt Laboratory

California Institute of Technology Is About to Install One in Its Electrical Department

THE electrical department of the California Institute of Technology expects to have a laboratory in service in the fall in which potentials of 1,000,000 volts and even higher can be produced from line to ground. Voltages of this magnitude will be obtained by means of four 250-kva. transformers (3,000-6,000/250,000 volts) developed by Prof. R. W. Sorensen and being built by the Westinghouse Electric & Manufacturing Company. When connected for full voltage to ground three of the transformers will be supported on redwood insulating platforms, the fourth transformer being grounded.

The transformers may also be used independently or connected for the following conditions: (a) 1,000,000 volts with grounded neutral and 500,000 volts line to ground; (b) 500,000 volts step-up-step-down system, one side grounded; (c) 500,000 volts step-up-step-down system, neutral grounded; (d) three of the transformers may be Y-connected with grounded neutral to give 433,000 volts between lines; (e) single-phase combinations for 250,000 volts may be made.

Two-legged core-type transformers with one high-voltage terminal on the secondary are used, the other terminal being grounded. Each transformer will be equipped with means for connecting instruments at the grounded end of the high-voltage coil and with crest voltmeter connections, voltmeter coils, protective reactances, etc. The weight of each unit is approximately 45,000 lb. complete with oil.

Although the primary of each transformer is wound for 3,000/6,000 volts, the power for the laboratory will be supplied by a 50-cycle, 15,000-volt line. Connection between this line and the testing transformers will be made through automatic oil switches and two regulating transformers. By means of these transformers energy can be supplied to the testing transformers at voltages varying smoothly from 0 to 6,000 as desired.

A 20-kw. Poulsen arc set and other high-frequency and direct-current apparatus for high-voltage work will also be installed in the laboratory. The building which will house the equipment will have an unbroken metallic lining to prevent interference with the radio work of the community, a door in one side, 40 ft. high by 40 ft. wide, through which a transmission line may be taken out when desired, and a transformer pit in which the supporting structures for three of the transformers used in getting 1,000,000 volts will be erected.

The laboratory will be under the general direction of Dr. Robert A. Millikan, director of physical research and chairman of the executive council of the California Institute of Technology. Experiments will be conducted in conjunction with the research engineers of the Southern California Edison Company and other power companies of the West.

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E. S. J. A. Questionnaire in Aid of New Business

A comprehensive questionnaire is being circulated among their customers by the salesmen representing members of the Electrical Supply Jobbers' Association in aid of the work of the Joint Committee for Business Development. The information is to be sought in every place visited by a jobbers' salesman and is to be sent by him to the house he represents. These houses will in turn forward the information to the headquarters of the Atlantic Division of the association in New York City. Thence the filled-in questionnaires will go to the Joint Committee for Business Development for tabulation. Since the jobbers' salesmen cover the entire country, it was felt that they better than any other agency could obtain the facts the committee wants.

The questions asked cover the activities of central stations, contractors and dealers and the degrees of aggressiveness and of co-operation displayed.

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Rehearing Asked in Wisconsin Rate Case

The Deputy Attorney-General of Wisconsin, on behalf of the Railroad Commission, has filed a motion in the State Supreme Court for a rehearing of the case involving rates to cities on the "loop" system of the Wisconsin-Minnesota Light & Power Company (see *Electrical World* for July 29, page 219). This is the case in which the Supreme Court held that the commission was wrong in its method of unit cost distribution to the communities affected and decreed that the proximity of communities to a generating station should be taken into consideration. It is held that the decision establishes a principle in rate making which will hinder the development of electric service to small communities by transmission-line extensions, and it is also believed that the decision robs the commission of an important part of its power in the establishment of rates.

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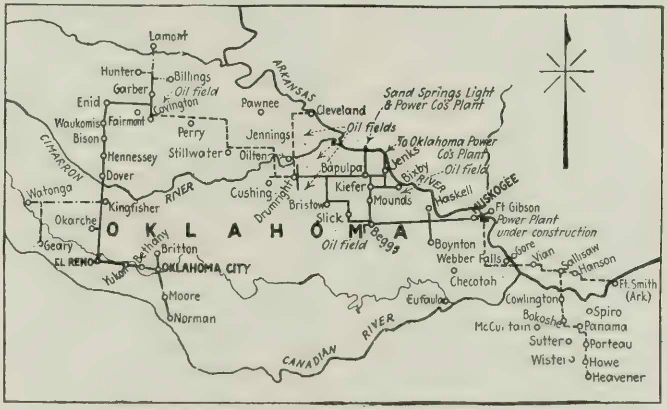
Work Begun on Oklahoma's Biggest Power Plant

Work has begun on the Oklahoma General Power Company's two-million-dollar power house on the east bank of the Arkansas River four miles northeast of Muskogee. It will be the largest electric power plant in the state and will require two years for completion. The company is controlled by H. M. Byllesby & Company.

Simultaneously with the beginning of construction work on the power plant work will commence on transmission lines to Checotah and Eufaula, where the electric plants were recently taken over by the Oklahoma company; to Fort Smith to connect with the Byllesby plant there, and to approximately a score of towns between Muskogee and Fort Smith.



TERRITORY SERVED BY OKLAHOMA GENERAL POWER COMPANY

The Arkansas River plant will have an initial installation of 10,000 hp., compared with the 4,600 hp. of the present Muskogee plant. The new plant will have one 7,500-kw. turbine of latest design, with space for another of equal rating. With the completion of the plant and transmission lines, the plants at Sapulpa, Drumright, Oklahoma City, El Reno, Enid, Muskogee and Fort Smith will be interconnected, and emergency lines will connect with plants at Sand Springs, Tulsa and the Oklahoma Railway Company at Oklahoma City.

The Oklahoma Gas & Electric Company, the parent corporation of the Byllesby interests in Oklahoma, has within the past few weeks acquired plants in ten towns. A number of municipal plants are included in this number. These will be abandoned and energy will be purchased wholesale from the Byllesby transmission lines.

Line Building in Indiana Co-ordinated

Electric Power and Telephone Utilities Accept Commission's Rules to Insure Safety and Prevent Inductive Interference on Transmission Systems

AFTER numerous conferences, Indiana utilities using electric wires have agreed upon procedure in the installation of wiring systems which will prevent loss of life and damage to property and save thousands of dollars in litigation, according to Earl L. Carter, chief engineer of the Indiana Public Service Commission. The movement began when the Indiana Telephone Association asked the commission to formulate rules and principles for safety and inductive co-ordination. Other utility companies agreed to send representatives to the conferences, and from that time until now much work has been done by all concerned. The new agreement provides that any party to it desiring to depart from the rules must petition the commission for a change, the commission having the right to make such changes for the public betterment.

The essential paragraphs follow:

SAFETY AND SERVICEABILITY SOUGHT

"All supply and signal systems should be so located, constructed, operated and maintained as to meet the reasonable service requirements of the public and in conformity with general co-ordinated methods as far as specified in these rules. These methods should facilitate the safety and serviceability of all systems. Reasonable foresight should be exercised in new construction and reconstruction to facilitate co-ordination between supply and signal systems and between supply or signal lines and the tracks of steam and electric railroad crossings.

"In situations where more than one set of facilities are now or are known to be likely to be concerned at some later date, as at crossings, conflicts and inductive exposures, each utility before locating and constructing new lines, or before making major changes in height, location or construction of existing lines, or before changing type of system, normal operating voltage, frequency or other operating conditions, shall give reasonable notice in advance in writing to all of the utilities that are now or are known to be likely to be concerned later, so that consideration may, when necessary, be given to any specific co-operative measures which may be advisable. Steam and electric railroads before making changes in tracks at crossings where signal or supply lines are involved shall give reasonable notice of such changes to the parties concerned and shall give due consideration to the requirements for relocating or reconstructing such lines. As an essential step in promoting co-operation there should be an interchange of pertinent data and information between the utilities concerned.

"Utilization of the highways is essential to the economical and efficient extension, operation and maintenance of supply and signal facilities. To avoid unduly increasing the number or difficulty of situations of crossing conflicts or inductive exposures incident to the use of the same highway by two different kinds of facilities, all lines should, in general, be located as follows:

"1. Where the conditions and character of the circuits permit, joint use of poles by signal and supply circuits is generally preferable to separate lines when justified by considerations of safety, economy and convenience, and presuming satisfactory agreement between the parties concerned as to terms and conditions.

"2. Where signal circuits and supply circuits on the same highway are not to occupy joint poles, or where either kind of circuit is alone on a highway, all signal circuits should be placed on one side of the highway and all supply circuits should be placed on the other side, so that, as far as practicable, one side of any section of a highway will be available as the signal side and one side as the supply side.

"3. Unnecessary crossings from side to side of the highway should be avoided.

"Where local signal lines are to be located on the same highway with local supply lines, joint use is generally preferable to separate lines, except sometimes in rural districts and except where the character of circuits involved makes separate lines on opposite sides of the highway more desirable. Where to be located on the same highway with transmission lines, separate lines on opposite sides of the highway are generally preferable unless a large number of service wire crossings would be involved, in which case joint use or other arrangements may be preferable.

JOINT USE PREFERRED TO OVERBUILDING

"Where toll or through signal lines are to be located on the same highway with local supply lines or lower-voltage transmission supply lines, separate lines on opposite sides of the highway are generally preferable, unless a large number of service wire crossings would be involved, in which case joint use or other arrangements may be preferable. Where proposed for location on the same highway or to follow the same general direction with higher-voltage transmission supply lines, co-operative consideration should be given to the question of whether such locations should be used and, if so, what specific co-ordinated methods are necessary. Where to be located on the same highway with higher-voltage transmission supply lines, separate lines on opposite sides of highway are preferable.

"Overbuilding of one line by another should be avoided where practicable. Where necessary for the two kinds of lines to occupy the same side of a highway, joint use is generally preferable to overbuilding.

"While signal or supply lines when alone should conform to general co-ordinated methods, such lines, pending the incoming or development of the other kinds of lines, may, if deemed economically advantageous, occupy locations or use types of facilities, construction and operating methods other than those conforming to general co-ordinated methods. However, the location and character of such facilities should be altered when and as deemed necessary to conform to these methods upon the incoming or development of another kind of facility conforming to general co-ordinated methods.

"When co-ordination of supply and signal lines of particular types cannot be technically and economically established under the methods of co-ordination covered by these principles, special co-operative consideration should be given to determining what location and type of construction should be established for each line of such type."

Sales Bureaus of N. E. L. A. Organize

The Lighting Sales Bureau of the National Electric Light Association has organized with the following officers: Chairman, G. Bertram Regas, Philadelphia Electric Company; vice-chairman, W. T. Blackwell, Public Service Electric Company, Newark, N. J.; secretary, J. Carl Fisher, Consolidated Gas, Electric Light & Power Company, Baltimore. There is an executive committee of twenty-four, of whom sixteen are members at large, representing every part of the country.

Responsibility of collecting and preparing data relative to various classes of service has been assigned as follows: Store lighting division, James Kirk, Commonwealth Edison Company, Chicago; residence lighting division, M. Luckiesh, National Lamp Works, Cleveland; industrial lighting division, J. Carl Fisher, Consolidated Gas, Electric Light & Power Company, Baltimore; large building lighting division, Charles C. Munroe, Detroit Edison Company; sign, display and billboard lighting division, H. H. Magdsick, National Lamp Works; street and highway lighting division, L. A. S. Wood, Westinghouse Electric & Manufacturing Company, South Bend, Ind.; commercial aspects of lamp equipment, G. H. Stickney, Edison Lamp Works, Harrison, N. J.

The officers named below have been selected for the Merchandise Sales Bureau: Chairman, F. D. Pembleton, Public Service Electric Company, Newark; vice-chairman, William Rawson Collier, Central Hudson Gas & Electric Company, Poughkeepsie, N. Y. The executive committee has twelve members at large and will have twelve geographic division representatives, of whom eight have been appointed, as well as eight manufacturers' representatives and one representative each of the National Association of Electrical Contractors and Dealers, the National Electrical Supply Jobbers' Association and the Society for Electrical Development.

Seek Permits and Licenses

Recent Applications to Federal Power Commission Come Mainly from Pacific Coast

THE Southern Sierras Power Company of Riverside, Cal., has applied to the Federal Power Commission for a preliminary permit covering the construction of four storage reservoirs on the headwaters of Bishop Creek, a tributary of the Owens River, in Inyo County, Cal. The water is to be utilized in four existing plants on Bishop Creek. This improvement will make 14,000 hp. of primary power available, the application states.

Walter C. Brower, Spokane, Wash., has applied for a preliminary permit covering a power project on Phantom and Blue Grouse Creeks. He estimates that 2,000 hp. of primary power will be made available.

The city of Los Angeles has applied for a license to cover a power site in the San Francisquito Canyon.

The application of the city of St. Paul for a preliminary permit covering various sites on the St. Croix River, which has been held up until it can be shown that the municipality has authority to operate the projects, covers the Nevers, Lower Kettle, Upper Kettle, Markham-Kelsey-Druar and all other sites on this section of the river. The engineers for the city estimate that 15,000 hp. of primary power can be made available.

The primary power involved in three applications previously noted is as follows: Anaconda Copper Mining Company, 1,200 hp.; Charles E. Schaup, 15,000 hp.; Empire District Electric Company, 60,000 hp.

Farley Gannett, Theodore E. Seelye and J. D. Carpenter, 204 Locust Street, Harrisburg, Pa., have applied for a preliminary permit covering a power project on Juniata River in Perry County, Pa. The 10,000 hp. available is to be sold through an existing central station.

The Shasta Power Corporation of 445 Sutter Street, San Francisco, has applied for a license covering two transmission lines in Shasta County, Cal.

The Nevada Irrigation District of Grass Valley, Cal., has applied for a preliminary permit for an irrigation and power project on the middle fork of the Yuba River and on Canyon Creek on the south fork of the North Yuba and on the north fork of the Middle Yuba. The primary power available is estimated to be 45,000 hp.

P. B. Cross, San Francisco, has applied for a preliminary permit covering a power project on Deer Creek near Chico, Cal. The primary power is estimated at 9,500 hp., but the applicant indicates his intention to install equipment capable of generating 20,000 hp.

The Washington Coast Utilities Company of Arlington, Wash., has applied for a license covering a transmission line which will cross certain public lands near Waterville, Wash.

The San Diego Consolidated Gas & Electric Company of San Diego, Cal., has applied for a license covering a transmission line to connect the Rincon Indian Reservation and the Henshaw Dam.

Program of American Electrochemical Society

Final arrangements for the forty-second general meeting of this society, at Montreal, on Sept. 21-23, are being made. The technical program will open on Sept. 21 with the presentation and discussion of papers on electrolysis and electroplating. The recently organized division on electrodeposition will take part in the discussion of these papers. One of the papers will deal with the physical properties of electrolytic iron—a product which is being turned out commercially, contrary to all predictions of ten years ago. There will also be papers on zinc, brass and other electrodeposited metals. A symposium on industrial heating will be held on Sept. 21 and 22, under the auspices of the electrothermic division. Twelve papers on industrial heating in electric furnaces, other than fusion and melting furnaces, will be open to discussion. There will be an excursion to Shawinigan Falls. Headquarters will be at the Hotel Windsor.

West Virginia-Kentucky Engineers Draw Up Program

A number of electrical topics appear on the program of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers, which will hold its second annual convention at Huntington, W. Va., on Sept. 19 to Sept. 22. There will be papers on "Automatic Electrical Apparatus as Applied to Coal Mining," by M. A. Whiting of the General Electric Company; "How Mechanical and Electrical Men Can Increase Their Usefulness," by W. C. Shunk, general superintendent Stonega Coal & Coke Company, and "The Wireless Telephone," by M. W. Crenshaw of Huntington.

Committee reports will cover, among other subjects, methods of checking power costs, underground transmission and distribution, automatic electrical apparatus as applied to coal mining, all-rubber insulation as compared with braid-covered cables for portable extensions, the use in mine locomotives of resistance grids made of rolled-steel plate as compared with cast grids, and the proper handling and care of insulating oils.

Brief News Notes

Electrification of the Hungarian Railways.—The Hungarian government is making strenuous efforts to electrify the state railways through the agency of a special government commission. Trials are to be made of a single-phase direct-current locomotive to be built by the Hungarian State Machinery Factory in connection with the Ganz Electric Company of Budapest.

Getting Electricity from Geysers.—An unusual form of power project is reported from Santa Rosa, Cal., where plans are under way to generate electricity from the geysers in Sonoma County. "Enough steam," the report says, "will be produced at the geysers in northern Sonoma to operate turbines large enough to furnish electricity to light most of northern California. The steam will be generated by boring shafts into the torrid heat wells in the bowels of the earth."

Northwestern Central Station to Make Use of Radio.—The Northwestern Electric Company, it is reported, is installing a 1,500-watt radiophone set at its hydro-electric generating plant at White Salmon, Wash., about 75 miles from Portland. The set will be used to insure communication with the plant during storms and other adverse conditions. A similar transmitting set will be installed at Portland, and receiving sets at both places.

Pawnee Abandons Municipal Plant.—The city of Pawnee, Okla., has voted to discontinue the operation of its municipal light plant and has contracted with the Oklahoma Gas & Electric Company for electrical energy at wholesale rates to be delivered over the new transmission line of the Drumright division. Construction of this new high-voltage line will be started at once. The city's first municipal plant was installed in 1901 and after being flooded three times in one year was abandoned in 1908. The present city light and water plant was built in 1909 at an expense of more than $100,000.

Electric Drive on San Francisco Ferryboats.—Two new ferryboats about to be built for the San Francisco-Oakland Terminal Railways Company are to be equipped with electric drive. These boats will differ from those being equipped at New York for the municipal service there in employing direct current instead of alternating current. The motors will be of standard double-armature type and will be driven by a steam-turbine generator rated at 1,100 kw. The boats will be of the usual double-end type, and there will be a 1,200-hp. motor at each end, mounted on the propeller shaft. They will carry passengers between San Francisco and Oakland, the trip being made in fifteen minutes each way, a considerable saving in time. In addition to these boats, the Golden Gate Ferry Company, which already has an electrically driven ferryboat in service, is to build a companion boat with carrying facilities for eighty-five automobiles and 500 passengers.

St. Gothard Electrification Completed.—The St. Gothard Railway, 140 miles long, from Lucerne, Switzerland, to Chiasso, on the Swiss-Italian frontier, is now completely electrified for both passenger and freight traffic. It is just forty years since this railroad was first opened. With electrification the time consumed between the terminals will be shortened from five hours to four and passage through the many tunnels, the longest of which extends 9¼ miles, will be free from the inconvenience of smoke and closed windows.

Russia and the German Electrical Industries.—According to a report from Berlin, Professor Krug, who was sent to Russia in the interest of the large German electrical works, has just returned from Moscow and has reported that since the Rapallo treaty great interest in German electrical enterprises prevails there. Technical agencies and depots will be erected in various districts of Russia and Russian electric plants will be leased to German concerns. A special bureau for the purpose of further study of electric possibilities in Russia will be established by the German manufacturers at Moscow.

New York Electrical League Appoints Committee on Electric Cookery.—The New York Electrical League has appointed a committee on electric cookery, of which Robert B. Basham, manager of the electric department of L. Barth & Son, New York City, is chairman. It is Mr. Basham's intention to establish two sub-committees, one to develop domestic cookery in New York City and its environs and the other for commercial cookery work. Mr. Basham is an experienced electrical man who has been in direct touch with the manufacture and sale of heavy-duty and domestic electric cookery equipment.

Central Indiana Power Company Absorbs Four Electric Utilities.—The Wabash Valley Electric Company of Clinton, Ind.; the Putnam Electric Company of Greencastle, Ind., and the Cayuga (Ind.) Electric Company have been purchased by the Central Indiana Power Company, which has also acquired ownership of the Merchants' Heat & Light Company of Indianapolis. These properties will continue to be under the same operating control as at present, but the holding company will develop plans for expansion, including a 40,000-kw. plant on the Wabash.

Bangor Company Purchases Machias Property.—Additional hydro-electric facilities have been acquired by the Bangor (Me.) Railway & Electric Company through the purchase of the property and franchise of the Washington County Light & Power Company of Machias, Me., the transaction to be completed upon confirmation by the courts. The Machias property has lately been in the hands of a receiver. The property acquired includes a plant in Machias which for some years furnished that community with energy and a water privilege at Saco Falls on the Pleasant River with a concrete dam about 75 per cent completed. It is reported that the development will be continued by the purchasing company.

Electrical Activities in North Carolina.—The Southern Power Company is completing a transmission line from Hickory, N. C., to Lenoir, N. C., to make possible the electrification of cotton and other mills at Lenoir, Hudson and Whitnel which have ordered equipment. Another transmission line from Mount Holly, N. C., to Mountain Island, N. C., will bring the 8,000 hp. generated at the Mount Holly plant of the company to its new development at Mountain Island for distribution. Hydro-electric sites on the Haw and Deep Rivers, near Greensboro, N. C., have been surveyed by the State Geologist, and interested manufacturers are likely to carry these surveys further with the view of bringing about the exploitation of these streams.

Post Office Reports Results of Radio Experiments.—Constant experiments by the radio service of the Post Office Department to attempt to limit static interference in receiving are beginning to bring results and seem to indicate that the day of the aërial antenna for receiving is over. The following description of the tests conducted has been made by James C. Edgerton, superintendent of the radio section: "The air mail radio section has eliminated the use of regular transmitting antennas for receiving purposes altogether, as it has been found that the surveyor static conditions prevalent, especially in the Middle West, make receiving impossible. Very good receiving conditions with favorable signal static radio have been obtained, however, through the use of three different methods of receiving, which are selected to conform to local conditions. These are large vertical outside multiple-turn loops, underground horizontal buried loops and underground antennas. The best results are obtained with the underground antenna when it can be laid in damp soil with a straightaway of 1,000 ft. The horizontal buried loop is more or less of a new departure and has been very successful when well insulated and buried in water or very damp earth. In actual use well-constructed underground antennas such as are used in the majority of the fifteen stations in the air mail circuit have given rather unusual results. Communication has been carried on in the Middle West between air mail stations when lightning was actually striking near by. As a matter of fact, it has been possible to carry on communication when the currents induced in the antenna from nearby lightning discharges blew out the arc. Receiving on an ordinary antenna would have, of course, been impossible long before the storm reached the vicinity."

Associations and Societies

Springfield (Mass.) Organizes A. I. E. E. Section.—A section of the American Institute of Electrical Engineers has been formed at Springfield, Mass., to meet the wants of numerous engineers in that vicinity who do not find it convenient to attend the Boston meetings. This promises to stimulate interest in the Springfield territory and lead to an increase of membership. Beginning in September, regular meetings will be held. The principal officers are: Chairman, **W. A. Dick**, Westinghouse Electric & Manufacturing Company; vice-chairman, **John M. Newton**, Roland T. Oakes Company, Holyoke; secretary and treasurer, **J. Frank Murray**, United Electric Light Company, Springfield.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Conference of Local Electrical Leagues—Association Island, N. Y., Sept. 5-7.
N. E. L. A. Geographic Divisions — New England, New London, Conn., Sept. 5-8; Rocky Mountain, Glenwood Springs, Col., Sept. 11-13; Southeastern, Atlanta, Sept. 12-15; Great Lakes, French Lick Springs, Ind., Sept. 27-30.
Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 6-9. H. M. Stine, 212 Locust St., Harrisburg, Pa.
Colorado Electric Light, Power and Railway Association—Glenwood Springs, Col., Sept. 11-13.
Association of Iron and Steel Electrical Engineers—Cleveland, Sept. 11-15. J. F. Kelly, Empire Bldg., Pittsburgh, Pa.
West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept., 1922. Herbert Smith, 211 Holson-Pritchard Bldg., Huntington.
Pennsylvania State Association of Electrical Contractors and Dealers—Philadelphia, Sept. 13-14.
American Electrochemical Society — Montreal, Sept. 21-23. A. D. Spillman, Columbia University, New York City.
Illuminating Engineering Society—Swampscott, Mass., Sept. 25-28. Samuel G. Hibben, 29 West 39th Street, New York.
American Institute of Mining and Metallurgical Engineers—San Francisco, Sept. 25-28. F. F. Sharpless, 29 West 39th Street, New York.
National Association of Railway and Utilities Commissioners — Detroit, Sept. 26. J. B. Walker, New York Transit Commission, New York.
Indiana Electric Light Association—French Lick Springs, Ind., Sept. 28-30. Thomas Donohue, Lafayette, Ind.
Telephone Pioneers of America—Cleveland, Sept. 29-30.
American Electric Railway Association — Chicago, Oct. 2-6. J. W. Welsh, 8 West 40th Street, New York.
Empire State Gas and Electric Association —Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.
Electrical Supply Jobbers' Association, Atlantic Division—Philadelphia, Oct. 6. E. Donald Tolles, 165 Broadway, New York.
Society of Motion Picture Engineers—Rochester, N. Y., Oct. 9-12.
Association of Edison Illuminating Companies — White Sulphur Springs, W. Va., Oct. 11-14. Preston S. Millar, 80th St. and East End Ave., New York.
National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St., New York.
Public Utilities Association of West Virginia—Charleston, W. Va. Oct. 13-14.
Electric Power Club—Asheville, N. C., Oct. 30. S. N. Clarkson, 506 Laclede Gas Bldg., St. Louis.

Commission Rulings

Assessment of Extension Costs Against Customers Is Disallowed.—The Kansas Gas & Electric Company of Wichita, Kan., has been forbidden by the Public Utilities Commission of the state to charge the cost of extending its lines against the consumers benefited. A commission order issued in March, 1921, had allowed the company to assess customers on new extensions 165 per cent of the annual revenue from each connection made. The order reversing this ruling and forbidding a charge for extensions affects all the towns and cities served by the company—twenty or more in number.

Propriety of Rule Requiring Deposits.—Pointing out that losses to an electric service company caused by failure of certain customers to pay for the service received have eventually, if not otherwise provided against, to be borne by those who do pay, the Michigan Public Utilities Commission criticised the attitude of some prospective customers of the Callier & Kinyon Light & Power Company in the village of Saranac. These citizens, although satisfied apparently with the proposed rates, declared a firm objection to making the deposit of $5 asked by the company. The commission upheld the requirement, but said that the company would be allowed to accept in lieu of the deposit a written guarantee signed by a responsible resident.

Principle Governing Permission to Abolish Distribution Line.—Granting an application of the Idaho Power Company to discontinue service over a certain distribution line and dismantle it, the Idaho Public Utilities Commission said: "An electric utility should be permitted to abandon a distribution line operated at a loss when the abandonment of this service in no wise interferes with the general system or plan of development, but is more in the nature of a special service for certain patrons and has no intimate connection or relationship with the rest of the system." Such a line, the commission went on, should not be allowed to share in the depreciation reserve.

Approval of Southern California's Financing Plans.—In authorizing the Southern California Edison Company to reclassify its stock and to issue and sell $9,500,000 of 7 per cent cumulative non-participating preferred stock to retire outstanding second preferred stock and for development purposes, the California Railroad Commission said: "The applicant under its present financial structure has but two sources from which to get moneys to finance permanently its construction expenditures, such sources being the sale of common stock and the sale of bonds. Its officers believe that it should have a third source of funds, namely, the sale of preferred stock. It is argued that there is a group of investors who will not buy common stock but who are interested in acquiring preferred stock and that the company will be able to get its money cheaper through the sale of bonds, preferred stock and common stock than through the sale of bonds and common stock only. The commission's attention is also called to the fact that one individual now owns and controls $12,029,900 of applicant's outstanding stock and that it is not to the best interest of the company to have so large an amount of stock eventually pass into the hands of owners who might take a different attitude toward the management of these properties from that taken by the present owner of the stock."

Current Prices Improper Basis for Valuation.—Discussing the contention of the Pacific Gas & Electric Company that prices and costs obtaining on the date of the filing of the application for rate adjustment must be used, the California Railroad Commission said: "Aside from the fact that the valuation presented by the company's engineers itself violates this theory within a wide margin, the commission should reject this theory. No public utility plant of any size can be built in one day. The commission in the valuation work done by its own engineering department should adhere to the rule laid down in the Redding case, that valuation estimates must be predicated upon a normal and reasonable construction period under normal and reasonable construction conditions, and this rule should have its influence on the labor and material costs and on the so-called overhead allowance applied to an inventory."

Wholesale Power Service Rates in Southern California. — The Southwestern Portland Cement Company, the Golden State Portland Cement Company and the American Trona Corporation, served by the Southern Sierras Power Company, applied to the California Railroad Commission for a material reduction in rates on account of the economic competition which they could offer in the way of generating their own electric power, because the existing rates were, in their opinion, very much in excess of both the value and the cost of the service rendered, and because the rates resulted in discrimination between consumers and companies engaged in similar lines of business situated south of San Bernardino and supplied by other electric utilities. The commission held that the differential in rates did not result in discrimination, that service should be rendered under regular schedules and not under contracts, and that costs could not be allocated to single districts or cities. The commission found that conditions warranted the fixing of a new rate applicable to wholesale power service for industrial use effective in the entire territory served by the company outside of its Blythe and Yuma districts.

Recent Court Decisions

Eminent-Domain Proceedings to Acquire Site for Transmission Line Upheld.—The Indiana Supreme Court has upheld the defendant company in a suit (Jones vs. Indiana Power Company) brought to set aside the condemnation of certain small tracts of property for electric transmission-line towers on the ground of misrepresentation. The court found that the company's allegations were sufficiently specific to be clearly understood and that the original complaint was not open to the objection that it sought to take a fee simple for purposes for which the statute only authorizes an easement to be appropriated. (135 N. E. 332.)*

Recovery for Damage Caused Through Contact of Wires Barred When Both Parties to Suit Were Negligent.—In Morris vs. Sierra & San Francisco Power Company the plaintiff obtained a verdict for damages in the lower court because of the destruction of his property caused by a short-circuit between plaintiff's high-tension and telephone wires. The telephone wire fell upon a telegraph wire owned by the defendant, and fire broke out in his store as the result. The California District Court of Appeal reversed the verdict, finding that neither plaintiff nor defendant had observed the clearance rules prescribed by the Railroad Commission and that the contributory negligence of the plaintiff forbade recovery. (207 Pac. 262.)

Toll Charges of County Against Central Station Lines Upheld. — Tulare County vs. City of Dinuba was an action involving the right of the county to recover from the San Joaquin Light & Power Company 2 per cent of annual gross receipts for the use and operation of a franchise over the public highways of the county. The California Supreme Court sustained the act under the provisions of which the suit was brought and held that the "gross receipt" charge under this act is neither a tax nor a license, but a toll which the holder of the franchise undertakes to pay for the use of the highways, being a matter of contract. The case was reversed and remanded for a new trial, that a distribution of the payments according to the relative mileage may be had within the intention of the act, the Supreme Court pointing out the absurdity of the position that any integral part of an electric distributing system is entitled to credit for the whole of the earnings from deliveries and sales in a given county or municipality, when a large part of such service is over parts of the system not subject to such franchise permit. (206 Pac. 983.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Calvin W. Rice Delegate to Engineering Congress

Calvin W. Rice, secretary of the American Society of Mechanical Engineers, has been appointed official delegate to the engineering congress to be held in connection with the International Exposition at Rio de Janeiro. Mr. Rice, who goes as the emissary of organized engineering in the United States, and who for purposes of representation at the congress has been elected an honorary vice-president of the A. S. M. E., sailed from New York Aug. 23 on the steamship *Pan-America*. A dinner in his honor was given at the Engineers' Club, New York City, Monday evening, Aug. 21, at which distinguished engineers, publicists and educators from many cities were present.

C. W. RICE

Mr. Rice, in addition to his work at the congress, will visit numerous South American engineering centers in behalf of the American Society of Mechanical Engineers and of organized engineering in general. His itinerary includes Rio de Janeiro, Buenos Aires, Santiago, Valparaiso, Callao and Havana. Mr. Rice plans to return to New York about Nov. 12.

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Officers of Central Indiana Power Company

Joseph H. Brewer, who is well known in the utility world and particularly in Indiana, is president of the group of companies the ownership of which was recently acquired by the Central Indiana Power Company. These include the Wabash Valley, Putnam and Cayuga Electric companies as well as the Merchants' Heat & Light Company of Indianapolis. Mr. Brewer's ability to provide capital for progressive and growing utilities is well known.

Charles O'Brien Murphy of Indianapolis becomes general manager of all the operating companies. H. R. Ellis becomes responsible for the financing. Both of these men are vice-presidents, as is also Marshall V. Robb, who is to have charge of the companies' future development. J. W. Robb and C. M. Poor remain on the directorate of the Wabash Valley, Putnam and Cayuga companies.

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Changes in G. R. & P. Company Personnel

W. F. Edwards, formerly superintendent of employment and instruction for the Georgia Railway & Power Company, has been appointed assistant superintendent of transportation to succeed E. G. Gramling, who has been transferred to the claim department. J. J. Duncan, formerly an instructor in the transportation department, has been appointed superintendent of employment and instruction, to succeed Mr. Edwards.

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D. L. Gaskill, Greenville, Ohio, was recently re-elected secretary-treasurer of the Ohio Electric Light Association for the current year.

Frank Espy of Canton, Ohio, was elected vice-president of the Ohio Electric Light Association for the year 1922-1923 at the convention recently held at Cedar Point, Ohio.

C. A. Sears of Keokuk, Iowa, was elected first vice-president of the Iowa Section of the N. E. L. A. at its recent meeting at Lake Okoboji.

F. F. McIntosh, associate professor in metallurgy at the Carnegie Institute of Technology, will supervise courses in metallurgy, electricity and physical chemistry prescribed for graduate officers of the United States Naval Academy which are to be given at the Carnegie Institute next fall.

E. B. Phillips of Jacksonville, Fla., has been appointed instructor in electrical engineering at the Carnegie Institute of Technology, Pittsburgh. He will join the staff of the College of Engineering on Sept. 1. Mr. Phillips was graduated from the Georgia Institute of Technology in 1917 and for the two years following was an electrical engineer with the Western Electric Company in New York City. During the past two years Mr. Phillips has been instructor in electrical engineering at the United States Naval Academy, Annapolis, Md., and also at the Georgia Institute of Technology.

J. L. Catlin, general superintendent of the Bridgeport (Conn.) plants of the General Electric Company, has been chosen vice-president of the Engineers' Club of Bridgeport. Mr. Catlin succeeds W. J. Newton, who has resigned.

H. A. Shepard, superintendent of telegraphy of the New York, New Haven & Hartford Railroad, with headquarters at New Haven, Conn., has been appointed superintendent of electric transmission and communication, with the same headquarters, and the position of superintendent of telegraphy has been abolished. The jurisdiction of Mr. Shepard's new office will include all lines of electric communication and transmission on the system, including the electrified territory between New York and New Haven.

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C. A. Corney Joins Staff of Boston Edison

Chester A. Corney, electrical engineer with Stone & Webster, Boston, has resigned to enter the electrical engineering department of the Edison Electric Illuminating Company of Boston. Mr. Corney was born at Boston in 1892 and after being graduated in electrical engineering at the Massachusetts Institute of Technology in 1914 spent a year as an assistant in the dynamo-electric laboratories of the institution. He then entered the employ of Stone & Webster and after a period of construction work in connection with power-supply problems on the Boston Elevated Railway was transferred to the Boston office of Stone & Webster for drafting and design service. In 1916 he entered the engineering department of the firm, and he has since been occupied with a variety of work, including electrical problems for the United Electric Light Company of Springfield, Mass., the Philadelphia Electric Company's Delaware station, the American Sugar Refining Company, Baltimore, and the Queens Borough (N. Y.) Gas & Electric Light Company. Mr. Corney is a member of the A. I. E. E. and the N. E. L. A.

C. A. CORNEY

Lawrence Russel, formerly manager of the Armstrong-Whitworth Company of Canada, has been appointed manager of the Celite Products, Ltd., Montreal.

Alfred F. Duemler, formerly sales engineer of the Philadelphia office of the McClave-Brooks Company, has been promoted to the position of assistant manager of the Pittsburgh office.

T. D. MacMullen, secretary and sales manager of the Majestic Electric Development Company of San Francisco, has recently been made secretary-assistant manager of the company.

George Blair, Jr., has been placed in charge of the Pittsburgh office of the McClave-Brooks Company. Mr. Blair will continue to direct the work of the Philadelphia office in the capacity of district manager.

H. L. Hergett, manager of the Pittsburgh office of the McClave-Brooks Company, has been selected as manager of the Syracuse office to replace W. H. Goodrich, who has recently resigned.

George M. Moffett of New York, vice-president of the Corn Products Refining Company, has been elected to the board of Allis-Chalmers Manufacturing Company, to fill the vacancy caused by the death of W. T. Abbott.

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H. B. Ennis Joins Bryant Electric Company

Harry B. Ennis has recently been appointed a field representative in the metropolitan district for the Bryant Electric Company of New York City. Mr. Ennis is well prepared to fill the rôle for which he has has been selected because of the contact which he established with many contractor-dealers in Brooklyn during the seven years he served with the new-business department of the Brooklyn Edison Company. After leaving that company he became associated with the Duplex Lighting Works of the General Electric Company as illuminating engineer and later represented the H. S. Whiting Company as sales engineer in the metropolitan district.

H. B. ENNIS

Vincent Gray, formerly secretary of the Standard Electric Construction Company of New Orleans, La., has recently severed his connection with the company.

N. E. Camp has resigned from the General Electric Company to become vice-president and chief engineer of the Roberts Engineering & Construction Company, Marysville and Sacramento, Cal.

S. D. Green, formerly associated with the Worthington Pump & Machinery Corporation, New York City, has been appointed sales engineer in the Boston office of the Elliott Company, manufacturer of power accessories.

Trice M. Bell, formerly assistant instructor in the electrical engineering department of the University of Illinois, is now connected with the lighting department of the General Electric Company at Schenectady.

T. E. Hosley, formerly with the Washington Water Power Company of Spokane, is now connected with the Los Angeles sales organization of the Western Electric Company.

Prof. F. C. Bolton of the department of electrical engineering of the Agricultural and Mechanical College of Texas has been appointed dean of the School of Engineering, to succeed Dean Nagle.

J. Elmer Housley, formerly assistant power superintendent of the Aluminum Ore Company, East St. Louis, Ill., has recently joined the Aluminum Company of America, Kansas City, Mo., in the capacity of sales engineer.

S. Herbert Lanyon has been recently appointed Western manager for the Okonite Company., manufacturer of insulated wires and cable, and will maintain offices in the New Call Building, San Francisco.

J. H. Rodger, Western manager of the Safety Car Heating & Lighting Company, with headquarters at Chicago, has been promoted to be vice-president in charge of that company's Western business, with the same headquarters.

F. J. Schlink, formerly of the development branch of the engineering department of the Western Electric Company, New York City, has been appointed assistant secretary of the American Engineering Standards Committee.

H. D. Shute, vice-president and general sales manager of the Westinghouse Electric & Manufacturing Company, has been elected a member of board of directors of the Standard Underground Cable Company, Pittsburgh.

Dr. A. A. Hamerschlag has resigned as president of the Carnegie Institute of Technology. He plans to enter the business field as adviser and consultant to business organizations. He has been engaged in educational work since 1892 and has been a cogent factor in the development of the great institute. Dr. Hamerschlag plans to establish offices in Pittsburgh and New York.

Dr. Thomas Stockham Baker, secretary of the Carnegie Institute of Technology of Pittsburgh for the past three years, has been appointed acting president. The resignation of Dr. A. A. Hamerschlag from the presidency necessitated the selection of an executive in charge and Dr. Baker has been chosen. He has had wide experience in educational fields and in his capacity as secretary has been actively identified with various movements contributing to the remarkable growth of the institute.

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W. M. Fagan Joins Chicago Flexible Shaft Company

Walter M. Fagan has resigned his position as manager of the appliance division of the Edison Electric Appliance Company, Chicago, after seven years' service, in order to join the Chicago Flexible Shaft Company.

W. M. FAGAN

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A. B. Saurman, general sales manager of the Standard Underground Cable Company, Pittsburgh, has been elected a vice-president of the company and will combine the duties of his new office with those of general manager of sales.

Obituary

Alexander H. Patterson, for many years vice-president and general manager of the Phoenix Glass Company of Pittsburgh, died recently at his home in New York City. Mr. Patterson was one of the pioneers in the electrical industry on the Pacific Coast.

James Kennedy, engineer and editor, died recently at his home in New York City. Mr. Kennedy was seventy-two years old and at the time of his death was editor and president of the Angus Sinclair Publishing Company. Previously Mr. Kennedy had been managing editor of *Railway and Locomotive Engineering.*

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Price Buying of High-Tension Equipment

Manufacturers Largely to Blame, but Purchaser Suffers Because Quality of Product Is Impaired

By J. M. Livingston
Sales Manager Electric Power Equipment Corporation, Philadelphia, Pa.

The last few years have had a demoralizing effect not only upon the market for high-tension equipment, but upon many other lines of manufactured apparatus. The end of the war brought a buyers' market, and, prices being high, there developed a certain amount of price buying which was out of all relation to the importance of price as a factor in the proper selection of this kind of apparatus.

High-tension equipment used in power houses and on outdoor substations and transmission lines is bought primarily for two purposes—first, service; second, safety. The first consideration must be quality, for it is protection that is desired by the central-station companies, and if the material cannot be absolutely depended upon to stand up under heavy stresses, no central station or individual plant can afford to install it, no matter what its cost may be. The price, therefore, should be a secondary influence in the selection of this class of material.

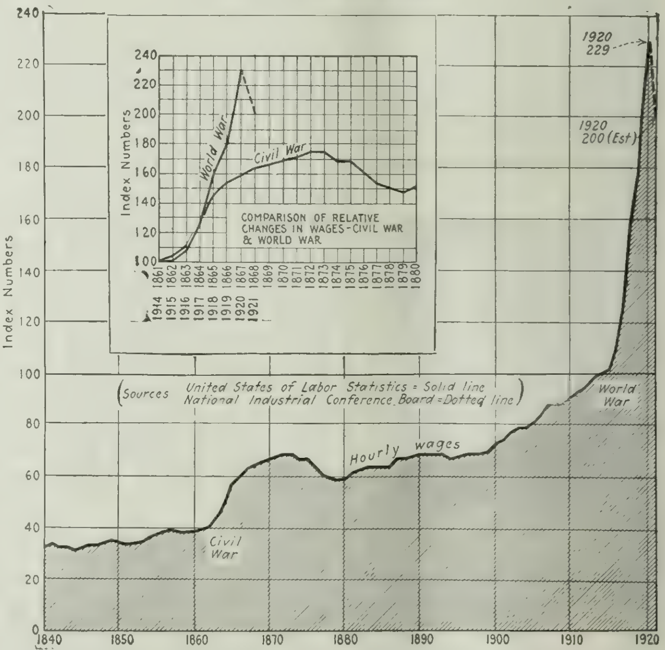
Result of Close Figuring

The depression which followed the war period resulted in part cessation of extensions to transmission lines and power houses, and competition for this class of business became keen. Manufacturers are, therefore, to a degree, to blame for the condition of price buying that exists at the present time, because, on account of the small amount of business available for the high-tension equipment manufacturers, the tendency was to figure on close profits, and, of course, the buyer took advantage of this circumstance.

It is quite natural for the buying public to allow itself to become interested in purchasing material at the lowest possible price, but too often the real purpose involved is lost sight of or subordinated. Central-station companies have continuity of service to provide for their consumers, and in purchasing protective equipment the important factor is to obtain insurance against possible failure of that device. Quality should, therefore, be very carefully weighed against the price, and to obtain quality manufacturers must carefully consider the matter of design, the materials used and the kind of workmanship applied. These are naturally and unavoidably reflected in the price.

Bartering over prices and shopping around to match one manufacturer against another is not really bartering for price alone, but usually for quality as well, although apparently this is not fully realized. In reality, securing a lower price is accomplished generally by finding some competing equipment that does not show the best design, workmanship and materials, yet is offered for the same service. If we would but stop to think of it, that is not at all what the buyer wants, for he knows that above all else the device must be safe and proof against breakdown. The buyer would not willingly select inferior quality, price being even, but the tendency is to select inferior

The Trend of Wages



This chart of the National Industrial Conference Board shows that there has been a steady upward trend in wages except in the two post-war periods and that hourly wages in 1921 were approximately six times as high as they were in 1840.

The insert diagram shows that on the same basis of comparison the rise of wages during the Civil War more nearly resembles that which has been caused by the World War than is apparent from the long time trend.

quality, price being uneven, there being a failure to consider the fact that this inequality in price usually indicates comparative standards in quality.

The manufacturers recognize that the buyer wants the best quality and is always ready to pay for it when he can be shown that the price is fair, and it is therefore their duty to convince the purchaser of high-tension equipment that this present era of price buying is not to the best advantage of those concerned. It is time that we took this message to our customers and supported it by reasonable and soundly based arguments.

Room for Every Manufacturer

Further Comments on the Small Manufacturer's Distribution Problem and a Reply to the Complaint that Distribution Is Too Much Controlled

BY W. R. HERSTEIN,
Vice-president and General Manager Electric Supply Company, Memphis, Tenn.

THERE is still much to be said on the subject of distribution in the electrical industry, and the article which appeared in the *Electrical World* recently by "A Small Manufacturer" is evidence of the extent to which misunderstandings may creep in, and opinions differ. This manufacturer complains that he finds the available supply of jobbers pre-empted by old-line manufacturers, and that a few of the largest manufacturers have so closely affiliated themselves with their distributors as to impel the complainant to classify the latter as "kept jobbers."

Since some one must take up the gauntlet thus thrown down, it may not be amiss for the writer, who is not what the Small Manufacturer terms a "kept jobber" but gladly claims close kinship with them, to point out to this manufacturer some of the injustice in his complaint. If the "Small Manufacturer's" particular product were known, the task might be simplified, but in the absence of this information it may be assumed that his line is a general one, and I will follow that assumption.

THE KINDS OF DISTRIBUTION

Manufactured products are marketed in this country largely by three methods of distribution—the centralized mail-order house, the chain-store system and the independent operator. All three methods lend themselves economically to the purposes for which they were created, and America is large enough to afford a legitimate and profitable field to each line of endeavor. While it is hardly fair to designate the manufacturer-controlled jobbing house as a chain store, yet, in a glorified sort of way, it is approximately that, and its ownership or management is entitled to credit for the fact that, notwithstanding its connection with practically unlimited resources, its competition is upon the same fair and businesslike basis as that of the most reputable independent jobbers, while from the personnel of its executives are recruited some of the most valuable leaders of the Electrical Supply Jobbers' Association.

OTHERS TOO LOSE CUSTOMERS

It is not the writer's purpose to answer the "Small Manufacturer's" indictment by recriminations, but the first thought impressed upon his mind by the manufacturer's complaint was that in venturing into the electrical field, he leaped first and looked afterward. Prudence should have caused him to investigate the market before entering it, and if, then, he had discovered the situation to be as he has outlined, he could have applied his energies and capital in other directions, where the field might be less competitive. Parenthetically, however, it may be doubted whether such field exists, since, if reports from other lines are true, there is no reason to feel that competition has not singled out our own industry for its principal activities.

The "Small Manufacturer" has charged that he, and others in his class, have lost many good customer-distributors by their becoming affiliated with one of the larger manufacturers. Granting, however, that the loss of important customers is a serious matter, the "Small Manufacturer" is in no worse case than the jobber, to whom the experience of losing half a dozen central-station customers at one fell swoop, owing to their purchase by some syndicate, is by no means novel. This is an ordinary hazard of business. Customers are lost just as customers are gained.

MAJORITY STILL UNCONTROLLED

All the foregoing, of course, even if correct, affords no consolation to the "Small Manufacturer," but here is a morsel of comfort for him. There are probably three hundred electrical jobbers in the country. The two large manufacturers he has in mind are affiliated with about seventy-five. By such affiliation they voluntarily refrain from competing with him for the business of the remaining 225. If the two largest manufacturers can market their output through one-fourth the trade, therefore, surely the "Small Manufcturer" can find an outlet through the remaining three-fourths, if he produces a meritorious article at a reasonable price, with fair compensation to his distributors—and shoulders faithfully and consistently his share in the burden of creating a demand for his product and popularizing the use of electricity.

There is a big job still to be done by the manufacturers and distributors of electrical goods and by the central stations and contractors. The idea of utilizing complete electrical equipment has got to be sold to the public and the market broadened and developed. There is room for every manufacturer and every jobber now in business and a lot more. But the problem needs creative work, and organization is required to get it done. Therefore, it seems to me that it is not the time to accuse the most highly organized and effective groups of jobbers in the industry of blanketing distribution and holding back the progress of the industry, but rather to search out a way for the small manufacturer to build up for himself also a better distribution than he says that he now has.

TWO KINDS OF COMPETITION

There are two kinds of competition among manufacturers. One kind competes for the division of the clearly apparent market, each competitor contending for the largest possible share of the existing business. The other kind competes in the creation of new business and in the service of the active existing market. The manufacturer who is constructively increasing the demand for his goods and progressively creating new uses and new markets has no fear of restricted opportunity.

Survey of Business Conditions

Says No Group Can Fix Arbitrary Fuel-Oil Prices

Under existing conditions in the oil industry, no one company or group of companies is strong enough to fix an arbitrary price for crude petroleum or its products, according to evidence given by R. L. Welch, secretary of the American Petroleum Institute, before the Senate committee on manufactures, in connection with the committee's oil inquiry.

Prices have been declining since early in July, Mr. Welch told the committee, because of an overproduction of crude oil.

"Overproduction will inevitably force down the price of oil," Mr. Welch said, "just as a demand in excess of the supply will cause the market to rise."

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Scarcity of Coal Hampers St. Louis Business

Industrial activity in the St. Louis district is materially hampered by scarcity of coal, and the situation regarding stocks and deliveries is daily becoming more critical. This is directly restricting electrical sales to industrial companies, and indirectly, through its depressing effect upon business generally, it is causing a slowing down of sales in virtually all lines of electrical goods.

A few construction jobs of industrial character have been deferred from this fall until next year. Weather conditions the past week have been unfavorable to agriculture, but because of the lateness in the season the detriment will not be great.

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Cleveland Building Industry Shows Much Activity

Midsummer finds the building industry in Cleveland making remarkable progress. There are few, if any, idle men in the ranks either of skilled craftsmen or common labor. The strike situation has resulted in an advance in the price of some lines of building materials, and the increasing demand is also responsible for the higher cost. Added to this is the increased cost of labor, all of which does not seem to have retarded to any appreciable extent the demand for new structures.

Cleveland's building operations show an increase of almost 20 per cent over last year, using June, 1922 and 1921, for comparison. The building commissioner issued 946 new construction permits in June, 1922, valuations amounting to $9,446,450. The records for June, 1921, show that only 620 new construction permits were issued and the valuation was $8,063,355. Alteration permits decreased in number this year, but valuations show an increase. A summary of both classes shows an increase in valuations of $1,651,715.

This is regarded by the trade as indicative of brisker business conditions among the builders, and obviously a more active money market prevails.

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Cities Service Company Storing Oil Following Price Cuts

Henry L. Doherty, president of the Cities Service Company, announced last week that his interests are beginning the purchase of crude oil in addition to storage of production wherever it is practicable.

"The recent cut in crude oil," said Mr. Doherty, "was not surprising to any thinking oil man, for conditions have been such for many months as would justify a drastic cut.

"I am glad to say that the subsidiary petroleum producing and refining properties of the Cities Service Company are in an enviable position. We have available storage tanks with a capacity of 4,000,000 barrels, and if the price of crude oil has not recovered when they have been filled, we will build additional storage capacity and buy more crude oil so long as this opportunity prevails."

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Points Out Important Use of Copper in Radio

The part played by copper and brass in the development of radio telephone is described in a bulletin of the Copper and Brass Research Association just published. The report states in part as follows: "Large demands are reported by manufacturers of copper wire, sheet, tube and bar stock for copper in one form or another for use in radio apparatus.

There is not a single instrument of a radio sending or receiving set but that requires copper, brass or bronze in its construction. The high electrical conductivity of copper makes it absolutely essential for all switches and parts using wire to convey the delicate electrical impulses received from the air. Brass, because of the ease with which it can be machined, is largely used for binding posts, plugs, audion bulb bases and the like. Where unusual strength is a requirement, phosphor or silicon bronze finds wide application.

"Sheet copper and brass are used in the construction of the adjustable condensers that assist in increasing the strength of the electrical impulses. From one to three condensers of ten to thirty plates each are necessary to the average amateur receiving station."

July's Industrial Construction Largest in Two Years

More industrial building construction was started in July than in any other month since November, 1920, according to figures compiled by the F. W. Dodge Company. The amount is given as $31,882,000, or 9 per cent of the month's total of $350,081,000 for all building operations. The total is 2 per cent above that for June, 1922, and 65 per cent over that for July, 1921. It is greater than any previous monthly total except the record figures for April and May of this year and marks the fourth successive month of unprecedented building activity.

Building contracts in the district comprising Illinois, Indiana, Michigan, Wisconsin, Iowa and Missouri, amounting to $124,655,000 in July, gave the largest monthly figure ever recorded. Construction in this district during the first seven months of 1922 has amounted to $595,668,000, or 29.2 per cent of the total of $2,041,065,000 for the twenty-seven states covered (everything north and east of a line from Topeka, Kan., to Savannah, Ga.). The total is 60 per cent above the figures for the first seven months of 1921.

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Canadian Reports on Electrical Market in Scandinavia

Norman D. Johnston, Canadian Trade Commissioner at Rotterdam, recently sent to the Department of Trade and Commerce at Ottawa a report on the market for electrical apparatus in the Scandinavian countries.

"In general, it may be said that among the products in demand in Scandinavia are electrical motor accessories, household electrical articles such as irons, toasters etc.; heating apparatus, electrical machinery of various kinds, material for the government railways and power plants, equipment for the municipal light, heat and power plants, as well as all kinds of electric fittings and cables. Heating apparatus is coming largely from the United States and Switzerland, while Germany supplies most of the imported light fittings. In most of the electrical products it is very difficult to compete with the low German prices which are quoted on account of the low exchange value of the mark. A similar factor also applies in the case of those products manufactured in Norway and Sweden, where the currency is depreciated. It may, therefore, be said that until conditions become more normal a large proportion of the trade which is not done by Scandinavian firms themselves will go to Germany. At the present time business in electrical products is not very good on account of the slump in trade, but it is very likely that there will be a large trade done in the future as there are uncompleted power, heating and lighting schemes which will mean a demand for transformers, motors and all kinds of machinery and cables, also lighting, cooking and heating apparatus."

Unsettled Conditions Affected Sale of Toys and Novelties

That merchants have not placed orders for electrical toys and novelties for the first six months of the year to the usual extent, for the obvious reasons of unsettled conditions and the tendency of those firms that have liquid capital to hold on to it, is the outstanding feature of a report just received by the *Electrical World* from a leading manufacturer of novelties. The president of this company says:

"Within the past two weeks conditions have changed materially, and we are receiving more orders than is usual at this time. It is our belief that immediately after Labor Day buyers will display added energy for the purchase of novelties, and that the season will show unusual activity. All materials, practically, are advancing, therefore prices are bound to stiffen."

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Prevailing Conditions Affecting Cost and Volume

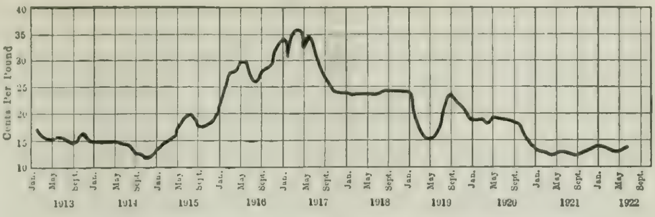
Bank Clearings Increase.—A decided widening of the ratio of increase in the bank clearings over last year's figures has been witnessed this week, an aggregate of $6,056,323,000 at twenty cities in the United States representing a gain of 18.1 per cent over the $5,129,444,800 of a year ago.

Failures Continue Gain.—Increased failures in the South and West this week over-balanced the decreases shown in the East and Pacific sections, so that the total for the United States is somewhat larger than it was last week. Defaults reported to R. G. Dun & Company for this week number 415, as against 402 a week ago and 357 a year ago.

Steel Output Further Reduced.—While the more favorable turn in the labor situation has improved the industrial outlook, iron and steel works are till seriously handicapped by the effects of the protracted suspension of coal mining and interruptions to railroad traffic. From practically an 80 per cent rate of operation earlier in the summer, the principal producer is now running at only about 60 per cent of capacity, and some independent companies are not averaging better than 50 per cent.

Business Volume 11 per Cent Larger—Volume of business for the week ended Aug. 16 was $7,969,000,000, marking an increase of $16,000,000, or about 2 per cent, over the total of $7,808,000,000 reported for the preceding week. As compared with the week ended Aug. 17, 1921, the volume of business for the week under review shows an increase of $794,000,000, or 11 per cent.

Export Trade Less Favorable.—A reduction of more than $90,000,000 in the nation's favorable trade balance during July as compared with a year ago will help the international exchange situation, the Commerce Department declared last week in a statement making public the results of the country's foreign trade for the month.



MONTHLY AVERAGE QUOTATIONS OF ELECTROLYTIC COPPER DELIVERED.
COMPILED BY THE "DAILY METAL TRADE."

Poles on Free List.—The Fordney-McCumber tariff bill, passed by the Senate Aug. 19, placed poles on the free list. The rate proposed was 10 per cent.

Coal Production Is Very Low.—Bituminous-coal production last week is estimated at about 4,300,000 tons by the Geological Survey. There were 4,576,000 tons mined in the previous week.

Warn Against Establishment in Germany.—Warning against the establishment of branch factories by American firms is contained in a report to Secretary Hoover by a special committee of business men appointed to handle economic problems relating to western Europe. The report asserted that any temporary advantage to be gained by the location of branches in Germany by American firms would be more than offset when stabilization in that country brings on further violent financial dislocation.

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Metal Market Situation

Copper Remains at 14 Cents—Wire Manufacturers Demand More Than Brass Makers

Another week has passed in copper with no change from the 14 cents price. The copper demand by wire manufacturers has been considerably better than the demand from brass makers.

Sales, foreign and domestic, during the last three months have averaged about 160,000,000 lb. a month. Shipments, foreign and domestic, have for the last three months averaged around 165,000,000 lb., the largest recorded for any three consecutive months in the peace-time history of the copper industry.

Before the war the United States normally exported about 60,000,000 lb. of copper a month. Without any especially important buying from the Orient, exports for the first half of this year have averaged 58,000,000 lb. a month compared with 46,000,000 lb. for last year, making European consumption, despite untoward political and industrial conditions, practically equal to the pre-war figures. Domestic consumption for the first half of 1922 has been somewhat better than 80,000,000 lb. a month, compared with about 65,000,000 lb. before the war, or about 20 per cent higher.

The main cause of this increase in domestic consumption has been the great expansion of the automobile industry since 1914 and the much increased consumption of copper by the hardware trade. Copper is consumed largely as brass in these industries, and the full effect of the two factors mentioned has not yet been felt in the copper market as only now have excess stocks of scrap brass in this country been used up. Consequently any decrease in fall demand for copper products either from the automobile or the hardware trade should be more than balanced by the smaller amount of scrap brass that will be used.

Europe has practically no available supplies of scrap brass and copper. British supplies have been exhausted by recent German purchases, and Germany with her own scrap used up will have the British scrap consumed by December. The only source of any brass supply in Europe outside Russia, where scrap supplies are not believed to be important, is the brass of the cartridge cases in the excess stocks of munitions that France has on hand. There is every indication that this French cartridge-case brass will come on the market very gradually, at least until France is much more certain of the future tranquillity of Europe than her national leaders are today.

ELECTROLYTIC COPPER PRICES

Average prices in New York

	1922	1921	1920	1919	1918
Jan....	13 60	12 85	19 02	20 00	23.50
Feb....	12 97	12 79	18 61	16 91	23 50
Mar ..	12 84	12 23	18 36	15 01	23 50
April........	12 71	12 54	18 54	15 40	23.50
May........	13 29	12 83	18 28	16 01	23.50
June........	13 71	12 76	17 97	17 65	23 50
July ..	13.90	12 35	18 61	21 71	25.89
Aug	. .	11 76	18 44	22 22	26 00
Sept...		12 10	18 04	21 95	26 00
Oct..... ...	. .	12.75	16 30	21 50	26 00
Nov..	...	13.16	14 39	19 96	26 00
Dec.........		13 67	13 48	18 48	25 29
Average..		12 65	17 50	18 90	24 68

NEW YORK METAL MARKET PRICES

	Aug. 9, 1922 Cents per Pound	Aug. 23, 1922 Cents per Pound
Copper		
Prime Lake .	14 00 14 25	14 00
Electrolytic	14 00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price..............	5.75	5.75
Antimony	5 25	5 25
Nickel, ingot.........	36.00	36.00
Zinc, spot...........	6.50	6.50
Tin, Straits...........	32.20	32.20
Aluminum, 98 to 99 per cent..........	19.10	19.10

OLD METALS

Heavy copper and wire .. .	11 00–11 25	11.00–11 25
Brass, heavy........	5 75– 6 25	5 75– 6 25
Brass, light.... .	5 25 5 50	5 25– 5 50
Lead, heavy .	4 62½ 4 75	4 62½–4 75
Zinc, old scrap	3 00 3 37½	3 00– 3.37½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE electric market is held at a standstill by the deadening influences excited by the coal and rail strikes. In some quarters it is believed that if a quick settlement comes business in materials will go ahead and become progressively active in a very short period. Conduit stocks are reported lower each day, shipments of pipe from the Pennsylvania district being held up. Poles are not moving so quickly and some price stiffening is noted. A good market for fixtures in schoolhouses is reported and manufacturers are busy supplying the demand. Lamps are selling well, especially in the ordinary sizes.

◆

New York

Market Without Feature—Conduit Stocks Reported Low—Lamp Supply Ample for Present

Last week's electrical market was without feature. No price changes are reported, although there is a gradual stiffening in quotations for flexible armored conductor and pole equipment. Conduit stocks continue to decrease. Lighting fixtures are selling well and lamps are in greater demand.

Conduit.—Construction is still causing the heavy demand for the smaller sizes. Stocks in some quarters are reported as very low.

Lamps.—Demand is mostly for the ordinary types. Stocks are reported ample for present needs.

Flexible Armored Conductor.—This material is still very active for rewiring and smaller construction jobs.

Motors.—Increased demand in the smaller sizes is reported. Great activity is expected in the coming fall months.

◆

Chicago

Armored Conductor Holding Its Own—Wiring Materials Flow Steadily—Pole Movement Satisfactory

Market for electrical equipment for the past week has been steady. Wiring materials have been selling at the same steady rate as in the previous weeks and prices are still firm. High-tension manufacturers report a brisk business. The pole market, while quiet during August, has been up to jobbers' expectations. The call for fans was hastened by a week of warm weather.

Conduit.—Prices are still firm, but the supply of the smaller sizes is still scarce. In 5,000-ft. lots the ½-in. black pipe sells for $47 and $47.50 per 1,000 ft.

Flexible Armored Conductor.—Steadily holding its own and dealers' stocks are normal. The No. 14 two-wire, single-strip is available in 5,000-ft. lots for $44 and $45 per 1,000 ft.

Wire.—An active building program is calling for a goodly volume. The No. 14, rubber-covered, is quoted at $6.35 per 1,000 ft. in 5,000-ft. lots, and prices are firm. Jobbers' stocks are in good shape.

High-Tension Equipment. — A sale was announced during the week by one manufacturer for fifty lightning arresters rated at 37,000 volts for a utility in southern California.

Poles.—Although August is a quiet month for this equipment, the movement of poles has been satisfactory. Extensions and rehabilitations are calling for most of this material. The 7-in. top, 30-ft. Western red cedar sells for $8.70 f.o.b. Chicago, and the same size in Northern white for $9.20 f.o.b. Chicago.

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Boston

Fixtures for Schoolhouses Active—Gaps in Conduit Stocks—Cross-Arms Slow

Trade was extremely spotty as the week began. Deliveries are more uncertain, shortages in rigid conduit and hard-pine cross-arms being reported. Railroad labor conditions are greatly improved in this territory and textile mills are resuming work in strike-ridden localities. Building contracts for the week ended Aug. 15 totaled $7,067,600 for New England, by far the best in two decades. Last year's record for the same week was $3,912,818.

Fixtures—Sales are active for schoolhouses. Stocks are satisfactory and prices firm. Collections on small accounts are poor in some cases.

Wire.—Weatherproof base rose to 17 cents Monday. Sales are fair. Rubber-covered No. 14 at $6.25 per 1,000 ft. in 5,000-ft. lots is in moderate demand. Bare copper wire at 16 cents base is stirring somewhat owing to transmission demands.

Rigid Conduit.—Gaps in stocks are being filled by local purchases at a premium in order to give service, a leading jobber reports. Prices are firm.

Fans.—Sales are very light in wholesale circles, but a fair season is reported considering the cool weather of the past two months.

Cross-arms. — Shipments on arms from distant sections are slow and unsatisfactory. Reasonable allotments for current demand are being made out of stocks, however, in Boston jobbing circles.

Dry Cells.—Although the vacation trade is practically over, orders are holding up well. Easy deliveries are reported.

Switches.—Industrial betterment work is absorbing good volumes of this product, along with house wiring. Competition is active, and sales are very diversified.

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St. Louis

Loom Demand Spotty—Interest in Industrial Heating Equipment Increasing

Loom.—Demand is somewhat spotty but of fairly good volume owing to extensive residential construction. Stocks are conservative. In 250-ft. coil lots prices per 1,000 ft. are $14.80 for 7/32-in. size and $18.90 for ¼-in. size.

Flexible Armored Conductor.—Stocks, though conservative, are ample for the demand, which was off this week. A representative quotation on No. 14, two-conductor, is $60 per 1,000 ft. in lots less than 250 ft.

Industrial Heating Equipment.—Increased interest is manifested due to greater sales efforts on the part of manufacturers and central stations. A large manufacturer of piston rings has placed an order for an 87-kw. furnace to be used in "normalizing" its rings. Increased usage of electric heating is also found in the japanning of automobiles, one company having recently installed heating units in its steam ovens to increase production.

Soldering Materials.—Steady demand has existed for some time and stocks have been built up to meet it.

Bells and Buzzers.—Rapid completion of residential construction jobs, and particularly of large hotels and apartments, is giving stimulus to demand, while stocks are in good condition. One type of bell is quoted as follows: 2½-in., $41 per 100; 3-in., $44 per 100; 4-in., $50 per 100. Buzzers are selling at $40 per 100 to $46 per 100, depending upon grade.

Bell-Ringing Transformers. — Slight improvement in demand is reported, but the total volume of sales remains small. Stocks are of ample proportions. Representative prices in lots of ten are from 80 cents to 85 cents each, varying with type and size.

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Cleveland

Slight Spurt in Fan Sales—Expect Motors to Be Active in Fall —Radio Dull

Business in electrical goods for the first seven months of the current year is reported to show a healthy increase over the last seven months of 1921. This increase is pretty well distributed over the various lines, with sales of apparatus for the home particularly strong.

The automotive equipment business, consisting of starting and lighting devices for automobiles, has improved considerably in the past six months. Public utility lines are on a firmer basis, and the electric railway industry is gradually working back to normal.

Fans.—A slight spurt in sales marks the end of a conservative fan season. There remained sufficient surplus to attract jobbers who are stocking up for the spring activity.

Motors.—No activity is expected in motor sales until well into the fall months, but the number and nature of inquiries received indicate that brisk trading with firm prices will prevail. Occasional requests are received for specification quotations but orders are far from being in proportion.

Radio Equipment. — Manufacturers, jobbers and dealers are experiencing depression in sales and attribute it to "summer dullness," caused by the lack of interest in such entertainment devices by consumers during the warm weather.

Washing Machines.—Progressive activity in sales is reported with substantial orders from jobbers and dealers. Prices remain the same and no difficulty is experienced in shipping.

Atlanta

Oil Switches Selling Well—Fixtures in Better Demand—Glass Type Insulators Popular

While the railroad strike has not materially interfered with passenger traffic, nevertheless considerable difficulty is being experienced in the receipt of freight shipments, particularly heavy material. Coal is becoming scarce, retailers refusing new orders in a large number of instances. This shortage has caused the shutdown of a large number of plants throughout the section, one of the largest cement mills having shut down last week. The rail tie-up is also being reflected in the difficulty in obtaining conduit, a general shortage existing. Business continues good, even in the face of these discouragements, and will experience almost a real boom if there is an early settlement of the strikes.

Industrial Motors.—There is a fair movement, with demand for the near future very promising. The electrification of industrial plants will take the greater portion of this business. Stocks and shipments are good with prices steady.

Oil Switches.—A fair volume of sales is reported, though it is not in keeping with motor activities.

Schedule Material.—Commercial and home building is holding up sales with prospects of continued sales into the fall.

Lighting Fixtures.—Approaching fall is responsible for a brisk demand, but failure to receive shipments is causing a shortage in residential types. The demand seems to be for the better and higher grade of goods.

Distribution Transformers.—A fair movement is reported, with prospects looking up on the fall trade, owing to municipal-plant and central-station expansion. Local stocks in the popular sizes are fairly good, but there is some delay in getting the larger sizes.

Wire.—A brisk demand is reported in all the popular sizes, with a fairly heavy demand and inquiries for the larger cable for industrial plant use. Stocks have reached a satisfactory point with prices steady.

Insulators.—The glass type continues to lead in popularity. There is also a fair demand for the high-tension types for use on the 11,000-volt and 66,000-volt transmission lines under construction.

San Francisco

Cleaners Attracting Attention—Greater Interest in Ranges Shown—Pole-Line Hardware Active

The railroad strike situation is better. Fruit shipments are again moving with only small loss to growers. Very little non-employment is reported.

Appliances.—Dealers realize need of reorganization and redirection of effort. Comparatively few firms are specializing actively just now, but a large number are quietly gathering data for future efforts.

Vacuum Cleaners.—Attachments are increasingly popular. A big September washer business is predicted.

Radio.—Radical broadcasting revision is expected. Stocks are high and demand is markedly improved. Excellent fall business is expected.

Ranges.—The Pacific Gas & Electric Company is staging a series of sixty combination lectures, entertainments and demonstrations of electric cooking.

Pole-Line Hardware.—One of the largest selling items. Several large, well-assorted stocks are maintained in San Francisco.

Portland—Seattle

Business Conditions Satisfactory—Railroad Situation Not Serious—Porcelain Knobs in Good Demand

Business conditions throughout the Northwest are very satisfactory and a better tone prevails. Trade with Alaska during July was 50 per cent greater than for July last year.

Electrical jobbers and contractor-dealers report business very satisfactory. While the railroad strike has caused serious shortages in stocks in some cities of the Northwest, the situation in general has not been serious.

Collections are still poor. Prices show a strong upward trend. An increase of 12½ per cent in the price of conduit became effective during the past week. Seattle reports a serious shortage of conduit with a heavy demand.

Porcelain Knobs.—Tubes and cleats have been in good demand during the entire season. Knobs have advanced somewhat in price, and a further increase of from 20 to 30 per cent is predicted for the near future.

Salt Lake City—Denver

Transportation Conditions Better—Wire Market Holds Steady—Electric Ranges in Good Season

Transportation conditions are better than a week ago. The copper output is gradually increasing, the manufacture of radio equipment widening the market for this metal.

Wire.—The market holds steady, with a better call for bare than weatherproof. Much line extension and repairs account for the demand.

Electric Ranges.—Jobbers report a good season, with sales meeting expectations. Stocks are good and prices hold an even tone.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Westinghouse Radio Apparatus Production Increasing

Owing to the expected heavy demand for radio sets for the coming Christmas trade, production at the Westinghouse Electric & Manufacturing Company's Springfield (Mass.) plant is steadily increasing. Receiving sets are now being turned out at the rate of 22,000 a month, with every prospect that an output of 35,000 a month will be attained by November. Eleven months ago the production was 400 a month.

Broadcasting now takes place from the Springfield station every night in the week, the Sunday evening program being a church service by a preacher and singers who go to the studio. The use of records for broadcasting has been almost entirely succeeded by personal talent. The company's new radio building is to be reinforced with an 8-in. brick wall on the inside throughout, which, it is said, will meet all building requirements. Additional space, however, will be required for this department in the near future.

Ohio Electric & Controller Makes Sales Appointments

The Ohio Electric & Controller Company Cleveland, announces the appointment of Paul H. Diver as manager of sales. Mr. Diver has been associated with this company four years as sales representative. The company also announces the appointment, effective

Sept. 1, of C. J. Pagel as sales representative. Mr. Pagel has been associated with the Robbins & Myers Company in the Cleveland district.

To Show Fuel-Saving Devices at Chemical Show

The managers of the Chemical Show, to be held in the Grand Central Palace, New York City, between Sept. 11 and 16, announced last week that the coal strike and the fuel shortage had given them the idea of expanding their display on fuel economy devices and that in the exposition would be devices suitable for both home and manufacturing plants.

"More efficient burning of fuel," said the announcement, "whether it be coal, coke, gas or oil and the cheaper generation of steam will be demonstrated in several new types of powerhouse equipment and also in improvements on systems now in use."

Electric Truck Parade to Be Feature of Exposition

Just how large a factor the electric truck has become in the transportation of merchandise about the city will be shown in the electric motor truck parade which is being arranged as one of the features of the annual Electrical and Industrial Exposition to be held at the Grand Central Palace, New York City, Oct. 7 to 14.

As in former years, electric trucks and passenger cars with their accessories will form one of the most important departments of the show. Every manufacturer in the Eastern market will be represented and the exhibits will range from 750-lb. delivery wagons to 5-ton trucks. The parade, however, is something new. There have been motor-truck parades in New York before, but never one made up exclusively of storage-battery vehicles.

The purpose of the parade is not so much to show the different styles of electric vehicles as it is to show what the electric truck is doing toward the solution of traffic problems in the city and the elimination of waste in delivery methods in the various fields of commerce. The local electric vehicle club has sent an invitation to every fleet owner in New York asking him to enter one or more of his cars, and several acceptances have been received. Entries will be grouped by industries, and accordingly there will be considerable competition as to which will make the best showing.

Westfield Company Suffers $100,000 Fire

The Westfield Machine Company, Westfield, Mass., sustained fire damages of about $100,000 on Aug. 15 to plant and stocks, which included a quantity of radio sets in production and ready to be marketed. The flames spread through the two stories of the factory, and considerable damage was done to a machine shop in the basement.

Wire Goods Companies in Million-Dollar Merger

The Wire Goods Company of Worcester, Mass., the Cassady-Fairbank Company of Chicago and the Andrews Wire & Iron Company of Rockford, Ill., and of Waterford, Canada, have been consolidated as a million-dollar corporation, with headquarters in Worcester. Eventually the business probably will be conducted under the name of the Washburn Company, the other corporation names disappearing.

The officers of the new corporation are: President, Charles G. Washburn; vice-presidents, Arthur G. Andrews, Rockford; Perry M. Shepard, Chicago, and William L. Walker; treasurer and general manager, Reginald Washburn; secretary, Irving A. Green; directors, Charles G. Washburn, Reginald Washburn, Arthur G. Andrews, Perry M. Shepard and William L. Walker.

The business of the Wire Goods Company was established in Worcester in 1880, and its growth has been large and steady ever since. In addition to the Cassady-Fairbank and the Andrews Company, the company has absorbed several other firms, including the Ayres Manufacturing Company, the E. Jenckes Manufacturing Company of Pawtucket, R. I., manufacturer of wire hardware, and the Woods-Sherwood Company of Lowell, the oldest concern in the country making kitchenware. The first factory was at what was then 2 Allen Court, now 12 Federal Street.

Lockwood, Greene & Company, Inc., Interests Move

Engineering, management and construction interests identified with Lockwood, Greene & Company, Inc., Boston, have removed their offices to 24 Federal Street in that city. Financial and all other activities of this house are now concentrated at the above address.

Allis-Chalmers Company Directors Meet

The board of directors of the Allis-Chalmers Company, at a monthly meeting held at the West Allis plant, Milwaukee, last week, declared a 1 per cent dividend on the common stock of record July 24, payable Aug. 15. They also elected George M. Moffett of New York, vice-president of the Corn Products Refining Company, a member of the board to fill the vacancy caused by the death of W. T. Abbott.

The directors, after looking over the plant and listening to statements by President Otto H. Falk and other officials, expressed themselves as well satisfied with conditions. It was stated that the June orders exceeded the month preceding by $2,470,000.

The feeling among the members of the board was decidedly optimistic. Each one predicted continued progress in prosperity throughout the country. With the present rail and coal strike settled, it was said, the country would move forward steadily toward a normal condition in business.

"The situation existing today is exactly what was forecast when we were here for the annual summer meeting of the board of directors last year," said Charles Hayden of Hayden, Stone & Company, New York, who is a member of the board.

Anaconda Copper Is Operating in Canada

The Anaconda Copper Mining Company has entered Canada through its subsidiary, the American Brass Company, and is operating Brown's Copper & Brass Rolling Mills Company at New Toronto.

The Anaconda American Brass, Ltd., has been formed, with the entire $1,000,000 capital stock owned by the American Brass Company. Charles F. Brooker is chairman of the board, John A. Coe president, G. H. Allen vice-president, C. F. Hollister treasurer, A. H. Quigley general manager, and M. S. Moss Secretary.

To Exhibit Cleveland Electrical Home in September

Preparations are being completed for the opening of the fourth and most complete Cleveland electrical home in the early part of September, according to an announcement by J. E. North, educational director of the Cleveland Electrical League.

A special committee of representative Cleveland electrical experts, headed by J. L. Wolf, secretary of the Lighting Fixture Dealers' Society, has been working on plans for the structure for more than six months.

The home will have ten rooms in addition to servants' quarters on the third floor, all fully equipped according to the very latest electrical laborsaving standards.

An electrical laundry with a number of new features and an electrical "dream" kitchen are included in the description.

The plans specify model lighting throughout the home with control switches at the bedside, making it possible to extinguish the ceiling lights after retiring.

A master switch in one bedroom will turn on all the principal lights in the home in case of an emergency.

The home will have a total of 186 electrical outlets, including those used for lighting purposes. This is more than four times the number of outlets installed in the average home, but is not too many according to Director North, who said, "Rather than attempt to overdo the matter of outlets we have tried to limit the number to those only absolutely essential.

"It will be the most complete electrical home we have yet been able to display in Cleveland," he added. "I believe it will be one of the best ever displayed in the country. We have spared no effort in getting the very best and the very latest of everything electrical included in the plans."

Wico Electric Company Plans New Home

The Wico Electric Company, Springfield, Mass., opened bids Aug. 24 for a new building in West Springfield, planned to be the first of five one-story units, each 400 ft. x 90 ft. in plan and of brick construction. The company reports a large increase since the beginning of the year in the production of motorcycle batteries and magnetos for small stationary engines. Next January it will have in production a new magneto for engines under 5 hp. Operations in the new building, which is to be ready January 1, will begin with 200 employees. The company expects to employ 400 in the near future. In addition to its old quarters on both sides of Taylor Street the company has rented the top floor of the American Electric Service & Maintenance Company's new building in the same street, to meet its requirements until the new building is ready.

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Eastern Utah Electric Company to Have Larger Quarters

The Eastern Utah Electric Company, Price, Utah, will occupy new and much more commodious quarters in a building which is being erected on Main Street. The building will have two stories and a basement, and the electric company will occupy the basement and entire first floor. A unique lighting system and electric signs will make the building conspicuous.

With this additional room, augmented by a large warehouse on North Ninth Street, the electric company will greatly increase its various lines of electric goods and automobile accessories, and the new store will be divided into departments.

This company was organized three years ago and does a wholesale business over the whole of eastern Utah and western Colorado.

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Federal Electric Announces Sales Personnel Changes

The following changes in the sales personnel of the Federal Electric Company, 8700 State Street, Chicago, have become effective, that company has announced.

John Berkhardt has been appointed manager of the Kansas City office. Mr. Berkhardt was previously with the estimating engineering department of the Commonwealth Edison Company for a period of more than twenty years.

R. D. Williams has been appointed manager of the Louisville (Ky.) office. His previous connection was with the Commonwealth Edison Company as assistant superintendent of construction of conduits for eleven yeears.

W. A. Keating, for fifteen years with the Duquesne Light Company, Pittsburgh, has been appointed manager of the Pittsburgh office.

E. W. Moore, previously Eastern European manager of the Ingersoll-Rand Company, has been appointed district manager of the Cincinnati office.

W. E. Brickman has been appointed traveling auditor for the Federal Electric Company, including its twenty-two branches all over the United States.

J. W. Sieverling, formerly with S. P. Bowser & Company, Inc., Fort Wayne, Ind., and Fulton A. Smith, Cleveland, has joined the Federal Electric Company as advertising manager.

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Warns Against Worthless Radio Securities

The Better Business Bureau has made public a bulletin telling of the operation of companies hawking the securities of radio enterprises characterized by the bureau as "wildcat companies."

The bureau reports it has just made an investigation of a company whose sales organization is said to have already taken in many thousands of dollars. Like similar get-rich-quick concerns, the principals have taken care of themselves by voting heavily padded salaries for services, which consist mainly in selling stock, according to the bulletin.

Most of the sales are made among wage earners, the bulletin states, and the corporations, the investors are informed, are organized for the purpose of selling radio equipment to amateurs. But the only sales that are made, apparently, are of stocks, and if the stock selling ceases, the concern becomes insolvent, according to the bulletin.

The bulletin relates that one of these corporations recently advanced its stock from par ($1) to $1.50, an official of the company declaring that the boost was warranted as the company had been making big profits, 300 per cent being the average profit on the materials turned out. This profit was almost entirely on paper, but in spite of this it was declared that before winter came the stock would be worth $4.

"Not the least deceptive of the buncombe employed in the selling of the stock has been a radio-equipped motor car which has been driven about the streets of New York," the bulletin continues, pointing out that the car, which was used to create interest in radio in general and the company's securities in particular, was actually not equipped with apparatus of the company's own manufacture, as claims made in the literature circulated represented it to be.

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The United Electric Construction Company, contracting electrical engineers, announces that its offices have been moved to 2318 Sansom Street, Philadelphia.

The Zeller Lacquer Manufacturing Company will exhibit at the coming Chemical Exposition in New York City a representative line of lacquers, lacquer enamels and bronzing solutions. Actual examples will show just how these materials are being used today for finishing economically products made from many kinds of materials.

The Hebern Electric Company, Inc., Newark, N. J., is completing plans for the construction of a new three-story reinforced-concrete building on Harrison Street, between Eighth and Ninth Streets, for the manufacture of electrical specialties, estimated to cost approximately $200,000. Bids will be called at an early date.

The Mercury Radio Products Company, 51 Thomas Street, Orange, N. J., has been incorporated with a capital of $100,000, to succeed the company of the same name heretofore operated as a partnership. Arrangements have been made for the removal of the plant to larger quarters at Little Falls, N. J., where production will be concentrated on complete radio sets and equipment. Myron S. Shields is president, Karl M. Jones vice-president, Bayard D. Brown secretary, and Edmund B. Osborne, Jr., treasurer, all of Montclair, N. J. Edgar Sisson, Jr., will act as radio engineer for the company.

The Dynamo & Motor Exchange, 41 Court Street, Buffalo, has leased a two-story building at 45 Elm Street, comprising about 7,000 sq.ft. of floor space, for expansion. A portion of the structure will be equipped as a shop for parts production and repair work, and the remainder of the structure will be used for the present as a warehouse.

The Spencer Electric Company, 320 Twelfth Street, Oakland, Cal., has purchased the stock and fixtures of the California Electrical Construction Company of that city.

The Apex Electrical Manufacturing Company, Cleveland, has acquired an additional factory site containing two acres of space. This will be devoted entirely to the manufacture of small electric motors and to the foundry department, officials of that company have announced. The company now owns two large factory units, and practically all of the material required for its cleaners, washers and ironers is manufactured in its own establishments.

The Electric Storage Battery Company, Philadelphia, has approved a pension plan for employees. A fund of $350,000 has been deposited. A male employee sixty-five years old who has been in the service of the company for thirty years is eligible for a pension. If his average earnings for ten years of highest pay were $2,000 per year, his pension would be thirty times 1½ per cent, or 45 per cent, of the average pay, or $900 a year.

The Potomac Electric Appliance Company, 607 Fourteenth Street, N. W., Washington, D. C., announces that J. S. Colt, formerly vice-president and general manager of the Wilmington Electric Appliance Company, has been appointed its general manager. Mr. Colt succeeds J. C. McLaughlin, recently resigned.

The Trenton Electric Supply Company, 207 East State Street, Trenton, N. J., has purchased property at 233 East State Street, 21 ft. x 150 ft., for future expansion. Charles F. McCoy is president.

Foreign Trade Notes

A NEW HYDRO-ELECTRIC SCHEME PROPOSED FOR VICTORIA, AUSTRALIA.—The Victorian Electricity Commission, the *Electrician* reports, has recommended to the government the adoption of a hydro-electric scheme to utilize the waters of the Sugar Loaf Reservoir and the Royston and Rubicon Rivers to supply electricity to the North-Eastern Couldbourne Valley and Melbourne areas, as an adjunct to the Morwell scheme. The cost is estimated at £5,000,000.

THE RAILWAY COMMISSIONERS MAY SUPPLY ADDITIONAL ELECTRICITY IN SYDNEY.—The General Purpose Committee of Sydney, New South Wales, Australia, the *Electrician* states, has decided to open negotiations for taking a bulk supply of electrical energy from the power plant of the Railway Commissioners under a five-year or ten-year contract. Forbes Mackay, engineer, has informed the Council that electricity can be generated at the plant of the Railway Commissioners at 0.6d. per unit compared with a cost of 0.7d. at the Council's plant. The committee has also agreed that Mr. Mackay shall have sole control of the management of the electricity department including the stores for that department.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN VENEZUELA.—The City Council of Carupao, the *Electrical Review* states, is considering the installation of a hydro-electric plant on the Guarenas River, about 18 miles from Caracas. The plant will have a capacity of about 2,500 hp. The project will include a 20-mile, 35,000-volt transmission line.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An engineer in Victoria, Australia (No. 3,221), wishes to purchase and secure an agency for all novelties, especially electrical articles.

An association in Italy (No. 3,252) desires to purchase and secure an agency for electrical batteries for telephones and other electrical installations, such as switches, alternators and circuit changers.

A commercial agent from the Dominican Republic (No. 3,163) is in the United States and desires to secure an agency for electrical machinery, hardware, etc.

ELECTRIC CRANES AND EXCAVATORS FOR PORT AT CONSTANTZA, RUMANIA.—M. Erbiceanu, Director-General du Port de Constantza, Rumania, the *Electrical Review* reports, is asking for tenders for six 3-ton electrically operated cranes and two excavators (continuous current at 440 volts supplied by the port authority).

TENDERS FOR EQUIPMENT FOR MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by R. Liddelow, secretary State Electricity Commission of Victoria, 22 William Street, Melbourne, Australia, until Nov. 4 for transformers, induction regulators and switchgear, as per specification No. 293. Copies of tender form and specification may be obtained upon application to the offices of the Bureau of Foreign and Domestic Commerce, Department of Commerce, First National Bank Building, Chicago, and 734 Customs House, New York City. Tenders may be inspected at the above offices and also at the office of the Commissioner for Australia in the United States at Room 3,012, 61 Broadway, New York City.

PROPOSED ELECTRIC PLANT FOR MARACAIBO, VENEZUELA, S. A.—Arrangements are being made by local capitalists to organize a company, to be known as the Planta Electrica del Zulia, according to *Commerce Reports*, to construct and operate an electric plant to supply electrical service in the city of Maracaibo. The company is to be capitalized at 600,000 bolivars ($115,800), for which subscriptions are now being taken. Names of persons interested in this company may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or through any of the district offices of the bureau, by referring to File No. 61,419.

ELECTRIC PLANT TO BE ESTABLISHED AT HANYANG, CHINA.—Steps have been taken, according to *Commerce Reports*, to build an electric light plant at Hanyang, Province of Hupeh, for which $150,000 is being raised.

EXTENSION OF DATE FOR RECEIVING TENDERS.—The time for receiving tenders for feed-water evaporators (Specification 227) for the Morwell power scheme by the State Electricity Commission of Victoria, Melbourne, Australia, the *Electrical Review* states, has been extended from Sept. 1 to Oct. 2.

New Apparatus and Publications

WELDING EQUIPMENT.—An engine-driven welding equipment for use where electric power for motor drive is not available has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

ELECTRIC SPACE HEATER.—An electric space heater that has many possible applications in industry, business and the home is manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

LIGHTING FIXTURES.—"Brascolite, the Ideal Light for Every Purpose" is the title of Catalog No. 9 issued by the Brascolite Company division of the St. Louis Brass Manufacturing Company, St. Louis, covering all of its various types of illuminating fixtures.

BUSHING.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is manufacturing a condenser type of bushing, designed for high-voltage service.

TRANSFORMER.—An oil immersed, self-cooling transformer which requires no auxiliary equipment is manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

VENTILATING FANS.—The Autovent Fan & Blower Company, 730 West Monroe Street, Chicago, is distributing bulletin 56, covering its new "Autovent" window ventilator.

HYDRAULIC PLATE PRESSES.—The Hydraulic Press Manufacturing Company, Mount Gilead, Ohio, is distributing two bulletins, one describing and illustrating its "H-P-M" hydraulic hot and cold plate presses for molding bakelite, condensite and other compositions, the other describing its operating system for the "H-P-M" hydraulic plastic molding presses.

NEW FINISH FOR FLUSH PLATES.—The Cutler-Hammer Manufacturing Company, Milwaukee, has developed a new finish for flush plates, known as "Brush Lac."

GOVERNOR FOR IMPULSE TURBINES.—The English Electric Company, Ltd., Queen's House, Kingsway, London, W. C. 2, has issued publication No. 365 describing and illustrating the "Seewer" governing device for impulse turbine.

GAGES.—The Foxboro Company, Inc., Foxboro, Mass., is distributing a leaflet covering the "Foxboro" triplex and duplex draft gages.

ROLLING CONTACTS FOR CONTROLLERS.—The advantages of rolling contacts for control apparatus are described in leaflet No. 3,428 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

New Incorporations

THE HARLO MANUFACTURING COMPANY, INC., New York County, has been incorporated by M. Harris, 451 Greenwich Street, New York City. The company is capitalized at $250,000 and proposes to manufacture electric appliances and specialties.

THE STODDER WAVE POWER CORPORATION, New Rochelle, N. Y., has been incorporated with a capital stock of $25,000 by E. D. Stodder, D. J. MacLean and G. L. Gleason. Tierney, Schrenkeisen & Kettner, New Rochelle, are attorneys.

THE METROPOLITAN ELECTRIC SIGN COMPANY, 4,250 Northwestern Avenue, Chicago, has been incorporated by Maurice M. Talmadge, Samuel O. Simons, William Kramer, Walter Elsner and Ray C. Pratt. The company is capitalized at $40,000 and proposes to manufacture and deal in electrical signs.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MEDWAY, ME.—The Public Utilities Commission has granted the Penobscot Power Company permission to issue $300,000 in capital stock and $600,000 in bonds, the proceeds to be used for the purchase of water privileges at Rockabem's Rips on the Penobscot River in the town of Medway, and to build a hydro-electric plant at that point and a transmission line to Howland and Enfield.

SUNAPEE, N. H.—Preparations are being made by the Sunapee Electric & Power Company for the erection of a new power house.

SWANTON, VT.—Arrangements have been made for the installation of a new 1,250-kva. Westinghouse generating unit directly connected to an S. Morgan Smith turbine to be installed in the municipal generating station on the Missisquoi River, at Highgate Falls. The cost is estimated at about $30,000. J. R. Tozer is superintendent.

NORTHAMPTON, MASS.—Bids will be received at the office of the quartermaster general, Room 2306 Munitions Building, Washington, D. C., until Sept. 12 for construction of a group of twenty-four hospital buildings at Northampton, including sewer, water and lighting systems.

PROVIDENCE, R. I.—Work will begin at once on the construction of a one-story power house at the Butler Hospital.

ANSONIA, CONN.—The S. O. & C. Company will begin the erection of a one-story power house, 30 ft. x 50 ft., at its local brass works.

WALLINGFORD, CONN.—The Borough Council has contracted with the Connecticut Light & Power Company for the purchase of electricity, to be distributed by the municipal system. Work will soon begin on the erection of a transmission line from Cheshire to Wallingford to supply the service.

WILLIMANTIC, CONN.—The Quidnick-Windham Manufacturing Company will make improvements to its hydro-electric power plant, increasing the capacity to 300 hp. New equipment, including a water-wheel, will be installed.

North Atlantic States

ANGELICA, N. Y.—Bonds to the amount of $20,000 have been voted for the installation of a municipal electric light plant. The village will build and operate the distributing system and purchase energy from the Genesee Valley Electric Company, connection to be made at Transit Bridge, 3 miles from here.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has purchased the Rockbottom Dam, which it proposes to enlarge for the purpose of furnishing power to industrial plants in Binghamton.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 29, for 87,000 ft. of lamp cord for use at the Brooklyn Navy Yard. (Schedule No. 110.)

COHOES, N. Y.—Bids will be received by Charles L. Cadle, Superintendent of Public Works, Capitol, Albany, until Sept. 6 for construction of the Crescent power house and work incidental thereto at Cohoes (A-3).

DANNEMORA, N. Y.—Work will soon begin on the construction of a new power house at the Clinton prison in Dannemora. Charles F. Rattigan, Superintendent of State Prisons, Albany, is in charge.

FREEPORT, N. Y.—The installation of an ornamental lighting system, to cost about $26,360, is under consideration.

LYNBROOK, N. Y.—The Queensboro Gas & Electric Company, Far Rockaway, will begin work at once construction of a two-story sub-station, 33 ft. x 37 ft., in Lynbrook.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, until Aug. 30 for installing electric wiring and fittings in the new Public School 80 on East Eightieth Street near First Avenue, borough of Manhattan. Bids will also be received until Aug. 28 for alteration and additions to the electric lighting equipment in Public Schools 7, 21, 29, 65, 110, 188 and West Side Continuation School, borough of Manhattan.

OSWEGO, N. Y.—The question of establishing a municipal electric light plant is under consideration by the Water Service Commission.

POUGHKEEPSIE, N. Y.—A petition will be presented to the Board of Aldermen by the residents of the Seventh Ward asking for an extension of the ornamental lighting system from Cherry Street to the city line.

CHATHAM, N. J.—The Commonwealth Electric Company, Summit, is negotiating with the Borough Councils of Chatham and Madison to furnish light and power service. It is proposed to close down the local municipal generating plant.

MADISON, N. J.—Bids will be received by Tribus & Massa, 15 Park Row, New York City, until Aug. 30, for artesian-well connections, pumping plant and electric equipment for the estate of H. McK. Twombly near Madison.

NEWARK, N. J.—The Public Service Electric Company has authorized plans prepared for the proposed addition to its Essex power station, Point-No-Point, to cost about $4,000,000.

BATH, PA.—Bonds to the amount of $5,600 have been authorized for the installation of a street-lighting system. The borough already has a residential lighting service.

EAST GREENVILLE, PA.—The Boyertown Burial Casket Works contemplates installing an electric plant.

HANOVER, PA.—Preparations are being made to erect an addition to the power station of the Hanover Light, Heat & Power Company in the West End. A new switch and coal elevator and two new boilers will be installed. Surveys are being made for a new transmission line from New Oxford to Gettysburg.

KINGSTON, PA.—The Luzerne County Gas & Electric Company will extend its transmission system to West Wyoming, Mocanaqua, Shickshinny and vicinity, to cost about $200,000.

MOUNT HOLLY SPRINGS, PA. — The Cumberland Valley Light & Power Company has applied to the Public Service Commission to acquire and merge thirteen electric companies, operating in York and Adams Counties. Extensions and improvements will be made.

NORRISTOWN, PA.—The Town Council has decided to accept the proposal of the Counties Gas & Electric Company to supply electricity to operate the municipal electric light plant. The municipal generating plant will be closed down in November.

OIL CITY, PA.—The installation of an ornamental lighting system in the business section is under consideration, and plans have been submitted by V. A. Redfield, superintendent of the Citizens' Light & Power Company.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company has issued $2,150,000 in bonds, part of the proceeds to be used for extensions and improvements in electric stations and system.

POTTSVILLE, PA. — The East Penn Electric Company has secured permission from the Public Service Commission to merge fourteen electric companies operating in Schuylkill County. Extensions and improvements will be made.

READING, PA.—The West Reading power plant of the Metropolitan Edison Company was recently damaged by an explosion, causing a loss of about $10,000.

FAIRMONT, W. Va.—The Fairmont-Chicago Coal Company, recently incorporated, plans to install electrical equipment at its local mine.

WASHINGTON, D. C.—Bids will be received by the office of the public printer, Government Printing Office, until Aug. 31 for two motor-driven air compressors and one general service pump.

WASHINGTON, D. C.—Extensions and improvements to the Armstrong Manual Training School are under consideration by the District Commissioners, for which $500,000 has been appropriated. Further information may be obtained by addressing chief clerk, care Engineering Department, 427 District Building.

WASHINGTON, D. C.—Bids will be received by A. L. Flint, general purchasing officer, Panama Canal, until Aug. 31, for five variable condensers, 10 lb. resistance wire, 147 lb magnet wire, 2,500 ft. lamp cord, twenty rotary-type switches, sixty rotary snap switches and 100 cut-outs. (Circular 2298.) Also, until Aug. 29, one power-factor meter, two tachometers, four arc controls, six storage batteries and 300 cartridge fuses. (Circular 2297.)

North Central States

ANN ARBOR, MICH.—The Detroit Edison Company has awarded a general contract to the Wolverine Engineering & Construction Company, Penobscot Building, Detroit, for the construction of an addition to its power plant on the Huron River, to cost about $50,000.

DETROIT, MICH.—The Board of Fire Commissioners are considering the installation of 5,000 ft. two-duct, 8,500 ft. three-duct and 12,000 ft. four-duct conduit and seventy manholes. L. Gascoigne is superintendent.

LANSING, MICH.—A special election will be called to vote on the proposal to issue $135,000 in bonds for extensions and improvements to the municipal electric system and waterworks.

ADA, OHIO—Work will soon commence on the construction of a one-story power plant for Ohio Northern University, to cost about $90,000.

COLUMBUS, OHIO—The H. C. Godman Company, 35 North Fourth Street, will begin work at once for the construction of a power plant at its factory, to cost about $50,000.

OAK HARBOR, OHIO.—The Northwestern Ohio Railway & Power Company will erect a transmission line from Clay Center to Milbury, a distance of about 4½ miles, and will install a distributing system at the latter place. A 2,200-volt transmission line also will be built from Curtice to Williston.

HOPE, IND.—The Chamber of Commerce is negotiating with the Interstate Public Service Company, Indianapolis, for the installation of a street-lighting system with ornamental lamps in the business section. The company will extend its transmission line from Edinburg.

INDIANAPOLIS, IND. — The Indianapolis Street Railway Company contemplates extensions to its power house and electrical system. New substations will be erected.

PERU, IND.—The municipal Electric Light Department has petitioned the Public Service Commission for authority to furnish electricity from the municipal electric light plant to consumers outside of the city limits.

EDWARDSVILLE, ILL.—The installation of an ornamental lighting system in the business district is under consideration. Street-lighting service is supplied by the Madison County Light & Power Company.

HILLSBORO, ILL.—The Illinois Commerce Commission has granted the Southern Illinois Light & Power Company permission to acquire the Tilden (Ill..) light and power plant and to extend its service from Belleville to Coulterville and from Pinckneyville to Winkle. The company was authorized to pay $9,750 for the Tilden property and to erect 33,000-volt transmission lines for the other extensions.

LA SALLE, ILL.—The Illinois Traction Company, Peoria, is preparing plans for an addition to its local substation, to cost about $45,000.

SIBLEY, ILL.—Bids will be received by the village of Sibley until Aug. 8 for a new storage battery and switchboard for the municipal electric plant. S. M. Waldon is village treasurer.

BARABOO, WIS.—Plans are being prepared by C. N. Ward, consulting engineer, for extensions and improvements to the hydro-electric plant of the Baraboo Linen Mills, owned by George S. McArthur & Sons. New equipment, including waterwheels and generators, will be installed.

IRON RIVER, WIS.—The North Wisconsin Hydro Electric Power Company, Port Wing, is reported to be negotiating for the purchase of the plant of the Iron River Light & Power Company.

POUND, WIS.—Plans are being prepared by the Wisconsin Public Service Company, Green Bay, for the erection of a high-tension transmission line from Pound to Menominee, Mich., a distance of 20 miles. Mead & Seastone, State Journal Block, Madison, are engineers.

DULUTH, MINN.—The McDougall Terminal Warehouse Company will build a power plant in connection with its new local freight terminal to cost $1,750,000. An ice-manufacturing and refrigerating plant will also be built. A. Miller McDougall is president.

ST. LOUIS, MO.—The Public Service Commission has given its approval to the reorganization and refinancing plan of the Union Electric Light & Power Company, under which the company will begin immediately on plans for expansion and improvements involving an expenditure of $90,000,000. One of the projects contemplated by the new company is the construction of a steam-driven power plant near the municipal bridge, to cost approximately $25,000,000. The entire output will be taken by the Union Electric Light & Power Company. Louis H. Egan is president of the new company.

SPRINGFIELD, MO.—The power plant and ice factory at the Stockton Roller Mills, recently destroyed by fire, it is understood, will be rebuilt. The loss is estimated at about $50,000.

KENNEBEC, S. D.—The power house of the Kennebec Electric Light Company was recently destroyed by fire. The town at present is without electric service.

ALVO, NEB.—Contract has been let to the M. B. Messler Electric Company, Chillicothe, Mo., for the construction of a transmission line and distributing system.

McCOOK, NEB.—The Chicago, Burlington & Quincy Railroad Company, Chicago, will erect a power plant in McCook to cost about $85,000.

OAKLAND, NEB.—Work will soon commence on extensions to the electric lighting system. The Rohrbaugh Engineering Company, City National Bank Building, Omaha, is engineer.

COLONY, KAN.—The Council has rejected bids and abandoned plans for proposed extensions and improvements to the municipal power plant. A transmission line for central-station service will be constructed instead. Plans are being prepared by Black & Veatch, 701 Mutual Building, Kansas Ci[illegible] Mo., engineers.

Southern States

CLIFFSIDE, N. C.—The Southern Power Company, Charlotte, has started work on the erection of a transmission line from the Shelby substation to Caroleen, Henryetta and Cliffside.

DURHAM, N. C.—The Durham Traction Company contemplates extending its electric service to a new subdivision southwest of the city.

LENOIR, N. C.—A. M. Kistler, Morgantown, who recently purchased the property of the Citizens' Light & Power Company, is interested in a project to erect a transmission line from the transmission system of the Southern Power Company at Hickory to Lenoir, to supply electricity to industrial plants.

MAYSVILLE, S. C.—Bids will be received at the office of the Commissioners of Public Works until Aug. 31 for the erection of a 13,200-volt or 6,600-volt transmission line, a 2,300-volt distribution system and two substations. The Ryan Engineering Company, Columbia, is engineer.

ATLANTA, GA.—The White Provision Company will build an addition to its power house. A five-story ice and cold-storage plant will also be erected.

ATLANTA, GA.—The Collins Development Company, 64 Peachtree Street, contemplates the installation of an electric lighting system in a new housing development, comprising 144 acres of land, near the city limits.

ORLANDO, FLA.—Bids will be received by the Utilities Commission of the city of Orlando until Aug. 30 for construction of power station and equipment. Alvord, Burdick & Howson are consulting engineers.

TAMPA, FLA.—The Tampa Electric Company contemplates extending its transmission lines to other parts of the county to supply electrical service.

TAMPA, FLA.—Arrangements are being made to erect a transmission line from Tampa to Plant City (22 miles) to furnish electricity to the Plant City Public Service Company. The company will also supply electricity in the towns of Sefner, Lake Thonotosassa, Valrico and Dover.

NASHVILLE, TENN.—The Tennessee Electric Power Company has issued $3,000,000 in bonds, part of the proceeds to be used for extensions and improvements. The company is a merger of the Tennessee Power Company, Chattanooga Railway & Light Company and Chattanooga & Tennessee River Power Company.

ROGERS, ARK.—Work has begun on the erection of the high-tension transmission line of the Fayetteville (Ark.) Gas & Electric Company from Springdale to Rogers. When completed the generating plant of the Rogers Light & Water Company will be closed down.

WALNUT RIDGE, ARK.—The Central Power & Light Company will make extensions and improvements to its system, including the installation of new equipment.

BASTROP, LA.—Extensions and improvements are contemplated to the municipal electric lighting system and waterworks, for which $45,000 in bonds have been voted.

SHREVEPORT, LA. — Bonds to the amount of $4,000,000 have been voted for a new courthouse, jail, storm sewers, pavements and firealarm system.

BARNESDALL, OKLA.—The Council has awarded a contract to the Bigheart (Okla.) Light & Power Company for the installation of fifty street lamps.

GLENPOOL, OKLA.—The Central Oklahoma Light & Power Company has applied to the council for a twenty-five-year franchise to supply electricity in Glenpool.

HOUSTON, TEX.—The Council will install a street-lighting system on Fannin Street from Congress Street to McKinney Avenue.

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Pacific and Mountain States

CHEHALIS, WASH.—The Council has rejected bids, recently received, for the installation of a lighting system and will handle the work through the engineering department.

OLYMPIA, WASH.—The Westside Rural Light & Power Company, recently organized, plans to install a power plant and system for service in towns near Olympia. L. E. Duval is head.

ROSEBURG, ORE.—The City Council has authorized the city attorney to take steps toward condemning the city electric lighting system. Connecting the city with the high-tension transmission line of the California-Oregon Power Company is also under consideration.

BURLINGAME, CAL.—The Council contemplates the installation of ornamental lamps on several streets in the city.

FRESNO, CAL.—Plans have been prepared for an irrigation project for the Mendota Irrigation District, to cost about $33,140,000. The project will include a power plant on the Kings River at Piedra, to cost about $1,200,000, a diversion dam at Fresno slough and a system of large pumping plants between Fresno slough and Kerman. I. Teilman, Fresno, is engineer.

INGLEWOOD, CAL. — The Southern California Edison Company, Los Angeles, is preparing plans for the construction of a 7,000-hp. substation in Inglewood, to cost about $60,000.

SATICOY, CAL.—Surveys are being made by the Southern California Edison Company for the erection of a transmission line from Saticoy to Santa Barbara County.

WEED, CAL.—Work has begun on the construction of a new power house for the Weed Lumber Company. Waste and sawdust from the factory will be used for fuel. The company at present purchases power from the California-Oregon Power Company.

GREAT FALLS, MONT.—Tentative plans are under consideration by the Anaconda Copper Mining Company, 25 Broadway, New York City, for building a brass fabricating plant in connection with its local works, to cost about $500,000.

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Canada

ST. JOHN, N. B.—A proposal offering to sell the property and holdings of the New Brunswick Power Company to the city has been submitted to the City Council.

NEW GLASGOW, N. S.—The Pictou Power Company is considering the construction of a power plant on the East River of Sheet Harbor.

LAKEFIELD, ONT.—The Canada Cement Company contemplates the installation of a 2,000 hp. electric power plant.

MONTREAL, QUE.—Plans are under way by the Bell Telephone Company of Canada for extensive improvements, involving an expenditure of about $25,000,000 during the next five years. About $12,000,000 will be expended in Toronto during that period.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 8, 1922)

1,425,079. Electric Perforating Appliance; Ralph R. Cone, Syracuse, N. Y. App. filed March 24, 1919. Punctures paper electrically when writing.

1,425,091. Polyphase Transformer; Samuel Horelick, Pittsburgh, Pa. App. filed May 28, 1921. Core construction with oval windings.

1,425,123. Impulse Transmitter; Ray H. Manson, Rochester, N. Y. App. filed Aug. 26, 1919. For controlling directively operated automatic switches.

1,425,154. Apparatus for Receiving Radio-signals; Roy A. Weagant, New York, N. Y. App. filed Dec. 13, 1917. Open-ended inverted trough-shaped screen protects antenna from disturbances.

1,425,163. Electric Storage Battery; Hans Bardt, Santiago, Chile. App. filed Sept. 17, 1921. Electrolyte of perchlorate solution, negative electrode of ferrosilicon alloy and positive electrode with coating of lead oxide.

1,425,170. Steering-Column Control Unit; Stephen F. Briggs and Edward N. Jacobi, Milwaukee, Wis. App. filed Sept. 30, 1916. All controlling devices usually on dash placed in terminal head on steering column.

1,425,180. Mechanical Movement; Victor R. Despard, Hinsdale, Ill. App. filed Jan. 2, 1917. For lamp-socket switch.

1,425,183. Transmitter; Thomas A. Edison, Llewellyn Park, West Orange, N. J. App. filed Oct. 26, 1918. Microphone transmitter supported by resilient material to eliminated jars, etc.

1,425,184. Production of Thin Metal Sheets or Foils; Thomas A. Edison. Llewellyn Park, West Orange, N. J. App. filed Aug. 26, 1920. Electrolytically deposited on electrode belt from which it is stripped.

1,425,229. Movable Element for Meters; Donald J. Angus, Indianapolis, Ind. App. filed May 20, 1918. Construction and mounting of element and of marking device.

1,425,235. Magnetic Separator; Walter E. F. Bradley, New York, N. Y. App. filed Sept. 21, 1918. For classifying or concentrating magnetic and non-magnetic filings.

1,425,344. Electric Toaster; Edward Schwartz, New York, N. Y. App. filed June 30, 1918. Three elements between which rack holding bread is slipped.

1,425,375. Controlling Device for Electric Mining Locomotives; Sidney W. Farnham, Chicago, Ill. App. filed Jan. 22, 1916. Connects motor either to trolley or gathering reel.

1,425,382. Squeeze Connector; George L. Hatheway, New York, N. Y. App filed Oct. 3, 1921. For making connection to pipes, etc.

1,425,440. Electrode Holder; William C. Beiswinger and Robert F. Morgan, Wilkes-Barre, Pa. App. filed Dec. 27, 1921. Clamp for holding welding electrode has insulated head to protect operator when changing length of rod.

1,425,462. Pilot Signal for Electric Heating Devices; Ray F. Farrell and Claude E. Moon, Oxnard, Cal. App. filed Oct. 16, 1920. Lamp fed from small transformer on electric iron.

1,425,469. Electric Storage Battery; Walter L. Gill, San Bernardino, Cal. App. filed Sept. 30, 1920. Separators in inverted-U shape around edges of electrodes.

(Issued Aug. 15, 1922).

1,425,522. System for Sound Transmission; John H. Hammond, Jr., Gloucester, Mass. App. filed June 7, 1917. Multiple sound transmission system controlled in response to electro-radiant energy.

1,425,523. Transmission System for Radiant Energy; John H. Hammond, Jr. Gloucester, Mass. App. filed June 22, 1917. System for transmission of radiant energy with central control station and one or more auxiliary control stations associated therewith.

1,425,572. Zirconium Alloy and Process of Making Same; Frederick M. Becket, Niagara Falls, N. Y. App. filed Oct. 1, 1920. Consists of iron, silicon and zirconium smelted in electric furnace.

1,425,573. Electric Battery; Raymond C. Benner and Harry F. French, Fremont, Ohio. App. filed Jan. 16, 1919. Dry battery with negative electrode of zinc and lead

1,425,583 Street Indicator for Street-Railway Systems; Alfred M. Gallery, Toronto, Canada. App. filed March 23, 1922 Operated by motor and under control of conductor.

1,425,606. Electric Light Bulb; Cleveland H. Quackenbush and Harvey E. Quackenbush, Cleveland, Ohio. App. filed April 6, 1921. Manufacture of miniature bulbs.

1,425,615. System of Ship Propulsion; Wilfred Sykes, Wilkinsburg, Pa. App. filed May 23, 1919. Generators driven by internal-combustion engines employed for energizing propeller motors.

1,425,632. Commutator Brush; William S. Click, Turtle Creek, Pa. App. filed Oct. 29, 1920. Pigtail screwed into brush.

1,425,633. Soldering Pot and Soldering Iron; Ora A. Colby, Irwin, Pa. App. filed Dec. 10, 1919. Electrically heated pot with clamp for holding iron in solder.

1,425,638. Screw-Socket Connection for Radiators; Frank F. Forshee, Flint, Mich. App. filed Nov. 20, 1919. Parabolic electric heater.

1,425,639. Centrifugally Actuated Short-Circuting Device; George H. Garcelon, Swissvale, and Joseph L. Chantemerle, Turtle Creek, Pa. App. filed May 3, 1916. For bringing single-phase commutator induction motors up to speed.

1,425,640. Motor-Control System; Adolph A. Gazda, Wilkinsburg, Pa. App. filed Jan. 29, 1917. Automatic accelerating of polyphase induction motors with resistors in wound-rotor circuits.

1,425,646. Control System; Albert L. Harvey, Wilkinsburg, Pa. App. filed May 12, 1919. System for controlling field excitation of shunt and compound-wound direct-current motors.

1,425,647. Control System; Albert L. Harvey, Wilkinsburg, Pa. App. filed May 15, 1919. System for controlling direct-current motors provided with dynamic braking.

1,425,648. Motor-Control System; Albert L. Harvey, Wilkinsburg, Pa. App. filed Nov. 3, 1919. Employed with auxiliary motors on machine tools.

1,425,652. System of Speed Control for Induction Machines; Rudolf E. Hellmund, Swissvale, Pa. App. filed Aug. 10, 1918. Permits operation at several speeds with high efficiency.

1,425,657. Motor-Control System; Henry D. James, Edgewood Park, Pa. App. filed Nov. 5, 1920. For motors employed to operate skip hoists.

1,425,662. Motor-Control System; Harold L. Keith, Wilkinsburg, Pa. App. filed Nov. 24, 1919. Employed in connection with the auxiliary motors on machine tools.

1,425,665. Maximum-Demand Meter; Paul M. Lincoln, Pittsburgh, Pa. App. filed July 10, 1918. Thermal type provided with compensating means for radiated heat.

1,425,685. Inclosed Toaster; Wilbur Pascoe, Detroit, Mich. App. filed Sept. 11, 1920. Metal casing with windows of mica.

1,425,689. Charging Rack; Raymond E. Powell, Chicago, Ill. App. filed Oct. 1, 1920. Apparatus for charging small batteries from commercial direct-current circuits.

1,425,694. Electrical Attachment Plug; Adolph C. Recker, Oakville, Conn. App. filed Aug. 26, 1919. For heating or lighting appliances.

1,425,721. Battery Container; Roy W. Taylor, Chicago, Ill. App. filed Oct. 25, 1920. Relates to combinations, construction and arrangements of containers.

1,425,728. Telephone-Exchange System; Harry G. Webster, Chicago, Ill. App. filed March 9, 1908. Selective switches employed in building up connections from calling subscribers' lines to the called subscribers' lines.

1,425,743. Apparatus for Producing Therapeutical Effects; Sydney N. Baruch, San Francisco, Cal. App. filed May 14, 1919. Produces dielectric or electrostatic hysteresis within body.

1,425,752. Electrolytic Cell; Alfred V. Davis, Elkton, Md. App. filed June 7, 1921. Cell in which electrolyte is maintained at practically a point of saturation.

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Local Work Comes First

WHEN all is said and done, it is the local work that will make the present movement for business development in the electrical industry a half success or a real one. What men do for themselves in their own towns will measure the achievement.

Associations may convene, societies may operate, committees may discuss, national headquarters staffs may labor, all in close co-operation. But watch the cities.

WE HAVE at the head of things two organizations. Both have the same purpose—to promote electrical business—but they are quite different in power and responsibilities. Each has an element of strength and one of weakness.

The Joint Committee for Business Development has no staff or equipment, but it has the direct support and authority of the organized industry. It represents officially the associations of all classes of electrical men. The Society for Electrical Development represents only individual members and has no official "tie-in" with the organized industry, but it has an office, an equipment, a personnel and an experience in publicity and sales promotion service to the industry. The society cannot hand over its possessions to the joint committee; the joint committee cannot delegate its authority to the society. But being supplemental to this extent they can combine in the work to great mutual advantage.

There are two kinds of work to be done: field work and headquarters administration. Of the two the field work is of course the more vital. For the message must be carried to every city that more local leagues may be formed and community effort inspired. By such leadership for a comparatively small expenditure, and appropriations that would not be burdensome on any group or any interest, it should be possible to carry on the program and stimulate the productive spending of infinitely larger sums applied in local activities. And there is where the money should be raised and used.

The opportunity stands out clear-cut therefore. The way to do this job is known, the machinery for doing it is ready and operating. We should soon see progress.

THE idea of a nation-wide movement to promote all electrical business has taken hold. The jobbers and the contractors are co-operating in a survey of all cities to see who are the best men to lead in each community. Ten more towns are already organizing. A national conference of league representatives is to be held next week. Many manufacturers and utility groups are co-operating.

But inevitably it will be the local planning, local selling and local financing that count. And it cannot be urged too strongly upon the central-station executive in each city to take the leadership in this local work and act at once. Moreover, the prompt service of these local workers should take precedence over all other interests at headquarters.

Herbert A. Barre

An engineer who has been intimately connected with Western hydro-electric developments.

CALIFORNIA and hydro-electric development are almost synonymous to the electrical engineer and others engaged in the light and power industry. A combination of elements has conspired to cause California to lead the rest of the world in hydraulic development. Immense resources in water power, a seaboard industrial district miles from the power sites, a climate that is famous and an enormous industrial activity stimulated by the environment and strategic trade situation—all these elements rendered it necessary that the exploitation of water power and the erection of transmission lines should be on a mammoth scale.

One of those who typify the engineers who have made possible the engineering achievements of California is Herbert A. Barre, executive engineer of the Southern California Edison Company. He is an example of those "sons of the Golden West" who have created an industrial empire and made the deserts blossom—one of those engineers who had the courage and vision to bring about the large interconnected power and transmission systems which render California immune from the effects of coal strikes and assure to the state an abundance of reliable power to develop her resources.

Mr. Barre was born in Nova Scotia, Canada, in 1875, but moved to California while still a youth. He attended the public schools of the state and was graduated from the University of California in 1897 with the degree of E.E. After his graduation Mr. Barre was engaged in railway and power-house construction work near San Francisco, and in 1902 he was associated with the Huntington properties in Los Angeles, where he was intimately connected with the development of the Los Angeles Railway, the Pacific Electric Railway and the San Joaquin Light & Power Company.

In 1906 Mr. Barre became an engineer for the Electric Bond & Share Company of New York and was engaged in valuation, appraisal and general engineering. In 1911 he became an electrical and mechanical engineer with the Pacific Light & Power Company of Los Angeles, retaining the same title when the Southern California Edison Company was formed in 1917, but recently exchanging it for that he now bears. In the service of these companies he has been connected with the Big Creek development and with the 150,000-volt transmission system.

Mr. Barre is well known and active in all engineering affairs. He is an active worker in the American Institute of Electrical Engineers and the National Electric Light Association and has served as an officer in these organizations. The electrical industry in the West has no more ardent and worthy supporter than H. A. Barre.

Editorial Comment

Electrical World, September 2, 1922

Volume 80 Number 10

Getting Together on Transmission

MOST of us are left behind when one of the few theoretical transmission-line experts appears before a convention to give a paper on late developments. Not a few transmission-line operating engineers, in fact, admit more or less ignorance of precise calculations of transient phenomena which involve hyperbolic functions and differential equations. It is not disputed that it is valuable to know these things in order to design, install and operate a modern high-tension system, but the claim is made that lack of time has prevented engineers in the field from keeping up with the subject. Consequently they feel entirely out of place in theoretical discussions.

The art of transmission has advanced by leaps and bounds, and means should be found to advance the educational status of all engineers on this subject. At conventions it is well to encourage the few experts to discuss the problems in their own language, but steps might also be taken to have the material presented to the rank and file in terms readily understood. We venture to assert that a graduate electrical engineer can grasp the essentials of hyperbolic functions and the differential equations required for transmission-line solutions in a very few lectures and would accept with pleasure any opportunity for hearing the subject developed by the experts.

"What's the Constitution Among Friends?"

ADMIRABLE in its simplicity and directness is the plan of the city government of Lima, Ohio, to insure good service at reasonable rates from the Ohio Power Company. To this end the municipal authorities insist on inserting in their proposed contract with the company the clause printed elsewhere in this issue of the *Electrical World* which bars the State Public Utilities Commission from participation in any controversy that may arise during the life of the franchise. With the unreasonableness and lack of public spirit characteristic of utilities, the company objects to thus obliterating the commission from the landscape; but the municipal finger has written down the happy thought of the municipal brain and has refused to cancel half a line of it.

The only trouble with the plan is that it does not go far enough. With the police power of the state thus waved aside, there remain the courts—reactionary bodies prone to obstruct and interfere. Why not perfect the agreement by adding another clause, in words to this effect: "And it is further agreed that no appeal to the courts, state or federal, shall be made, and that the state and federal constitutions, and in particular the Fourteenth Amendment to the latter instrument, are in all matters covered by this franchise null and void"?

In this way the tail will wag the dog; the municipal government of Lima—whose political guide is evidently that famous Bowery statesman who demanded to know why the Constitution should stand between friends—will free itself from the jurisdiction both of Columbus, Ohio, and Washington, D. C., and public service companies all over the country will receive an admonitory hint. Seriously, Lima's City Commission will have to think again.

The Accomplishments of Gisbert Kapp

WITHIN the short period of a month the electrical industry—indeed, the whole world—has lost two great pioneers in two widely different yet closely related fields. As we still mourn the loss of Alexander Graham Bell there comes the news of the death of Gisbert Kapp. It is, indeed, the melancholy task of the chronicler of events to add almost day by day new names to the list of those who have answered for the last time the roll call of "the thought-worn chieftains of the mind, head servants of the human kind."

A generation which takes for granted all that creative genius has wrought within the last half century passes by without much notice or thought the disappearance of the creative minds of Bell and Kapp. As Bell was associated with the invention, evolution and creation of the machinery for the transmission of speech, so Kapp was associated with the creation and evolution of the machinery for the transmission of energy.

Our knowledge of the principles and the theory of electrical machines may well be dated from 1885, when, almost simultaneously, Dr. John Hopkinson and Gisbert Kapp developed the theory of the magnetic circuit, which is the fundamental principle on which dynamo design is based. Here, as in the case of Bell, we find the curious phenomenon of codiscovery, and as Bell had his Elisha Gray so Hopkinson had his Kapp. Hopkinson's masterly exposition was surely well supplemented by Kapp's remarkable capacity for lucid explanation and clarity of thought. The great influence exerted by Kapp in the design of direct-current dynamos and his mastery of alternating-current theory made him one of the central figures in the days during which the fabulous growth of electrical engineering occurred. Grasping the great importance of a clear physical understanding of alternating-current theory, he developed the "Kapp" vector diagrams, by means of which he explained some of the most complex phenomena, such as those observed by his friend Ferranti in the latter's 10,000-volt transmission from Deptford to London.

The clear demonstration between Lauffen and Frankfort-on-Main of the transmission of electrical energy at 30,000 volts gave an impetus to Tesla's invention of polyphase electric currents, the importance of which no one more clearly seized upon than Gisbert Kapp. His treatise on the "Electric Transmission of Energy" marks an epoch in electrical engineering. It was not his only noteworthy treatise, as works on dynamo design as well as numerous scientific papers and inventions help to form his contribution to the art of engineering, to which he was devoted. A notable figure, a character pure and generous, he holds up to this generation of engineers the highest ideals and standards. With him has passed away one of the great men of our profession.

Designing Meters to Conform to Rate Systems

IT HAS often been said that the rapid development of the electrical industry has been due to the early and continued possession of accurate measuring instruments. The voltmeter, ammeter and watt-hour meter are the most accurate devices used to measure energy in any of its manifestations.

But now meters are desired to measure energy in a way to conform to logical rate systems. The measurement of demand, power factor and reactive kilovolt-amperes and the separation of primary and secondary power inherently tend to force meter designers to produce inaccurate instruments. The question of cost also enters into the situation, and an economic problem is involved in serving all customers with such complicated meters. Another difficulty is the maintenance and repair of the meters, which require the services of expert engineers. Any one familiar with the long, slow educational process required to produce a good meterman realizes the impossibility of educating the public to a degree where it would understand the technical reasons back of the complicated measurements.

However logical may be the tendency toward complicated rate systems, there are problems connected with their application whose solution will call for strenuous efforts by metermen and publicity men alike. The whole question is vitally important and worthy of thorough study and investigation.

Potential Gradient of Suspension Insulators

THE unequal distribution of the total potential to ground over the several units of a string of suspension insulators was recognized very soon after their introduction. So also was the influence of the capacities to ground of the metal parts as the disturbing cause. Therefore engineers have known for a number of years that by means of relatively simple modifications of design of the units and their attendant hardware a practically uniform potential gradient over the string could be obtained. It is merely a question of the proper proportioning of the successive capacities between units and to ground. However, these expedients have hardly been applied in practice at all. Operating companies have feared the complication and expense attendant upon the use of several different types of unit. Consequently effort has centered on the construction of a single unit which would withstand the maximum stress of the line end of the string, although this may often be twice as great as that on other units in the same uniform string. It has simply been a case of the end not being worth the means.

However, with the recent tendency to voltages up to 220 kv. it has been realized that advantage must be taken of some, if not all, of the several obvious means that have been suggested for equalizing the duties of the successive units in a string. The confidence expressed in the practicability of 220-kv. insulation is founded on the realization that with uniform potential gradient safe insulation is only a question of the number of units. The methods so far adopted in the experiments of Ryan, Peek and others have centered more particularly on the hardware and have shown the immediate value of a ring or other extended conductor at the line end in increasing the capacity of the adjacent units and so reducing the stress over them.

However, the shape of the porcelain itself, as well as that of its metal parts, can be utilized to the same ends. New data on this phase of the subject are presented in an article by D. F. Miner in this issue. Results are given of tests of potential gradient for strings of mixed types of unit, including one especially designed for high capacity. Particularly interesting are the photographic studies of the distribution of stress in the electric field surrounding an insulator unit. With continued experimentation of this character one of two things should be expected. The results may lead to the use of composite insulator strings for the highest voltages, consisting of some form of extended conductor at the line end and two or more different forms of porcelain units, possibly with graded spacing, in the string, or they may show that the operating benefits are not worth the cost.

Changes in Street-Lighting Feeder Practice Necessary

WITH the present great demand for more illumination on streets and highways, it might be well to consider existing methods of feeding street lamps and determine the general tendencies. We find that of late most operators on looking into their operating costs have found conditions which were non-existent when street-lighting and highway-lighting business was of small importance. The present rapid rise of the actual kilovolt-ampere load of that business points to the necessity of finding new methods of handling it in order to keep the cost down or reduce it as should be done to stimulate the demand still further.

The principal source of large expense in handling street-lighting load possessing a small kilovolt-ampere capacity per square foot is the fact that substation space must be provided for the installation of arc machines, rectifier outfits or tub transformers. From the substation, in general, the circuits run through single-duct lines, the cable usually carrying a very small amount of energy, at the most between 60 kva. and 80 kva. If many street-lighting cables have to be brought out from one substation, the available duct space will soon be used up and it will be impossible to bring out other cables that handle more load.

These two conditions mean a very high fixed charge per unit of energy for street lighting both in the substation space and in the duct line. It is therefore at these two places that the remedy must be applied. When the energy feeding the street lamps goes out on the underground or on the overhead power lines and these lines are used as connections between various lamps, the original investment per kilovolt-ampere is very much decreased. It is not negligible, but deserves less immediate attention than do the two other conditions.

The first step, which has already been taken by a number of companies, to reduce the amount of space occupied in the substation and the duct line is to use one controlling distribution circuit to feed a number of outdoor series transformers installed in manholes or on poles. This step in itself has reduced investment to a large extent. Further steps seem to be promised in the use of "wired wireless" in the operation of switches on outdoor transformers that will close and open switches on the street-lighting transformers fed directly from the distribution circuits.

It is possible to imagine still greater economies resulting from individual control of each lamp connected on the secondaries of the distribution system by means of a very inexpensive piece of apparatus. It is evident, however, that this last step must be taken only after a thorough study of the economies involved. There is no question that at present the most economical means of handling street-lighting work is a distribution circuit of relatively high kilovolt-ampere capacity controlling and feeding a number of outdoor transformers which in turn feed a relatively small series of circuits, of, say, 20-kva. to 30-kva. capacity.

With the present development of the art the greatest drawback to the use of the direct-current arc is the substation space required for its machines or its rectifiers. The trend of development shows that the incandescent lamp will probably, for a time at least, prove to be the most economical method of street lighting.

For the Small-Plant Engineer

TO THE man who is about to install his first underground system or whose experience in such work is limited the article in this issue by William S. Jones on "Underground Construction Suggestions" should furnish data which will be of great value. Many engineers and operators in small and medium-sized cities are facing the necessity now of installing a certain amount of underground construction, though a few years ago aërial work met all requirements for the distribution of energy. This condition is brought about by increased density of load, by the enlargement of the power stations and by a desire on the part both of the community and the central-station company to remove overhead lines where these detract from efforts for the improvement and beautifying of streets and boulevards. One can find in this article specifications that will cover all the principal materials for duct-line construction and their proper installation. These specifications are given by a man of wide experience in this work and represent a safe guide in general underground construction.

Although a relatively small number of engineers are in constant contact with underground construction, and therefore have adopted their own standards based upon their own experience, the majority now obliged to install such construction will, we think, be greatly assisted in their search for information by studying this article. As Mr. Jones himself admits, his contribution presents no pioneer methods or ideas, but it does broadcast valuable information to many who are in great need of it. The result should be an improvement in the methods in underground installation in many places where this form of distribution has just started. The information should save operators considerable trouble and worry and show them how to install durable and satisfactory duct lines, with a resulting economy of operation.

Extravagant Claims for the Lead-Hydrate Battery

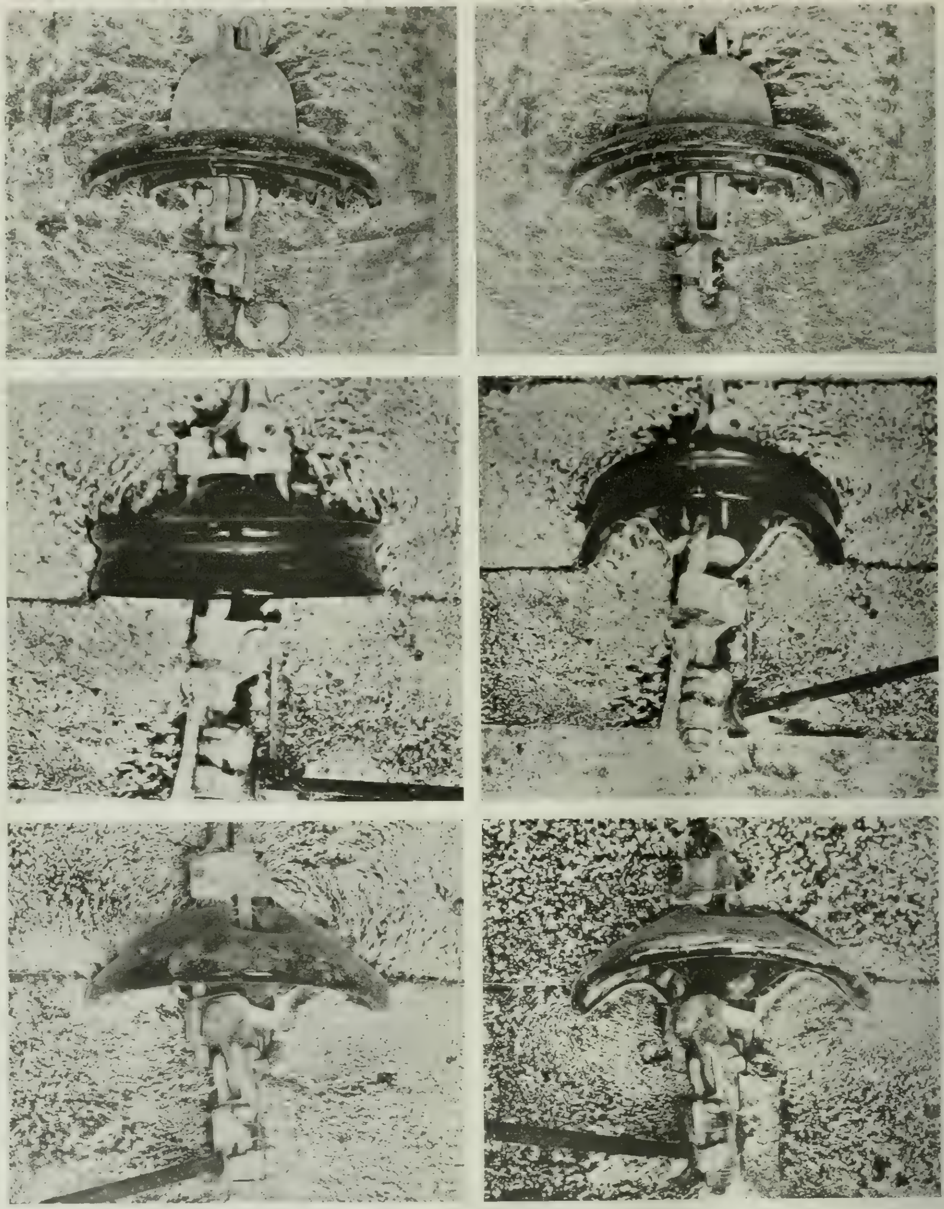
CERTAIN laws of nature are so familiar to us as to excite no wonder at their mystery. Others, not so obvious in daily experience, are not only surrounded for us with mystery but they often take on the air of the supernatural. The unfolding phenomena of electricity and magnetism are examples of the latter class, and this atmosphere of transcendent powers is often utilized by unscrupulous promoters for strengthening the claims of new devices or methods. The situation is all the more dangerous for those tempted to invest under such circumstances because of the fact that there actually have been many instances of new discovery so important and marking so long a step forward as to make the mind peculiarly receptive to news of even further wonders.

It should be possible in most cases to answer definitely the question as to the actual value of any new electrical device. Of the very first importance is the manner in which the new announcement is made. Secrecy, on the grounds of protection or other cause, is always a danger signal. Even when full information and details are given, competent expert opinion should be invoked before giving sure credence to claims. A further signal for caution is in the extravagance of the claims for the new device. In such a case it is all the more important that sound engineering evidence or opinion be demanded before giving credence or support. Occasionally there arise cases in which no new discoveries are claimed, but only improvements in old methods. These are more difficult to analyze, for not only are their promoters usually honest in their beliefs, but also the device may show an initial or superficial value and actually require the test of time.

For some months past attention has been directed to the so-called lead-hydrate storage battery, recently announced by a responsible English firm, for which extraordinary claims as to performance and weight are made. The claims made for this battery are so remarkable and so far beyond the well-known possibilities of lead batteries as almost to stamp the new battery with suspicion from the start, were it not for the sound reputation of the firm that is offering it. It is well known that the output per unit weight of the lead storage battery falls far below the theoretical maximum, the limitations being caused largely by the difficulty of maintaining structural integrity and reasonably permanent electrical characteristics. This gives the opportunity for improvement, and the announcements of the performance of the new cell have taken such unrestrained advantage of these opportunities, and are so glowing, as to give it the earmarks of the usual sensational stock offering. There have been many announcements of similar new batteries in the past, and bygone experience suggests for the lead-hydrate battery the short life and collapse of claims which have characterized so many others.

Obviously the expert has not yet had a chance at this battery. The present situation can only be accounted for by supposing that the promoters and manufacturers did not have the advantage of the best engineering opinion before offering a lead battery which apparently contains no new features and which claims capacity and life surpassing from two to six times the performances recognized as marking the limits of conservative design.

Dielectric Requirements of Insulators Should Not Overshadow the Mechanical



AFTER the best mechanical design has been determined for insulators they should be adapted or modified to give good dielectric flux distribution. Too often good porcelain design is entirely offset by improper use of hardware, when a little more care would give good electrical and mechanical properties. At other times dielectric flux distribution and arrangement is almost totally sacrificed to obtain long creepage surfaces.

Examples of units in which the mechanical and electrical characteristics might be better co-ordinated are shown. In the two uppermost views the mechanical features of design and support interfere with the ideal stress distribution; the stress is greatest at the end of the clamps. In the middle set the field form is good below the disks but bad above; the stress is greatest at the rims of the flange. In the right-hand unit the stress is distorted near the bottom of the shed. The units in the lowermost set show another type which conforms more nearly with the equipotential dielectric surfaces. When wet this unit has high stress at the edge of the rain shed, but the field distribution is still very good.

Composite Insulator Strings Improve Distribution of Dielectric Stress

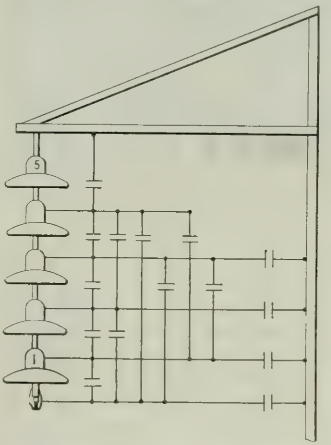
Detailed Analysis of Dielectric Fields Surrounding Insulator Hardware Indicates How to Produce Uniform Stress—Use of Disks Having Different Values of Capacity Helpful

By **D. F. MINER**

Material and Process Engineering Department, Westinghouse Electric & Manufacturing Company

NOT many years ago "bulk insulation" was the rule. That is to say, insulators were formed chiefly with mechanical considerations in view, and then a sufficient amount of insulation was added to withstand the test necessary. Only when the requirements became more severe were attempts made to design insulation members rationally. This demands efficient use of the right materials and design of electrical parts to distribute the electrical load properly. In both problems potential gradient and stress distribution are important factors.

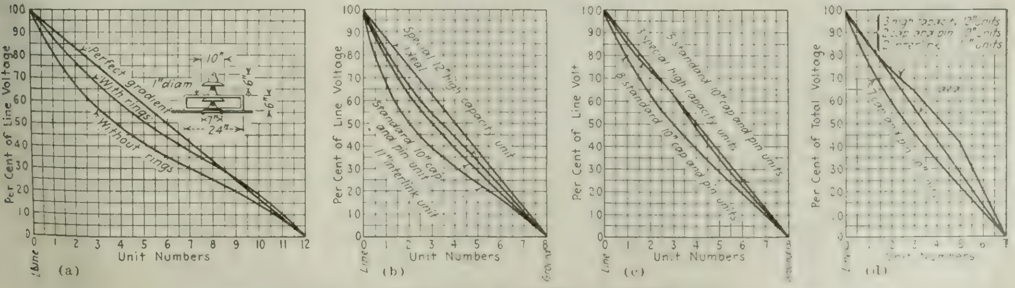
The potential distribution from line to ground in a string of suspension insulators is determined by the individual capacity of units and combinations thereof. This has been determined to be about 0.000023 microfarad for the standard 10-in. cap-and-pin-type unit. The interlinked type, because of less metal, has a capacity about one-half of this. There also exists a capacity of each set of hardware to ground and to the line wire, and also the capacity of each metal section to combinations of the others, as shown in a schematic diagram. Of these four classes of capacity existing, only the internal capacity of units and the capacity to ground are of appreciable value. The charging current of succeeding units must flow through the units nearer the line. Thus, in a string of five units the charging current for the five must flow from the line through unit No. 1. Through the second unit must flow the charging current for Nos. 2, 3, 4 and 5. Considering this situation alone the voltage across the units is unequal, that across the line unit being the greatest and that across the ground unit lowest. But the capacities between units affect this distribution, tending to make the middle unit assume the least potential stress. The net result, as is well understood, is to give the string a potential gradient curve which droops from line to a unit beyond the center and then rises some.



CONDENSER EQUIVALENT OF A STRING OF INSULATORS

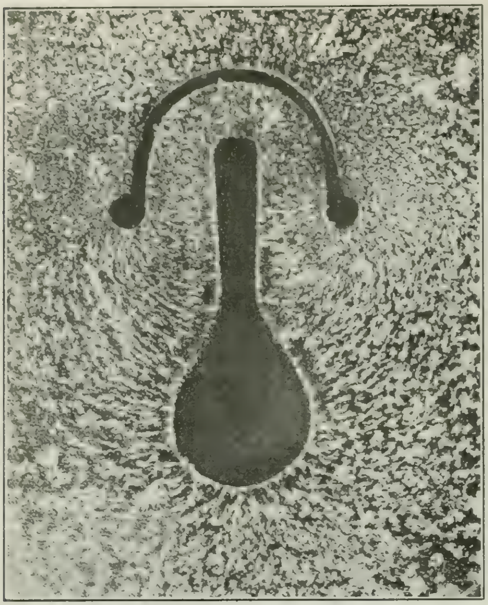
Several methods of representing the electrical stress load on units of a suspension string are available. The two most used are the potential-gradient curve and the individual-stress curve. In the gradient curve a uniform distribution would be represented by a straight line from 100 per cent to 0 per cent between the abscissa point of the line and ground. The usual way of numbering units is from line to ground so that No. 1 represents unit at highest potential. The curve may slope up from ground to line or down from line to ground, depending on personal point of view. Actual gradients droop below the line of uniformity, with the steepest slope at the line end. Composite strings and shielding devices alter this curve and change the slope. The usual effort is to reduce the slope at the line end. Gradient curves show the potential of the metal parts between insulating members and indicate the amount by which the slope must be changed to approximate the ideal slope.

On the other hand, the method showing individual



POTENTIAL GRADIENT CAN BE ALTERED IN SEVERAL WAYS

(a) Shows the effect of guard rings, (b) of various types of insulators, (c) of composite strings containing high-capacity disks and (d) indicates overcorrection.



THE DIELECTRIC FIELD FORM OF THE CAP-AND-PIN HARDWARE FURNISHES A BASIS FOR DESIGN OF THE PORCELAIN INSULATING MEDIUM

stress represents the conditions in the porcelain. In long strings we may find the line unit may be under a stress two to three times the average and more than four to six times the least stress. Part of the units are being worked to a dangerous percentage of their flashover strength and others are assuming little duty. Addition of more units does not increase the flashover of the complete string proportionately.

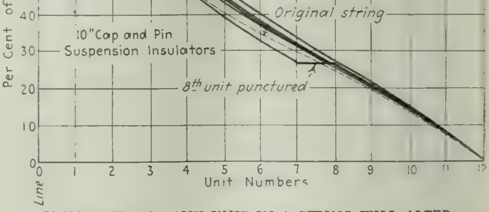
This condition of unequal stress is obviously far from ideal. To correct it requires a careful study of dielectrics and electrostatic fields. In an insulator string the real dielectric is air. The best dielectric condition imaginable would be to have the line hung in space below the tower with no material support. Provided that the shapes of terminals were correct, we should be able to approach the theoretical strength of air—30 kv./cm. When we put in a connecting body we change the conditions. We are still using air as a dielectric, but in parallel with or in contact with a solid surface. This at once reduces the available strength. The character of this surface and its shape limit the insulating values obtainable. Some years ago C. L. Fortescue* showed that forming of the electrodes to shapes which eliminate high points of stress and molding of the dielectric to conform to the Faraday tubes of force between such electrodes permits the most efficient use of the surrounding air dielectric. As high as 30 kv. per inch has been obtained with these rationally designed parts. Under existing practices it is not easy to incorporate these principles entirely, but some attempt should be made to adopt them, since present designs of insulators in strings rarely give more than 12 kv. per inch, dry.

At some distance from a string the surrounding air assumes a potential along a certain characteristic gradient. If the gradient over the surface of the string is radically different, points of stress will be formed which are starting points for flashover failures. Where a considerable portion of the length of a string is metal hardware, the gradient is obviously a series of discontinuous portions, for every point of each group of hardware is at the same potential. This disturbs the external field.

The common method of judging the insulating value of an insulator is by its flashover value (dry and wet) under certain standard conditions. Quite as important, however, are the potential distribution along the string and the provisions for withstanding arcing, mechanical design and dirt collecting qualities. A string with good stress distribution and a certain flashover value would be preferable to a string with poor distribution but higher flashover. Unstable line conditions, surges and other causes would break down the weak points of the second string and cause progressive failure. If the most highly stressed unit spills over, the total stress is then imposed on the remainder and ultimate failure of the whole results. With a properly distributed stress, all parts tend to assume more equal load and the total permissible stress is higher.

Mechanical requirements have been met by two general types of units—the cap-and-pin and the interlinked. In both porcelain is used under compression and the shapes of metal parts or electrodes are roughly limited. Of course, corners and sharp curves should be avoided as much as possible. As far as possible the main body of the dielectric should be made to conform to the shape of the tubes of electrostatic force and rain sheds should conform to the equipotential surfaces.

The field surrounding some of the present forms of suspension units has been studied and found quite instructive. The shape of the fields was determined by means of shredded asbestos sprinkled in the field with potential applied. Study of the accompanying diagrams will indicate how difficult it is to obtain surfaces which conform to proper lines and yet are reasonable from other standpoints.



PUNCTURING OF ANY UNIT IN A STRING WILL ALTER THE POTENTIAL GRADIENT OVER THE STRING

To correct the non-uniform gradient produced with ordinary strings of insulators three general methods have been employed: (a) External shielding and distributing devices; (b) variation in capacity of individual units by addition of metal parts, and (c) variation in capacity of individual units by change in design. Each of these methods has several modifications. A more uniform field and better gradient can be produced by guard rings on the top and bottom of the string or even on the bottom alone. They increase the capacity and impose a field which has less concentration of stress. They also provide a path for the arc so that the porcelain is cleared during flashover. Vertical or horizontal cylinders supported at some distance from the string have been tried with considerable improvement. Combinations of special disks with rings and other forms produce the same result, and in fact the means of correction of this type are large in number. Enlargement of the line wire in the vicinity of the string and remodeled hardware help distribute stress considerably and reduce corona. For very high voltages it will probably be necessary to adopt this last expedient regardless of use of shielding devices. These devices, of course, must not be confused with arcing horns and rings which are provided purposely to provide points of high stress and consequent weakness. They lower the flashover but furnish an easy discharge path so that the porcelain disks are protected.

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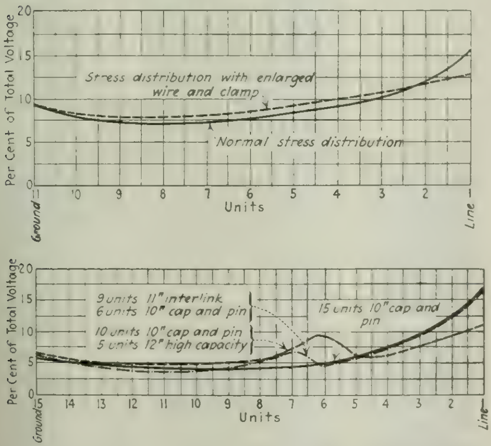
*A. I. E. E. Transactions, 1913.

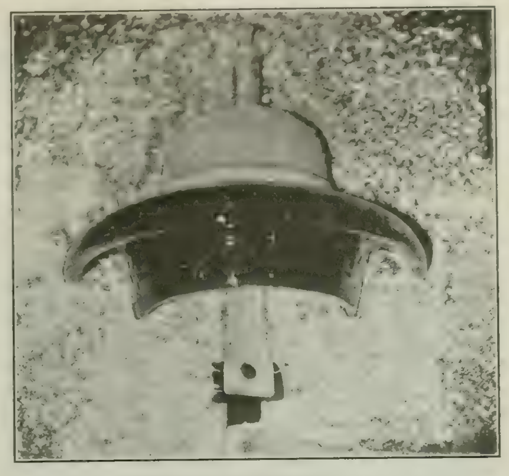
An investigation of guard rings for a string of 12 cap-and-pin units with 6-in. spacing developed interesting facts. Variation of size and number of rings as well as position allows change of the gradient from the original condition where line stress is the greatest to a condition where the ground units are under greatest stress or any intermediate stage. With the string used the best practical combination found was a combination of two 24-in. rings of 1-in. diameter material, one in the plane of the line wire and one 6 in. above—approximately even with the base of the cap of the second unit.

All these external devices present problems other than electrical which are serious enough to discourage their use to any extent at present. These forms are expensive to build, hard to apply and add an element of uncertainty in maintenance with which operating engineers are reluctant to contend.



EFFECT OF ENLARGING LINE WIRE AND CLAMP AND USE OF DIFFERENT TYPE INSULATORS ON STRESS DISTRIBUTION

Several years ago potential gradient was improved by coating a portion of the top or under side of each unit with metallic paint or attaching metal disks. This added metal was varied in amount along the string, with the greatest amount at the line end. As would be expected, a very fine distribution was obtained. This method of grading units is open to criticism on the basis of complexity and trouble in replacement. It involves a large number of different units. Furthermore, corona is liable to occur at the edge of metal surfaces.



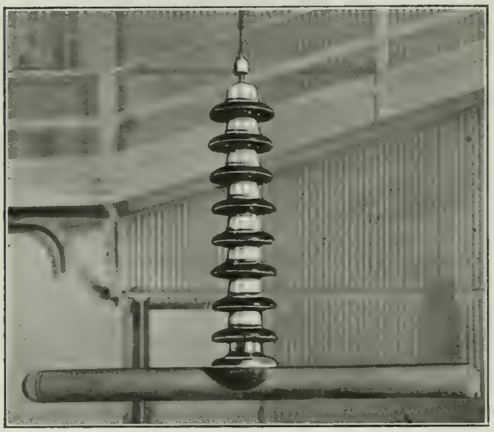
A UNIT DESIGNED FOR HIGH INTERNAL CAPACITY HAS FLUX LINES THAT TURN CORNERS ABRUPTLY

Probably the greatest hope lies in proper design of individual units to improve the field. Two courses are open—one to build a string of units of two or more designs, and the other to mask out the effect of capacity to ground by increasing the internal capacity of each unit. A combination of both is also possible. The former gives rise to composite or mixed strings composed either of similar units of different size or of different types of units. Strings have been proposed using cap-and-pin type units of 12-in. diameter at the line end and 10-in. units for the remainder. Some engineers have even gone so far as to use three sizes, 12-in., 10-in. and 6-in. or 8-in. disks. Such a string gives a commendable improvement, but the results obtained hardly justify the effort. Operating men criticise it because it involves the stocking of several sizes of units, involving a danger that the wrong size may be applied in renewals. A preferable method, which to some degree removes the objection just noted, is to use composite strings of unlike units. Interlinked units together with cap-and-pin units offer possibilities, as has already been shown.[†] The cap-and-pin units, being of much greater internal capacity, should be placed on the lower third of the string, and the remainder at ground end may be interlinked units. The unequal net capacities and stress on each unit are thus corrected. Under certain conditions the improvement experienced leaves much to be desired. The capacity of the interlinked units which must compose the major portion of the string is so low that the effects of capacity to ground and to one another destroy part of the value obtained.

Units have been designed with inherent high capacity which accomplish the results desired in a very satisfactory manner. Such a unit, with large-area metal parts, gives a gradient unshielded that is far superior to anything attained before. The maximum stress is reduced several per cent. This improvement warrants the higher expense of the unit, which can be made to incorporate other valuable properties such as increased mechanical strength, conformation to true electrostatic field and easily cleaned surfaces.

[†] F. G. Baum, *A. I. E. E. Transactions*, August, 1921.

Especially important is the adaptability of a high-capacity unit to composite strings. A combination of high-capacity units and cap-and-pin units, each being one step higher than the previously used interlink and cap-and-pin combination, gives remarkable results. In strings of eight units the lowest three of which are of the high-capacity type an almost perfect gradient is possible without a shielding device of any kind. In strings of fifteen units five of which are high-capacity a great improvement over cap and string is obtained. The maximum stress is reduced from 17 per cent down to 11 per cent of line potential. To demonstrate that correction can be carried to any desired degree by choosing units of proper capacity, a composite string of two interlinks, two cap-and-pin and three special high-capacity units was made up. Tests on it showed overcorrection of the potential gradient, the greatest stress being thrown on the ground end.



ENLARGEMENT OF THE LINE WIRE OR USE OF SHIELD RINGS IMPROVES STRESS DISTRIBUTION AND REDUCES CORONA

Objection has previously been raised to use of mixed strings because of the discontinuity of the curve of gradient at the junction of the two types. This offers a point at which the air-potential gradient outside the string is widely at variance with the string potential. During surges or other special conditions a concentration of stress is thus allowed which invites flashover to this point and from there over the rest of the string. The characteristic flashover known as cascading results. Mixing of cap-and-pin units and units of higher internal capacity, which has been tried, has not given this trouble, and the discontinuity in the curve is not so great as with previous combinations.

When for any reason an insulator in a string is punctured, a change in distribution of stress takes place. The punctured unit cannot in all cases be considered short-circuited, for the charging current to remainder of the string may be insufficient to make a completely conducting path. Megger tests of punctured units sometimes fail to detect the failure, whereas the unit would not withstand flashover. In such a case the stress distribution has been found to be practically the same as it was originally. However, continued stress on the defective unit or moisture entering the puncture path will usually cause the unit to become a complete conductor eventually. The surprising feature of this change in distribution of stress is the smallness of the effect.

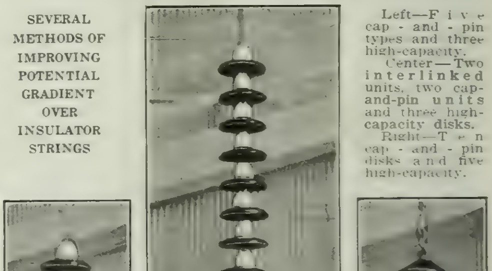
String	Actual Flashover (Dry), Kv	Estimated‡ Flashover (Dry), Kv.
a	487	489
b	497	475
c	457	447

‡The discrepancies noted may be accounted for by makeshift connectors, but the general result is quite gratifying.

Analyzed critically, it will be discovered that puncture of any of the first few units at the line end produces a slight increase in stress at that end. Puncture of a unit near the middle produces no effect at the ends of the string and only a slight discontinuity in the middle. This discontinuity may offer a point of weakness, in some cases leading to overstress of other units and flashover of the string.

There has been some question as to the effect on flashover voltage value of mixing types of insulators. Experiments were made on three strings composed as follows: (a) Five cap-and-pin and three high-capacity; (b) two interlink, two cap-and-pin and three high-capacity; (c) six cap-and-pin and one high-capacity. The results are given in the above table.

In comparing flashover voltage of composite strings with flashover of uniform strings, the inherent differences in flashover voltages must be taken into account.



SEVERAL METHODS OF IMPROVING POTENTIAL GRADIENT OVER INSULATOR STRINGS

Left—Five cap-and-pin types and three high-capacity.
Center—Two interlinked units, two cap-and-pin units and three high-capacity disks.
Right—Ten cap-and-pin disks and five high-capacity.

The flashover value of "interlinks" per unit with 7-in. spacing is the highest; that of cap-and-pin units with 5½-in. spacing is less, and that of high-capacity units with the 4-in. spacing is least. Thus the flashover of each section must be weighted.

Technical Section for Broader Thinking

Chairman Schuchardt Points Out the Aims of the Technical Section of the National Electric Light Association — Emphasizes Benefits to Member Companies and Their Men

DEVELOPMENT of technical men in the central-station field to think of problems in their economic and public relations aspects as well as those of a technical character is declared to be the most important job of the Technical Section of the National Electric Light Association. To this end the work of the section can be effective only as all the technical men in the industry become interested in some form of technical committee work. The geographic division organization as an integral part of the organization is an important means to this end. Chairman Schuchardt emphasized these features of the section work before the Technical Section executive committee meeting at Madison, Wis., in July. They are again emphasized in this interview with a representative of the *Electrical World.*

DISCUSSING the activities of the Technical Section of the National Electric Light Association R. F. Schuchardt, chairman of the section, reiterated to a representative of the *Electrical World* the thoughts that formed the keynote of his opening address at the recent executive committee meeting of the section at Madison, Wis. Mr. Schuchardt said:

"The fundamental consideration on which the Technical Section of the National Electric Light Association is based is that of the association itself—service to the industry. A geographic division organization is provided as an integral part of the national technical organization to handle the division and local problems, so that the national committees can devote their efforts to improving and extending their work on problems of broad national interest. With the local problems are intertwined the problems of national scope. The division organizations should be able to present effectively data and local viewpoints to the national committees because of their intimate touch with their territory. Based on the work of the division committees and such independent activities as will be undertaken, the result of the technical committee work should be more far reaching than it has ever been. Information presented in the past through the yearly reports has been of great value to central-station men in general.

PERSONAL CONTACT BRINGS BENEFIT

"However, the men who have been able to participate in the activities of the technical committees have been the recipients of even more benefit because of the personal contact with other men in similar work but with different conditions and problems and new, fresh viewpoints. Unavoidable conditions, the limitations of membership, and the distances involved in traveling, have kept down the number of men who could enjoy these benefits in the national committee activities. It is impossible to remove these limitations unless some supplementary organization is provided which will maintain intimate touch with the national technical committees and at the same time avoid the limitations imposed by distance. The geographic divisions provide this organization, and the technical committees in these divisions should be composed of all the men in the division who can possibly be interested in the work of any particular committee. The leaders of these committees should be the active members of the national technical committees and act as the ties between the division and national work. In some sections of the country, and perhaps in all, there are problems that are chiefly of state interest, and committees of state organizations for handling such matters are already formed or will be as future problems develop. Although the questions may at any particular moment have the appearance of local interest only, it is probable that most, if not all, of them will eventually become of national interest. For this reason the men who are active in the state or local committee movements should be the active members of the geographic division committees.

"If the work of the central station in its association technical affairs can be carried out as indicated, the result will be a development of personnel that will be invaluable to the industry. The most valuable man in any organization is the one who has the widest possible touch with the things in his field and who, because of that knowledge, can find or indicate solutions of everyday problems with the least possible delay or floundering about in experimental work. A wide contact with progress cannot be had by the man who has his nose to the grindstone of routine every day in the year. In an educational way much can be done by study of the technical literature that is constantly appearing, but this has its limitations. Personal contact with the men in the same field who are facing the same type of problems is the finishing touch needed to prevent the tendency to fall into a rut which is almost unavoidable on the part of the man who is held in an unvarying routine the year around. If the individual can be brought into contact, for a few days of the year, with other men doing similar work under different conditions, he soon learns of many methods of solving problems. He is provided with an incentive to study and to better himself. He is also led to supplement his personal contact with the men he has met by correspondence.

DISCUSSION DEVELOPS INTEREST

"Discussions of problems in this way are a source of real profit to the individuals and lead to greater personal interest in the development of the industry and also to a knowledge of what is happening that inspires men to fuller investigation of subjects before decisions are reached. Many times snap judgment leading to serious error is prevented. In addition to the broadening influence of such contacts, the man who is wide awake and makes the most of his opportunities will acquire specific information on improved methods with which operating economies can be made in his own job more than sufficient to pay the expense of participation in committee work, leaving the gain in the value to the man himself and to his company as a clear profit.

"The biggest and most important phase of the technical section work, however, is concerned with the relation of the technical man to economic and public relations matters. The engineer has been charged with confining his attention to purely technical matters and ignoring the important human relations and economic side of his problems. While some of the committees of the Technical Section are concerned with purely technical problems, others are handling matters that are founded on technical work but which in their most important phases are primarily economic and public relations problems. In a broad sense, the Technical Section is the common ground on which the technical, economic and public relations phases of the industry meet. Here the engineer is brought face to face with economic questions—matters of business policy in which executives, who must make the final decisions, depend on advice as to technical affairs from the engineers; questions of public relations in which the executives are similarly dependent upon technical advice, and all the various problems that face the industry. These problems are so completely interwoven with technical affairs that it is impossible to tell where one begins and the other ends. As a result the Technical Section is dealing, not with intricate research problems in which primary engineering principles and the highest type of pure science are the sole considerations, but with the problems of fitting these engineering principles and attainments of scientific men into practice in the workaday world.

"Perhaps the charge that the engineer has ignored practical affairs has had some foundation in past practice. It should have no foundation in future practice. So far as the member companies of the National Electric Light Association are concerned, the Technical Session is one of the principal agencies through which the engineer is being educated to consider his problems in the light of economics and human relations. He is brought into contact with the thinking on all phases of the problems before the committees because those problems cannot be segregated into purely technical and business matters.

Most Important Technical Section Work

"In the final analysis the development of such thinking is the real fundamental job of the Technical Section. The road to successful accomplishment of the job lies in the direction of the active participation of every technical man in any company organization in some form of local or state technical committee activity. The most active of these men and the outstanding leaders should make up the geographic division technical committees, and in turn the national technical committees should be made up mainly of the outstanding leaders and the most active members of the division committees. In this way the entire technical force of the member companies will be knit together for effective work. This is the condition needed as contrasted with the present condition of benefits to comparatively few. The opportunities are now within easy reach of all. Acceptance of these golden opportunities will serve as an incalculable aid in the effort to advance the electrical industry and make ourselves better American citizens. Development of men to broader thinking and better work is the most important aim of the Technical Section."

Record Output During June

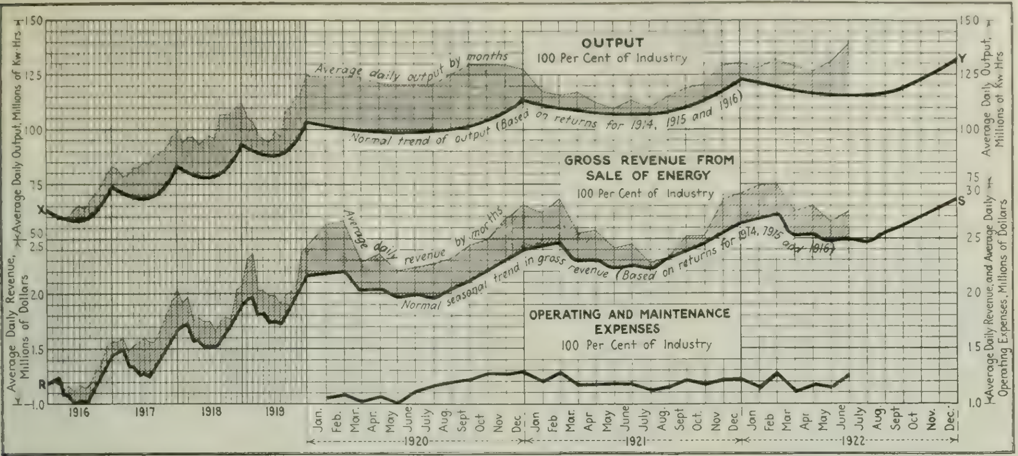
TWO new records for output were hung up by the electric light and power industry during June. Reports for the month received by the *Electrical World* from central generating and distributing companies representing 83 per cent of the installed generator rating of the country indicate that the average daily output was 138,793,000 kw.-hr., which exceeded the previous record, made during February, by 6,073,000 kw.-hr. In addition, the total output for the month of June was 4,163,000,000 kw.-hr., which exceeded the former high monthly figure set during May by 89,000,000 kw.-hr. and the output reported for June, 1921, by 21.1 per cent.

The significant fact about this new record is that it was made during a month which is normally expected to report close to the lowest operations of the year. But this cannot be considered a normal year for the electric light and power industry. It is estimated that 1,231,000 domestic lighting customers will have been added to the central-station lines by the end of the present year, and it is probable that 75 per cent of this new load has been taken on during the first half of the year. This new lighting load has undoubtedly more than overcome the decrease in lighting requirements which would be expected during a normal spring and summer.

Moreover, a falling off in industrial energy requirements would normally be expected owing to seasonal slackening, and this year there were added the effects of the long-continued coal strike and the uncertainty connected with the railroad difficulty. In spite of these adverse conditions, however, the government reports indicate that only one of the primary industries which are the largest consumers of electrical energy was operating under the May capacity. The record electrical energy output for June is, therefore, attributed to the

TABLE I—CENTRAL STATION RETURNS FOR THREE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)				Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase			1922 Thousands of Dollars	1921 Thousands of Dollars	Per Cent Increase	Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
														1922	1921	1922	1921	1922	1921
Apr...	82	3,121,346	2,769,100	12.7	75	62,784	58,484	7.4	Apr..	61	21,402	21,657	—1.2	48.3	53.9	25.3	27.6	34.8	47.7
May..	83	3,381,598	2,804,660	20.5	76	62,401	57,791	8.0	May.	62	22,775	22,385	1.7	53.7	58.1	25.1	22.4	43.3	46.0
June..	83	3,455,994	2,854,042	21.1	76	62,939	56,724	10.9	June.	62	23,532	22,479	4.6	54.2	56.9	26.4	28.1	44.9	48.5



combined effects of materially increased lighting and industrial energy requirements.

The total output of the central generating and distributing companies for the first six months of this year was 23,787,000,000 kw.-hr., as against 20,700,000,000 kw.-hr. during a similar period for 1921. Taking into consideration the curve of normal seasonal trend and the industrial conditions of the country, there appears to be little doubt that the total ouput for 1922 will exceed fifty billion kilowatt-hours.

During the first half of this year the total gross revenue from the sale of energy was $511,200,000, against $472,700,000 for a similar period during 1921. It appears, therefore, that the total gross revenue for 1922 will be considerably over one billion dollars.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to gross revenue from sale of energy, gives evidence of the material increase in the low-revenue load as compared with the high-revenue or lighting load during the first half of the year. In June the operating ratio of companies having steam electric generating plants only, taken in the aggregate, was 54.2 per cent, as against 45.7 per cent in January of this year.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States			Percentage of Installed Ratings Represented	Atlantic States			Percentage of Installed Ratings Represented	North Central States			Percentage of Installed Ratings Represented	South Central States			Percentage of Installed Ratings Represented	Pacific and Mountain States		
		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase
KW.-HR. OUTPUT:																				
Apr.	81	232,294	205,100	13.2	82	1,129,200	979,666	15.3	80	1,019,170	910,482	11.9	63	158,524	137,240	15.5	94	582,400	536,612	8.5
May	82	241,879	200,030	20.1	83	1,207,565	984,646	22.5	82	1,108,082	935,268	18.5	62	166,171	138,576	19.9	95	657,901	546,140	20.4
June	82	243,664	200,343	22.6	83	1,197,576	981,045	22.1	82	1,165,272	961,886	21.1	62	166,400	139,100	19.6	95	683,082	571,668	19.4
REVENUE:																				
Apr.	81	$6,132	$5,808	5.6	76	$23,809	$21,847	9.0	67	$19,534	$18,017	8.4	62	$4,123	$3,928	5.0	94	$9,186	$8,880	3.5
May	82	5,787	5,508	5.1	76	22,596	21,203	6.6	69	20,239	18,175	11.4	62	4,131	3,782	9.2	95	9,648	9,123	5.8
June	82	5,788	5,428	6.6	76	22,394	20,421	9.6	68	20,603	18,200	13.2	61	4,114	3,798	8.3	95	10,040	8,877	13.1
OPERATING EXPENSES:																				
Apr.	53	$1,626	$1,650	1.5	56	$7,322	$7,295	0.3	53	$7,142	$7,255	−1.6	61	$2,063	$2,075	−0.5	93	$3,249	$3,382	−3.9
May	53	1,617	1,692	−4.4	57	7,550	7,398	2.1	55	8,369	7,848	6.7	61	1,866	2,043	−8.6	93	3,373	3,404	−0.9
June	53	1,754	1,857	−5.6	57	7,699	7,368	4.4	55	8,525	7,870	8.3	61	2,152	2,032	5.9	94	3,350	3,407	−1.7

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months	
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	192.
Steam Plants:																				
April	49.5	62.5	57.5	66.5	47.3	51.5	50.7	56.7	48.7	55.2	52.3	61.9	50.6	54.7	50.0	56.0	47.4	54.5	48.4	55.0
May	58.8	62.4	57.1	66.0	54.4	58.0	50.6	56.6	50.6	58.8	61.5	52.0	54.1	56.1	50.1	55.1	54.7	56.3	48.8	55.3
June	56.5	66.3	56.8	65.2	54.8	56.6	50.4	56.3	54.8	56.8	51.9	60.4	52.2	54.5	49.9	55.7	46.6	54.2	48.3	55.0
Hydro Plants:																				
April	38.4	37.0	33.1	44.1	21.0	24.5	18.5	22.8	23.6	24.3	22.6	22.1	37.2	22.4	36.0	34.2	27.5	31.7	26.9	26.4
May	32.0	28.7	33.2	42.1	16.2	18.0	18.5	22.7	22.1	22.7	22.3	22.6	33.0	28.0	36.4	34.4	35.2	32.8	27.2	26.8
June	36.5	37.0	33.8	43.0	26.9	26.1	19.9	23.4	21.3	20.5	22.6	22.4	32.0	27.3	36.5	34.8	25.1	20.0	29.6	26.1
Combined Systems of Steam and Hydro Plants:																				
April	43.7	45.9	52.6	52.4	47.7	50.6	45.1	49.7	47.8	52.7	46.9	55.8	39.8	43.7	43.5	45.1	33.7	38.2	36.8	41.0
May	46.2	43.4	52.4	52.5	44.8	45.3	45.4	49.5	50.6	55.1	47.7	55.8	38.5	44.5	43.1	45.3	31.3	34.4	36.6	40.7
June	48.8	58.7	51.9	52.0	48.7	51.0	45.8	49.8	51.4	53.7	48.3	55.2	43.7	49.3	43.0	45.8	31.9	38.0	35.8	40.0

Trade Prospects in Australasia and Far East

Extent of the Present Export Business—Existing Conditions and Local Products—Trade Prejudices and the Outlook for American Manufacturers

By P. S. SMITH and R. A. LUNDQUIST*

AUSTRALASIA and the Far East with their growing industrial development offer a steadily increasing market for electrical goods. It must not be underestimated and misjudged owing to the fact that the standard of living in India and China, for instance, is on the average very low. India with 330,000,000 people and China with approximately the same number make a total close to 700,000,000 whose purchases in the aggregate must be of immense volume, even if the per capita expenditure per annum is small.

As an indication of the extent of the growth in the use of electricity, the exports of electrical goods from the United States to some of the more important of these countries during the years 1913 and 1921 are significant. They are shown in the accompanying table.

The classes of electrical goods that can be sold in the various countries of the Far East and Australasia vary considerably with the particular market. This is readily apparent when one considers the relative developments in the countries, their natural resources and the social and industrial conditions existing in each.

JAPAN PROGRESSING FAST

In Japan industrial production was greatly accelerated under the pressure of war-time demands, and wonderful progress was made in the development of the abundant water-power resources and in the distribution of electricity to all parts of the Island Empire. Yet Japan, in spite of its own extensive electrical manufacturing industry, is still a good field for heavy apparatus, switches and high-voltage items and for certain specialties. For very comprehensive plans have been developed by the Japanese government for progressive electrification of the government railways.

POWER METHODS IN INDIA ARE STILL PRIMITIVE AND THERE IS GREAT NEED FOR THE ELECTRIC MOTOR. THE ACTIVE DEMAND IS GROWING

Japan offers small opportunity, however, for the sale of wiring devices or wire. The minor electric appliances that are in best demand are meters, electric ranges and small heating devices, electrical supplies for automobiles and carbons. Much telephone equipment and some cable is still sold in Japan from time to time, but on the whole it is confined to things that

EXPORTS FROM THE UNITED STATES TO FAR EAST AND AUSTRALASIA

	Japan		China†		India		Australia		New Zealand	
	1913*	1921	1913*	1921	1913*	1921	1913*	1921	1913*	1921
Batteries	....	$71,652	....	$77,273	....	$83,513	....	$185,156	....	$171,928
Carbons	....	52,782	....	2,365	....	280	....	2,539	....	58
Generators	$848,357	1,755,041	$7,641	564,896	$2,655	376,651	$117,577	327,449	$1,548	123,698
Fans	10,474	16,100	34,006	141,165	36,965	433,473	6,211	21,480	37	930
Heating and cooking appliances	....	91,337	....	36,060	....	14,709	....	110,336	....	59,986
Insulated wire and cable	....	109,571	....	442,290	....	286,292	....	156,086	....	162,983
Wiring supplies and fixtures	....	35,853	....	77,907	....	22,154	....	121,415	....	29,838
Lamps (electric)	4,783	1,845	7,084	73,073	2,135	26,354	41,688	267,264	3,975	62,766
Magnetos and spark plugs	....	49,805	....	20,859	....	39,995	....	77,446	....	20,623
Meters and measuring instruments	....	536,779	....	161,989	....	20,951	....	306,275	....	81,494
Motors	399,393	1,654,504	25,350	786,282	105,453	988,375	264,449	2,373,722	7,845	329,454
Rheostats and controllers	....	235,659	....	9,151	....	35,872	....	135,156	....	17,491
Switches and accessories	....	328,385	....	388,484	....	79,979	....	242,458	....	34,454
Telegraphic apparatus, including wireless	5,178	59,523	....	9,318	19	27	7,826	12,855	1,433	4,576
Telephones	30,407	233,289	9,815	125,671	136	120,252	5,394	620,020	5,900	149,627
Transformers	....	1,082,485	....	737,355	....	251,356	....	1,017,080	....	264,272
All other	1,067,246	3,384,526	86,629	993,660	317,266	906,055	671,730	1,556,704	195,990	412,335
Totals	$2,365,838	$9,699,126	$170,525	$4,647,798	$464,632	$3,686,288	$1,114,875	$7,533,441	$216,728	$1,926,513

* Fiscal year. † Includes Hongkong.

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have a special application. The telephones in Japan are controlled by the government, and with the extensive local manufacture of this class of goods there will be in the future less opportunity for outside products.

Outlook in China

China is an uncertain export field for electrical materials at the present time, but opportunities are constantly being presented. Electric lighting stations and telephone exchanges are found in most of the more important cities, but there are only a few towns in the country that have as yet sufficient load to require units of large capacity, and for some years the equipment will be mostly in units under 500 kw. to 1,000 kw. rating. Moreover, owing to the economic conditions, service must be rendered as cheaply as possible and wiring materials must be simple and inexpensive in order to meet the needs. Contracts for complete systems are generally awarded to some European firm in Shanghai, Hongkong or some other large city, and in such cases it is the practice of the builder to install all possible equipment of some particular type over which he has selling control and for which he can get the renewal and extension business. But when such control is not in effect the tendency is to use the cheapest possible materials, and in many instances Japanese and German wiring supplies will meet the requirements.

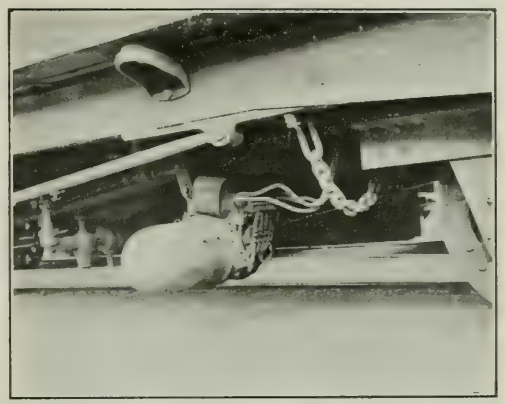
However, China can be regarded as a great potential market for American exports. Standards of living are rising steadily, and the return of young Chinese engineers who have been educated in the United States results in a constantly increasing call for high-class American equipment with which they have become familiar while in this country.

India Promises Much

India is further advanced electrically than China in many ways, but here the American manufacturers are confronted by the lack of selling facilities and by the fact that a considerable number of the more important existing central stations are more or less linked to British manufacturers. There are seventy-five jute mills and 284 cotton spinning and weaving mills, in addition to a large number of other industries where electric power is being steadily introduced. These plants are generally of considerable magnitude and install prime movers of large capacity. British capital predominates, but there is some American investment in the jute plants and considerable native ownership of cotton mills, so that in this field buying is less restricted than in the central-station field.

FAN MOTOR SHOP OF THE SHIBOURA ENGINEERING WORKS, JAPAN

On the east coast of India steam-power plants are popular since the coal resources of the country are centered about Calcutta. On the west coast, centering about Bombay, water-power resources have brought about hydro-electric developments of considerable magnitude. Further water-power sites are under development at the present time, and it is likely that several new installations of large capacity will be made within the next few years. American manufacturers have been very successful in the past in bidding on water-power equipment, and their recognized superiority in high-voltage equipment places them in very good position for much of the large hydro-electric business which is contemplated.



STONE TRAIN LIGHTING SET IN USE IN AUSTRALIA, NEW ZEALAND AND OTHER BRITISH COLONIES

India offers only a limited field, however, for the sale of American wiring devices because of the fact that English standards prevail and British methods are more or less required. Nevertheless, there is a good demand for certain American electrical appliances. The electric fan is probably the most widely sold, and this is purchased in all grades, types and sizes. Electric irons, grills and toasters also have a sale in moderate volume, with ranges and radiators coming rapidly into popularity in certain favorable sections. India undoubtedly is a very good potential field for American manufacturers, and efficient local representatives should be engaged in order to open up the market.

Australian Market

In Australia water power is found in the island state of Tasmania, but there are only a few feasible sites of importance on the mainland, although very good coal deposits exist. Strong urban concentration offers opportunity for the sale of a few large prime-mover units, mainly steam-turbine sets, and Australia is a good field for high-tension, moderate-voltage and distribution-type transformers, the latter being of large capacities, since the tendency is to concentrate distribution transformer capacity more than is common in the United States. In the high-tension field generally

American transformers, switchboards, switchgear, insulators, protective devices and line wire take a considerable portion of the business offered, and it may be expected that this will continue in reasonable volume. The growing industrial activity has resulted in a steady increase in motor installations, and since alternating-current service is largely employed, American induction motors in small and moderate capacities can be and are imported. The tendency is toward standardization at 50 cycles, with four-wire, three-phase distribution.

Very important telephone extensions are planned by the Australian government, and the high standing of American manufacturers in Australia should result in a fair portion of this business going to the United States. The tendency appears to be toward the installation of full automatic systems.

PUMPING IN THE "PADDY" (RICE) FIELDS OF CHINA WILL SOME DAY PRODUCE AN EXTENSIVE MARKET—AND CENTRAL STATIONS ARE ALREADY REACHING OUT FOR IT

In wiring supply lines, British standards being quite commonly used, there is only a fair market for the usual American fittings. Snap switches and screw-base sockets of standard American types, however, have a fair sale, though tumbler switches and bayonet sockets are predominant. Rigid conduit and American conduit fittings are not used to any extent, British standards for this class of material prevailing. The restrictions against any wire which is not the actual product of a member of the Cable Makers' Association of England are so severe as practically to keep American rubber-covered wire off the market, at least for the time being. Our standard wire cannot meet the megohm test called for by the underwriters in Australia, and this is a feature which also handicaps it in other British colonies.

All the usual domestic appliances which find favor in the United States will sell in Australia, with the exception of washing machines and electric mangles, and if backed up by persistent missionary work these eventually should find a limited market. In heating-appliance lines American products have always had a very good name in Australia and have always been able to meet the competition.

NEW ZEALAND STRONGLY BRITISH

New Zealand is well provided with central-station systems, and the expansion there will probably take the form of a broader use of electricity by the people. The available water power is being systematically developed and a federal superpower scheme is rapidly taking form.

Opportunities for American manufacturers exist in connection with the high-voltage network of the national hydro-electric developments, but the New Zealand government's policy is to place all possible business in England. In wiring supplies the tendency is to adhere even more closely to English standards than is the case in Australia, and standard American products do not have the opportunity for sale that they have in the latter country.

Domestic appliance lines, such as flatirons, kettles, toasters and grills, sell well in New Zealand, though possibly not in the volume that might be expected in view of the prosperity of the people. The power motors called for will be largely of moderate capacity since people depend more upon pastoral and agricultural resources than upon industry.

LOCAL MANUFACTURING

Japan and Australia are the only countries that manufacture electrical goods to any appreciable extent, although China has begun to enter the field. In Japan all classes of goods are made, but the reliability of the native product, especially in the case of high-voltage and large-capacity apparatus, has not been sufficiently assured to result in the domination of their home market by local manufacturers. Steam turbines, waterwheels, motors, generators, wire and wiring devices, lamps and telephone materials are all produced there in considerable quantity and on the whole are of fair quality. Some little export business to India; Africa, Australia and the Dutch East Indies has also been done in wiring devices, flashlamps and other articles of secondary importance.

In Australia some apparatus has been made for a number of years and certain minor wiring supplies and fixtures are produced, but the volume is small and industrial conditions and local problems are such that no extensive manufacturing is justified at the present, nor are the domestic manufacturers able as yet, as a rule, to produce such high-class equipment as can be imported.

In order to estimate the effect of local manufacture in these countries, it is interesting to note that Japan is at present the only one with any appreciable output of electrical goods, and that although that country has been manufacturing for some years, it is still one of the most consistent markets for American goods.

The scope of this paper will not permit more than the briefest mention of Far East countries other than those specifically noted. Java, Indo-China, Malaysia, Siam and the Philippine Islands, however, all offer markets of growing importance to electrical manufacturers and should be carefully investigated. Some lines of American types will not appeal, but there are many of our standard lines which should have a good sale.

Responsibility for Telephone Circuits

Supreme Court of Washington State Holds that Telephone Company Cannot Recover from Power Company the Cost of Metallicizing Ground-Return Circuits Against Superior Right Based on Prior Occupancy

THE finding of the Washington State Supreme Court in the inductive-interference suit noted in the *Electrical World* for Aug. 12, page 345, by which judgment awarding damages of $1,400 was reversed and the case remanded to the Superior Court with directions to dismiss the action forms an important precedent in the legal status of the ground-return telephone circuit. The case came before the Supreme Court on appeal by the Pacific Power & Light Company, which operates an extensive transmission system in central Washington extending on the west from Yakima to a point on the east about 60 miles to the north and east of Walla Walla, with the operating control point of the system at Pasco. In 1917 the company constructed a 66-kv. transmission line from Pasco to Lind by way of Kahlotus which tied into the system of the Washington Water Power Company. The line supports are cedar poles, and because of the rough nature of the territory many double-pole or H structures were used and spans up to and in some cases longer than 1,000 ft. were employed. The design of the line was carried out very carefully, and the circuit was balanced by transposing so that properly constructed telephone circuits that came into the territory later could be co-ordinated with it. Except for rural telephone lines there were no telephone circuits in the territory, the lines involved in the court action being of the class that belong under this designation. Nearly all the telephone circuits were ground-return, and as the cheapest and best method of constructing crossings complying with the state law the telephone circuits were carried underground at the crossing spans in iron conduit.

TELEPHONE COMPANY CLAIMS DAMAGE

The specific case concerned the Connell-Kahlotus Telephone Company. Circuits belonging to this company paralleled by the power circuit north of Kahlotus and on the highway were rebuilt and metallicized for a distance of approximately 8 miles, and repeating coils were put in the ground-return branches connecting with the line on the highway. A section of the telephone line immediately north of Kahlotus which occupied a position on a section line was removed to a location along a highway about half a mile east of the original location and rebuilt as a ground-return circuit for a distance of about 2 miles measured along the new location. This section was connected to the metallicized section through repeating coils. As a result of the work done to put the power line in the best possible condition there was no claim that the power line was not constructed, operated or maintained in accordance with the best standards of modern engineering practice, but the telephone company asked damages to cover the cost of metallicizing other circuits and for the loss of profits.

The jury in the lower court returned a verdict in favor of the telephone company in the sums of $900 for metallicizing circuits and $500 for the loss of profits. A motion to direct the jury to return a verdict against the plea of the telephone company was denied and, as already stated, the case went to the Supreme Court on appeal. The power company contended that it was on the highway by reason of a franchise properly granted and was under no obligation to bear any part of the cost of modernizing the telephone system to prevent inductive effects. The telephone company contended that because the power line interfered with the use of the telephones the power company should bear the cost of metallicizing, the prior occupancy of the highway by the telephone circuits being cited as giving the telephone company a superior right. The important parts of the decision are as follows:

"The testimony shows that the electric field created by the power line in this case extended for 1,000 ft. to one mile on either side thereof. The induction from the power line to the telephone line in no manner injured any property of the telephone company but only interfered with its use. When the power line was not energized the telephone could be used, the buzzing noise not being present. There was no way that the power line could have been constructed, operated, or maintained which would prevent interference by induction.

"The controlling question, then, is whether the power company was under obligation to bear such cost [that of metallicizing the telephone circuit]. This question is one of first impression in this court. It should be remembered in considering the question that the telephone company did not own the land through which with its single-line system the current returned to the point of origin. The weight of authority so far as the question has been determined is in favor of non-liability of the power company.

"In Lake Shore & Michigan Southern Railway Company vs. Chicago, Lake Shore & South Bend Railway Company (92 N. E. 989) were involved the conflicting claims of two transportation companies each operating on its own right-of-way. In that case the plaintiff was operating a steam railroad through a portion of the State of Indiana. In connection with the operation of the railroad it used a system of electric telegraph lines and signals necessary to its operation. The defendant was engaged in constructing on its private right-of-way adjacent and paralleling its road an electric railway between the towns of Gary and South Bend, a portion of which had been constructed and was in operation. The company's cars were operated by an electric system known as 'single-phase alternating current.' By reason of the proximity and parallelism of the two lines the high-tension circuit used by the defendant interfered with the maintenance and use by the plaintiff of its system of electric telegraph lines and signals, the current there as here passing from the defendant's line to the plaintiff's by induction. It was held that the operation of the defendant's line would not be interfered with at the suit of the plaintiff. In the course of the opinion it was said:

"'This controversy is between users of electricity, appellant using light currents and comparatively delicate instruments, which are interrupted by escaping currents from the wires carrying exceedingly high voltage belonging to the appellee. It is not a question between one engaged in the ordinary development of his land and the customary and appropriate employment of it according to its inherent qualities and its surroundings, without bringing upon it artificialty of any substance not naturally found there (Evans vs. Reading, etc., Company, 160 Pac. 209, 28 At. 702; Pennsylvania Coal Company vs. Sanderson, 113 Pac. 126, 6 At. 453, 57 Am. St. Rep. 445), and one engaged in the unnatural and extraordinary use of his property, calling for the application of the maxim *Sic utere tuo*, etc., which is the governing principle in Fletcher vs. Rylands and Rylands vs. Fletcher (L. R. 3 H. L. 330). In this case the use of electricity is common to both parties, and both are acting under legislative grants. In such cases it seems to be the consensus of opinion, both in England and in this country, that where one is acting under legislative authority, and within the right thus given, and reasonably within the exercise thereof, using care and caution regarding the rights of his neighbor, any inconvenience or incidental damage that may arise in the absence of any negligence from the reasonable use of his own property will be regarded as within the rule *damnum absque injuria*.

QUOTES SOUTH AFRICAN CASE

"A like result was arrived at in the case of Eastern and South African Telegraph Company vs. Cape Town Tramway Companies (2 British Ruling Cases, 114), decided by the House of Lords of England on appeal from the Supreme Court of the Cape of Good Hope. In that case an action was brought by the telegraph company against the tramway company for damages for disturbance of the telegraph line caused by the working of the tramway and for the cost of appliances to prevent such interference. The interference there as here was caused by induction, and it was held that the tramway company was not liable, and in affirming the case it was said:

"'Certainly there is here no injury of the same genus or species with the tangible and sensible injuries which have hitherto founded liability on the principle in question and which have always constituted some interference with the ordinary use of property. Now the kind and degree of interference with the respondents' property is pretty well illustrated by the fact that it can only take place if the cable is constructed without certain precautions, for, given the cable as it now is, there is no injury. This is referred to, not because their Lordships consider that the respondents have made out that the twin cable had the general use and recognition which they ascribed to it, but as showing that it cannot be predicated of the electric escape in question that it is destructive of telegraphic communication generally, but only that it affects instruments made in a certain way. Now, if the instrument be taken as it was when the injury occurred, its nature is such that to insure its immunity from disturbance is a somewhat serious liability to cast on neighbors. To describe this as a delicate instrument might be inaccurate, if the term were used in relation to other electrical instruments of extreme sensibility. But in the present discussion this is not the true comparison at all.

"'The true comparison is with things used in the ordinary enjoyment of property, and this instrument differs from such things in its peculiar liability to be affected by even minute currents of electricity. Now, having regard to the assumptions of the appellants' argument, it seems necessary to point out that the appellants, as licensees to lay their cable in the sea and as owners of the premises in Cape Town where the signals are received, cannot claim higher privileges than other owners of land and cannot create for themselves, by reason of the peculiarity of their trade apparatus, a higher right to limit the operations of their neighbors than belongs to ordinary owners of land who do not trade with telegraphic cables. If the apparatus of such concerns requires special protection against the operations of their neighbors, that must be found in legislation. The remedy at present invoked is an appeal to a common-law principle which applies to much more usual and less special conditions. *A man cannot increase the liabilities of his neighbor by applying his own property to special uses, whether for business or pleasure.*'

"In the case of the Dakota Central Telephone Company vs. Spink County Power Company (176 N. W. 143), the Supreme Court of South Dakota sustained the rule of liability by reason of the particular statute of that state, but indicated that if there had been no legislative direction either way the court would adopt the view that there was no liability.

"While the precise question has not been considered by many courts or text writers, we are inclined to adopt the rule of non-liability. The telephone company, in order to maintain its single-wire system, must make use of the earth in which it has no rights for the completion of its return circuit. It does not seem reasonable to hold that the duty was not upon it to standardize its line in a way that would prevent interference in accordance with good modern engineering practice, when to maintain a single line it must make use of something which it does not own.

SUPERIOR RIGHT ARGUED

"It is suggested that since the telephone company was first upon the highway it has a superior right, but this position cannot be sustained. The statute (Remington's 1915 Code, Section 5,612) provides that no exclusive franchise or privilege shall be granted. The authorities are against the rule of superior right based upon priority.

"The prior occupant, as stated in 'Joyce on Electric Law' (Vol. 1, Section 372-A), 'while it obtains no exclusive right to the occupation of the street, does acquire a right, which is in the nature of an exclusive one, to the continued occupation of the space occupied by its poles and wires, subject to the proper control by the state or municipal authorities, and this right must be recognized by the subsequent company in the construction of its line.'"

The entire decision indicates that utilities occupying highways do not acquire by reason of prior occupancy any rights over later comers that release them from the obligation to maintain their systems in a condition complying reasonably well with the standards of the art and that they cannot throw the expense of bringing systems up to such standards on the later comer. The case in question is especially clear-cut, since poor physical condition or improper design or construction on the part of the power company was not an element in the controversy, and the decision is thus rendered free from extraneous circumstances.

Underground Construction Suggestions

Material Specifications and Installation Requirements that Can Be Applied to Advantage Where Better or More Elaborate Standards Have Not Been Adopted

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MANY electric service companies and large industrial plants have developed their own standards of practice for installing underground circuits. Such companies the author does not presume to advise. But besides these there are many medium and small-sized plants that are leaving the form of construction and material specifications to their construction foremen, and these plants might, it is thought, benefit by applying some of the following standards. They are based on the practice of the United States Navy Department Bureau of Yards and Docks and have been found very effective under a variety of conditions.

FIBER DUCTS FAVORED FOR POWER CIRCUITS

The designing engineer should give complete specifications for his material, and the engineer in charge of the installation should give definite instructions on all details, for the system is inherently expensive and every consideration of economy demands that it be put in correctly. Of the materials used the vitrified-clay duct and the fiber conduit are well known, and the engineer can do no more than see that his specifications are correct and that the proper kind of duct is used.

Specification for Vitrified-Clay Duct.—Vitrified-clay duct should be made of finely ground compact clay thoroughly vitrified and salt-glazed inside and out and free from stones and pebbles and iron, lime or other foreign substances injurious to the finished product. The conduits should, when practicable, be of the multiple-duct type, 3¼ in. inside and uniform in size and quality, with inner walls not less than 7/16 in. thick at any point and outer walls ⅝ in. thick. Ducts should show an average absorption of not more than 5 per cent when completely submerged for twenty-four hours in water at a temperature of 60 deg. to 80 deg. F. The outer walls should be scarified, or otherwise suitably roughened, for at least 2 in. at each end, and each section of multiple duct provided with at least two dowel-pin holes or other approved means for accurately centering duct holes at each end.

Specification for Fiber Conduit.—Fiber conduits should be of 3½-in. inside diameter with not less than ¼-in. wall and of the taper and sleeve-joint type. This conduit should be made of wood-pulp fiber, thoroughly impregnated with an insulating compound which will render it impervious to the action of salt water, and itself free from all substances which may corrode the lead sheath of a cable. The bore should be straight, the cross-section should not vary at any point more than ⅛ in. from a true circle, and the inner surface should be free from excess compound, flaky areas, dents or other obstructions as gaged by its ability to pass a 36-in. mandrel of ¼ in. less diameter than that of the conduit.

Fiber conduits have come into rather extensive use during the last ten years, and they have a distinct advantage in ease of transportation because of their light weight and high resistance to breakage. The weight of standard fiber conduit is only about 15 per cent of that of the equivalent in multiple terra-cotta duct. The lighter-weight fiber duct, with ⅛-in. wall, weighs less than 10 per cent. It has been found in some instances that with clay duct as much as 10 per cent of the quantity has been broken or destroyed on the way to the job. There is also more or less of this material broken in handling before it actually reaches its final resting place in the trench. Considerably less care is required in handling the fiber product, and there is practically no waste. These matters, as well as the difference in freight rates, should be taken into consideration in determining the relative costs of the two duct materials.

Fiber conduits are made up with several different types of joints, each suited to the particular condition of the installation. The tapered joint with sleeve is more generally used because it allows gradual changes in the direction of the line and permits curves of long radius for the purpose of avoiding obstructions. The thickness of wall of the standard fiber duct varies with the size of bore and type of joint, from ¼ in. to 7/16 in. It can readily be seen that the conduit having a threaded type of joint will require a thicker wall than that having a tapered joint.

THIN-WALL TYPE OF FIBER SERVES AS CONCRETE FORM

In the concrete structure shown by detail B on Fig. 1, a type of construction recommended for fiber-conduit installations, the wall thickness of the conduit need only be ⅛ in. to act as a form for the concrete. This structure provides a 1¼-in. concrete wall at its thinnest point between ducts. Construction of this character makes the entire conduit line a solid monolithic mass of concrete, the duct itself simply serving as a form. This type of construction is considered superior to terra-cotta, as shown by detail A, in that the concrete surrounding the duct offers more resistance to the heat of a flaming arc such as is frequently experienced in short circuits of high-power electric cables. Quite frequently several cables in adjacent ducts are damaged or destroyed by the failure of one cable. Using the thin-wall type of fiber duct eliminates in a measure the objection in regard to softening due to absorption of moisture, which reduces the duct bore. Should the fiber soften and swell with the thinner duct, it will not form an obstruction but may be forced out in particles when pulling in or withdrawing cables, thereby leaving the solid concrete walls.

Short Circuit of Cables Within Ducts.—It has been found that a sustained short circuit on low-voltage feeders in clay duct would communicate to all four ducts of the multiple at the joint, thereby destroying all of them at this point and usually melting the terra-cotta, copper and lead into a molten mass. This necessitates the digging up of a considerable length of duct line before the damaged cables can be removed and new ones installed. In the case of a cable fault of this character in the fiber-conduit construction as recommended it has been observed that only the fiber is destroyed, leaving the concrete intact, and no communication of the arc with the other ducts has been experienced. The cable may be readily withdrawn, the duct cleaned and new cable immediately pulled in.

Considerations in Deciding on Duct Material.—Telephone companies appear to favor the terra-cotta duct construction and in some instances use creosoted wood duct. Their cables, however, do not carry sufficient current, on short circuit or ground, to damage the duct. In determining the type of duct best suited to a particular installation, the following points should be given consideration: (a) Transportation; (b) amount of handling necessary before being laid; (c) purpose for which ducts will be used; (d) class of labor obtainable.

Separation of Telephone Ducts from Those for Light and Power.—Telephone companies as a rule require that there shall be a separation of at least 6 in. of concrete or 12 in. of dirt between their conduits and those carrying electric light or power cables. It has been found in practice that 3 in. of properly composed concrete will provide ample protection for signal or telephone cables, and this separation is recommended where the ducts for the two systems are to be placed in the same trench. It is considered extremely advisable to provide manholes for telephone systems entirely separate from those used for lighting and power cables.

LOCATING OBSTRUCTIONS BY TEST HOLES

Before starting the excavation of a trench for underground ducts test holes should be dug at proposed manhole locations to ascertain whether obstructions are to be encountered and to locate them exactly. Obstructions, such as buried gas mains and other underground pipes, which have not been taken into consideration, may require a redesign of the particular part of the system where such obstructions exist. It is frequently found advantageous to move the obstructions or, as is usually the case, to pay the owner to move them. Gas pipes or mains should never run through manholes, nor should piping of any character where it is possible to avoid it.

Curves.—The trench should be dug in as straight a line as practicable. It may be found desirable in avoiding obstructions or for other reasons to provide offsets or curves in the duct line, in which case the distance between manholes or pulling points should not exceed 250 ft. and the sum of the total curves should be not greater than a right angle. Curves should be made at a radius of not less than 25 ft., using regular or short lengths of conduit. It will be found in the case of terra-cotta ducts that lengths can be selected which have a slight curvature and therefore serve well for the purpose.

Depth of Duct Line.—Conduits should usually be laid so that the top of the duct structure will be from 24 in. to 36 in. below grade, depending considerably upon traffic conditions. In no case should conduits other than steel pipe be less than 18 in. below grade. The bottom of the trench should be graded not less than 3 in. in 100 ft. so that the conduit will drain from one manhole to the next or from the middle of the run toward both manholes. The bottom of the trench should be graded evenly, and where unnecessary excavation has been made below the bottom line of the trench it should be filled in with concrete and not the excavated material. Ducts entering and leaving a manhole should be as near as possible at the same level.

Obstructions Within Ducts.—Conduits should be carefully examined just before laying them to see that the inner surfaces are free from obstructions, projections and dirt and to see that the duct is otherwise perfect The ends of ducts should always be plugged when leaving work for the day. Where the plugs are not especially treated so as to be waterproof, they should be thoroughly soaked in water and covered with wet cheesecloth. Untreated dry plugs are liable to swell, owing to the absorption of moisture from the ducts, thereby bursting or cracking the ends of conduits.

Where necessary to use short lengths of conduits, owing to the location of manholes, the short sections should not be placed directly at the entrance of the manhole, but further out in the line. In passing through rock soil a 3-in. layer of sand should be placed under the concrete bed supporting the ducts. The sand acts as a cushion and prevents damage to the conduit structure from earth shocks or vibrations. Joints of conduits should be staggered, both horizontally and vertically, and for clay ducts a thin layer of mortar should be placed between each tier. For fiber ducts, combs which will separate the ducts the proper distance should be used, only one tier being laid at a time. The sections of multiple clay duct should be secured in alignment by means of at least two dowel pins and the joints wrapped with strips of wet burlap or coarse muslin, plastered over with about ½-in. thickness of cement. The burlap or muslin strips should be not less than 9 in. wide and should overlap at the top by from 3 in. to 5 in.

As duct sections are laid a mandrel of ¼ in. less diameter than that of the duct should be pulled through them. This will give immediate indication of imperfect duct structure or misalignment and will smooth over any concrete which may ooze through at joints. The trench from one manhole to another should not be filled in until the ducts in this section have been completely laid and tested.

Although numerous arrangements have been proposed and are in use in providing concrete protection for ducts, it is thought that in these days of increasingly heavy traffic the factor of safety has in some instances been too low. In Fig. 1 are indicated various recommended duct structures. It will be noted that all of these structures have a complete concrete envelope.

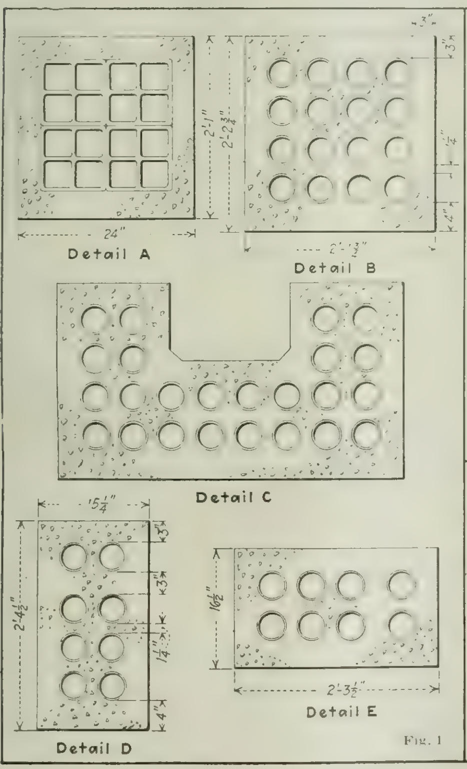
It has been often noticed in plans covering underground distributing systems that duct sections are shown as narrow as 10 in. Where the soil conditions permit it is desirable from all standpoints to have the earth sides of the trench act as the concrete form, in which case such narrow duct sections are impossible, if they are to be laid to any depth. Detail D in Fig. 1 indicates a duct section 15¼ in. wide and 28½ in. deep. If we assume that a duct line of this section is to be placed, with top of structure 30 in. below grade, it will require a trench almost 5 ft. deep and only 15¼ in. wide. The designer of such a trench fails to take into consideration the fact that men have to get down into the trench to lay the duct and that he has made this impracticable. Where the number of ducts is as indicated in this section the arrangement should be as shown by detail E, which requires a trench of sufficient width to permit efficient working and of less depth. It is therefore considerably cheaper to install.

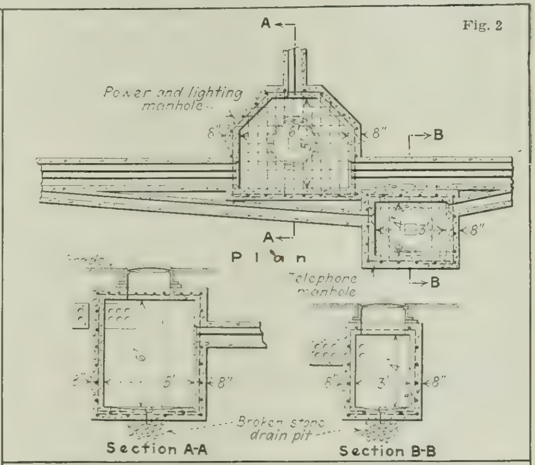
Arrangement for Large Number of Ducts.—Detail C in Fig. 1 shows a proposed arrangement for a large number of ducts. With the usual formation the center and top ducts are subjected to the heat from cables in lower and adjacent ducts, and the carrying capacity of cables in these ducts is thereby greatly reduced. The formation shown provides greater radiating surface and is recommended for consideration for that reason. In other cases where a large number of ducts are required it is found to be of sufficient advantage to separate the conduits into two parallel lines with separate concrete envelopes and in this manner to obtain the necessary radiating surface.

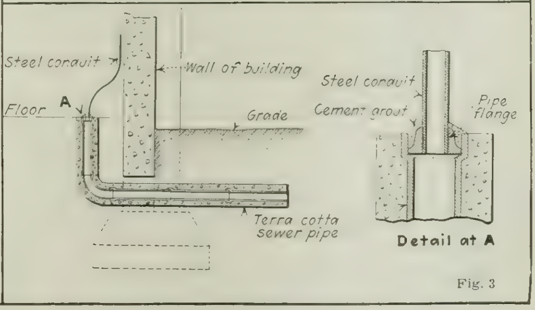
PRACTICE AT CROSSINGS

In crossing under street railways the top of the conduit structure should never be less than 24 in. below the bottom of the ties, and it is quite frequently found necessary to use reinforcement in the concrete envelope. In the case of steam railroads the depth should be not less than 48 in. Where it is impossible to obtain these depths, steel conduits should be used, but they should be avoided as far as possible because of their shorter life. The life of steel conduits may be considerably lengthened by galvanizing or coating with hot tar and embedding in concrete.

Duct Bore.—It has not been found economical to install main ducts of a smaller diameter than 3 in., and ducts as large as 4 in. inside diameter are coming more and more into favor among the larger duct-using companies. The additional cost of the larger ducts is very slight and may be represented as the difference in cost of the duct material alone.







FIGS. 1, 2 AND 3—DUCT-LINE, MANHOLE AND SINGLE-DUCT ENTRANCE CONSTRUCTION DETAILS

1—Formation, separation and protection of circuits. 2—Manhole arrangement for mixed telephone and light-power system. 3—Single-duct entrance to building using standard clay sewer pipe; steel conduit grouted into opening at floor level.

Trench-Digging Machines.—For the installation of a system involving any great amount of work the digging of trenches is now done with a special power-operated trenching machine. Most of these machines are adjustable as to the width of trench they will excavate, but the operation is considerably simplified if the duct sections are arranged with widths as uniform as practicable.

Split Ducts for Repair Work.—In making repairs to existing duct work where cables are already installed it becomes necessary to replace broken or defective ducts. For this work split-duct sections may be used so as to obviate the necessity for withdrawing cables which may be in service. Up to a short while ago it was the practice to split the duct on the job. Ducts are now obtainable in split sections, which simplifies this class of work to a considerable extent.

Manhole for Mixed System.—Fig. 2 shows typical manhole details for a combined underground system for lighting and power and for telephone or signals, with separate manholes for the telephone or signal system, but with a common trench for the duct line. Manholes are usually constructed either of brick or concrete.

Brick Versus Concrete Manholes

In congested districts and at points where obstructions exist it is often found advisable to build manholes of brick. In excavating for brick manholes a clear space of not less than 4 in. should be provided beyond the outside walls. Brick walls for manholes should never be less than 8 in. thick, and they should be not less than 12 in. thick when the floor of manhole is more than 8 ft. below grade. A good grade of hard-burned brick should be used and wetted thoroughly before laying. Every fifth course should be bonded with headers and the brick laid up approximately nine courses in 2 ft.

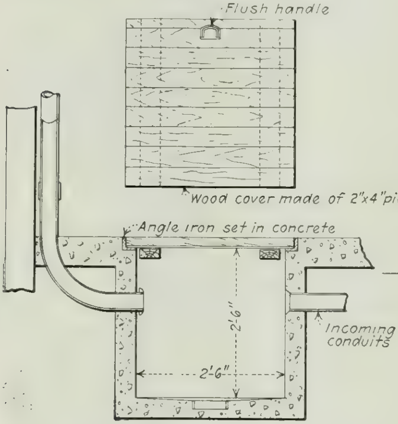


Fig. 4

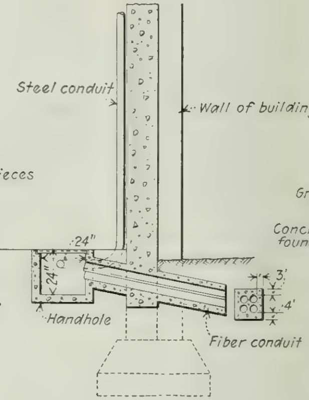


Fig. 5

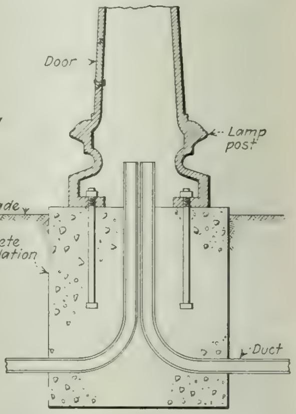


Fig. 6

FIGS. 4, 5 AND 6—HAND-HOLE FOR INTERIOR WORK, MULTIPLE-DUCT ENTRANCE AND STREET-LAMP CONDUIT CONSTRUCTION

Concrete Manholes.—Concrete manhole walls should never be less than 6 in. thick, and they should be not less than 8 in., unless suitably reinforced, where the floor depth below grade exceeds 8 ft. or the length of the manhole, inside, exceeds 9 ft. Forms for concrete manholes should be securely braced in position before pouring concrete. Forms should be cleaned and wetted just before pouring and the concrete placed evenly all around, rammed and puddled as it is being poured. This insures a more dense and therefore stronger structure and provides smoother walls. Forms should be left in place, after pouring is completed, for at least seven days, although the top frame may be placed and the refilling or paving done within twenty-four hours. Manhole roofs should always be reinforced.

Manhole Frames and Covers.—The manhole cover frame should be placed on a brick collar in order to provide an even bearing surface for it. Cover frames are usually of cast iron and are warped to a greater or less degree. The brick collar provides a ready means of raising the manhole frame and cover in case the grade of the street of roadway is raised—it being a comparatively simple matter to provide one or more additional courses to the brick collar. In the case of an installation where there is a future prospect of the surface grade being lowered it would be wise to provide a brick collar of several courses, which may be readily reduced in height when the actual grading takes place. In order to facilitate the pulling of cables, manhole openings should be centered with respect to the main line of ducts and eyebolts provided in the walls of manholes.

Manhole Shape and Capacity.—Some authorities have advocated building manholes of oval shape or with rounded corners to provide better for racking cables within them. This shape of manhole does not work out to the best advantages where transformers, oil switches or other equipment are to be provided, so that the shape of the manhole should be determined by the conditions under which it may possibly be used in service.

The capacity of a manhole or vault for transformer installation is not determined alone by the floor space or head room which may be available, but principally by the heat losses of the transformer and the radiating surface of the side walls and roof of the vault. For transformer capacities up to 200 kw. an allowance of 3½ cu.ft. of vault space for each kilowatt has been found to be good practice.

Manholes Should Be Waterproof

Wherever possible manholes should be drained to a sewer system. Where this is not practicable and the manhole floor is below mean-high-water level the walls and floor should be waterproofed. Broken stone or sand pits are sometimes found satisfactory for draining manholes. A typical broken-stone drain is shown in Fig. 2. There are in use today several methods of waterproofing the walls and floor of concrete manholes, and this question is a topic of more or less discussion and difference of opinion. The methods to be used are as follows:

(a) By combining with the cement a weight of hydrate of lime equal to 10 per cent of the weight of the cement used.

(b) By coating the outside walls of the manhole with hot tar and laying the floor on tarred felt.

(c) By building sheets of tarred felt within the concrete structure.

The first method would be effective were it not for the fact that the concrete walls almost invariably crack, thereby permitting water to seep in from the outside. The second method depends upon the thoroughness with which the tar is applied and has in practice been found to become ineffective after several years. This method has the disadvantage of requiring the excavation to be sufficiently large to permit application of the tar on all four sides, and therefore, in addition to the large excavation, it requires an outside form. The third method, which is considered the most reliable, is, as is usually the case, the most expensive in that it requires two forming operations for each manhole. In the case of an 8-in. wall the first form is set to provide a wall approximately 3 in. thick. When this wall becomes hardened the form is removed and the tarred-felt sheets applied to all walls and the floor. Another form is then set to build the remaining wall and floor thicknesses.

Hand-Holes.—Pull-holes or hand-holes are essential to most systems of underground distribution. They are used where a pulling point is necessary or a tap is to be made and where a subway structure as large as a manhole is not required. Fig. 5 indicates a hand-hole at the entrance of multiple duct into a building. Fig. 3 shows how sewer pipe is generally used for single-duct entrance into a building. Fig. 4 represents a hand-hole proposed for use in connection with an underground system within a large shop building. It is considered that for the large distributing system hand-holes should not be too small, and it is recommended that where a regular size manhole is not required a smaller manhole such as is shown in Fig. 2 be provided. This will permit keeping the ducts at the proper depth.

Conduits at Street Lamp Post.—Fig. 6 shows a method of terminating conduits at lamp posts for street-lighting systems. With this arrangement, if the posts be not spaced too far apart, it is practicable to pull the cable directly from one post to the next, thus eliminating the necessity for pull-holes. The splices between cables and the post wires are made in the base of the lamp post.

Pulverized-Coal Systems in America

SYSTEMS for burning pulverized coal and experience therewith are both considered extensively in the revised edition of the (English) Fuel Research Board's Special Report No. 1 on "Pulverized Coal Systems in America." Among the subjects covered are operating conditions with pulverized fuel, notes on range of fuels suitable, cost of installation and cost of powdered coal, standard mill-house practice and tabulated answers given on questionnaire sheets sent to American users of pulverized coal, transportation of coal dust to burners, notes on pulverized coal storage and spontaneous combustion, feeders, mixers and burners, applications, opinions of users, working results, etc. The conclusions of the board are stated, and five appendices are included as follows: (1) Systems investigated in 1918 and new systems, (2) installations visited by the author in 1918, (3) pulverized-fuel users, (4) difficulties in the use of pulverized coal, and (5) bibliography.

Although this report was conducted by the Department of Scientific and Industrial Research, copies are obtainable from H. M. Stationery Office, Imperial House, Kingsway, London, W.C. 2.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Strength of Poles Determined by Their Taper

To the Editors of the Electrical World:

The writer noted with interest your editorial of June 10 regarding the relative importance of ground-line and top diameters of wooden poles. During some experiments* conducted by the writer at the Massachusetts Institute of Technology to determine the strength of telephone poles more than twenty full-sized poles were actually set in the ground and broken. In view of the data obtained from these experiments it is questioned whether it would not be more correct to state that the strength of a telephone pole is determined by its taper. The maximum stress on a pole of a given taper comes at a definite distance below the top irrespective of its length, provided this point of a maximum stress is at or above the ground line. If the taper is great enough, as in the case of most cedar poles, this point may be a considerable number of feet above the ground line, and the strength of the pole is proportionate to its top diameter. If the taper is small enough, this point of maximum stress may be at the ground line or below, and the strength of that pole is proportionate to the ground-line diameter.

LAURENCE S. WINCHESTER.

19 Milk Street, Boston, Mass.

Why a Lighting Code May Be Opposed

To the Editors of the Electrical World:

The editorial in the Aug. 12 issue of the *Electrical World* entitled "Unreasonable Opposition to Lighting Codes" appears likely to create a wrong impression of the reasons underlying the opposition to the Massachusetts Lighting Code originally proposed, to which the editorial obviously refers.

The majority of the opposition—in fact, all the specific opposition—came from electrical engineers of the industrial plants, men who are constantly in touch with practical illumination problems and who are bound by the ethics of their profession not to lend their support to an unworthy cause. Objections were not made on the ground of increased operating expenses, but from the standpoint of the great investment required if the code be literally interpreted.

The 15-degree cut-off from the horizontal provision of the proposed code for general lighting reflectors permitted only the use of one specific reflector of the drawn-steel type, namely the "RLM," which leaves much to be desired in the uniform distribution of light in the horizontal plane, especially with bowl-enameled lamps. Because of the fact that this "RLM" reflector is a comparatively recent development comparatively few of them exist in manufacturing plants today. A little development on the part of the reflector manufacturers should render this type obsolete.

Unfortunately, the only reflectors giving good light distribution are made of glass, which, reasonably, would not be considered suitable in many locations.

The 30-degree cut-off requirement for local lighting

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*See *Electrical World*, March 16, 1911, page 667.

reflectors required the replacement of the cheap cone-shaped reflectors with 25-watt lamps, which are generally used below the level of the eye and often placed so they can be fixed in any position at the option of the workmen. If an illuminating engineer is willing to admit he can sometimes be wrong, it is generally possible where serious objection to general lighting is made to get the workmen's point of view in wanting his own little lamp.

Any reasonable interpretation of the uniform lighting requirements of the originally proposed code would have required a high intensity of general illumination in spite of the fact that local lights might have to be increased in size to overpower the general illumination.

It is the writer's experience that manufacturers are willing to spend money for lighting reflectors if they have any reasonable assurance that such expenditure will be of benefit to their employees. Such benefit would be sure to be reflected in increased production. Illumination, like medicine, is an abstract science, and the practice of either cannot be specifically covered by law.

Simonds Manufacturing Company,
Fitchburg, Mass.

R. G. CUSHING,
Electrical Engineer.

A Patent Index Freak

To the Editors of the Electrical World:

This is to call your attention to a freak in indexing found in the "Annual Indexes of Patents," published by the United States Patent Office. In each volume at least as far back as 1913 a curious non-alphabetical sequence has been adopted, as follows: "Driers," "dry battery," "drying process," "drill," "drum," "dumping."

Any one interested in dry batteries, for instance would naturally search for such entries between "drum" and "dumping," but would find nothing.

New York City.

A. LAW VOGE.

Discussions at Conventions

To the Editors of the Electrical World:

I am interested in the editorial in the issue of the *Electrical World* for Aug. 12 under the caption "How Can Convention Discussions Be Stimulated?" This is a problem that the National Electric Light Association has considered for a long time past, and I believe that the present administration is in accord with the suggestion that efforts be made to create proper and constructive discussion at conventions and other meetings.

In my opinion the greatest aid to those in attendance at conventions and other group meetings is the interchange of ideas and knowledge on the different problems under consideration, and I think it is a fact that too often those with intimate and accurate knowledge on various subjects are apt to "hide their light under a bushel" and not impart their information by entering discussion on the floor of the convention. This attitude, I think, is not due to any selfish motive or to any lack of desire to impart the information, but in some cases to reticence or mistaken modesty and in other cases to the lack of opportunity for such discussion because of the limited time sometimes given to consideration of important subjects.

I think your editorial is timely and that much can be done for the good of the industry to improve this condition. The subject is one now under consideration by the N. E. L. A.

FRANK W. SMITH,
President.

National Electric Light Association,
New York City.

Property Investment Versus Power Factor for Demand Billing

To the Editors of the Electrical World:

In the Aug. 12 issue of the *Electrical World* Prof. L. H. Rittenhouse of Haverford College objects to one of the conclusions drawn by the writers in their joint paper on "Kva. Basis Favored for Demand Billing," which appeared in the May 6 issue of the *Electrical World.*

The professor shows where the difference between the "property-investment" method and the "power-factor" method for computation of billing demand *may* be of much smaller magnitude than 23 per cent if the proper standard power factor is selected. This is true indeed, and, as Professor Rittenhouse shows, it may be made as low as 2 per cent when a standard power factor of 95 per cent is used in the same problem. By working the problem backward we can find that 93.4376 per cent gives exactly the same result as the property-investment method which is by definition the correct method to use for demand billing.

Professor Rittenhouse points out that "in obtaining the billing demand for the 'property-investment' method they [the writers] boost the units to be billed to 4,550 by the simple expedient of: 2,800 × 100 ÷ 61 = 4,550." The professor states further: "Naturally a larger bill will result, but it is not due to the application of the 'property-investment' method, but rather to the use of a 100 per cent standard power factor in place of the 75 per cent."

The professor uses the same billing problem and a 95 per cent standard power factor and gets a higher demand bill than the writers get with what their critic terms the simple expedient of using 100 per cent standard power factor; thus 2,800 × 100 ÷ 61 is less than 2,800 × 95 ÷ 61, which of course is untrue. The mathematics in both problems is equally precise, and therefore Professor Rittenhouse proves by his own example that he is wrong in the statement that he has made.

The example which the writers used was an actual case of billing, using the metered quantities and the rates in vogue. The professor will no doubt agree that in the specific case cited the return on 23 per cent of the investment serving the customer was lost. This example was used because many utilities have identical power-factor clauses incorporated in their rates for electric service.

That which Professor Rittenhouse terms as a gain in his conclusions is really an error. We must bear in mind that the loss in demand revenue is not a loss sustained by the utilities alone. The loss is an economic loss sustained by the utilities and the customers served. Most of the loss, however, is sustained by the customers. Public utility commissions fix the rate on the "cost of service" theory and allow a fair return on the investment.

Public utilities commissions do not allow discriminatory rates, and yet rates which have power-factor clauses not based on property investment are discriminatory in that they do not afford proper distribution of the demand charges.

The writers are indebted to Professor Rittenhouse for his discussion of the paper and wish to thank him for his courteous criticisms.

J. E. DORAN,
R. C. FRYER,
J. B. HODTUM.

Union Gas & Electric Company,
Cincinnati, Ohio

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Production Expenses at Connors Creek

THE total production expense of the Connors Creek power station per kilowatt-hour of output for the twelve months ended June 30, 1922, has shown a decided decrease over the figure for the year ended Dec. 31, 1921, according to figures that are again available through the courtesy of Alex Dow, president and general manager of the Detroit Edison Company. Another notable change since the *Electrical World* last printed these figures (see issue for April 1, 1922, page 635) is the further increase in plant economy, the B.t.u. per kilowatt-hour being the lowest since the data have been printed in these columns. The figure—19,700 B.t.u. per pound of coal, a decrease of 6.7 per cent from the former low figure of 20,040 B.t.u. per pound of coal for the year ended June 30, 1917—is truly a remarkable one and is a credit to the operating force.

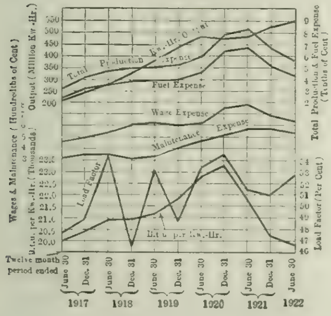

FIG. 1 — TENDENCIES IN PRODUCTION EXPENSES, ECONOMY AND LOAD FACTOR

In regard to the results in the past year Mr. Dow says:

"You will note that the coal per kilowatt-hour and the B.t.u. per kilowatt-hour are both down to a creditable figure, whch should be interpreted to signify that the coal supply during the twelve months has been satisfactory and that the boiler-room efficiency, as well as the turbine efficiency, is back to the pre-war standard—indeed, it appears to be a little better.

"Present disturbed conditions of coal supply, if they continue for any length of time, will spoil the showing of the next twelve months, although so far, because of the use since April inclusive of a large proportion of reserve coal, the disturbance of heat economy has not been very great. Costs, of course, will be increased by the present high prices of such coal as is purchasable. As the Connors Creek station has no economizers, they may have to be installed if prices stay up."

During the past twelve months both the average load and the yearly output have increased more than 5 per cent, the maximum demand increasing a little less than 2 per cent. While the peak period for operating and maintenance expenses per kilowatt-hour was in the year ended June, 1921, which showed an increase of 153 per cent over the figures for June, 1917, this year's figures are only about 75 per cent greater. Maintenance of steam equipment is still at a high level, but this is due largely to the undertaking of maintenance which was deferred previously because of high prices.

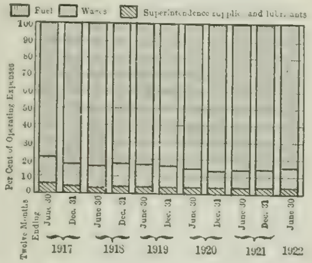

FIG. 2—RELATION BETWEEN FUEL, WAGES AND SUPERINTENDENCE

To afford a comparison of produc-

COMPARISON OF PRODUCTION EXPENSES PER KILOWATT-HOUR OF OUTPUT FOR CONNORS CREEK POWER HOUSE OF DETROIT EDISON COMPANY

	Twelve-Month Periods Ending										
	1917		1918		1919		1920		1921		1922
	June 30	Dec. 31	June 30	Dec. 31	June 30	Dec. 31	June 30	Dec. 31	June 30	Dec. 31	June 30
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
OPERATION:											
Superintendence	0.010	0.010	0.009	0.009	0.010	0.010	0.010	0.012	0.015	0.014	0.013
Wages	0.047	0.050	0.055	0.061	0.062	0.060	0.062	0.076	0.079	0.069	0.065
Fuel	0.240	0.325	0.368	0.382	0.394	0.407	0.471	0.652	0.682	0.532	0.438
Water											
Lubricants	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.002	0.002	0.002	0.001
Station supplies and expense	0.005	0.005	0.006	0.009	0.010	0.007	0.011	0.012	0.010	0.010	0.010
Total	0.303	0.391	0.439	0.462	0.478	0.486	0.555	0.754	0.788	0.627	0.527
MAINTENANCE:											
Station buildings	0.011	0.010	0.008	0.007	0.008	0.011	0.010	0.011	0.012	0.011	0.012
Steam equipment	0.019	0.024	0.025	0.023	0.024	0.029	0.036	0.038	0.043	0.045	0.041
Electrical equipment	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.003	0.003	0.002	0.002
Total	0.031	0.035	0.035	0.031	0.033	0.041	0.047	0.052	0.058	0.058	0.055
Total production expense	0.334	0.426	0.474	0.493	0.511	0.527	0.602	0.806	0.846	0.685	0.582
Output in kw.-hr	210,039,700	249,192,200	280,814,700	327,020,500	383,252,000	445,535,500	488,060,600	479,425,900	485,189,500	527,121,200	555,896,300
Maximum demand in kw. (30-minute)	50,000	58,000	59,000	80,000	82,000	104,000	104,000	100,000	107,500	118,000	120,000
Average load (kw.)	23,900	28,400	32,100	37,300	43,700	50,800	55,600	54,600	55,300	60,200	63,500
Load factor	0.478	0.489	0.544	0.466	0.533	0.488	0.534	0.546	0.515	0.510	0.529
Coal per kw.-hr. (lb.)	1.52	1.61	1.63	1.63	1.67	1.73	1.83	1.92	1.78	1.62	1.55
B.t.u. per kw.-hr.	20,040	20,470	20,930	20,900	21,200	21,800	22,800	23,300	21,800	20,250	19,700

tion expenses since 1917 the accompanying table is given. Fluctuations of the various items in the table and the present trend are given in Figs. 1 and 2. Production expenses, kilowatt-hour output, load factor and B.t.u. per kilowatt-hour are shown in Fig. 1, while the relation between fuel, wages and superintendence, etc., is given in Fig. 2.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Oil and Coal Mixture for Emergency Fuel

As an emergency fuel a mixture of fuel oil with fine coal in as large proportions as the coal will absorb and hold is suggested by the United States Bureau of Mines to steam coal users to augment their fuel supply during the present shortage. While under conditions of normal fuel supply such a mixture probably would not prove satisfactory unless it involved a cleaning feature, in places where fuel oil is available it can be used to piece out a poor coal supply without the changes in equipment necessary to convert boilers to oil burning.

The finer the size of coal used in this mixture, the larger is the amount of oil which will be held. Slack coal that has a high percentage through an eight-mesh screen or which may be crushed to sizes of ⅛ in. or less will take up in oil from 30 per cent to 40 per cent of its own weight and make a fuel high in calorific value. Coarse slack coal, however, will absorb oil to only 3 per cent to 10 per cent of its own weight, which would give a fuel having 4 per cent to 15 per cent increased heating value. Tests made by the bureau at its Pittsburgh experiment station indicate that the mixture can be made with either bituminous slack or anthracite culm. Anthracite culm or dust which will sift through ordinary grate bars can be used successfully when mixed with the oil, as the oil causes it to adhere and the oil residue cokes as soon as heated.

Chain grates and certain other automatic stokers are usually well adapted to handle the oil-fuel mixture if the bin and feeding devices are suitable. The mixture will not fire spontaneously, but care should be exercised to ventilate bins where external heat may tend to drive off lighter gases, although most of the fuel oil which is on the market has had the lighter oils distilled from it. In using oil-coal mixtures the fire will smoke badly after firing or while breaking up the coke bed from time to time. The amount of testing that has been done in this work shows that careful firing is required to prevent continuous smoking. Experimenting must be done in each case to determine the best method of firing.

The method of mixing oil and coal bears a relationship to the Trent process of purifying coal by fine grinding and amalgamation with oil, now in operation at a plant at Alexandria, Va. This plant has demonstrated the success of a combination of oil and coal for steam making, gas manufacturing and other fuel purposes. The present emergency proposal does not contemplate the cleaning process, but involves merely the simple mixing by shovel or concrete mixer. The Trent Corporation has volunteered to assist in advising in the use or application of oil-coal mixtures and to waive during this emergency any claim of infringement of its process which may or may not be involved, without reference to cleaning.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Supplying and Metering Primary Power

IN MAKING all installations for primary-power customers the Depew & Lancaster (N. Y.) Light, Power & Conduit Company follows one standard type of construction. This reduces the time required to install the equipment and facilitates the quick checking of wiring and the making of tests. A typical design for a three-phase, 4,800-volt installation for loads of 25 kva. or larger is shown in Fig. 1. The figures in this drawing refer to the bill of material given in table form.

The pole on the left of the illustration is the receiving point of the 4,800-volt circuit upon which the fuse cut-outs are installed. The line continues to the other pole, where the lightning arresters are mounted. The line then drops from the first pole to a bus across the bottom arms as shown, and breakers are inserted in the *A* and *C* buses in front of and over the metering transformer shown at the extreme left. The metering transformer unit and customers'

BILL OF MATERIAL ACCOMPANYING DETAIL DRAWING OF 4,800-VOLT POWER INSTALLATION

Key	Quantity Required	Material	Furnished by Company	Furnished by Customer
1	2	Cedar or straight chestnut poles	1	1
2	10	Long-leaf yellow-pine cross-arms	2	8
3	60	1½-in. x 9-in. locust cross-arm pins	12	48
4	20	¼-in. x 1¼-in. x 28-in. galvanized cross-arm braces	4	16
5	20	⅜-in. x 4-in. galvanized carriage bolts	4	16
6	2	½-in. x 5-in. galvanized through bolts		2
7	20	⅝-in. x 10-in. galvanized through bolts	.	20
8	2	⅝-in. x 14-in. galvanized through bolts	1	1
9	4	⅝-in. x 16-in. galvanized through bolts		4
10	2	⅝-in. x 18-in. galvanized through bolts		2
11	2	⅝-in. x 20-in. galvanized through bolts		2
12	4	⅝-in. x 16-in. galvanized spacing bolts	2	2
13	4	⅝-in. x 20-in. galvanized spacing bolts		4
14	10	½-in. x 4½-in. galvanized fetter drive lag screws	2	8
15	1	⅝-in. x 16-in. galvanized eye bolt	1	
16	92	⅝-in. x 2-in. x 2-in. galvanized square washers	10	82
17	3 lb.	Sixpenny galvanized wire nails		3 lb.
18	52	1-in. No. 10 galvanized flat-head wood screws	6	46
19	4	4-in. No. 16 galvanized flat-head wood screws	4	
20	8	No. 1001-04 Pierce galvanized cross-arm straps		8
21	8	No. 4401-01 Pierce galvanized clamp pins		8
22	6	No. 106 Pierce galvanized house brackets		6
23	2	No. 350 Pierce galvanized secondary racks		2
24	2	2½-in x 5-in. strap hinges		2
25	1	8-in. hasp		1
26	2	Padlocks	1	1
27	9	4-in. galvanized pole steps	9	
28	20	1¼-in. galvanized pipe straps	3	17
29	16 ft.	1-in. galvanized iron pipe	8 ft.	8 ft
30	2	1-in. Shawmut ground clamps	1	1
31	1	Matthews cable clamps	1	
32	3	4,800-volt No. 106,918 G.E. 100-amp. cut-outs	3	
33	. .	4,800-volt G.E. lightning arresters	.	
34	31 ft.	Wood-ground wire molding	4 ft.	27 ft.
35	30	No. 44 Locke blue-white primary insulators	6	24
36	16	No. 44 Locke green secondary insulators	.	16
37	8	No. 355 Pierce rack insulators	.	8
38	2	Single wire porcelain cleats	2	. .
39	2	Style No. 121,730 Westinghouse wood strain insulators	2	.
40	1	Concrete base	. .	1
41	.	Power transformers		. .
42	1	Packard polyphase metering transformer	1	. .
43	.	T.B.W.P. stranded primary wire	.	. .
44	.	T.B.W.P. stranded secondary wire	. .	
45		Five-wire metering cable		
46	30 ft.	No. 4 T.B.W.P. solid wire, arrester ground		30 ft.
47	10 ft.	No. 4 T.B.W.P. solid wire, transformer ground	10 ft.	.
48	4	2-in. x 4-in. x 18-ft. common rough lumber	.	4
49	4	2-in. x 4-in. x 10-ft. common rough lumber		4
50	60	¾-in. x 12-in. x 7-ft. common rough lumber	. .	60
51	2	2-in. x 4-in. x 3-ft. common rough lumber	. .	2
52	1	2-in. x 4-in. x 5-ft. common rough lumber	. .	1
53	6	6-in. diameter x 10-ft. fence posts, butt-treated	. .	6

NOTE: Items that cannot be found in Fig. 1 refer to material in other detail drawings not shown.

transformers are mounted on a concrete platform between the two poles.

Inside the case of the metering unit are two 4,000/100-volt potential transformers and two current transformers with a ratio of five to five. The method of tying the current transformers into the 4,800-volt circuit is clearly shown in the diagram. To each of the five primary leads brass tags are fastened stamped with the proper phase and polarity. For the secondary connections a terminal board with five copper strips is mounted inside the case. The secondary leads from the transformers are connected to these, using a point common to potential and current, and a stud from this connection runs through the case for the ground wire, which is on the opposite pole from the arrester ground. There is also a bushing provided at one side of the tank, through which is inserted a five-wire cable that goes to the meter panel. A definite color scheme is used for these wires.

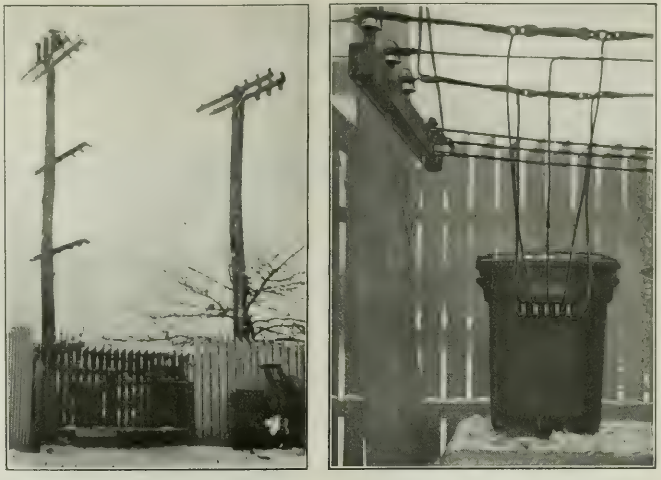

FIG. 2—ENTIRE METERING STRUCTURE DESIGNED TO BE FLEXIBLE

Instrument transformer (right) is located just to the right of the left-hand pole. The method of connecting this transformer to the primary circuit is shown in Fig. 1.

The entire structure is designed to be flexible in its arrangement. The clearances of high-tension leads from surrounding objects and the necessity of placing the metering transformer unit as near as possible to the meter are the determining factors in locating the rest of the equipment. Whenever possible, the secondary buses should be on the side nearest the building to be served.

Some of the specific instructions to be followed in an installation of this kind, and which accompany these drawings are:

(1) The concrete foundation between the poles for the transformers should be designed and set in the ground to such a depth as to carry a distributed load of 5 tons.

(2) The cover bolts of each transformer are to be grounded to each other by means of a wire bent in a figure "8," and the three transformers, together with the metering transformer, are to be connected to the ground wire, as shown in Fig. 1.

(3) The neutral wire is to be run on the extreme end of the cross-arm so that when taken to the service rack it will be the top wire.

(4) Pins should be placed in all cross-arm holes, all unused pins being sawed off, except on the top arm, to prevent the arms from decaying.

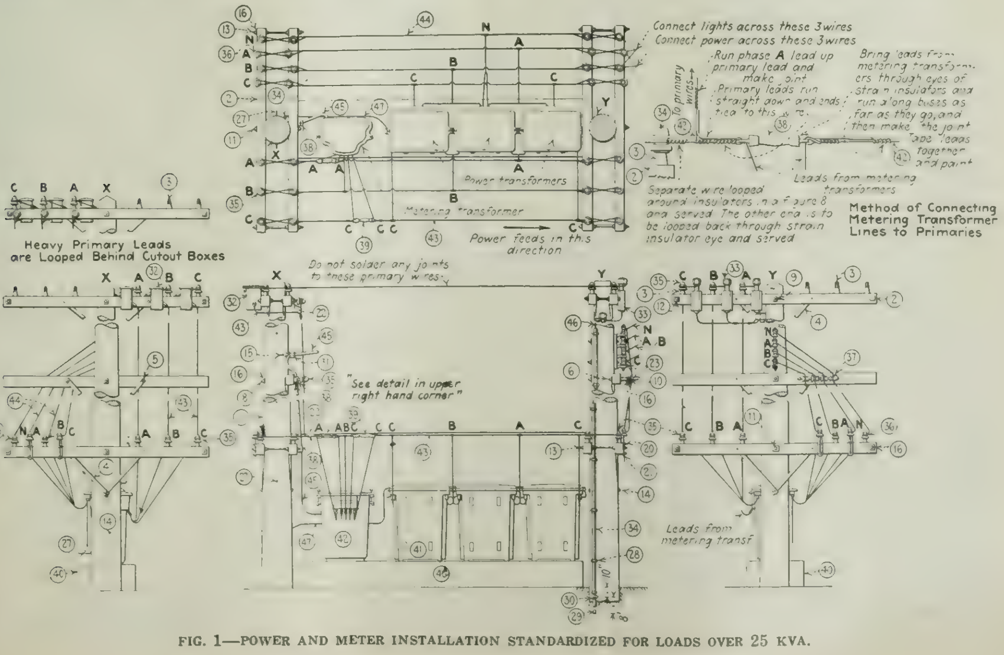
Connect lights across these 3 wires
Connect power across these 3 wires
Run phase A lead up primary lead and make joint
Primary leads run straight down and ends tied to this wire
To primary wires
Bring leads from metering transformers through eyes of strain insulators and run along buses as far as they go, and then make the joint
Tape leads together and paint
Leads from metering transformers
Separate wire looped around insulators in a figure 8 and served. The other end is to be looped back through strain insulator eye and served
Method of Connecting Metering Transformer Lines to Primaries
N
A
B
C
X
Y
Power transformers
Metering transformer
Power feeds in this direction
Heavy Primary Leads are Looped Behind Cutout Boxes
Do not solder any joints to these primary wires
"See detail in upper right hand corner"
Leads from metering transf
10"

FIG. 1—POWER AND METER INSTALLATION STANDARDIZED FOR LOADS OVER 25 KVA.

(5) Metering transformer leads must not be shortened by cutting. No splices should be made in the secondary leads between the transformers and the building. Lightning-arrester leads must not be cut, but should be spliced out to the primary. All joints are to be soldered, taped and painted.

(6) A solid board fence 7 ft. high should be built around the pole structure. It should be made in four sections and each section bolted to posts to permit the removal of any or all sides with ease. The gate should be opposite the pole that has the cut-out boxes, so that boxes may be reached at all times without danger. The gate must be kept closed and locked. The poles are to be butt-treated and set 3 ft. deep.

BURTON R. PAYNE,
Manager.
Burdick Electric Company, Inc.,
Lancaster, N. Y.

◆

Remote Control Station for Auxiliary Service

AN OUTDOOR substation has been constructed by the El Paso (Tex.) Electric Railway Company to supply a 2,300-volt power circuit at a point distant from the generating station and is planned for remote control from this generating station. At the present time the substation feeds a section of a two-phase power circuit which has been cut loose from the generating station, but it is the intention to feed this circuit from both the 13,200-volt, three-phase transmission line and the generating station two-phase bus. The station is equipped with automatic control apparatus protected against serious trouble, and control lines are strung to the generating station so that the substation switches may be operated from the main station, thus doing away with an attendant.

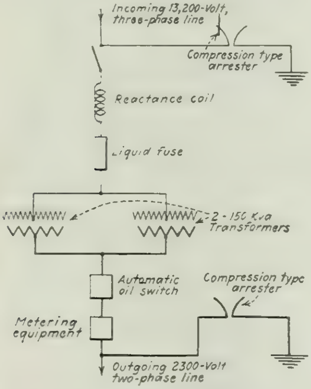
Incoming 13,200-Volt, three-phase line
Compression type arrester
Reactance coil
Liquid fuse
2 - 150 Kva Transformers
Automatic oil switch
Compression type arrester
Metering equipment
Outgoing 2300-Volt two-phase line

FIG. 1 — FLEXIBILITY OF OPERATION IS ACHIEVED BY AUTOMATIC SWITCHES

The transformers fit on a concrete floor which fills the area within the 10-ft. high fence that is shown in Fig. 2. Meters are housed within a small wooden building in one corner. The transformers are protected by means of liquid-filled fuses, and flexibility in operation is achieved by the disconnecting switches illustrated in Fig. 1. The poles used are 40 ft. high, and both the poles and the fence are protected against weathering by painting.

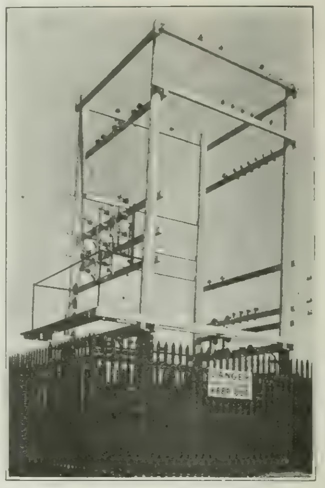

FIG. 2 — THE WIRING OF THIS STATION IS KEPT AS SIMPLE AS POSSIBLE

P. M. HATCH,
Supt. of Light and Power.
El Paso Electric Railway Company,
El Paso, Tex.

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High Turbine Vacuum by Attention to Packing

NEGLECT of the carbon packing around the shafts of turbines is one of the prime causes of low vacuum, with a consequent loss of economy. This carbon packing is installed to prevent steam and air leaks, either of which seriously affects the operating efficiency of the machine.

The first requisite of a good carbon packing is that it be fitted properly on the shaft; the second is that the carbon-packing springs be properly adjusted. When these two conditions are complied with the full benefit of the carbon packing will be obtained if close attention be given to the seal valves. When starting a steam turbine the valves on the steam lines to both the top and the bottom carbon packings should be opened sufficiently to overcome the atmospheric pressure. As soon as the machine is on the line and the first-stage pressure is above atmospheric pressure, the steam line to the top seal should be closed. The drain-line valves to the top carbon packing should be handled in such a way as to give the proper drainage. Usually about one and one-half turns of the valve is sufficient. After the machine is running it is necessary to open the steam line to the top seal if an extremely light load is carried or if the machine is motoring in order to obtain enough steam.

PACKING WORN DOWN BY EXCESS STEAM IN SEAL

The lower carbon-packing seal valve should be open at all times when the unit is running and great care must be taken to have the proper amount of steam admitted for various turbine loads, if the highest vacuum is to be maintained. About 1½ lb. steam pressure on the lower seal is usually sufficient when the carbon packing is in good condition. If the valve is opened wide, too much steam will be admitted and wasted, the carbon packing worn down, the packing springs deteriorated and their elasticity lost, the turbine shaft excessively heated, and the step-bearing oil temperature raised.

A low vacuum is often an indication that sufficient steam is not going to the seals, and on opening the seal valves a little it has been found that the vacuum has increased sometimes an inch or more. With a load of 12,000 kw. on a turbine this increase of an inch in the vacuum would mean a saving of approximately 7 per cent in the total amount of fuel used.

When the vacuum is low the first step should be to see that the seals have sufficient steam; then look for air leaks in the turbine casing and the piping to the air pump; examine the air pump to see if it is in good condition; see if the condenser is clean, if the circulating pump is up to speed, if sufficient water is being put through the condenser, or if the carbon-packing springs are rusted out, allowing the packing to fall away from the shaft and making it impossible to get a good tight seal. Any one of these conditions will cause low vacuum with resultant loss in efficiency.

W. E. THOMSON,
Steam-Plant Engineer.
Southern California Edison Company,
Los Angeles, Cal.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Income from Range and Heater Loads*

Analysis of Demand, Power Cost and Diversity Factor of Combined Electric Range and Water Heater Loads in Residential Districts

"PROFITABLENESS of range load" is a different subject from "profitableness of range and water-heater load." For the range load there is a pretty clear case. The water heater alone looks hopeless. The range and water heater combination presents a problem, but also supplies some of the means for its solution, and it is far from hopeless.

The cost of power delivered to the distribution system at the substation will average around $57 per kilowatt-year. From this point on the investment per customer and the operating cost will vary more or less with the class of service.

TRANSFORMER CAPACITIES REQUIRED

It is necessary to install 3 kw. in transformer capacity for single ranges, 5 kw. for two ranges, 7.5 kw. for four ranges and 1.5 kw. per range where more than four are connected to one transformer. In one instance a 25-kw. transformer having a connected load of fourteen ranges and ten 1-kw. water heaters showed a maximum load of 30 kw. for a period of twenty-five months and loads slightly in excess of normal for short periods each day, never exceeding twenty-five minutes.

In adding range load to the ordinary distribution system there is required an average additional investment in the distribution system of about $75 per range, making an annual investment cost of $9 per range. Distribution operating costs will average $6 per kilowatt and the commercial and general expense or customer costs will average $7.50 per customer.

Various group tests show that the average range contributes approximately 1.22 kw. to the total simultaneous demand on the distribution system. This average demand of 1.22 kw. is the result of diversity among cooking customers, but there is also a diversity between this demand and the demand of other classes of customers which we have not yet taken into account and which will further reduce the total simultaneous demand on the station.

Investigations indicate that the average range demand on the station is thus reduced from 0.6 kw. to 0.9 kw.

For the purpose of this discussion we will be conservative and assume 0.9 kw. On this basis the annual cost of service per range is:

Cost of power delivered at the substation	$51.30
Distribution investment cost	8.10
Distribution operating and maintenance	5.40
Customer costs	7.50
Total	$72.30

The average annual kilowatt-hour consumption per range is about 1,700 kw.-hr. and the cost per kw.-hr. is then 4.3 cents.

The successful development of electric cooking is dependent upon some satisfactory solution of the water-heating problem. This problem, however, is fraught with no little difficulty, for water heating in proportion to the power required is a low-value service, and moreover, the load factor is such as to leave no room for dividing the cost with any other class of service. Naturally the greatest convenience to the customer is supplied by unlimited service, but it costs more to furnish such service than it is worth to the residence customer.

MUST LIMIT WATER HEATER LOAD

Several methods have been suggested for limiting the water-heater load. None of them has been very thoroughly tried out in practice, but the most effective and seemingly most workable method yet proposed is the installation of a double-throw switch separating the range and water heater and alternating their use.

It is assumed now that a universal residence service rate is in effect, and that we are delivering power for any and all purposes in the residence through one service and measuring through one meter, thereby reducing the investment and maintenance cost of services and meters. It is also assumed that the range and water heater are required to be connected for alternate use only. What average revenue must we receive from residences using lighting, cooking and water heating in order to pay the cost of service? The total simultaneous demand based on the average customer is:

	Kw.
Lighting	0.25
Cooking	0.9
Water heating	0.5
Total	1.65

The annual cost of service is then:

Cost of power delivered at substation	$94.05
Distribution investment cost — 12 per cent of $125 × 1.65	24.75
Distribution, operating and maintenance	9.90
Customer costs	7.50
Total annual cost	$136.20

Or a total of $11.35 per month. The average kilowatt-hour consumption is:

	Annual	Monthly
Lighting	250	21
Cooking	1,700	141
Water heating (twenty hours per day)	7,200	600
Total	9,150	762

This is an average cost of 1½ cents per kilowatt-hour. Or if the water heater be connected ahead of the meter and charged at $4 per month, the lighting and cooking must pay the remaining $88.20 per year, or an average of 4.5 cents per kilowatt-hour.

The natural division of this cost based on average use is:

	Per Month	Per Kw.-Hr. Cents
Lighting and appliances	$2.25	9.00
Cooking	5.10	3.00
Water heating	4.00	0.55
Total and average	$11.35	1.5

With our present average load factors this is what it costs, but the cost per kilowatt-hour goes down nearly in proportion to the increase in the load factor, and utility companies can therefore offer very attractive inducements for increased load factor of residence business. The addition of cooking load to any ordinary central-station system will increase the total load factor, and the value of the service will guarantee an average of 3 cents per kilowatt-hour. It is, therefore, profitable business to take on, even when accompanied by that evil but necessary companion, the water heater.

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*From a paper presented at the Northwest Electric Light Association convention, Boise, Idaho, June 7 to 10, 1922.

Two golden opportunities are open, however, for increased profits: Cut down costs by adopting the one-meter universal residence service plan. Deliver more service at the same expense by increasing the customer's load factor.

Puget Sound Company Provides Summer Camp

VACATIONS without cost can now be had by the 800 employees of the Seattle division of the Puget Sound Power & Light Company, following the opening of a summer vacation camp on the shore of Lake Kirkley, Wash.

Formal transfer of this camp from the company to the employees was made on July 16 by President Alton W. Leonard and D. C. Barnes, manager of the Seattle division, to a committee of employees. This committee hereafter will have entire charge of the camp.

The idea of a summer vacation camp for all employees and their families was conceived by Norwood Brockett of the legal department of the corporation, and owing to his efforts the plan was brought to a successful culmination. The camp has been named Norwood Lodge in honor of Captain Brockett.

The main buildings consist of a combined dining hall and dormitory on two floors, with every convenience afforded, including running water, electric lights and other electric equipment, part of which is an electric laundry.

A common lodge, 30 ft. by 60 ft., has a large open fireplace, a wide porch overlooking the lake and an excellent dancing floor. In addition to the two main buildings, there is an open-air kitchen with a large hotel range and an open brick oven around which ten or fifteen can cook at the same time without inconvenience. The laundry and the washroom are directly back of the kitchen. Grouped about these buildings are a number of sleeping tents, each in a clump of trees to shade them from the heat of the sun.

ENTRANCE TO CAMP

The company provided the land and buildings with their equipment and carried on the building construction, but the employees did all of the work of preparing the ground, laying the water mains and installing the lighting and other electrical conveniences.

The establishment of this vacation camp was made possible by the thorough and enthusiastic co-operation of company officials and executive and department heads on the one hand and the employees and their committeemen on the other. It is felt that the first stage of success has been reached with the transfer of actual control to the employees, and that, with the use of a maintenance fund to be provided annually by the company, all of the plans for the development of the finest vacation camp and playground to be found anywhere may be carried out and finally realized.

VIEW OF EMPLOYEES' CAMP, SHOWING LODGE, DINING HALL AND SLEEPING TENTS

Machine Billing Improves Accounting System

ADOPTION of accounting machines and the rendering of customers' electric and gas bills on one statement by the British Columbia Electric Railway of Vancouver, B. C., have resulted in a decided reduction of errors in billing and a consequent decrease in complaints. After eighteen months' operation under machine billing E. H. Adams, comptroller of the company, believes that the new system has had a sufficient trial to permit definite results to be cited.

When the new system was put in effect three distinct changes were made in the company's billing methods, all of which were important and required special preparatory work and careful supervision to bring about successful operation.

1. It was decided, for the convenience of the customer, to render accounts for electricity and gas in one statement, showing the amount due in one total for both services. This was a difficult operation as the services are rendered by two different companies, whose accounting records must be kept separate.

2. At the same time bookkeeping machines were introduced to take the place of hand billing.

3. The use of customers' ledgers was discontinued.

ERRORS CUT DOWN

One of the principal reasons for the adoption of accounting machines, which are largely automatic in the hands of well-trained and skillful operators, was the elimination of accounting errors, which, under the hand method, were only too plentiful. Errors in customers' accounts have three direct results: They may affect the company's revenue if the error is in favor of a customer who will take advantage of it. If against the customer, it results in a complaint, which means counter-work and the maintenance of a large staff of clerks to attend to this end of the business.

In either event the correction of errors usually doubles or trebles the amount of clerical work, all of which is costly.

Before the change-over from hand methods it was not customary to check the bills back to the source, namely, the meter-book, and many bills were sent out which, owing to oversight or carelessness on the part of the staff, were incorrectly prepared, resulting in complaints. This did not tend to increase the customers' regard for the company.

Complaints received by the British Columbia Electric Railway are now only a small percentage of what they were two years ago, and the reduction is directly due to the care taken in preparing the accounts (which is partly automatic since the introduction of billing machines), and to the fact that every bill is checked and initialed before being sent out, so that in the event of an incorrect bill getting into the hands of a customer the error can be taken up with the checker concerned.

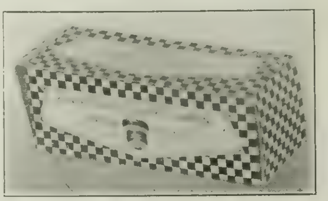
There is one other source of error which leads to complaints, and the company has taken steps to eliminate this as far as possible. It is natural that there should be cases of over-reading of the customer's meter, which may get to the checker before being discovered. It has been arranged to have checkers hold back for investigation all accounts which show an unreasonable increase in consumption over the previous month, and in this way many complaints are avoided.

In designing this system of consumers' accounting, while speed, accuracy and economy were important essentials, the greater convenience of customers and better service were the principal objectives and results indicate that these have been attained.

Selling Fuses to Customers Lessens Trouble Calls

TO MEET the problem of replacing blown fuses without necessitating a trip by a troubleman whenever a customer's lights go out, the Kansas Gas & Electric Company of Wichita has adopted a plan of selling fuses. A carton containing three fuses is sold for 20 cents. The carton, as shown in the accompanying cut, was designed in a conspicuous black and yellow checkerboard pattern to facilitate locating the box.

All of the company's troublemen carry a supply of these fuses and are allowed a commission of 5 cents on every box that they sell. When they make a trouble call to replace a fuse they almost invariably sell the idea of a standard package and thus lessen the likelihood of another call in the near future for the same kind of trouble. Such calls have so far been made gratis and the fuses were furnished free of charge, but the company feels that the use of these fuses has been made so convenient that it will shortly be able to discontinue the free service.



THIS CARTON OF THREE FUSES IS SOLD FOR 20 CENTS

The replacement of fuses by customers themselves not only materially reduces the expense of "trouble shooting," but is a great convenience to the customer in enabling him to restore his service without having to wait for the arrival of the trouble-man. Furthermore, because of the shorter period of interruption there is a greater consumption of energy by the consumer.

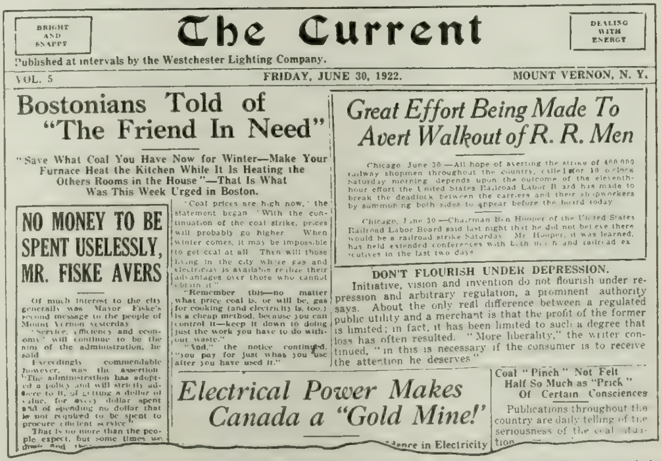
What Other Companies Are Doing

Chicago, Ill. — Customer-ownership sales of preferred stocks by companies under the management of the Standard Gas & Electric Company during the month of July resulted in 1,162 transactions, having a total par value of $780,600.

Vancouver, B. C.—This city's first "home electric" will be opened to the public for a period of three weeks beginning Sept. 1. Plans for the electrical equipment call for 197 outlets, including switches, lighting, baseboard and convenience outlets. Intercommunicating telephones and an annunciator system are being installed and there will be two outlets for radio sets. Another feature will be a master switch at the bedside in the owner's bedroom controlling four outside and nine inside lights as a burglar alarm. The operation and advertising of the home will be under the supervision of the Electrical Service League of British Columbia.

Spring Valley, Minn.—Appliances sold by the North West Utilities Company during the last week in July were four washing machines, five flatirons, three toasters, six ranges, thirty-four portable lamps and one oven. Merchandise sales and job orders of this company for July showed an increase of 100 per cent over July of last year.

A Newspaper Page Tells the Utility's Story



BRIGHT AND SNAPPY

The Current

DEALING WITH ENERGY

Published at intervals by the Westchester Lighting Company.

VOL. 5 FRIDAY, JUNE 30, 1922. MOUNT VERNON, N. Y.

Bostonians Told of "The Friend In Need"

"Save What Coal You Have Now for Winter—Make Your Furnace Heat the Kitchen While It Is Heating the Others Rooms in the House"—That Is What Was This Week Urged in Boston.

"Coal prices are high now," the statement began "With the continuation of the coal strike, prices will probably go higher When winter comes, it may be impossible to get coal at all Then will those living in the city where gas and electricity is available realize their advantages over those who cannot obtain it"

"Remember this—no matter what price coal is, or will be, gas for cooking (and electricity is, too.) is a cheap method, because you can control it—keep it down to doing just the work you have to do without waste."

"And," the notice continued, "you pay for just what you use after you have used it."

NO MONEY TO BE SPENT USELESSLY, MR. FISKE AVERS

Of much interest to the city generally was Mayor Fiske's second message to the people of Mount Vernon yesterday

"Service, efficiency and economy" will continue to be the aim of the administration, he said

Exceedingly commendable however, was the assertion "The administration has adopted a policy and will strictly adhere to it, of getting a dollar of value, for every dollar spent and of spending no dollar that is not required to be spent to procure efficient service"

That is no more than the people expect, but some times we

Great Effort Being Made To Avert Walkout of R. R. Men

Chicago June 30 —All hope of averting the strike of 400,000 railway shopmen throughout the country, called for 10 o'clock Saturday morning depends upon the outcome of the eleventh-hour effort the United States Railroad Labor Board has made to break the deadlock between the carriers and their shopworkers by summoning both sides to appear before the board today

Chicago, June 30 —Chairman Ben Hooper of the United States Railroad Labor Board said last night that he did not believe there would be a railroad strike Saturday Mr Hooper, it was learned, has held extended conferences with both men and railroad executives in the last two days

DON'T FLOURISH UNDER DEPRESSION.

Initiative, vision and invention do not flourish under repression and arbitrary regulation, a prominent authority says. About the only real difference between a regulated public utility and a merchant is that the profit of the former is limited; in fact, it has been limited to such a degree that loss has often resulted. "More liberality," the writer continued, "in this is necessary if the consumer is to receive the attention he deserves"

Electrical Power Makes Canada a "Gold Mine!"

dence in Electricity

Coal "Pinch" Not Felt Half So Much as "Prick" Of Certain Consciences

Publications throughout the country are daily telling of the seriousness of the coal situation

The above illustration shows the effective way in which the Westchester Lightng Company of Mount Vernon, N. Y., is familiarizing the public with the utility business. From time to time the company uses a half page of space made up to have the appearance of a daily newspaper page under the name of "The Current," and in this space matters of public interest regarding the utilities are discussed. The company has found this to be a very satisfactory means of getting its story across to the public without material increase in the cost of its newspaper advertising.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Electricity Supply in Birmingham, England.—Work is just being completed on the new Nechells generating station, which has a present capacity of 30,000 kw. and an ultimate capacity of 105,000 kw. An interesting feature of this plant is the condensing-water system. This water is taken from filter beds from which approximately 3,000,000 gal. per day of filtered sewage water can be obtained for the cooling towers. A description is given of the control room, coal and ash handling systems, cooling towers and circulating-water systems, boiler and engine rooms, step-up transformers and switching arrangements. — *Electrician*, June 23, 1922.

Developments in Power-Station Design.—Generator cooling by washing air from outside and by the entirely closed circuit method are taken up in this article. A short description is also given of the switch gear in large central stations.—*Engineer*, June 2, 1922.

Burning Bituminous Coal on Stokers.—The importance of keeping a bituminous-coal fire agitated and the dangers of using a low-fusing ash are pointed out. Typical stoker installations are described with the best methods for operating them.—*Mechanical Engineering*, June, 1922.

Power-Plant Engineering.— W. G. Diman.—A survey of apparatus and requirements for central-station practice is made. The burning of various coals and the question of combustion is taken up, and an idea of what may be expected in various installations is outlined.—*National Engineer*, June, 1922.

Generation, Control and Switching

New Developments in Electrical Apparatus.—D. Vogelsang.—The author describes a new line of time-controlled and current-controlled switch relays, a 400,000-volt testing transformer set and a 110,000-volt oil switch. The latter two are of special interest. Based upon the Dessauer principle, one single-phase transformer of 200,000 volts and two single-phase transformers of 100,000 volts each are arranged in series, with their low-voltage windings excited from two insulating transformers, resulting in a total potential of 400 kv. against ground. Such a series connection of testing transformers somewhat simplifies the necessary insulation of the individual transformer windings against core and ground and guarantees at least a partial testing voltage in case of a breakdown of one of the transformers. The 110,000-volt, three-phase oil switch is designed for the unusually high flashover voltage of 300,000, a normal operating current of 150 amp. and a rupturing capacity of 150,000 kva. A bushing transformer is built into each one of the high-voltage leads to operate ammeters and the automatic release. Six breaks are provided for each phase, and the contacts are so dimensioned that two of them are longer than the four others. The two longer contacts are connected with a resistor, so that in closing the switch resistance is inserted. This prevents a dangerous rush of current at the instant of closing.—*Elektrotechnik und Maschinenbau*, May 28, 1922.

Turbines at the Hell Gate Station.—The turbine room of this new plant of the United Electric Light & Power Company, New York, contains four main units and two house turbines. These are divided into two groups, each consisting of one 40,000-kw. tandem-compound turbo-generator, one 35,000-kw., 25-cycle single-cylinder turbine generator and one 2,000-kw., 60-cycle house turbine. The 25-cycle main units generate at 11,400 volts and the 60-cycle units at 13,200 volts, the house turbines feeding the auxiliary bus at 2,300 volts. The article describes the main units only.—*Power*, Aug. 8, 1922.

Transmission, Substations and Distribution

Economic Factors Which Determine Power Expenditures.—L. J. Moore.—The engineer must determine whether the investment planned will pay interest on the money expended through a saving in expense or additional revenue before he recommends new power construction work. A few examples based on actual practice are given to show the working out of economic principles.—*Journal of Electricity and Western Industry*, Aug. 1, 1922.

Transmission at 220,000 *Volts.*—R. J C. Wood.—A very complete account of the investigation and research carried on by the Southern California Edison Company to determine whether to increase its transmission voltage to 220,000 or to duplicate its lines in order to meet the increasing demand for electric power. One of the most important features of the research was the equipping of 27 miles of line with additional insulators and shield rings to carry out field tests. This line was energized to 280,000 volts for one month and to 241,000 volts for about five months. Considerable care was taken to obtain reliable measurements of voltage, current and corona losses. The results lead to a firm believe that nothing extraordinary will happen with 220,000-volt transmission. No pressing need of new insulator designs seems to exist. The investigation covered insulation tests, field tests, corona losses, charging currents, residual current to ground, air-break switches, tower design and protective devices.—*Journal of the A. I. E. E.*, July, 1922.

Calculating Size of Synchronous Motor for Power-Factor Correction.—Charles A. Armstrong.—The author works out problems by graphically drawing the relation of the energy component of a power load with the reactive component and shows how to draw conclusions from these diagrams of alternating-current loads. — *Power*, Aug. 8, 1922.

Units, Measurements and Instruments

Electromechanical Device for Rapid-Schedule Harmonic Analysis of Complex Waves.—F. S. Dellenbaugh, Jr.—An electric network system for the analysis of alternating-current waves is described in which long mathematical work is eliminated, though the results are practically the same. This method is compared with other methods of analysis, the advantages and disadvantages of each being pointed out.—*Publication No. 28 of Massachusetts Institute of Technology.*

Study of Electrical Insulating Papers.—Investigations carried on by the British Electrical and Allied Industries Research Association on untreated insulating papers for purposes other than the manufacture of cables. A schedule of definitions has been prepared and a series of tests developed that have proved suitable for ascertaining the properties of chief importance which these materials should possess. These tests have not been devised as purchasing or acceptance tests, but are for furnishing a basis for the development of such tests. The processes of treatment of the papers during manufacture, such as bleaching, coloring, staining, glazing, etc., are stated. The tests recommended are determination of thickness and density, tensile strength and extension, aging, tearing strength, porosity, chemical tests for determining moisture loss on drying at 100 deg. C., acidity and alkalinity tests, chemical tests for detecting metallic particles, flash tests and crinkling under tension.—*Journal of Institution of (British) Electrical Engineers*, June, 1922.

Illumination

Voltage Regulation with Iron Resistors.—L. Bloch.—Owing to the great voltage variations which occur on the lines of street railways, any lamps connected to these lines will give a very fluctuating illumination. An improvement can be obtained in such cases by the use of iron resistors. A small iron wire held within a glass bulb in a hydrogen atmosphere will hold the current automatically within

10 per cent, while the voltage may vary within a range of as much as 300 per cent. The reason for this is the very pronounced temperature-resistance coefficient of iron. For example, a 0.5-amp. resistor will maintain 0.47 amp. to 0.52 amp. while the voltage rises from 30 volts to 90 volts. The author gives diagrams from which the proper type of resistor may be chosen for any particular condition. — *Elektrische Kraftbetriebe und Bahnen*, July 24, 1922.

Motors and Control

Application of Electricity in the Manufacturing Industry.—The present article—the second of a series on the subject—deals with the application of electricity to woodworking. A large number of small plants distributed all over Canada, in every city and almost every town, make up the woodworking industry of that country. The demand for power by any one plant is comparatively small, but in the total it is quite large. Individual drive is a feature in this art and makes possible many advantages. Among these are an increased output per machine due to better control, constant speed and many other features, the smaller powerhouse or transformer capacity required, the reduced operating cost, increased safety for operators gained by removing shafting and belts, and that the machine can be placed to the best advantage as regards flow of materials, etc. Several typical installations are illustrated.—*Electrical News*, June 15, 1922.

Details of Coil-Making Methods.—A. C. ROE.—In the article on making up diagrams for coil winders published in the June issue general information and data that should be available when making different kinds of coils were given. In this article additional information is presented on winding particular types of coils. This information is arranged under the names of the various coils that are used in motor windings, including mush coils, bip or flat-mush puller, concentric mush, threaded-in puller, insulated puller, mold-wound and strap-copper coils. Details of laying out, winding and insulating various kinds of coils are outlined and illustrated.—*Industrial Engineer*, July, 1922.

Heat Applications and Material Handling

Manufacture and Use of Commercially Pure Iron in Gas and Electric Welding.—C. A. MCCUNE.—The success of welding depends upon five factors which are of practically equal importance. These are the welder, including methods of welding; the design of weld, the welding equipment, the metal to be welded, and the welding wire. Dependable welding materials should be as free as possible from injurious elements. The welding wire plays an important part in the production of uniformly successful welds. A wire should be of the same general physical characteristics as the base metal, should not contain or tend to create gases, should be free from slag or slag-forming ingredients, should be uniform and should embody ease of operation.—*Journal of American Welding Society*, June, 1922.

Intra-Plant Transportation of Materials.—J. E. HOUSELY.—The details of the system used by the Aluminum Ore Company, East St. Louis, Ill., which provides for the dispatching of trucks, periodic inspection of trucks and cost analysis, are described. In this plant the trucks are at all times at the control of truck foremen, who direct their travel so that runs without load are kept to a minimum.—*Industrial Engineer*, July, 1922.

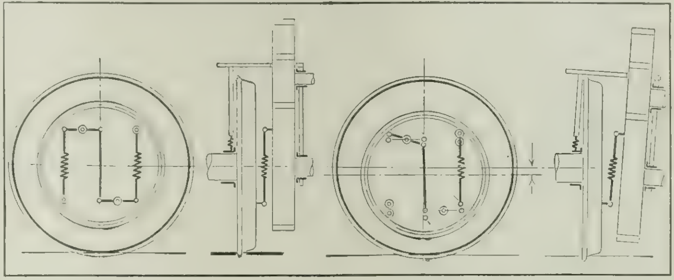
Electrophysics, Electrochemistry and Batteries

Delayed Crystallization in the Carbon Steels.—A. F. HALLIMOND.—The formation of pearlite, troostite and martensite in carbon steels was investigated. The article includes recent researches on delayed crystallization and inoculation, linear crystallization velocity and crystal habits, diffusion of heat and on the material and crystallization in ordinary carbon steels.—*Engineering*, June 16, 1922.

X-Ray Equipment of the Medical College in Würzburg.—K. LASSER and F. JANUS.—According to the totally different requirements of the three departments, three individual sets of apparatus have been installed for diagnosis, operation and therapy. The first of these sets is equipped with a high-tension transformer and a synchronous mechanical rectifier, delivering to the tube up to 120,000 volts direct current at 150 milliamperes momentarily. The second set has an induction-coil-operated tube, installed movably under a special aluminum-top operating table, to be used during operations. The third and largest apparatus consists of two forced-air-cooled high-tension transformers in series and a synchronously rotating mechanical rectifier, delivering from 3 to 5 milliamperes at 200,000 volts for very long exposures to the rays, as required by depth therapy. Modified Siemens-Coolidge Röntgen tubes are used for this purpose in specially designed protective tube holders. The complete equipment has been in use since 1920 and has given very satisfactory performance.—*Siemens Zeitschrift*, May and June, 1922.

Traction

Flexible Drive for Traction Motors. —On the three-phase railway system from Burgdorf to Thun in Switzerland a novel gear drive has been installed which is interesting on account of its great flexibility. The motor with its pinion, an intermediate gear wheel and the driving gear are mounted on the locomotive frame in rigid relation. But between the driving gear and the driven engine shaft is interposed a symmetrical system of double-acting levers and heavy springs, so arranged that a considerable displacement between the centers of the shaft and the gear may take place while a heavy side tilting of the engine frame against the vertical plane of the wheel may occur simultaneously. Such displacements occur in actual service. — *Bulletin Oerlikon*, March, 1922.


COUPLING GEAR OF TRACTION MOTORS THAT IS VERY FLEXIBLE

Telegraphy, Telephony, Radio and Signals

The Design of Loud-Speaking Receivers.—M. ADAM.—This article contains a very detailed description of a serviceable electrodynamic "loud speaker," suitable for home building by the amateur, with drawings and full data.—*Radioélectricité*, June, 1922.

Modulation in Radio Telephony.—L. C. F. HORLE.—The author reviews the various methods of oscillation that have been used in the past and points out lines of experimentation which should be followed up.—*Q. S. T.*, July, 1922.

High-Output Electrone Tubes.—A 5-kw. oscillator tube built of quartz has recently been developed. The cylindrical bulb measures 4 in. in diameter, the electrodes being arranged concentrically. A special process, the nature of which is not disclosed, has been used to insure perfect tightness of the leading-in wires. The filament current is 15 amp. at 16 volts, the plate tension 15,000 volts to 20,000 volts, and the plate can dissipate 2,500 watts, representing an antenna output of 5,000 watts. The bulb is inclosed in a perforated tube, through which a 50-watt fan forces a stream of cooling air. A life of 2,000 hours may be expected of the tube.—*Radioélectricité*, June, 1922.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

To Honor Edison on Anniversary of Electric Light

Monday next, Sept. 4, is the fortieth anniversary of the inauguration of electric lighting service, which took place in 1882 in New York City in a converted brick warehouse at 255 and 257 Pearl Street. Electrical men in that city are planning to observe the anniversary with a dinner at which Thomas A. Edison and his surviving associates of forty years ago are to be the guests of honor. The dinner will be held at the Commodore Hotel on Monday evening, Sept. 11, and will bring together the leaders of the electrical industry from all over the country.

A historical collection of early electrical apparatus is also being assembled. This collection is being gathered by the Edison Pioneers—the men who worked with Edison forty years ago—and by the Association of Edison Electric Illuminating Companies. It will be on public view at the Grand Central Palace during the Electrical and Industrial Exposition, which begins on Oct. 7. Included in the collection will be one of the "jumbo" generators from the original Pearl Street station. This is the only generator that was saved when fire partly destroyed the station in 1890.

The *Electrical World* for next week—Sept. 9—will be an anniversary issue and will cover the history of the development and progress of the electric light, heat and power industry, beginning with the Pearl Street installation.

Muscle Shoals Fight Goes On

Representative Garrett of Tennessee, acting minority leader of the House of Representatives, is still endeavoring to force consideration by that body of Henry Ford's offer for Muscle Shoals. By parliamentary tactics he prevented a proposed three-day adjournment of the House, and he hopes to bring about such a clearing of the calendar that nothing will obstruct the introduction of a resolution on the matter.

No eagerness to take up the Ford offer is shown by the majority party, and it is likely to go over to December.

President Authorizes Use of $600,000 for Wilson Dam

Funds totaling $600,000 have by authorization of President Harding become available to enable army engineers to begin construction work on the Wilson Dam at Muscle Shoals, Ala., on an extensive scale, pending use of the appropriation of $7,500,000 by Congress, which will become available on Oct. 1.

Brigadier-General Taylor, Assistant Chief of Engineers, explained that the $600,000 was part of an old appropriation of which an unexpended balance of about $900,000 remained subject to Presidential disposal. The remaining $300,000 is reserved and probably will be allowed the Agriculture Department for use in making experiments with nitrogen for fertilizer.

Power Possibilities of Upper Snake River

Confirmation of the power possibilities of the upper Snake River has been made by L. A. McArthur, general manager of the Pacific Power & Light Company of Portland, Ore., which has filed an application with the Federal Power Commission for a preliminary permit for the development of water-power sites on that river between Huntington, Ore., and Lewiston, Idaho. A report made by engineers in 1920 put the potential energy of this part of the Snake River at 900,000 hp.

Mr. McArthur journeyed on a powerful gasoline launch from Lewiston to Pittsburgh Landing, about 77 miles up the stream. This part of the river is not navigable for steamboats on account of its numerous rapids, full of whirlpools and rocks. An idea of the stream's velocity may be had from the fact that it took a day and a half to make the up trip and only four and three-quarters hours to return.

Low Water at Keokuk Hinders Stations on Mississippi

Factories at Alton, Ill., and several other Mississippi River cities served by electric power companies which depend on the development at Keokuk, Iowa, for their energy have lately been obliged to curtail their operations to some extent because of low water in the river. Even the Union Electric Light & Power Company of St. Louis, which has first call on the Keokuk output for its constant or "firm" power, has had its excess supply cut to some extent and has had to make up the deficiency by steam-generated power.

Under rulings now in force the amount of water allowed to pass through the turbines at the Keokuk Dam is limited to insure a supply for river craft. It is reported that appeals have been sent to Washington in the hope that something can be done to remedy the situation.

Permit for Entire Power on Cheat River Sought

Much significance is attached by the Federal Power Commission to the application of the West Virginia Power & Transmission Company for a preliminary permit covering a comprehensive development of the entire Cheat River in West Virginia and Pennsylvania. This is one of the three streams which were considered by the government as possible sites for the national nitrate plant which afterward was built at Muscle Shoals on the Tennessee River. The applicant for this preliminary permit is understood to be very closely allied with the West Penn Power Company, which has an extensive transmission system throughout the industrial territory tributary to Pittsburgh and Wheeling. That company is operating two large power plants at the mines which supply its fuel. It is the idea to develop all the available power on the Cheat River to interconnect with these plants in the carrying out of a superpower project.

The West Virginia Power & Transmission Company already has a permit from the War Department for a large development near the state line between Pennsylvania and West Virginia. It is now asking the Federal Power Commission for a permit to cover ten additional developments which will utilize all the fall of the Cheat River and virtually all the reservoir sites along that stream. The primary power available is estimated at 300,000 hp., but equipment capable of developing at least 500,000 hp. will be installed.

The idea of this development is the same as that of the scheme recently proposed for the Clarion River. Instead of using steam as an auxiliary to water power, the intention is to reverse this method so that the water power will be used to take the peaks off the steam load. The site is in the very heart of one of the largest coal-producing regions of the country.

Applications to Power Board

The San Gorgonia Power Company, First National Bank Building, San Francisco, has applied to the Federal Power Commission for a license to cover two diversion dams, conduits, pipe lines and power houses on the San Gorgonia River in Riverside and San Bernardino Counties, Calfornia.

The Virginia-Western Power Company, Clifton Forge, Va., has applied for a license covering an existing power project on the James River at Balsony Falls, Va.

Production of Bituminous Coal Increases

Secretary Hoover Believes that Shipments Will Meet Demands—The Interstate Commerce Commission Arranges Priorities, Putting Utilities in Class 2—Strike Situation Improves

THE general strike situation has improved to such a degree as to cause the officials at Washington to reject any plan to seize mines and railroads in the interests of public welfare. Coal production has increased, although the anthracite-coal miners and operators are still deadlocked.

On Aug. 29 Secretary Hoover of the Department of Commerce issued a statement to the effect that during the next six weeks the railroads may be called upon to move seventeen million tons of coal a week. "We believe that we shall be able to take care of the fuel needs of the country," Mr. Hoover said, adding that the test would come within the next two weeks.

The administration's optimism that coal shipments can be kept up with the new demands is apparently based upon confidence that its policy of giving priority to coal movements, even to the extent of the annulment of a large number of mail, passenger and ordinary freight trains, will achieve the desired results.

INTERSTATE COMMERCE COMMISSION ISSUES PRIORITY ORDER

Official action of far-reaching importance to the country's public utilities was taken on Aug. 29, when the Interstate Commerce Commission issued Amendment No. 4 to Service Order No. 23, which restricts Class 1 priorities on coal to such extraordinary cases as may be designated from time to time by the commission. Coal intended for emergency uses generally is included in Class 2 priority. Owing to the limited time during which lake transportation will be available, shipments of coal on the lakes may be made under Class 1 priorities. Public utilities come under Class 2, the regulation governing which is as follows:

"Class 2. For fuel for railroads and other common carriers and for bunkering ships and vessels; for public utilities which directly serve the general public, under a franchise therefor, with street and interurban railways, electric power and light, gas, water and sewer works; ice plants which directly serve the public generally with ice or supply refrigeration for human foodstuffs; hospitals; for the manufacture and production of foodstuffs and medicines, and for the manufacture of containers therefor; for the United States, state, county or municipal governments, and for their hospitals, schools and other public institutions—all to the end that the foregoing may be kept supplied with coal for current use for such purposes, but not for storage, exchange or sale; for bituminous coal consigned to a pool or pools of lake cargo or bunkerage coal at any port upon Lake Erie for trans-shipment by water to ports above Lake Erie; bituminous or anthracite coal or coke for household use and for the heating of buildings. It is not intended by this paragraph to give any priority as between the classes of persons and uses mentioned herein."

The issuance of this amendment brings the situation back to that which existed when John W. Lieb issued his first circular to the public utilities. It is expected to correct the evils arising under federal fuel distribution, which was cutting off a large number of public utilities from their regular fuel supply, leaving them in an emergency class and compelling them to buy coal at prices greatly in excess of their contracts.

GOVERNMENT PRICE CONTROL CEASES TEMPORARILY

Federal control of coal prices and of distribution of fuel by volunteer organizations stopped on Aug. 28, pending the passage of emergency legislation by Congress. Fuel Distributor Spencer issued the following statement:

"The agreement as to price restraint with the non-union operators expires today with the resumption of the union bituminous mines. About 70 per cent of the operators have held to this agreement, and it is felt that the public has been saved a very large sum.

"Pending the action of Congress and the state authorities, the only restraint upon price is the schedule of fair prices declared by governors or by state coal commissioners in some of the states, to which it is earnestly hoped the operators and dealers will conform. These prices are about $4.50 a ton maximum in the Kentucky, West Virginia, Tennessee and Virginia fields, $3.75 for Pennsylvania thick vein and $4.75 for thin vein. Standards have not yet been set in other states.

"The legislation before Congress can only control the price of coal moving over state lines, that is, in interstate commerce. The price of coal produced and consumed in a state, together with the charges which wholesalers and retailers within the state may make, the latter including even interstate coal, should be controlled by the state authorities. There can be no real control of profiteering unless the state authorities act."

Except in the upper lake sections, Mr. Spencer said no more coal would be directed to different states under emergency priority orders of Class 1 unless a situation arose which warranted such forced measures. A new plan for the fuel relief of the Northwest is in process of formation by the Interstate Commerce Commission and the Fuel Distribution Committee.

Reports reaching Washington indicate that the public utilities are getting their share of the increased volume of coal being produced, but owing to the fact that reserves have been so generally used up, the situation of a large number of utilities will continue to be serious for weeks to come, particularly since they are not allowed to build up stocks and because of the uncertainty of transportation.

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Wisconsin Commission Takes Hand in Coal Situation

The Wisconsin Fuel Commission has delegated authority to the Wisconsin Railroad Commission by which the latter body will have direct charge of ascertaining the coal requirements of all public utilities and devising means of procuring coal for them. The commission has obtained the services of John N. Cadby, executive secretary of the Wisconsin Utilities Association, in its effort to speed coal shipments.

J. P. Pulliam, president of the Wisconsin Utilities Association, in an address at the midsummer session of the street-railway division of the Wisconsin Utilities Association, said that electric and gas utilities would probably be forced to adopt a rationing plan in the distribution of their service as soon as the cold weather sets in. He also said that unless the coal-hauling equipment of the railroads was improved many electric and gas utilities would be forced to shut down, owing to the fact that householders would attempt to use gas and electricity to heat their homes when they found they could not procure coal and would thus overtax the supplying plants.

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High Price of Coal Troubles Indiana Utilities

Indiana public utilities will be forced to seek higher rates immediately or go into the hands of receivers, if they are compelled to pay present prices for coal, which are 100 per cent higher than before the coal strike, according to John W. McCardle, chairman of the Indiana Public Service Commission. Mr. McCardle is seeking to obtain regulation of coal prices in Indiana by the Interstate Commerce Commission.

"Many of our public utilities are almost out of coal," said Mr. McCardle. "Some are buying wood at enormous prices to keep their service to the public. They are being compelled to pay outrageous coal prices, but are themselves receiving the same rates that were in effect before the strike. Indeed, the rates of many have been decreased."

The return of the Indiana miners to work means little immediate relief to the utilities of the state. Indiana operators say it will be at least four weeks before normal production will be reached. Cave-ins during the five months the mines have been abandoned, necessary repairs to machinery and the like will make it impossible to hoist coal as it should be done in view of the present emergency.

The rail officials of the state have promised cars sufficient to take care of maximum production, but the operators are taking these assurances with several grains of salt. They say that never yet have the railroads been able to handle coal in Indiana when the mines were being worked to capacity, and they feel sure that, with a strike of rail employees being fought out, three or four days a week will be the limit of production.

English Coal Causes Trouble in American Stokers

Difficulty in burning the coal recently imported from England has been reported from several plants, notably those of the Interborough Rapid Transit Company of New York City and wherever high rates of forcing are employed. It is thought that modifications will have to be made in the stokers if the load is to be carried in the same way as American coal.

At the plants of the Interborough company approximately a third of the boilers are being supplied with Welsh coal. According to analysis this is a high-grade coal, running about 14,500 B.t.u., 15 per cent volatile and 6 per cent ash. Up to 200 or 225 per cent rating of the boilers the coal gives excellent results, but above this rating it cakes and does not permit the proper amount of air though the fuel bed. At these plants the boilers are forced as high as 320 per cent rating, and it is therefore impossible to get more than 70 to 75 per cent capacity. It was found that the older-type overfeed stokers handled this coal better than underfeed stokers.

It soon became apparent that this condition would be aggravated, possibly to the point of a power shortage, as the reserve supply of American coal became used up and more and more boilers had to be run with English coal. The engineering force has endeavored to meet the difficulty by increasing the air passages through the stokers, cutting down the velocity and the pressure from 5 in. to 3 in. and increasing the volume of air. Tests under these conditions are being made for the Transit Commission by Professor Lucke of Columbia University.

California Commercial Bodies Oppose Power Act

Action against the proposed "water and power act" of California has been taken by the Chambers of Commerce of both Los Angeles and San Francisco in the form of resolutions just adopted by the respective directors of these bodies. This action is based upon a hearing given by these organizations to both sides of the case and would seem to be a fair indication of the position taken by business interests on the proposed law. The action of these bodies, the leading commercial associations of the state, confirms the recent survey made by the *Electrical World* of the opinions of the newspapers in all sections of the state, which showed an overwhelming majority opposed to the measure. The bill will be voted upon at the November election.

Would Bar Out Commission

Lima, Ohio, Asks Ohio Power Company to Sign Away Its Right of Appeal to State Body

AN UNUSUAL utility situation has arisen in Lima, Ohio, where the City Commission, the municipal governing body, demands that there be inserted in a proposed contract for electrical energy with the Ohio Power Company a clause excluding the Public Utilities Commission of Ohio from participation in any controversy that might arise during the life of the franchise granted. This provision as drawn up by the city authorities reads as follows:

"It is expressively agreed by and between the City of Lima and the Ohio Power Company, for itself and for its successors, lessees and assigns, as a part of the consideration of this contract, that neither the Public Utilities Commission nor any other commission or state agency, or any other agency now or hereafter established or created, except the City Commission of Lima, Ohio, and its successors, shall have the right to change, alter or amend or increase the rates, prices or other matters and things herein provided for; and it is expressly agreed that if the said Ohio Power Company, its successors, lessees or assigns shall at any time during the continuance of this contract petition to, apply to or appeal to any such commission or state agency now existing or hereafter created from any order, regulation, rate, price or other thing now or hereafter established by the City Commission of Lima, Ohio, or its successors, that thereby, immediately upon the filing of any such appeal, petition or application to said Public Utilities Commission or to any other state agency or board or commission, this contract shall, without any further action by the City Commission or its successors or any other person, be revoked and held for naught and shall thereupon immediately terminate and become null and void."

Company's Representative Walked Out

The insistence on this clause led to a rupture of negotiations between the city and the company, the representative of the latter walking out of the meeting at which it was attempted to force its acceptance. The city commissioners contend that future disputes should be settled directly between the two parties concerned. The view of the company doubtless coincides with that expressed to a local paper by D. J. Cable, who represents stockholders of the Lima Street Railway Company. Mr. Cable is quoted as expressing these views:

"In my opinion, the provision is unjust and highly improper, its effect being that after large investments are made by a company in providing a service for the city its rights may be terminated if it defends them according to the established law of the land. Such a clause would render financing impossible by any company. Securities issued based upon such a contract could not be sold.

"Furthermore, a company entering into such a contract to disregard the law of the land, the procedure established by the constitution and statutes of the state, stultifies itself and does an un-American act, even if such a clause would have no legal effect. Any such arrangement is the breeder of more trouble and litigation than almost any provision that could be devised."

Ontario Hydro Commission's Annual Report

The fourteenth annual report of the Hydro-Electric Power Commission of Ontario has been completed but will not come from the printers for some time. This report, which is for the year 1921, shows the results of operation in 205 municipalities by ten separate and distinct systems. As usual the Niagara system stands in a class by itself owing to the relatively low price of power and the large industrial loads, which give the maximum benefits of loaded transmission lines and transformer stations. Out of a total of 131 municipalities embraced in this system, there were but seven showing actual money loss, amounting to a total of $1,675.87, while the total gross surplus in the remainder amounted to $1,474,738.66.

It must be understood in this connection that the Hydro-Electric Power Commission has no profit and loss account. The apparent deficits and surpluses indicated in this operating report are passed on to the municipalities and incorporated in their cost of power, so that the summary of municipal operation is the real measure of the success or failure of the general scheme of co-operative development, transmission and distribution of electrical energy at cost under the power commission act.

The operation of the smaller systems may as a whole be considered quite as satisfactory as that of Niagara. Out of a total of seventy-four municipalities served by nine different systems, there were twenty-five which showed a gross loss, this list being largely made up of the new municipalities connected to the Eugenia and St. Lawrence systems during the year. In these the operation covered but a few months and the revenue was far below normal. While these gross deficits totaled $39,604.77, the rest of the municipalities in these systems accumulated a gross surplus of $235,765.39, so that collectively the year's operation showed a gross surplus of $196,160.62. The summary shows that out of a total of 205 municipalities there were thirty-two which failed to meet all the operating expenses, including the debenture charges and the full cost of power, and there were in all fifty-one which failed to provide full theoretical depreciation. However, the summary also shows a net surplus of $625,602.26 after providing for depreciation to the extent of $1,043,620.85.

Gisbert Kapp Dies at His Home

Distinguished British Electrical Engineer Ranked with the Leaders of the Profession—Sketch and Tribute from a Co-worker and Lifelong Friend

WORD has reached the United States of the death of Gisbert Kapp on Aug. 10, at his home in Birmingham, England. Professor Kapp's eminence as a pioneer in electrical engineering is recognized in America as well as in Europe. The following brief account of his achievements and tribute to his memory is contributed to the *Electrical World* by his lifelong friend, B A. Behrend, consulting engineer, of Boston:

"The name of Gisbert Kapp has been a household word to a generation of electrical engineers, to whom his books and papers were beacon lights at a time when the art was well-nigh a pathless jungle in which we were frontiersmen.

"The career of Mr. Kapp, like his commanding personality, has been a fascinating one. Born near Vienna, Austria, of a Scotch mother, he went to England as a youth, becoming an ardent devotee of English life, ideas and manners. He devoted himself at first to mechanical design, and he developed for the Allens centrifugal pumps and other pumping machinery. In 1882 he joined Colonel Crompton at Chelmsford, where he invented the compound-wound direct-current generator. He told the present writer how he conceived the idea, and how he paid for the experimental coils himself, in view of the speculative nature of experimental work of that character at the time. He left Crompton two years later and set up as consulting engineer in Westminster. He then began his association with Johnson and Phillips, and he designed numerous power stations completely, including all the electrical machinery and apparatus, among them being particularly the St. Pancras station.

HIS GRASP OF ALTERNATING-CURRENT THEORY

"When Tesla's patents appeared in 1888 Kapp instantly recognized their value and through his friendship with Dobrowolsky and C. E. L. Brown he became the leader and inspirer of these men. The present writer had the privilege on numerous occasions, while assistant to Mr. Kapp, to be present at these inspiring sessions, which lasted late into the night at Mr. Kapp's house, and the memory of the exchange of ideas among them and their capacity for rapid thought is still a source of delight to him. Mr. Kapp understood the theory of alternating currents. He not only understood this theory, but he knew how to present it to the reader. Our William Stanley paid him a high compliment when he republished in this country, in 1893, a series of lectures by Kapp on alternating currents. His books were eagely sought by students and engineers, and no one ever laid them down without obtaining enlightenment and accurate knowledge. They were the works of a scholar, but their presentation in lucid plain English was of infinite value at a time when mathematical jargon obscured the theory. Mr. Kapp was happy among a group of men with whom he was connected through intimate friendship. William Morris Mordey, John Perry, the Hopkinsons, Professor Ayrton—the names of these great Victorians suffice to bring out the atmosphere in which he lived.

GISBERT KAPP

"Following the electrical exposition at Frankfort-on-Main in 1891, and the great interest aroused by the demonstration of the transmission of energy by means of Tesla's three-phase system over a distance of 100 km. at 30,000 volts, Mr. Kapp was led to consider, and eventually to accept, an offer from the Association of Electrical Engineers of Germany to take up the work as their general secretary. Although Mr. Kapp's activities during his incumbency of this position were most useful, he was never happy in his surroundings, and when Sir Oliver Lodge, on the advice of the late Sylvanus P. Thompson, offered him the professorship of electrical engineering at the University of Birmingham he eagerly accepted, to return to the country to which he was devoted. Here, at the University of Birmingham, he built up the electrical engineering department, and he published a treatise on the 'Principles of Electrical Engineering' which constitutes his last published work.

"Among Mr. Kapp's greatest achievements is the exposition of the theories of the magnetic circuit in dynamos. He once showed to the present writer sketches in multicolored pencil made by Lord Kelvin—then Sir William Thomson—which the latter had given Mr. Kapp in the course of their discussion of the theory of the magnetic circuit. Next in order of time came his vector analysis of alternating currents, which was summed up in a remarkable lecture before the British Institution of Civil Engineers. In this paper he explained the "Ferra effect," viz., the rise in voltage over Ferranti's 10,000-volt cables from Deptford to London. He explained in a simple manner, following, however, strictly scientific methods, these complex phenomena, and this work is to-day a classic in the analysis of a difficult engineering problem. Next in order he wrote his treatise on 'Dynamos, Alternators and Transformers.' In this he produced for the first time tables for the windings of direct-current machines, and he summed up the entire history of the calculation of 'dynamos and alternators' in a manner which has never been excelled and which is a classic in engineering literature. Then he wrote his treatise on 'Electric Transmission of Energy,' which went rapidly through four editions. In this he treated the theories of polyphase currents, the theory of wattmeter readings and their corrections, the theory of the rotating field, the theory of the calculation of long-distance lines, applying Kelvin's law for the most economical cross-section, and, last but not least, he emphatically stated his position of complete faith and confidence in alternating currents, and polyphase currents in particular. Needless to say, this prediction has been completely vindicated by events.

"These labors were followed by a small treatise on transformers which it is yet a delight to read. A larger work on dynamo design, in which the present writer had a share as assistant, followed. Papers on boosters to compensate for the electrolytic destruction of the return current in electric railway plants and on the pendulum oscillation of alternators have become unique and classic contributions.

RECIPIENT OF MANY HONORS

"Mr. Kapp received many honors. He was a Telford medalist, he was made honorary doctor of engineering, president of the British Institution of Electrical Engineers, and president of the Engineering Section of the British Association for the Advancement of Science. He was extremely fond of yachting and also of golfing. He loved his garden at his beautiful country house, 'Treganor,' in Selly Park, Birmingham. In 1884 he was married to Theresa Mary Krall, a gifted Englishwoman and a brilliant musician and singer. Their marriage for thirty-eight years was one of complete devotion and harmony. Two sons, Norman and Reginald, both engineers, survive their father.

"To the present writer Mr. Kapp and his wife were almost like foster-parents. Let the chronicler thus be allowed to wind up these last words of tribute with the touch of profound affection and esteem which he would fain lay at the bier of his great teacher and friend."

Wisconsin Electrical Code

New Rules Adopted by Railroad and Industrial Commissions to Be Discussed by Utilities

THE new Electrical Code adopted by the Industrial Commission in conjunction with the Railroad Commission, which becomes effective Sept. 13, will be the subject of discussion by superintendents and engineers of public utility plants in Wisconsin. J. N. Cadby, executive secretary of the Wisconsin Utilities Association, is making plans for such a conference.

The new code consists of five major portions as follows: 1. Introductory part, consisting of the general requirements, definitions of special terms and the methods to be pursued when making protective grounds where called for elsewhere in the code. 2. (Part 1) Construction requirements for electrical supply systems, substations and equipments of such stations. 3. (Part 2) Construction requirements for electrical supply and signal lines, both overhead and underground. 4. (Part 3) Construction requirements for electrical utilization equipment, which means ordinary interior wiring and all equipment utilizing the electrical energy, as, for instance, lighting equipment, motors, heating and welding apparatus. 5. (Part 4) Safety measures to be observed in the operation of electrical equipment and lines.

The latter rules apply in particular to employees in stations and substations and on electrical supply and signal lines, since such equipment cannot always be completely guarded and it frequently becomes necessary temporarily to remove such guards as may have been installed. Therefore the safety of employees must be attained to some extent through the observation of proper precautions while at work about such unguarded equipment.

Three important new requirements for utilization equipment and wiring are as follows: (1) The placing of all service entrance wires in conduit; (2) the requirement that all knife switches except on switchboards be of the so-called safety type; (3) the requirement that all new wiring of lighting circuits be of the so-called polarity type, i.e., the grounded wire to be identified by an outer braid differently colored from the other wires.

The committee which drafted the code comprises the best talent in all branches of the electrical industry. C. B. Hayden, engineer of the Railroad Commission, was chairman and John A. Hoeveler, electrical engineer of the Industrial Commission, was secretary. Two years was devoted to a complete study of electrical safety requirements. The new code is based in large part upon the National Electrical Code of the National Board of Fire Underwriters and upon the National Electrical Safety Code of the Bureau of Standards. It therefore comprises a complete standard for electrical construction and is aimed to conserve both life and property.

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Vacation Season Affects August Financing

The rush of utilities to obtain funds for making extensions and betterments during the summer is over, as is evidenced by the August stock and bond issues of electric light and power companies, which amounted to only $9,809,000. The large decrease under the total reached in July which this figure denotes resulted from the falling off in both the size and number of single issues and the inopportune season for issuing new securities. There were seven single issues offered in August; in July there were nineteen. The only issue last month which exceeded $3,000,000 was that offered by the Indiana General Service Company, amounting to $3,322,000. During July six issues exceeded the three-million-dollar mark. The rate of return yielded the investor was 6.60 per cent, as compared with 6.61 per cent for the month of July. All the issues were long-term securities. The utility security market is stable and new issues have been taken immediately at favorable rates.

Southwestern Activities

Public speaking and company organizations as methods of building good public relations were recommended by the executive committee of the Southwestern Geographic Division of the National Electric Light Association, which met in Dallas, Tex., recently and selected Oklahoma City as the place for the meeting in March or April next in connection with that of the Oklahoma Utilities Association.

The meeting of the executive committee was attended by about thirty executives and central-station representatives from Oklahoma, Louisiana, Mississippi, Arkansas and Texas. President E. H. Kifer of San Antonio appointed several committee chairmen. The meeting heard a report on the work of the Texas Public Service Information Bureau and made arrangements to co-operate with the bureau in educational and public-speaking work.

Arrangements have been made for a course in utility economics at each of the colleges and universities of Texas where such course has not already been established and for co-operation in colleges that have such courses.

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New Plant on Housatonic

Work is reported as about to begin on excavation for the Connecticut Light & Power Company's new plant at Devon, Conn., on the Housatonic River. The plant will be one of the largest central stations in New England, covering 55 acres, and will have an ultimate rating of 150,000 kw. or more. The original plans, if carried through, will entail a cost of approximately $4,500,000, this figure including the plant and the transmission lines, of which there will be about 75 miles.

The station will, either directly or indirectly, furnish power to every city and town in western Connecticut. The towns and cities to be directly served include Waterbury, New Britain and all the towns in the Naugatuck valley, while those furnished indirectly are in western Connecticut.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Offered at	Per Cent Yield
Indiana General Service Co.	$3,322,000	Twenty-four-year	First mortgage gold bonds	To provide funds for additions and extensions	5	90	5 75
Tennessee Electric Power Co.	3,000,000	......	Cumulative first preferred stock	To provide funds for additions, maturing obligations and floating debt	7	90	7 75
San Diego Consolidated Gas & Electric Co.	1,500,000	Twenty-five-year	First and refunding mortgage gold bonds, series B	New construction	5	87	6
Matachewan Power Co., Ltd. (Province of Ontario)	450,000	Fifteen-year	First mortgage sinking-fund gold bonds	...	7	95 (with 20 per cent common stock bonus)	7 50
Wheeling Electric Co.	487,000	Nineteen-year	First mortgage gold bonds of 1911	To provide funds to reimburse company for expenditures for additions and extensions	5	92	5.70
Iowa Light, Heat & Power Co.	400,000	Thirty-year	First mortgage sinking-fund gold bonds of 1916	To reimburse company for expenditures for extensions and improvements, to reduce floating debt and for other corporate purposes	5	84½	6.25
Lower St. Lawrence Power Co. (Province of Quebec)	650,000	Twenty-five-year	First mortgage non-callable gold bonds, series A	...	7	97	7.30
Total	$9,809,000*						

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*The issue of $270,000 of preferred stock of the Associated Gas & Electric Company appearing in the table of July securities was included in error. This was not a new issue, but merely represented the sale of stock of certain interests to others.

Wiring and Tree Trimming

Need of Better Work in Both Directions Is Emphasized at Michigan Convention

STRONG support of the enforcement of the National Electrical Code as a means of preventing the hazards of poor wiring was voiced in the report of the wiring and meters committee of the Michigan Electric Light Association before the annual convention at Ottawa Beach on Aug. 21-23, whose proceedings were outlined in the *Electrical World* for Aug. 26. As a means to the desired end the committee expressed itself as of the opinion that no one should be permitted to do electrical wiring unless he had qualified before an examining board. State legislation looking toward the licensing of contractors and electricians was suggested in the report, and a form of law was presented.

In the discussion of the report Henry Roseberry, president of the Michigan Contractors' Association, expressed himself as strongly in favor of regulation of wiring practices so that work would be uniform all over the state and all the safety measures which have been found necessary in the cities would be enforced in the smaller places.

Tree trimming was discussed by H. P. Sedwick and H. J. Eddy of the Public Service Company of Northern Illinois, who told of experiments last year that led to the employment of a qualified forester to handle tree trimming for that company. An experiment was first tried in part of the territory by the employment of a forestry organization of national reputation. The entire work of obtaining permits, trimming and cleaning up was turned over to this organization, and the results led to the employment of the trained men referred to. Under the supervision of this man trimming gangs composed of a wagon foreman who must be a hot-wire man, three trimmers who need not be hot-wire men, a groundman and a driver who also does ground work do all the tree trimming on the system of the company.

In the discussion Mr. Eddy emphasized the fact that the first trimming under such a plan is expensive because every effort is made to put the trees in proper condition, just as though the trimming were being done with that object in view, and to trim so that future growth will be in the direction of least interference with the power circuits near by. Subsequent trimmings will be aimed at maintaining this condition and will be less onerous and more rapid.

President Smith of the N. E. L. A. in his address said he was not expecting to initiate new and spectacular policies, but that there was ample room for hard work in pushing to completion the various lines of activity that have been inaugurated in previous years. He emphasized the national scope of the central-station problems. Harry Reid of Indianapolis, Ind., president of the Great Lakes Division of the N. E. L. A., Carl D. Jackson, president of the National Association of Railway and Utility Commissioners, and W. L. Goodwin also addressed the convention.

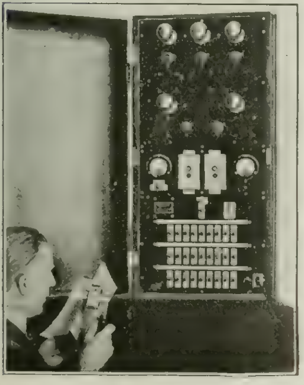
The report of the committee on public utility information showed progress under the leadership of Alfred Fischer.

Rural Line Problem Studies in Michigan

For the consideration of rural lines as an economic problem, free from political and other influences, the Michigan Public Utilities Commission has appointed a committee of sixteen to investigate the subject. The chairman of this committee, David Friday, president of Michigan Agricultural College, is assisted by the State Commissioner of Agriculture, the master of the Michigan State Grange, the president of the State Farm Bureau, the entire rural lines committee of the Michigan Electric Light Association, one specialist on rates and standards of service and the director of the Michigan Committee on Public Utility Information. Two engineers of the commission are advising.

Professor Friday sought first to determine the elements of cost and established to the satisfaction of the agricultural representatives that the greatest item of expense comes in establishing and maintaining the distribution system. He has asked his associates to determine whether electric power is worth what it costs the farmers. At the present time a number of sub-committees are at work. Each of these committees has representatives of both agricultural and utility interests. One of these is determining the uses of light and power on various types of farms. Another is working out a plan upon which rates will be based, with the idea in mind of finding a workable formula which will be applicable generally. A committee on public policy is investigating the legal phases of the problem.

"Loud-Speaker" Installation in Piedmont (Cal.) High School



AN INTERESTING installation has recently been completed for the Piedmont High School, Piedmont, Cal., involving a distinct improvement over present methods of inter-classroom communication. The apparatus, which was developed by the Magnavox Company, a pioneer in the field of devices for sound amplication, consists of a central or master station and twenty-five receiving stations, each equipped with a "telemegraphone," the motor-generator and battery being installed in a steel cabinet in the basement. The master station is operated like an ordinary telephone. Talking into the instrument in usual tones, the speech is amplified in any or all of the twenty-five classrooms in sufficient volume to be distinctly audible to all the students. Radio entertainments can also be heard over the system if desired. Similar installations have been developed for hotel, railroad terminal and other commercial uses, but this is the first application of the "loud speaker" to school service.

The illustrations show the Piedmont High School and the principal talking to his scattered audience.

Brief News Notes

A New Plant for Dallas.—Formal approval of the plan of the Dallas, (Tex.) Power & Light Company for the construction of an electric power station to cost $2,180,000 has been given by the city, and work will start at once. It will take about eighteen months to complete the plant.

Birmingham Substation Struck by Lightning.—During a severe electrical storm at Birmingham, Ala., recently, a bolt of lightning struck the Magella substation of the Alabama Power Company, causing an explosion, with the result that the city was without light or power for two hours during the evening peak load. Following the storm the company announced that work would soon be under way on the construction of a transmission line to connect with the lines of the Birmingham Railway, Light & Power Company. Half of the electrical supply of the city will be carried over the new line, greatly lessening the danger of interruption by lightning.

Middle West Utilities Expands.—The Middle West Utilities Company has acquired four utility companies in northern Indiana. They are the Hawks Electric Company, the Middlebury Electric Company and the Electric Transmission Company of Northern Indiana, all having headquarters at Goshen, Ind., and the Winona Electric Light & Water Company of Warsaw, Ind. These companies serve Goshen, Warsaw, Winona Lake, Nappanee, Bremen and fifty-five smaller communities with electrical service. The combined properties have 6,004 electric customers, and the annual gross earnings are approximately $425,000. The properties will be operated by the Interstate Public Service Company, a Middle West subsidiary.

Power Development of Deschutes River Favored.—Utilization of the Deschutes River, Oregon, and its tributaries for irrigation of approximately 14,000 acres in the Deschutes basin, with incidental power development, has been recommended to the Federal Power Commission by the board of engineers which has been investigating the project. The board began more than a year ago to work out a policy to be followed by the federal government and the State of Oregon in using, reserving or disposing of public lands, waters, reservoirs and power sites contiguous to the Deschutes River. By using the upper Deschutes for irrigation an aggregate of 555,000 hp. could be developed on the lower river, according to the report of the board, and if the upper Deschutes storage be used for power, the aggregate horsepower would be increased to 613,000.

National Personnel Association.—An association with this name has been organized at New York and includes prominent engineers among its directors. According to official announcement, the new organization, which takes over the activities of the National Association of Corporation Training and the Industrial Relations Association of America, will aid business executives in solving problems of personnel administration. Co-operative research will be conducted on a nation-wide scale, and close relations will be established with colleges and universities in carrying out an extensive educational program.

Electric Rates Cut 10 per Cent in San Diego.—The California Railroad Commission has ordered a reduction of approximately 10 per cent in the electric rates of the San Diego Consolidated Gas & Electric Company, based on a drop of about $1 a barrel in the price of oil since rates were fixed in March, 1921. The reduction affects domestic, industrial and agricultural tariffs and brings residence and commercial rates within 10 per cent of pre-war levels. Power rates will be virtually equal to those in effect in 1919. The top lighting rate is reduced in San Diego and vicinity from 9 cents to 8 cents and in Escondido from 11 cents to 9 cents per kilowatt-hour. No reduction is made in street-lighting rates, which were not advanced above pre-war prices, while sign and display lighting rates remain as at present, owing to a previous reduction. Minimum bills are not reduced. Thirty thousand customers are affected.

Hydraulic Laboratory Would Aid Water Power.—Although in the advocacy of the proposed National Hydraulic Laboratory now attracting attention in Washington and indorsed by the Federated American Engineering Societies chief stress is laid on the problem of flood control and of scientific construction of irrigation conduits, John R. Freeman, the prominent engineer who first proposed that the government establish such a laboratory, is convinced that the experiments will be useful to engineers engaged in water-power development by giving them more precise data and coefficients for computing the cubic feet of water per second discharged at various depths over a given form of dam crest. There is also great need, Mr. Freeman points out, for more information as to the absorption of energy in the discharge of spillways or dam overfalls or from sluiceway gates. "Although American engineers have developed the boldest hydraulic structures for water-power development and municipal water supply that can be found in the world," Mr. Freeman says in a preliminary report submitted to the Senate committee, "they have been compelled to base designs largely upon formulas known to be lacking in precision and therefore have had to use larger factors of safety than might otherwise have been necessary."

Associations and Societies

Oklahoma City to Have Two Conventions.—Oklahoma City has been selected as the place for the convention of the Southwestern Geographic Division of the N. E. L. A. to be held in March, 1923. In the same week the Oklahoma Utilities Association will hold its fifth annual convention in that city.

Institute of Radio Engineers.—A paper on "Vacuum Tubes" will be presented by F. S. McCullough of the Westinghouse Electric & Manufacturing Company at the next meeting of the Institute of Radio Engineers on Wednesday, Sept. 6, at 8:15 p. m., in the Engineering Societies Building, New York City.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Conference of Local Electrical Leagues—Association Island, N. Y., Sept. 5-7.
N. E. L. A. Geographic Divisions—New England, New London, Conn., Sept. 5-8; Rocky Mountain, Glenwood Springs, Col., Sept. 11-13; Southeastern, Atlanta, Sept. 12-15; Great Lakes, French Lick Springs, Ind., Sept. 27-30.
Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 6-9. H. M. Stine, 212 Locust St., Harrisburg, Pa.
Colorado Electric Light, Power and Railway Association—Glenwood Springs, Col., Sept. 11-13.
Association of Iron and Steel Electrical Engineers—Cleveland, Sept. 11-15. J. F. Kelly, Empire Bldg., Pittsburgh, Pa.
Pennsylvania State Association of Electrical Contractors and Dealers—Philadelphia, Sept. 13-14.
West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 19-22. Herbert Smith, 211 Hobson-Pritchard Bldg., Huntington.
American Electrochemical Society—Montreal, Sept. 21-23. A. D. Spillman, Columbia University, New York City.
Illuminating Engineering Society—Swampscott, Mass., Sept. 25-28. Samuel G. Hibben, 29 West 39th Street, New York.
American Institute of Mining and Metallurgical Engineers—San Francisco, Sept. 25-28. F. F. Sharpless, 29 West 39th Street, New York.
National Association of Railway and Utility Commissioners—Detroit, Sept. 26. J. B. Walker, New York Transit Commission, New York.
Indiana Electric Light Association—French Lick Springs, Ind., Sept. 28-30. Thomas Donohue, Lafayette, Ind.
Telephone Pioneers of America—Cleveland, Sept. 29-30.
American Electric Railway Association—Chicago, Oct. 2-6. J W. Welsh, 8 West 40th Street, New York.
Empire State Gas and Electric Association—Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.
Electrical Supply Jobbers' Association, Atlantic Division—Philadelphia, Oct. 6. E. Donald Tolles, 165 Broadway, New York.
Society of Motion Picture Engineers—Rochester, N. Y., Oct. 9-12.
Association of Edison Illuminating Companies—White Sulphur Springs, W. Va., Oct. 11-14. Preston S. Millar, 80th St. and East End Ave., New York.
National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St., New York.
Public Utilities Association of West Virginia—Charleston, W. Va. Oct. 13-14.
Electric Power Club—Asheville, N. C., Oct. 30. S. N. Clarkson, 506 Laclede Gas Bldg., St. Louis.
Ontario Association of Electrical Contractors and Dealers—Toronto. Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.

Commission Rulings

City Cannot Levy Taxes to Pay for Energy Furnished to Part of Community Only.—A contract entered into by the city of Gary and the Gary Heat, Light & Water Company by which the company agrees to furnish electrical energy to the city at stipulated rates has been approved by the Indiana Public Service Commission with the exception of one clause under the provisions of which the city would be required to levy taxes to pay for energy purchased by it and resold to consumers in a particular district. This provision the commission held to be illegal.

Discrimination Not Involved in Lowering Rates Through Combining Departments of Company.—The Arizona Corporation Commission, which allowed a combination of gas and electric property valuations of the Central Arizona Light & Power Company at Phoenix in order to make possible a lower gas rate in that city, the gas department not being self-sustaining, has decided that in approving higher gas rates for the same company in Tempe—which city the company was unwilling to serve unless the rates were made compensatory as they stood—it has not indorsed a discriminatory tariff.

Security Issues for Interstate Utility.—In granting an application from the Connecticut River Power Company for authority to issue stock the New Hampshire Public Service Commission said: "The whole of a proposed stock issue of an interstate electrical company may be considered when expenditures have been actually made in the acquisition or improvement of plants partly within and partly without the State of New Hampshire in such a way that it is more convenient to pass upon the propriety of the entire expenditure than to determine the portion which should be allocated to New Hampshire, although no authority from the commission is necessary to issue securities for capital expenditures outside of the state."

Rural Service and Rates.—In the course of a complaint made by the city of Canby, Ore., against the Molalla Electric Company and the drawing up of a new rate tariff for that company by the Oregon Public Service Commission, question was raised concerning the company's rural service. The evidence showed that the company's system is largely overbuilt in the agricultural communities and embraces large areas of sparsely settled territory. The commission held that the burden resulting from such improvident capital investment must fall upon the company and not upon the consumers generally. Realizing that the rural rates now effective do not provide an adequate return, the commission held, none the less, that a rate must not exceed the value of the service, or be so high that present consumers will be forced to discontinue or materially curtail the service. Variations in voltage on the rural lines were also complained of, and the commission ordered the company to follow the prescribed rules governing standards of quality, pressure and other service conditions.

Separate Departments of Municipal Plant Should Bear Their Own Costs.—Denying an application of the city of Kaukauna for authority to increase its rates in the village of Little Chute, the Wisconsin Railroad Commission said that electrical consumers of a municipal plant should not be required to carry the burden of a water department which operates at a loss and that a municipal plant earning a surplus above 8 per cent should not be authorized to increase rates in a neighboring village, although the cost of service may be greater in the village, if there is no evidence to indicate that such additional cost is great enough to justify an increase of rates.

One Utility Department Must Not Be Burdened to Support Another One.—A contention of users of water for irrigation who complained against the rates of the Sierra & San Francisco Power Company, contending that the electric and water systems of that company should be considered as a unit for rate-fixing purposes, was thus answered by the California Railroad Commission: "The commission is called upon to establish fair and proper rates for various classes of utility service, among which are rates for electricity. In establishing such electric rates it is the commission's duty and endeavor to adopt only those rates which yield a fair or reasonable return upon the property used in affording the service. To allow a rate which produced not only a reasonable profit upon the electric properties but an amount additional which would overcome a deficit accruing in another and separate department of the utility's activities would result in burdening one class of consumers at the expense of another."

"Going-Concern" Value of Electric Plant.—In determining the sum to be paid by the city of Oroville, Cal., for the electric distribution system of the Pacific Gas & Electric Company contained in Oroville and adjacent territory, the California Railroad Commission rejected the "going-concern" estimate presented by the company, which was based upon the profitableness of the enterprise and also the cost of developing the business. The commission did, however, make an allowance for going-concern value, following the method adopted in the Redding case—that of allowing 2 per cent per annum, the difference between the normal return of 8 per cent and a minimum return of 6 per cent, during the assumed development period of the enterprise. The commission concluded that two years would be a sufficient length of time to attach to the Oroville electric plant such business as in fact was attached to it on Aug. 15, 1918, the date of the filing of the application, and that this method would result in a 4 per cent increase in plant value.

Recent Court Decisions

Company Not Bound by Rates Published When Higher Rates Were Subsequently Approved by Voters.—The Supreme Court of Michigan has affirmed the finding of the Superior Court of Grand Rapids (see *Electrical World*, Sept. 17, 1921, page 588) in a suit brought by that city against the Consumers' Power Company to enforce rates advertised by the company in 1907 and afterward put in force despite the subsequent approval by the voters of an ordinance passed just previously to the advertisement and granting higher rates. The company claimed the right to change to these higher rates, and the courts have sustained its contentions, pointing out that the advertisement did not state how long the lower rates were to continue, that they were never formally approved by the city authorities, and that subsequent ordinances increasing rates (afterward repealed) showed that the advertised prices had no recognized character of permanency. (188 N. W. 530.)*

Contributory Negligence a Question for Jury.—Evidence in Bailey vs. Fort Smith Light & Traction Company, a suit for damages for the death of a lineman employed by a company purchasing energy from the defendant, tended to show that the victim had neglected to observe the safety measures prescribed by the company employing him, including the use of ground chains, but had instead telephoned to the Fort Smith company's generating plant and asked to have the current turned off while he worked on certain transmission lines; that this was done, but that, in violation of the lineman's request, the current was turned on again before he had finished his work, thus causing him to lose his life by contact with an energized wire. The point was made that the deceased was not an employee of the company sued and received no instructions from it as to the method in which he should do his work, but was led to infer that his own instructions to the plant engineer would be observed. The Supreme Court of Arkansas held that instructions to the jury that contributory negligence was established had been rightly refused by the trial court and that the jury had the right to decide otherwise (241 S. W. 42).

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

C. C. Pratt Elected Chairman Utah Section, A.I.E.E.

C. C. PRATT

Chester C. Pratt, Utah plant superintendent of the Mountain States Telephone & Telegraph Company, was recently elected chairman of the Utah Section of the American Institute of Electrical Engineers. Mr. Pratt, who was born in Salt Lake City March 4, 1882, and received his education in the public schools of that city, has been associated with the Mountain States Telephone & Telegraph Company and its predecessor, the Rocky Mountain Bell Telephone Company, for twenty-two years. He first entered the employ of the latter company as a collector in 1900 and through diligent effort and study has advanced step by step to his present position. He is exceedingly well versed in all matters pertaining to the telephone business and is in close touch with electrical affairs in general.

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Colonel Byllesby Receives Distinguished Service Medal

Presentation of the United States distinguished service medal was made at the Chicago Club on Aug. 21 to Col. H. M. Byllesby of H. M. Byllesby & Company by Major-General George Bell, Jr., commanding the Sixth Corps area. The citation reads as follows:

"Henry M. Byllesby, then lieutenant-colonel, Signal Corps. For exceptionally meritorious and distinguished services. As general purchasing agent for the American Expeditionary Forces at Base Section No. 3, in Great Britain, from May to December, 1918, he displayed great energy, a comprehensive knowledge of large business affairs and executive ability of the highest order. By this broad experience, foresight and splendid ability to co-operate with representatives of our allies, he solved many difficult problems of fuel supply with conspicuous success and in a manner which insured at critical times a plentiful supply of coal both for our transport service and our troops in France, thereby rendering services of great value to the American Expeditionary Forces."

The British government conferred the distinguished service order on Colonel Byllesby in 1919.

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John W. Lieb Again Decorated by Italian King

Another decoration has been conferred upon John W. Lieb, vice-president of the New York Edison Company and past-president of the N. E. L. A. and the A. I. E. E., by the King of Italy, who has made him a Knight Grand Officer of the Crown of Italy. Mr. Lieb had already been made Knight Commander of the Crown of Italy for his work in connection with the installation of electric trolley systems and the introduction of electric light and power service throughout Italy when he was technical manager of the Italian Edison Company at Milan from 1883 to 1894.

The insignia of the new decoration are to be presented to Mr. Lieb by the Italian government through the diplomatic channels.

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J. G. G. Kerry, a consulting engineer of Toronto, has been retained by the City Council of Vancouver, B. C., in connection with a survey of sites suitable for a municipal hydro-electric plant.

C. W. Stokes has resigned as manager of the English Electric Company in Montreal to engage in business. Mr. Stokes has had a wide and varied experience in his twelve years' association with the English Electric Company and the Siemens Company of Canada.

Ernest V. Pannell, who is associated with the British Aluminium Company as a consulting engineer for transmission line construction, is at present in Japan. In view of the prevailing activity in water-power development in that country he will probably make an extended stay.

A. E. Hatley has been appointed purchasing agent for the Eastern Texas Electric Company. H. C. Morrow, who formerly held the position, has gone into business for himself. Mr. Hatley was formerly in the transportation department of the Houston Electric Company.

A. P. M. Fleming Returns to England

A. P. M. Fleming, C. B. E., manager of the research and educational department of the Metropolitan-Vickers Electrical Company, England, has recently sailed for that country after spending several weeks in America. Mr. Fleming represented England at the convention of the A. I. E. E. at Niagara Falls. He visited electrical manufacturing establishments while here and obtained first-hand information on manufacturing and educational conditions.

A. P. M. FLEMING

"We have learned many valuable lessons from the radio broadcasting experience of the United States," said Mr. Fleming. In England government control will be used to prohibit interference and to establish co-operation between stations. It is thought that eight 1½-kw. stations will be established for broadcasting purposes. Mr. Fleming was much interested in radio development in this country, and his researches will be very influential in establishing regulatory rules in Great Britain.

Mr. Fleming received his technical training at Finsbury Technical College and then had a wide and varied experience in England and in the United States. He is a specialist on insulation and was manager of the Metropolitan-Vickers transformer department for many years. Recently he has become interested in educational and training courses.

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Harold Cole has been appointed distribution engineer for the Detroit Edison Company. After being graduated from Cornell in 1916 Mr. Cole was assistant to P. O. Reyneau, formerly assistant electrical engineer of the Detroit Edison Company.

T. F. Keefe, formerly division superintendent of the Mineral Point Public Service Company, has resigned his position with that company to be associated in the management of the electric and gas utilities of the Wisconsin Power, Light & Heat Company at Baraboo.

Westinghouse International Officer Leaves for South America

J. H. Payne, supervisor of agencies of the Westinghouse Electric International Company, sailed recently from New York for South America. Mr. Payne will spend several months in that continent making a survey of business conditions there and endeavoring to cement further the business ties existing between the Westinghouse company and its customers in South America. On his trip Mr. Payne will visit Brazil, Argentina, Chile and Peru, spending about a month in each of these countries. During his stay in South America he will make his headquarters in the cities in which the Westinghouse Electric International Company's offices are situated.

J. H. PAYNE

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Keith A. Wood Heads New Cowan Truck Department

Keith A. Wood has been appointed head of a new division of material handling just established by the Cowan Truck Company. Mr. Wood was born in West Medford, Mass., Aug. 24, 1890, and prepared for college at the Portsmouth (N. H.) High School and Vermont Academy. He was graduated from Dartmouth in 1913, following which he entered the service of the General Electric Company in Lynn, Mass., taking the student engineering and sales engineering courses. From 1916 to 1918 he was sales agent for that company in Chicago, after which he joined the sales force of the Mercury Manufacturing Company, Chicago, having charge of the New England district with headquarters in Boston. In June, 1920, he became a division sales manager for the Cowan Truck Company, and in January, 1921, general sales manager.

In addition to his work at the head of this division of the Cowan company, Mr. Wood, in his capacity as assistant to J. M. Eaton, general manager, will undertake various special missions from time to time.

C. R. Phenicie, vice-president of the Wisconsin Public Service Company, was recently elected a director of the Green Bay Association of Commerce.

Capt. George B. Baldwin, formerly special agent in the new-business department of the Sacramento division of the Pacific Gas & Electric Company, has been transferred to the head office in San Francisco, where he will engage in special promotion and exploitation work.

Owen D. Young, chairman of the board of the General Electric Company, is receiving the sympathy of his friends on account of the death of his son John, age eighteen, at a construction camp on Hood River, Oregon, where the young man was spending his vacation.

H. W. Johonnott, manager of the Beaver Dam Light & Fuel Company for a period of several years, is leaving the utility field to engage in the automobile business. Mr. Johonnott will be succeeded as manager by Harold H. Kirkpatrick of Fox Lake.

Clinton B. Ferguson, for the past eight year sales engineer in the New England district office of the Cutler-Hammer Manufacturing Company, has been transferred to the New York office, where he will continue work along this line. Mr. Ferguson was stationed at the Milwaukee factory of the company for two years before going to Boston. He is well and favorably known in New England electrical circles.

D. C. Griffiths and **D. B. Graze** have opened offices in the Marshall Building, Cleveland, as manufacturers' agents to handle the distribution of electrical material in Ohio for the M. B. Austin Company and Appleton Rubber Company and in parts of the state for the S. H. Couch Company, Inc. Mr. Griffiths has been associated with the M. B. Austin Company for the past three years, covering the same territory, and, realizing the benefits of co-operative effort, has divided his tasks with Mr. Graze, who has been a specialist on power apparatus in this territory for the past nine years.

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A. W. Fox Assumes New Position with Johns-Pratt Company

Arthur Ward Fox, formerly secretary and assistant treasurer of the Johns-Pratt Company, Hartford, Conn., has been elected to the office of vice-president and general manager. Mr. Fox has been associated with this company for sixteen years, starting as a clerk and working up through the various departments, becoming assistant treasurer and factory manager and later secretary. He is therefore well qualified to direct and maintain the logical relations between manufacturing and sales that are so essential in the new-business relations of the Johns-Pratt Company. Beginning with the administration of Mr. Fox as vice-president, all Johns-Pratt products will be marketed direct. Mr. Fox will make his office at the factory, Hartford, Conn.

A. W. FOX

Obituary

Arthur Breese Proal, a civil and electrical engineer, died recently of pneumonia at his home in Nutley, N. J. Mr. Proal was fifty-two years of age and was known as an expert in methods of fuel reclamation. He was a graduate of Stevens Institute of Technology and had been employed on the Panama Canal.

Mark C. Ewing, for many years manager of the Wisconsin Valley Electric Company and a past-president of the Wisconsin Electrical Association, died at Wausau, Wis., on Aug. 11, at the age of fifty-three. Mr. Ewing had been a pioneer in many ways. He was one of the first utility men in Wisconsin to develop the water resources of the state. Fifteen years ago he saw the wisdom of customer ownership of securities and this policy has been followed in his company with much success.

Alven Beveridge, formerly financial representative of the late George W. Westinghouse, died recently after a short illness. Mr. Beveridge started his business career with the old cotton house of Benjamin Noah. Later he entered the banking house of P. W. Gallaudet & Company. While a member of that firm, with Mr. Gallaudet, he was responsible for the building of the bridge over the Hudson River at Poughkeepsie, a vast undertaking in those days. Mr. Beveridge was the financial representative of Mr. Westinghouse for twenty-seven years. He was seventy-four years old.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

A Call for Coal-Handling Equipment

Manufacturers and Engineers Have Allowed Coal Handling to Fall Behind in the Progress of Station Development

By H. E. Birch
R. H. Beaumont Company, Philadelphia.

FOR years coal has been handled in about the same way in power stations. During this time all kinds of improvements have been made in the boiler-room and engine-room equipment. Fire-tube boilers have disappeared along with low-pressure boilers. The turbine has taken the place of the reciprocating engine. High-duty stokers have crowded out the older types. Large central stations are now installing 2,000-hp. boilers and steam-flow meters, and so many changes have come in type and design that the equipment used ten years ago could hardly be recognized. But coal conveyors remain about the same as of yore.

Larger Equipment Needed

Out of this has developed a really critical situation. The rapid advance in the progress of the art of station building has set up a demand for larger coal and ash handling equipment. Five years ago a plant that could move 100 tons of coal an hour was a big one. Today a capacity of 200 tons or 300 tons an hour is demanded. A track hopper that measured 12x20 ft. used to be a good-sized piece of apparatus, but now the call is for continually increasing capacity, hoppers 20x40 ft. and mechanism that will lift, turn over and dump an entire coal car. But the coal-handling industry is not keeping up with the procession. Manufacturers of conveyors have developed little new apparatus. Naturally the need is becoming greater all the time, and unless something is undertaken to relieve the situation, embarrassment is bound to follow.

The reason why coal-handling practice has lagged is not hard to see. Few engineers are specializing in this work except the men employed by the manufacturers of present equipment. These men know their work and know their opportunity, but they are naturally inclined to promote the utilization of their own product and prone to prolong its use and delay the substitution of new methods and new materials. Consequently the power-station engineer is at a loss for guidance, and while he proceeds intelligently with the development of larger and more concentrated stations of greater and greater power, applying the steadily evolving new standards for electrical equipment, he falls back on the old-established practice for coal handling. Many of the most elaborate stations built in recent years are in reality out of balance.

Men seem to have failed to recognize the importance of this feature of a modern station. This truth is well illustrated by the fact that the recent report of the National Electric Light Association committee on prime movers had but three pages devoted to coal handling, despite the fact that most of the tremendous amount of coal used by the industry is handled mechanically. Because there has been so little activity in the field the subject has been crowded out of mind by the more stirring developments in power-plant design. Yet we have here perhaps the greatest labor problem and the greatest construction problem involved in the building of a plant. For coal handling has great influence on the basic design of the plant, and inadequate facilities have a decided effect on costs and earnings.

Economies Offered

There is great interest at present in the comparative merits of powdered fuel and stokers. Large investments are made to save one-tenth of a mill per kilowatt. A recent report, however, which tabulated the various items of cost among the more important central stations of the country gave the labor cost for handling coal from cars or barges to the boilers at 4 cents a ton in some plants, while in others the cost ran as high as a dollar a ton. Such a variation is enough to make the difference between no profit at all and a reasonable return upon the investment.

In short, it is high time that the subject received more study and more constructive development by the industry, both manufacturers and power-station men. But more than this is needed. Effort must be applied to meeting the needs and demands of the greater stations of the day directly and providing for the still greater requirements that the next five or ten years are going to bring. It is an engineering problem, true, but it must not be left to the engineer alone. For, above all else, it is a commercial problem—one that offers a great opportunity to the manufacturers who will promulgate the idea and provide equipment.

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Problem of Meter Repairs

Users Fail to Appreciate Either the Need for Care of These Delicate Instruments or the Cost of Repairs

By Orval Simpson
President Jewell Electrical Instrument Company, Chicago

ALTHOUGH the manufacturing side of the electrical instrument business is often attended with hazard and loss, the hardest problem to handle comes after the instrument has left the factory. It is to insure safe and careful treatment for the instrument at the hands of employees or customers. It certainly is unreasonable to expect an instrument to maintain its accuracy within one-tenth or even one-fourth or one-half of 1 per cent when an operator insists on slamming or throwing it on a table, bench or shelf. An instrument operating under such a range should be handled with mittens. Without extreme care proportioned to its delicacy an instrument cannot be expected to maintain adequate control of a circuit.

Just how the manufacturer can educate and instruct the users of meters in how to take care of them properly is a puzzle that still requires much thought. Upon examining many groups of instruments returned for repairs, it has been found that in more cases than one the fault was not in the instrument. It was caused by the rough treatment and careless handling given it by some unskilled or careless operator. The mere dropping of a meter is oftentimes enough to blunt the pivots and necessitate its being sent back to the factory. It seems ironical to think of the care and attention given to many other kinds of equipment compared with the little consideration given to a single instrument the lack of which might remove an entire expensive equipment from operation.

One way to counteract this evil might be to have central-station managers distribute literature on the care of measuring instruments to their employees—especially to the newcomers. Many companies are more than willing to do so. To find out whether employees had profited by these instruction books, all that would be necessary would be to observe them casually while using the instrument. Any one seen using an instrument as if it were a sledge hammer should be taken aside and made acquainted with the fact that an instrument is a tool of precision and not a piece of junk. Manuals could also be distributed among university men in technical schools and men in meter-testing schools.

THE HIGH COST OF REPAIRS

At some time or other most central-station men have protested against seemingly excessive charges for meter repairs, but it is not hard to explain the large expense entailed. In training men to make accurate measuring instruments much time is required. To manufacture and assemble some of the most delicate movements requires a man absolutely reliable and trustworthy. When a meter is sent in for repairs it cannot be given to an apprentice; it must go to the most highly trained man in the factory. This, of course, takes him off his regular production. He has to look the instrument over very carefully and determine just what is wrong. Then, if possible, he is required to give an estimate of the cost of the repairs, which is sometimes greater than the cost of a new instrument, since his time and materials must be included in the final estimate.

This is one reason why the repair bills are generally higher than were expected. It affords a most practical argument in favor of proper care of the meter in the customer's hands.

The repair department offers the most difficult problems which the meter manufacturer is called upon to face, for we are required to repair all types and these instruments arrive in all degrees and stages of damage. Practically every returned meter also represents some larger and more expensive equipment or apparatus, out of service as a result of a damaged instrument of comparatively small value.

Then, too, the demand for repairs invariably comes for instant work, with its resultant problem of scheduling production and balancing the payroll in the repair department so as to render prompt service. Unfortunately the manufacturer has no control over the peak demand for repairs. This factor further increases the repair costs.

Survey of Business Conditions

Electric Truck Manufacturer Is Having Best Business Sales

Electric truck manufacturers almost without exception are enthusiastic regarding the possibilities for business developing in line with the increase of transportation by electric vehicles throughout the country. A leading maker of electric trucks reports the best sales for 1922 in the history of the business, and this statement finds an echo with several other manufacturers.

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Flexible Armored Conductor Shows Much Activity

A survey of the market for flexible armored conductor shows a condition more or less usual in the electrical field, practically all manufacturers reporting close-to-capacity business. At least one manufacturer has given up production of the larger sizes in order that he may devote all his capacity to the smaller sizes, for which demand has been very good.

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French Showing Great Interest in Utilization of Electricity

The critical shortage of coal during the war and the period immediately following has resulted in an awakening of public opinion to the possibilities and the economy of electrical power, says Consul Paul H. Cram, Nancy, France, reporting to the Department of Commerce. The presence of abundant undeveloped hydraulic power, the permanent dependence on foreign coal and the unfavorable economic situation of the country are factors which will doubtless continue for a long period to guide public policy and to encourage private initiative toward a greater utilization of electricity.

The French government has not only given its moral support in favor of a more intensive use of electricity but has also aided materially by the construction of lines for the distribution of power. In fact, the government advocates the construction of such lines as may be necessary to connect the important centers of hydraulic production, such as the Alps, the Pyrenees, Auvergne, the projected centers involving the harnessing up of the Rhone and Rhine rivers and the tidal force in Brittany, with the steam-power centers of Paris, Lorraine and northern France.

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More Electrical Devices Cause Less Drudgery in Canada

The increase in demand for labor-saving devices throughout Canada and the opportunity afforded for further introduction of this line of American goods finds interesting confirmation in certain facts brought out by the latest Canadian census.

During the last ten years cooks have decreased in number 21½ per cent, chambermaids 26 per cent, housemaids 20 per cent, home laundry workers 25 per cent, and home dressmakers 47½ per cent. These figures have significance for the adoption of labor-saving machinery in the home and the curtailment of drudgery incident to housekeeping.

Evidence of increased production of household electrical devices in Canada is also significant, this increase being in direct proportion to the decrease of domestic employees above noted. A marked increase is found during the years in question in the number of mechanical engineers, machinists and technical engineers, a fairly large percentage of whom are engaged in making home appliances.

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Prevailing Conditions Affecting Cost and Volume

Freight-Loading Gains.—Loading of revenue freight on the railroads of the country totaled 852,580 cars during the week ended Aug. 12, which was an increase of 1,229 cars compared with the preceding week, according to reports just filed by the carriers with the American Railway Association. This was an increase of 44,311 cars over the correcponding week in 1921, but a decrease of 118,689 cars compared with the corresponding week in 1920. Coal loadings during the week totaled 84,559 cars, an increase of 5,313 over the previous week. This was, however, a decrease of 72,332 cars compared with the same week last year and a decrease of 137,285 cars compared with the same week two years ago.

Bank Clearings Gain 19.3 per Cent.—A further widening of the margin of increase in bank clearings over last year's figures is noted this week, an aggregate of $5,625,187,000 at twenty cities in the United States, as reported to *Dun's Review*, being 19.3 per cent in excess of the $4,714,087,062 of this period of 1921. This week's total, however, is 13.1 per cent less than the $6,471,151,591 of two years ago.

Failures Decrease.—This week all sections of the United States, especially the South and West, showed decreases in the number of failures reported to R. G. Dun & Company, so that the total, 348, was much less than that of the previous week, which was 415, and almost down to the level of the corresponding week in 1921, when 339 defaults were reported. A distinct decline was also to be noted in the number of insolvencies with liabilities of $5,000 or more in each case, which totaled 190 this week, as compared with 235 in the previous week, while the smaller figure was 54.6 per cent of the total, as against 56.6 last week. For the corresponding period last year, defaults aggregated 163, a percentage of 49.8.

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Spain Reduces Duties on Our Electric Machinery

Electric locomotives and self-propelled vehicles, electric machinery and installations weighing over 1,000 kg., made in America, are now accepted in Spain at reduced duties, according to the Department of Commerce. The report states:

"Owing to the conflicting interpretations on the part of the Spanish customs officials as to the application of the concessions granted to France to similar products of other countries, a definite ruling from the Spanish Minister of Finance was informally requested by Commercial Attaché Cunningham, working in co-operation with the embassy, and the present order appears to give assurance that American products will continue to enjoy the most-favored-nation treatment which they have thus far been accorded in Spain.

"The reductions in the Spanish duties were granted in return for varying concessions from the French general duties accorded to certain characteristic Spanish products, particularly wines. American products have not for some time enjoyed most-favored-nation treatment in France, and in view of the fact that the present concessions in French duties granted to Spain are not below those minimum rates which had already been accorded by France to a number of other countries, no new handicap upon American products is being imposed and no list of the particular commodities affected seems necessary."

Motor Sales Gradually Increasing

One Factory Shows Gain of 25 per Cent in Business—Deliveries Are Still Satisfactory—Prices Are Highly Competitive

ELECTRIC motors under 25 hp. in rating have been selling better during the last few months than a year ago, and while existing manufacturing facilities are far from overtaxed, the producers of such equipment are facing a real problem in anticipation of business expansion this fall. Last week's motor sales in one factory in excellent touch with conditions throughout the country were about 25 per cent above those of the same week last year, and this notwithstanding a perceptible and probably temporary falling off of demand attributed to disturbed labor conditions in transportation and mining circles. The market for motors is extremely diversified and widely distributed geographically and industrially. At present great interest is apparent in the machine-tool industry in the design of unified machine and motor equipment, and there is also intense activity in the laundry trade along the line of individual motor driving. This demand for special motors suited to the particular requirements of machinery developed for highly specialized industries is a striking feature of the market. It carries with it certain serious problems in its effect upon the economical production of standard motors, but is looked upon by progressive manufacturers as a necessary part of the extension of electrification to industry in general.

Motor deliveries are still satisfactory, but considerable difficulty is being experienced in the securing of raw materials, especially steel. Expected shipments have been canceled or badly delayed in not a few cases, and this situation is causing motor manufacturers to look very sharply into their stocks of insulation, magnetic steel, etc., since the war-time stocks of material procured at high prices have now been pretty thoroughly liquidated. In anticipation of increased demand for motors this fall, factories equipped for this class of production are being "tuned up" for early service or put into active operation. There is also a scarcity of high-grade labor for motor manufacturing in some quarters, and the demands of some purchasers for special motors built along lines of greater accuracy than hitherto are absorbing the best quality of labor.

Motor prices are highly competitive at this time, and in some circles it is stated that manufacturers here and there are offering motors at quotations which do not represent adequate consideration of overhead charges above factory costs. It is questioned whether a more general study of overhead would not be the wisest move motor manufacturers could make at this time. The scattered and highly technical demands made upon motor sales forces have increased the cost of marketing this class of equipment very decidedly, and it is felt that overhead is being badly underestimated, to say the least, in many cases of close competition for sales. The seriousness of this matter is recognized by many men in the motor field, but the tendency of others to shut their eyes to it is dangerous. According to well-informed opinion, the outlook for the fall trade in motors is excellent, given more stabilized price and labor conditions throughout the country.

While the sale of standard motors is improving slowly from month to month, the demand for special equipments to meet the requirements of machine-tool and other designers is a marked tendency at present in manufacturing circles. To a representative of the *Electrical World* a prominent motor manufacturer stated recently that this tendency is inevitable with progress in motor applications, although it interferes materially with mass production of regular lines and types. It is no exaggeration to state that in many cases two standard motors can now be built at the cost of one special motor in a well-organized factory. For this reason it is felt to be important in motor factories to undertake such work only after careful analyses of the machinery-driving problem involved, and the cost of maintaining qualified staffs to deal with these problems and maintain close contact with the builders of the specialized machinery that is used in different industries is by no means small.

BETTER SERVICE GIVEN

Manufacturers of machine tools, laundry machinery and other power-using equipment are no longer content in more progressive circles to build such machines for driving by externally applied motors picked up here and there as the consumer may find opportunity. The power cycles of the machines have been analyzed at great length on the basis of experience and exhausive tests, and motor requirements are now scientifically determined in a great number of cases which formerly would have been left to the hurried "cut-and-dry" method of "home-made" driving installations. A manufacturer of shoe machinery has developed individual drive within the last few years for over 100 machines, and more than 3,000 such machines from this one house are now in service. Many more are in process of development. This tendency illustrates the breadth of the motor market and at the same time the field of service for standard motors is widening, especially in connection with the electrification of existing installations and the powering of machinery for ordinary service involving no unusual torque or speed characteristics. This increased precision of motor application, it is believed, represents potential gains of large magnitude both in the investment and operating phases of electric power application.

Good Prospects for Heater Sales During 1922 and 1923

Prospects for heater sales during the season of 1922 to 1923 reveal many interesting factors. From present indications there will be a shortage of coal, which should help demand. Some sections of the country where natural gas is used as fuel report a scarcity of that too. Furthermore, a great deal of publicity and intensive selling has been carried on in pushing heater sales since last winter's buying. Production of heaters has been proceeding smoothly, with a good and more sufficient supply of labor available. Raw-material shortages have been naturally overcome, and though some complaint is still heard regarding such items as porcelain, steel, lamp cord and switches, it is in less degree.

Austria's Foreign Trade in Electrical Products Gains

Detailed statistics have been issued by the English government respecting the foreign trade of Austria in electrical manufactures in the first half of the year 1921. The figures are as follows, those for the corresponding period of 1920 being given for the purpose of comparison:

	First Half of 1920 Metric Tons	First Half of 1921 Metric Tons
IMPORTS:		
Dynamos and electric motors (except automobile motors).....	247	459
Meters, etc	20	66
Switches, contacts, etc..	86	131
Electric bulbs, etc.......	66	173
Other electrical apparatus	143	177
Cables and insulated wires	23	29
Carbons for electrotechnical purposes.........	45	28
Other classes not specified	2	3
Total...............	643	1,070
EXPORTS:		
Dynamos, electric motors (except automobile motors) and transformers..............	868	2,283
Telephones and microphones	24	189
Meters . .	30	93
Switches and contacts, etc.	68	144
Electric bulbs, etc.	352	674
Other electrical apparatus	385	1,053
Cables and insulated wires	230	541
Accumulators, with lead plates, and plates alone	293	366
Carbons for electrotechnical purposes....	64	83
Total................	2,317	5,430

Little Interest in Radio Shown in Sweden

Owing to government regulations nothing has been done so far to stimulate popular interest in amateur radio telephony in Sweden. The use of radio apparatus is controlled by the Royal Telegraph Board. Private firms may use it under license, but up to the present time they have not availed themselves of this right.

Only one Swedish firm is at present manufacturing radio apparatus and parts, and it has supplied considerable quantities to the Swedish government. The factory is comparatively small, and arrangements have been made for its expansion should circumstances warrant. The apparatus imported into Sweden is mostly of German make.

Swedish electrical dealers have for some time been trying to obtain modification of the regulation which forbids the use of radio apparatus by amateurs, but so far without results.

Says American Cable Facilities Are Being Widened

Communication systems throughout the world were so generally affected by the war that the traffic handled on every route in operation after the armistice was greatly in excess of any previous record, says P. E. Nagle, communications expert of the Department of Commerce. This increased traffic, he states, was partly due to the suspension of service on such important communication routes as the Indo-European Telegraph Company, the Great Northern Telegraph Company and the various German and German-Dutch cables, and the officials of American companies were generally of the opinion that with the restoration of service on the routes mentioned there would be a noticeable falling off in the volume of messages handled by American companies. Events, however, according to Mr. Nagle, did not bear out this view, and at the present date American cable and radio companies are handling more traffic than they ever did except during the war and the two years immediately following the armistice.

"The result of this steady growth in traffic," Mr. Nagle says, "has been to keep up the interest in plans for new cables and new radio stations, and every American communication company is now actively engaged in the construction of additional facilities and in plans for new routes and methods for the improvement of operating conditions."

Slight Improvement in Porcelain Sales Reported

"Porcelain sales during the past six months have slightly improved," is the report of a leading manufacturer of porcelain. "Deliveries are prompt, except occasionally for a complaint of lack of proper coal supply.

"Prices are at their low-water mark. There is every possibility of a slight change to higher figures, if not immediately, in the near future. We believe the next half year will be better than the last, that the lowest ebb in the market has been reached and that we are now on the upward turn. Our sales indicate increasing business and inquiries are more numerous."

Says Constantinople Homes Need Heating Devices

Two gas companies which operated in Constantinople in pre-war days have not yet resumed service, and this fact, combined with proposed special rates for electric heating, should result in the broader use in that city of electric radiators and, to some extent, of electric ranges and smaller cooking devices, according to reports to the Department of Commerce.

Welding Devices Sales Rapidly Increasing

"Current sales in welding devices are two to three times as good as six months ago, and we have no idea what is causing the improvement. In fact, with strikes and other disturbing conditions, we would predict the opposite result," says a leading manufacturer. "Deliveries are good enough, but we are trying to stock up. We have changed our prices downward in the last six months."

Metal Market Situation

Copper Trading Dull—Curtailment of Output—Statistical Positions Strengthened Greatly

Trading in the copper market last week was dull, but in view of present conditions demand from domestic interests was fair. The strikes have interfered considerably with production of refined metal, and the movement into consuming channels also has suffered from the same causes.

This curtailment of output, however, is strengthening the statistical position of the market greatly. Electrolytic copper is held for 14 cents, and even at this figure offerings have been scaled down to a small point.

Foreign buying continues at the rate of about 2,000,000 lb. daily, and exports from New York City since Aug. 1 totaled 11,267 tons. A feature of the present movement is the heavier shipments to England, as the first seven months of the year the demand from that country was extremely limited.

There is a fair demand for copper wire, particularly from magneto manufacturers, who are doing a splendid business with the automotive industry. Public utilities are buying increasing quantities of copper material.

Undoubtedly a large amount of copper remains to be bought by wire and brass mills during the next few weeks, but they are waiting for a clearing of the domestic situation before making further commitments of importance. During the last week or so the rail and coal situation has tended to decrease placing of orders by ultimate consumers. Prior to that consumers' orders were unusually good for more than a month. Much of the metal to cover these orders remains to be bought.

NEW YORK METAL MARKET PRICES

	Aug. 23, 1922 Cents per Pound	Aug. 30, 1922 Cents per Pound
Copper		
Prime Lake.... .	14.00	14 00
Electrolytic	14.00	14.00
Casting . .	13.45	13.45
Lead, Am. S. & R. price..............	5.75	5.75
Antimony	5.25	5.25
Nickel, ingot.........	36.00	36.00
Zinc, spot	6.50	6.50
Tin, Straits. ...	32.20	32.20
Aluminum, 98 to 99 per cent.........	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00–11.25	11.00–11 25
Brass, heavy	5 75– 6.25	5.75– 6 25
Brass, light.. . .	5 25– 5 50	5.25– 5 50
Lead, heavy... ...	4 62½–4 75	4 62½–4 75
Zinc, old scrap......	3.00– 3.37½	3.00– 3 37½

Three Porphyry Copper Firms Report Losses for 1922

The reports of the four porphyry copper companies for the second quarter of 1922, after a shutdown of twelve months from April 1, 1921, to April 1 last, show three of the companies operating at a loss. However, the Utah Copper Company, the fourth and largest of the group, reported a comparatively small profit from production.

The Utah Copper's report for the quarter ended June 30, 1922, showed total income of $704,158, equal to 43 cents a share (par $10) on $16,244,900 capital stock, contrasted with a deficit of $444,229 in the corresponding quarter last year.

The Chino Copper Company reported a deficit of $126,131 for the quarter compared with a deficit of $304,608 in the same three months of 1921. Its gross production of copper aggregated 6,898,030 lb.

The Ray Consolidated also reported a deficit totaling $247,867, compared with a deficit of $370,209 a year previous, the deficit from operations being cut down to the former figure by $64,202 in miscellaneous income. Its gross copper production totaled 5,772,527 lb.

Nevada Consolidated reported an operating loss of $103,308 figured on a basis of 13.209 cents a pound. Shutdown expenses and miscellaneous nonoperating costs brought the total loss to $234,218.

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Reports Amateur Radio Work in Germany Restricted

German manufacturers of radio apparatus and equipment are not in a position to make extensive deliveries of their product, according to Vice-Consul Nathaniel B. Davis, Berlin, in a report to the Department of Commerce. This is due to the fact that up to the present time the demand has not been sufficiently great to warrant the manufacture of radio instruments in large quantities.

"Amateur radio work is not popular in Germany," Mr. Davis reports, "and stations are not numerous. Radio telephony in particular is almost an unknown science except to engineers, professional operators and experimenters.

"The principal reasons given for the lack of interest in radio on the part of the general public are that amateur stations are a luxury beyond the means of the average German, under present economic conditions, and official restrictions on their use.

"All radio communication in Germany is under the control of the Federal Post Office Department, which operates the commercial stations. Private installations must ordinarily be made by the department but in exceptional cases private companies or individuals may be authorized to erect their own plants, but they must first obtain a license from the Post Office Department. The fee for such a license varies according to the size of the plan, with a maximum of 2,000 marks per annum.

"At present only one station in Berlin is licensed to broadcast. This station broadcasts market and exchange quotations. Subscribers to the service are permitted to install receiving stations upon payment of the license fee and the monthly subscription rates, which vary at present from 1,000 marks to 7,500 marks according to the class of subscription. Subscribers may rent receiving sets from the Post Office Department for 2,500 marks per month if they do not desire to build their own.

"A similar service for broadcasting news items is being planned but has not yet been put into operation. The organizers of this service, however, intend to serve provincial newspapers rather than amateurs.

"In spite of the lack of demand for short-wave amateur apparatus there are a number of firms in and about Berlin which manufacture either complete receiving sets or parts. Vacuum tubes are almost unavailable, and practically all receiving sets manufactured in this district operate with crystal detectors."

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No Delayed Shipments of Motors in New England

New wiring installations, largely in residences, are creating a fair demand for meters of the more common sizes. Delivery conditions are easy, and the proximity of some representative factories to the New England consumer is a favorable feature under present conditions, although so far no reports of delayed shipments from interior points have come to the attention of the *Electrical World.*

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

Much improvement in demand for electrical materials is noted this week. Reports from all over the country indicate that the rail and coal strikers are having a less deadening effect on deliveries and prices. A feature of this week is the slight increase in the price of conduit. This is the third increase in two months. Central-station outputs show healthy gains over last year. Factory production in electric radiators is very active in expectation of a heavy fall demand, a better trade being anticipated owing to the prospective hard-coal shortage. Wire sales are in good volume with prices firm. Improvement in motor sales continues.

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New York

Motor Sales Improving—Crystal Decorated Fixtures Active—Interest in Radiators Increasing

Demand in electrical materials shows improvement. Conduit stocks are reported lower than two weeks ago, and prices for this material have advanced slightly during the last few days. Outputs of central stations show large gains over last year. Appliance sales are improving greatly.

Motors.—Sales are improving, the smaller sizes continuing to sell best. Prices are steady and stocks are lower.

Fixtures.—A slight improvement is noted. Better grades continue to sell best. Some calls are noted for the new styles of crystal hangers.

Lamps.—Demand is improving, and the ordinary sizes are selling in greater volume.

Radiators.—Increased interest is being shown following extensive advertising campaigns among the dealers.

Chicago

Conduit Deliveries Are Uncertain—Wire and Lamp Cord Prices Expected to Increase

Nothing of prominence has been reported by the electrical trade this week. Business in general is very good. Because of the increase in demand conduit has gone up three points and deliveries are uncertain on most sizes.

Wire.—Demand continues good. Rubber-covered No. 14 is being quoted at $6.10 to $6.20 per 1,000-ft. in 5,000-ft. lots, and a price increase is expected.

High-Tension Equipment.—In general, business in fuses, lightning arresters and disconnecting switches is very brisk.

Safety Switches.—Business is moving very slowly. The demand for the 30-amp. type is the greatest.

Lamp Cord.—The call for lamp cord is fair. There is an expected increase in present price, which is $15.00 per 1,000 ft. for the No. 18 twisted cotton with 1/64-in. insulation.

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Boston

Central-Station Outputs Show Healthy Gains—Water-Heater Sales Improve—Motors Active

Uneven business characterizes the local market in electrical supplies this week. Underlying conditions in New England industry are improving with few exceptions. Railroad transportation is rapidly recovering from the effects of the shopmen's strike, which in this district were never very evident to the public; textile labor is resuming work, building operations are extremely active, and the outlook is much improved in the soft-coal situation. Central-station outputs show healthy gains over last year. Prices stiffened last week on rigid conduit, and deliveries continue unsatisfactory on this material. Appliance sales are responding to vigorous merchandising efforts.

Flexible Armored Conductor.—Sales are active, with good supplies in hand and firm prices. No. 14, single-strip, in 5,000-ft. lots, is quoted at $48 to $50 per 1,000 ft.

Water Heaters.—Recent sales show improving demand, and a better trade is anticipated this fall owing to hard-coal shortage.

Electric Radiators.—Inquiries of manufacturers reflect increased interest among jobbers as to fall sales. Factory production is very active and stocks are in shape to meet the first autumn rush.

Wire.—Sales are in good volume, with firm prices. Weatherproof base is 17 cents and bare base 16 cents.

Motors.—Improvement continues in sales of smaller sizes, both new and second-hand. Competition is very sharp.

Appliances. — Vacuum cleaners are moving faster, and washing machines are attracting more interest in retail circles. Fans are very quiet. Electric range sales are better than last year's.

Atlanta

Building Slowing Up—Vacuum-Cleaner Stocks Are Satisfactory—Battery-Charging Outfits Are Active

Building activities have slowed up somewhat on account of the difficulty in the receipt of materials of the heavier type. Cement is reported somewhat scarce owing to shutdown of cement plants on account of coal shortage, while embargoes and freight congestion are causing considerable difficulty in receipt of all freight shipments. The coal strike is beginning to be felt, and it is reported that the railroads are confiscating coal in transit intended for utility use. Should this continue, the steam-driven utilities are going to have considerable embarrassment in meeting their customers' demands.

Fans.—Sales have picked up again and jobbers' stocks are reported low. A few small lots are on hand but are going rapidly.

Vacuum Cleaners.—Retailers report little success in interesting prospective customers. Dealers' stocks are ample and factory shipments satisfactory. Prices steady.

High-Tension Transformers. — Shipments have lengthened until deliveries are on a fourteen-week to eighteen-week basis, with the exception of one or two of the smaller manufacturers.

Battery-Charging Outfits. — These show a slightly increased movement but are still much slower than was anticipated.

Dry Batteries.—Fall pick-up has not materialized, but satisfactory sales are anticipated as soon as the harvest season and cool weather begins. Stocks and shipments are satisfactory.

Lamp Cord.—Fair sales are to be noted, with a probable increase for temporary work if fixture shipments continue to be delayed. Jobbers' stocks are sufficient to meet demands.

St. Louis

Slight Business Improvement Reported—Conduit Prices Advance—Safety Switches in Demand

Slight improvement in business seems to have been generally experienced by the jobbers this week. The opening of the mines has started movement of electrical goods to that field. Residential construction continues on a big scale, but costs remain very high and lumber concerns are anticipating a substantial slump in building activity by next year.

Stocks are not particularly affected by railroad difficulties. The only item that is especially short is iron conduit. Prices, are firm, with conduit as the principal item showing increase.

Conduit.—With stocks low and deliveries difficult, prices were again raised this week. Revised quotations are as follows: ½-in. black, $55.60 per 1,000 ft.; ½-in. galvanized, $79.60 per 1,000 ft. Demand is firm, with little change from last week.

Wire.—Weatherproof is commanding higher prices, the base price now quoted being 17½ cents per pound. Base price on bare is from 16 cents to 16½ cents per pound. No. 14 rubber-covered sells for $6.50 per 1,000 ft. in 5,000-ft. quantities.

Fuses.—Steady demand and prices, with conservative stocks, are generally found.

Safety Switches.—This type of switch is becoming increasingly popular. Stocks are good and immediate delivery can ordinarily be given. Entrance switches are priced from $1.30 to $2 in standard packages of ten switches. A 30 amp., three-pole motor starter sells for $8.

Cleveland

Radio Market Dull—Washers Active—Ranges in Fair Demand—Refrigerator Prices Steady

Radio Equipment.—Last week's inactivity continues. Express facilities here have prevented the rail controversy from subjecting orders to delay in delivery.

Washers. — Manufacturers report a demand equal to capacity and no price change. Jobbers have met the vacation depression with intensive selling campaigns, and dealers are far from pessimistic.

Ironers and Dishwashers. — Dealers have promoted sales with attractive window displays and demonstrations. The number of inquiries received is regarded as indicative of the existence of a potential field, and jobbers and dealers are planning to capitalize it with selling campaigns.

Ranges.—Fair demand is reported, and dealers are closely following up inquiries with satisfactory results.

Heaters.—The fluctuating barometer here in the past week has been considered responsible for the slight increase in heater sales. Dealers are ordering the small portable type for the fall demand.

Fixtures.—The sudden increase in building and construction has proportionately affected the sale of fixtures, and activity in the better grades indicates that a brisk autumn season may be expected.

Refrigerators.—The general interest in appliances has included refrigerators, and while nothing spectacular in sales is reported, jobbers are expecting to dispose of the present supply without difficulty. The market is plentiful but prices are steady.

San Francisco

Curling Irons Reported Popular—Jobbers Allowing Better Profit Rate on Washers

Heating Appliances. — Curling irons are popular. Small disk stoves are also popular, and dealers in college cities report excellent business. There is a marked tendency of jobbers to give a better rate on washers and larger appliances during 1922. The average washer profit has progressed from 25 per cent to 30 per cent.

Vacuum Cleaners.—Prices are steady. Public demand for all is steadily growing.

Schedule Material.—Huge and steady boat shipments have produced large and well-assorted local stocks.

Salt Lake City—Denver

Conduit Demand Steady—Radio Dealers Expect Improvement—Motor Stock Reported Ample

Aside from an occasional delayed shipment, the strike is having little direct effect on the electrical trade. With producers of perishable crops, however, it is working havoc in many cases. Enough cars cannot be secured to carry ripe fruits to market, the movement of coal to famine centers apparently having the right-of-way.

Employment conditions are good. The general buying power is improving, and the disposition to spend indicates that prices have about reached the point of complete adjustment.

Conduit.—Demand is steady. Prices have recently shown a stiffening tendency. A 5 per cent increase is reported for the last month.

Radio.—Jobbers are preparing for a big jump in demand. Stocks are in good shape. Dealers display only moderate interest. Prices are downward.

Motors.—Fair demand. Stocks ample in all types and sizes.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Large Increase in Wakefield Brass Company's Business

Business in commercial lighting hangers manufactured by the F. W. Wakefield Brass Company, Vermilion, Ohio, increased 94 per cent in the second quarter of 1922 as compared with the first quarter. The company reports that approximately the same rate of growth is still holding good.

◆

American Pole Protective Taken Over by Trust Estate

The American Pole Protective Company, an Illinois corporation, has been taken over by the Appco Trust, Ltd., a common-law trust estate. The estate is to be administered by five trustees. The present trustees are S. M. Mulnix, W. G. Scott, S. A. Nelson, H. C. Heyer and A. L. Slusser.

The transfer was made so as to provide for expansion and development. Under the old organization the Appco pole protector—an appliance made of corrugated galvanized sheet iron which is assembled around the base of a pole for the reinforcement of telephone, telegraph and transmission-line poles at their weakest point, the ground line, and to protect the poles from fire—was patented and improved.

◆

Electric Motor & Engineering Appoints Sales Agents

The Electric Motor & Engineering Company, Canton, Ohio, announces that it has appointed the following sales agents:

The Charles Lakin Sales, 4937 Maplewood Avenue, Detroit; C. M. C. Electric Sales, 507 Odd Fellows Building, Indianapolis, and James R. Jordan, Jr., 217 East Third Street, Cincinnati.

◆

Westinghouse Announces Recent Sales Appointments

Changes affecting the personnel of the Atlanta, Denver, Seattle, New York, San Francisco and New Orleans sales offices have been announced by officials of the Westinghouse Electric & Manufacturing Company.

In the Atlanta office R. H. Moore has been appointed office manager and Thomas Fuller has been made manager of the central-station division and placed in charge of the sale of supply apparatus.

E. C. Means has been appointed manager of the central-station and transportation divisions of the Denver office, and J. P. Sprunt, Jr., has been made manager of the merchandising division which was recently organized there. Mr. Sprunt will also have general charge of the sale of supply apparatus in the Denver territory.

J. G. Miles has been appointed manager of the central station division and has been placed in general charge of the sale of supply apparatus in the Seattle district. A. W. Eshelby has been appointed manager of the transportation division, and A. A. Miller has been made special representative in large negotiations and power developments in the Seattle office.

C. V. Holmes has been appointed district auditor with headquarters in the New York sales office.

Edward C. McCarty has been appointed treasury and accounting representative of the San Francisco office, succeeding A. L. Austin, resigned.

O. P. McCord has been appointed branch manager of the New Orleans office.

◆

National Transformer Company Moves to New Quarters

The National Transformer Manufacturing Company, formerly of 5247 North Clark Street, Chicago, has moved to 154 Whiting Street in that city, officials of that company announce.

The manufacturing floor space was increased 260 per cent, which will facilitate increased production on toaster stoves, special transformers and radio equipment. J. W. Crenerius is president and I. J. Mendels secretary. This firm was recently incorporated for $25,000.

Roebling Company Announces Wage Increase

Following the recent wage increases by the United States Steel Corporation, the John A. Roebling Sons Company, wire and cable manufacturer, Roebling, N. J., announces wage increases for its 6,500 employees. The increase, to take effect Sept. 3, will be about 20 per cent for common labor, with equitable adjustments for other classes.

◆

Morecroft Appointed Engineer of New York Radio Firm

The Jewett Manufacturing Corporation, radio-apparatus manufacturer, with executive offices at 342 Madison Avenue, New York City, announces that it has appointed Professor Morecroft of Columbia University its radio engineer. Professor Morecroft has designed a new vario-coupler which the company is using in all its short-wave sets.

◆

Supply Company Joins with Franklin Electric

The Champion Electric Supply Company has moved to 733 West Jackson Boulevard, Chicago, after being established for three years at 204 West Randolph Street. This company is now controlled by J. L. Cohen, president of the Franklin Electric Company, and the capitalization has been increased to $100,000. Mr. Cohen has brought the Franklin Electric Company, formerly at 63 East Lake Street, to the same address and states that he will manufacture lighting supplies and electrical equipment, while the Champion Electric will serve as distributor and jobber. His floor space has been increased 5,000 sq.ft., and his present capacity is 12,500 sq.ft. The personnel of the Champion Electric Supply Company has not been completed.

Harvest Days and Washing Machines

BY H. M. C.

THE opportunities for selling appliances at agricultural fairs are not realized by all manufacturers. A bumper crop has put a great deal of money in the famers' pockets.

A sales bulletin, as rugged as a field of healthy corn, was issued last week. It tells of wonderful opportunities—selling the product of the Laundryette Manufacturing Company, Cleveland, U. S. A., at agricultural fairs. The story starts directly at the very top of the first page. Whoever wrote it must have experienced many dusty roads, tough prospects and days without sales. Perhaps he is the company's president; he is a salesman.

"The vacation season will be passed, the crops will be in and the fairs will be thronged. . . . Generally speaking, almost anything can be displayed profitably at a fair. They will inspect the best apples produced in their territory just as readily as they will visit the side shows in the Midway. They're in a looking mood and they have money to spend. Brush up on your demonstration talk. It will do no good to show the machine if you can't talk intelligently about it after you have secured attention," are words of the writer. "Remember, if you are a man, that the women you talk to are doing washings each week and they think they know as much about it as you do about tying your tie or shaving yourself."

You see, he warns salesmen to prepare for the selling field.

Harvest days for all. Washing machines are sisters of vacuum cleaners, and irons and toasters cousins of both. All can be sold at these agricultural fairs.

Radio Corporation of America Secures Large Order

The Radio Corporation of America has announced that it has received orders for the building of five radio stations, three for Central America and two for the United States. Each of the stations will have a sending radius of more than 2,000 miles.

The stations will be built for the Tropical Radio Telegraph Company and the United Fruit Company. The three Central American stations will be at the corners of the triangle embracing Honduras, Nicaragua and Panama. The Tropical Radio Telegraph stations will be at Managua, the capital of Nicaragua, and at Tegucigalpa, the capital of Honduras, which has been designated as the capital of the new Central American Union. These stations will connect with the United Fruit Company's station at Almirante, Panama.

◆

Believes America Will Adopt German Standards

Oscar R. Wikander, an American engineer, has just returned from Germany, where he represented the American Engineering Standards Committee of New York City in several conferences regarding various methods of international standardization. German industries have developed many efficient standard systems within the last few years, and he believes the time is not far distant when American manufacturers will receive inquiries from foreign countries asking if they can furnish goods according to the German national standards.

◆

Italian Hydro-Electric Enterprises Financed by Americans

The report is confirmed by the London *Times* "Trade Supplement" that an American financial group has granted a ten-million-dollar credit for certain Italian hydro-electric enterprises. It is said that a corporation is being formed in the United States to issue securities and that extensive preparations have already been made for advertising and selling the bonds. It is said also that this loan is to be the first of a series which will eventually include all of the provincial districts in northern Italy. Future loans will, however, depend on the measure of success achieved in marketing the first issue.

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Multiple Storage Battery Firm Appoints Sales Manager

The Multiple Storage Battery Corporation, New York City, manufacturer of "A" and "B" storage "radiobats," has placed R. H. Butler in charge of sales and advertising for its radio division.

Mr. Butler has been associated with the merchandising of radio products for three years. During that time he has been actively connected with several of the most important advertising and selling campaigns in the radio industry.

An extensive selling and advertising campaign will be launched by the company this fall, calling for dominating space in leading national magazines and newspapers as well as the radio press. The sale policy will also include the liberal use of selling helps and various forms of sales co-operation for the benefit of the radio dealer.

The newly enlarged plant of the Multiple Storage firm is located at Jamaica, L. I., with a capacity of 5,000 "A" "Radiobats" and 10,000 "B" "radiobats" per week, in addition to the automobile, farm-lighting, aëroplane and other types of batteries for various purposes.

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Cooper Hewitt Electric Company Holds Sales Convention

The Cooper Hewitt Electric Company recently held a convention at its factory annex, Eighth and Grand Streets, Hoboken, N. J. The managers and salesmen from all the district sales offices except the Pacific coast, together with the members of the manufacturing, engineering and general office executive forces, were present. After brief addresses by W. A. D. Evans, president, and A. D. Childs, sales manager, a general inspection of the factory was conducted by Messrs. Mailey, Buttolph and Smalley.

SALESMEN AT COOPER HEWITT CONVENTION HELD RECENTLY AT HOBOKEN, N. J.

The chief object of the convention was to acquaint the selling force with the improvements in manufacturing processes that have been developed and put into production since the company was taken over by the General Electric interests.

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The Fulton Iron Works, St. Louis, announces that it has been awarded a contract for a three-cylinder 285-boiler-hp. Fulton Diesel to be installed in the municipal light plant at Granite Falls, Minn. This engine is arranged for direct connection to a 190-kw. alternating-current generator with belted exciter.

Associated Engineers, Inc., announces that it has moved to larger quarters at 373 Broadway, Milwaukee.

The Ford Instrument Company, Inc., announces the removal of its offices and factory to its new building, Rawson Street and Nelson Avenue, Long Island City, N. Y., on Aug. 1.

The Millers Falls Paper Company, Millers Falls, Mass., is electrifying its entire plant. Each machine is to be driven by a separate motor. Energy will be supplied from the Franklin Electric Light & Power Company.

The Hartford Instrument Company, Hartford, Conn., has been incorporated under the laws of that state to manufacture electrical, mechanical and optical devices. The capital stock is $5,000, and the incorporators are Alden L. McMurtry, John R. Sexton and Harry H. Skerrett, Jr., all of Hartford.

The American Malleables Company, Lancaster, N. Y., has awarded a contract to the Bonnot Company, Canton, Ohio, for the installation of a Holbeck pulverized-coal system in its Owosso (Mich.) plant. This plant has been partly equipped with pulverized coal for some time. The contract was awarded to the Bonnot Company for equipment to serve twenty-four annealing furnaces, three melting furnaces and two small boilers, and provision was made for equipping the core ovens later.

The Standard Underground Cable Company, Westinghouse Building, Pittsburgh, Pa., has filed plans for extensions and improvements to its plant on Sixteenth Street, to cost about $25,000. The J. W. Cowper Company, Oliver Building, is the building contractor.

The American Wireless Company, Windham, Conn., has organized and has elected the following officers: President, Jonathan Starr; vice-president and treasurer, Frank H. Foss; secretary, Mary H. Foss. The capital stock is $30,000, and the company will manufacture instruments and apparatus for aerial communication.

Foreign Trade Notes

ELECTRIFICATION OF THE ENTIRE TOKYO-KOBE TRUNK RAILWAY PROPOSED.—Another large electrification project has been adopted by the Japanese Department of Railways, *Commerce Reports* states, which involves the electrification of the Tokyo-Odawara and the Tokyo-Yokosuka lines. The new project takes in the whole Tokyo-Kobe trunk line. The cost of the entire work is estimated at 67,000,000 yen. Of this amount 35,000,000 yen will be used for construction and improvement of locomotives and cars. The number required is estimated at 291, including freight cars, passenger cars, express locomotives, special express train locomotives, etc. The work is to be started with the erection of cables over the present tracks from both terminals.

INTERCOMMUNAL ELECTRICAL CO-OPERATIVE SOCIETY PROPOSED FOR LIEGE, BELGIUM.—The special commission appointed by the Provincial Council of the Province of Liège in 1920 for the study of the distribution of electrical energy throughout the province, according to the *Electrical Times*, has furnished a report suggesting that an intercommunal electrical co-operative society be formed at once.

MEXICAN LIGHTHOUSES TO BE EQUIPPED WITH WIRELESS OUTFITS.—The installation of small wireless outfits in all lighthouses of the Mexican Department of Communication, according to *Commerce Reports*, is under consideration. Two sets have been installed on trial. If they prove satisfactory, all lighthouses will be similarly equipped.

CONSTRUCTION OF HIGH-TENSION TRANSMISSION SYSTEMS IN FRANCE AUTHORIZED.—The bill authorizing the construction of high-tension transmission systems in France has, according to the *Electrical Times*, been passed by both the Chamber of Deputies and the Senate. The bill aims at making provision for irregularities in power of central stations due to seasonable variations in water supply. Permission was granted by a law of August, 1920, for the construction of connecting systems for the transmission of energy in the liberated provinces of France. Work on that scheme was completed in the north in 1920, but it is expected that work in the east will not be finished until 1923. The Senate adopted various amendments to the bill, one of which empowers the state to take the initiative in the construction of high-tension transmission systems for provision of mutual assistance and co-operation in case of dearth or abundance in individual stations. By the terms of a second the state may purchase undertakings in case of refusal of co-operation by producers and distributors.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

The representative of an American firm in Italy (No. 3,295) desires to secure an agency for the sale of electric wire, etc.

An agent in Uruguay (No. 3,305) desires to secure an agency for the sale of electrical goods and railway supplies.

A merchant from the Netherlands (No. 3,374) is in the United States and desires to secure agencies for electrical household appliances, telephone booths, etc.

A merchant in Spain (No. 3,377) desires quotations on electrical, photographic, surgical and optical supplies.

ELECTRIC DISTRIBUTION SYSTEM FOR BELGIAN CONGO.—Tenders will be received by the Belgian Ministère des Colonies (Cinquième Direction), 20 Rue de Namur, Brussels, until Dec. 20, the *Electrical Review* states, for the installation and operation of an electric distribution system at Elizabethville, in the Belgian Congo.

STORAGE BATTERIES, MOTOR-GENERATOR, ETC., FOR VICTORIAN RAILWAYS, AUSTRALIA.—Tenders will be received by the Victorian Government Railways Commissioners, Melbourne, Australia, according to the *Electrician*, until Oct. 11 for furnishing an electric storage battery with accessories and spares at the electric light station, Melbourne (Specification No. 35,090); also until Oct. 18 for a static transformer complete with oil and a motor-generator set complete with accessories, to be delivered at the electric light and Pintsch gas station, Melbourne.

ELECTRICAL EQUIPMENT FOR A PROPOSED HYDRO-ELECTRIC STATION IN CZECHOSLOVAKIA.—The Direktion des Stadtlichen Elektricitäts, Kaaden, Czechoslovakia, according to the *Electrical Review*, is asking for bids for electrical equipment and machinery for a new water-power station at Kaaden.

New Apparatus and Publications

INSULATING COMPOUNDS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing a publication (4,249-A) entitled "Westinghouse Proved Insulating Compounds," describing its line of insulating and soldering compounds.

MAGNETO.—The American Bosch Magneto Corporation, Springfield, Mass., has developed a new "F" type waterproof "Bosch" magneto, comprising oscillating and rotary types.

RADIO SUPPLIES.—The Lewis Electrical Supply Company, Boston, has issued Radio Catalog No. 2. It is published in loose-leaf form, and provision is made for the maintenance of a separate price list.

INSULATING MATERIAL.—A new finish for electrical apparatus, known as "Viscolac," has recently been developed by the chemical products division of E. I. du Pont de Nemours & Company, Wilmington, Del.

ELECTRIC CLEANERS.—"Good Housecleaning" is the title of a booklet distributed by the United Electric Company, Canton, Ohio, covering the "Ohio-Tuec" electric cleaner.

STRAIN INSULATOR.—A new strain insulator, "Duro," is now being manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

STEEL WINDOWS.—The David Lupton's Sons Company, Allegheny Avenue and Tulip Street, Philadelphia, is distributing catalog No. 110, describing its steel windows for all classes of buildings.

FUEL SAVING.—"Automatic Combustion Control" is the title of a twenty-eight-page booklet published by the Automatic Fuel Saving Company, Philadelphia, combustion engineer and contractor, covering the "Gray" system for economical boiler plant operation.

MOTOR STARTERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, has issued folder 4,500, describing a new line of motor starters recently developed by the company.

BOOKLET ON UTILITIES.—The General Engineering & Management Corporation, 141 Broadway, New York City, is distributing an illustrated booklet, describing its service in constructing, financing and operating public utility properties, and making investigations, valuations, reports, etc.

ELECTRIC CEILING FANS.—The Hunter Fan & Motor Company, Fulton, N. Y., has issued catalog No. 305, describing its electric ceiling fans, ornamental and plain types.

LACQUER.—The Zeller Lacquer Manufacturing Company, 342 Madison Avenue, New York City, is distributing a booklet entitled "250 Lacquer Questions Answered." It should be of value to all who are interested in finishing products of every nature.

STREET-LIGHTING FIXTURES.—Folder 4,500 published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, describes some of the "Westinghouse" lighting fixtures and gives illustrations of a number of its typical city installations.

New Incorporations

THE CAPE MAY COUNTY ELECTRIC COMPANY, Camden, N. J., has been incorporated with a capital stock of $150,000 by Joseph S. Low, H. V. Allgaise, Camden, and Charles M. Bridge, Merchantville, N. J.

THE PENN-JERSEY POWER COMPANY, Jersey City, N. J., has been incorporated by Charles W. Alpaugh, Alfred B. Nelson, Bernardsville, and H. Otto Wittpen, Jersey City. The company is capitalized at $125,000 and intends to construct dams in the Delaware River.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

SOUTH BERWICK, ME.—The Berwick & Salmon Falls Electric Company, it is reported, has awarded a general contract for the construction of a hydro-electric plant on the Great Works River, near South Berwick. The equipment will include two vertical-type waterwheels directly connected to electric generators of 425 kva. and 200 kva. Energy generated at the station will be transmitted at 13,200 volts to the present station of the company at South Berwick.

PAWTUCKET, R. I.—The Blackstone Valley Gas & Electric Company is planning to erect a double steel power transmission line from the Tidewater Street plant to the state line to connect with the lines to Woonsocket and future lines interconnecting with other power stations to the east and south.

PROVIDENCE, R. I.—The United Electric Railways Company contemplates the construction of a one-story and two-story, 88-ft. by 250-ft. garage and service building on Melrose Street, to cost about $100,000.

BRIDGEPORT, CONN.—The Atlas Body Works, McKinley Avenue, will build a one-story addition to their power house.

DEVON, CONN.—The Connecticut Light & Power Company, Waterbury, will build a 75-mile transmission line in connection with its proposed generating plant at Devon.

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North Atlantic States

AMSTERDAM, N. Y.—The erection of an additional transmission line from the Inghams Mills power station to Oneida County is reported to be under consideration by the Adirondack Power Corporation.

BOLIVAR, N. Y.—The Bolivar-Richburg Electric Company contemplates the erection of transmission lines in Bolivar, Richburg, Wirt and Genesee. The cost is estimated at about $30,000.

BROOKLYN, N. Y.—The Brooklyn Edison Company is having plans prepared for an electric plant at Marshall Street and Hudson Avenue, to cost about $5,000,000. Thomas E. Murray, Inc., 55 Duane Street, New York, is engineer.

BROOKLYN, N. Y.—Benjamin G. Hutchins, Inc., 990 East Thirty-fourth Street, will make extensions and improvements to its power house on East Thirty-fifth Street, to cost about $25,000. Lockwood, Greene & Company, 101 Park Avenue, New York, are engineers.

BUFFALO, N. Y.—The Sikes Chair Company, 500 Clinton Street, contemplates rebuilding of its power house and factory, recently damaged by fire.

CALDWELL, N. J.—Bids will be received by the purchasing agent, Board of Freeholders, Court House, Newark, until Sept. 19 for electric work in connection with additions and improvements in the Essex County Penitentiary in Caldwell.

PHILLIPSBURG, N. J.—The Eastern Pennsylvania Power Company will build a new substation at Anderson and Grant Streets.

PHILLIPSBURG, N. J.—The Town Commission has adopted an ordinance providing for the installation of a street-lighting system on South Main Street, to cost about $23,000.

FREELAND, PA.—The Pennsylvania Power & Light Company will build a transmission line from Freeland to the Butter Valley district.

LANSFORD, PA.—Work will soon begin on the construction of the new coal-loading docks and storage plant on the Lehigh Canal, near Northampton, by the Lehigh Coal & Navigation Company to replace its present plant at Coalport, to cost about $500,000. It will be equipped with cranes, loading machinery, etc.

PHILADELPHIA, PA.—Bids will be received at Room 216, City Hall, until Sept. 7 for construction and equipment for the Southwest sewage-pumping station, Fortieth Ward, lowland drainage, as follows: Contract No. 1—substructure and superstructure; No. 2—mechanical equipment; No. 3—electrical equipment; No. 4—plumbing system; heating and ventilating systems. Frank H. Caven is director.

PHILADELPHIA, PA. — Plans for the proposed new plant of the Fisher High-Grade Dairies, Inc., 1,935 East Willard Street, to be erected on Worth Street, provide for a power house. William H. Timm, Perry Building, is architect.

PHILADELPHIA, PA.—Plans have been completed for the construction of a power house at the new textile dye works of Walter E. Knipe & Sons, Hancock Street, to cost about $22,000. W. E. S. Dyer, Land Title Building, is engineer.

PITTSBURGH, PA. — Plans have been prepared by the Monongahela Inclined Plane Company for the erection of a power house on Granview Avenue.

TATAMY, PA.—The Tatamy Light, Heat & Power Company contemplates extensions and improvements to its system.

WILMINGTON, DEL.—Bids will be received at the office of the Board of Harbor Commissioners, Municipal Building, Wilmington, until Sept. 8 for mechanical equipment for the Wilmington marine terminals, including light-duty traveling electric portal cranes (2½ tons capacity), portable electric dock winches (2 tons capacity), electric tractor trucks, with two spare battery equipments, trailers for electric tractors, etc.

OAKLAND, MD. — The West Maryland Power Company, recently organized by the West Penn Electric Light & Power Company, Pittsburgh, as a subsidiary, has acquired the municipal electric plant and system. Extensions and improvements will be made. A transmission line will be erected to the upper Potomac and Carroll County coal fields.

MILLVILLE, W. VA.—The Potomac Public Service Company, a subsidiary of the American Water Works & Electric Company, contemplates increasing the output of its local power plant.

WASHINGTON, D. C.—Bids will be received by the purchasing agent, Post Office Department, until Sept. 6 for 1,000 ft. No. 18 fixture wire, single, silk-covered. Also, until Sept. 8 for 20,000 ft. single electric cable, low-tension, 5,000 ft. high-tension electric cable and 5,000 ft. dual low-tension electric cable.

WASHINGTON, D. C.—Bids will be received by the Board of Commissioners until Sept. 12 for 5,500 ft. of telephone and signal cable, as per specifications on file at Room 320, District Building.

WASHINGTON, D. C.—Bids will be received until Sept. 7 at the office of the Public Printer, Government Printing Office, for synchronous converters, 4,500 kw. capacity, 25-cycle, 3-phase, 6,600-volt, together with switchboards, cable, transformers, etc.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Sept. 6 for 100 switchboard lamp caps, 500 binding posts, etc. Also, until Sept. 8 for miscellaneous telephone material called for under Proposal 11838-C-1CP.

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North Central States

CADIZ, OHIO.—The property of the Cadiz Electric Light & Power Company has been purchased by the Ohio Service Company, Coshocton. Work, it is understood, will begin at once on the erection of a high-tension transmission line from Dennison to Cadiz.

MARIETTA, OHIO. — Extensions and improvements to the municipal electric light plant are under consideration by the City Council.

TOLEDO, OHIO. — The State Board of Control has given its approval of an expenditure of $20,000 to remodel the power plant at the Toledo State Hospital.

BEDFORD, IND.—The Indiana Quarries Company contemplates rebuilding its plant, recently destroyed by fire. The cost of the new mill with machinery and power equipment is estimated at $350,000.

HAMMOND, IND.—The installation of forty new ornamental lamp standards on Morton Avenue is under consideration by the Board of Public Works.

HAMMOND, IND.—Bids will be received by the Board of Public Works until Sept. 15 for the installation of a complete power piping and steam-heating system in connection with a new pumping station. John Ericson, 30 North La Salle Street, Chicago, is consulting engineer.

HOPE, IND.—Steps have been taken to establish an electric plant in Hope to supply electricity in the towns of Hope and Flatrock. The local plant, owned by Alex. Porter, and the Winterroad plant at Flatrock will be taken over. A high-tension transmission line will be erected from Edina through Hope and Edinburg, which will furnish electricity in both towns and possibly to farmers along the line. The cost of the project is estimated at about $30,000.

INDIANAPOLIS, IND. — The Terre Haute, Indianapolis & Eastern Traction Company contemplates extensions to its power plant on West Tenth Street, including the installation of a 15,000-kw. generator and auxiliaries. Line extensions will also be made.

PEORIA, ILL.—Plans are being prepared by Leonard D. Jeffries, city engineer, for the installation of ornamental lamps on Chestnut and South Adams Streets.

SHUMWAY, ILL.—The installation of an electric lighting system is under consideration by the Village Board. It is proposed to erect a transmission line to Stewardson to connect with the plant of the Prairie Electric Light Company. The cost is estimated at between $7,000 and $8,000.

GREEN BAY, WIS. — Preparations are being made by the Fort Howard Paper Company for the construction of a three-story, 100 ft. x 120 ft. mill addition, with a separate boiler house and power plant, to cost including equipment about $350,000.

HARTFORD, WIS. — Preliminary work has begun on extensions to the power plant of the Kissel Motor Car Company, which will include extension to the power house and the installation of additional generating equipment. The boiler house will be equipped with three 300-hp. Stirling boilers with automatic stokers, coal and ash-handling and conveying machinery. A 175-ft. brick stack will be erected. The cost is estimated at about $100,000. The work is in charge of Cahill & Douglas, 216 West Water Street, Milwaukee, consulting engineers.

LONE ROCK, WIS.—The Village Council has petitioned the Wisconsin Railroad Commission for permission to sell the municipal electric light plant to the Wisconsin River Power Company.

WAUSAU, WIS.—Plans have been completed by the D. J. Murray Manufacturing Company for the erection of a machine-shop and assembly-floor addition, 60 ft. x 230 ft. New equipment, including a 10-ton electric traveling crane, will be installed.

INDEPENDENCE, IOWA.—The Northeastern Iowa Power Company, Clermont, contemplates the construction of a hydro-electric power plant on the Wapsipinicon River, at Independence. The Fargo Engineering Company, Jackson, Mich., is engineer.

MERRILL, IOWA.—The City will install a new street-lighting system. W. E. Buell & Company, Davidson Building, Sioux City, are engineers.

OSKALOOSA, IOWA.—Plans are under way by the City Council for the construction of a municipal hydro-electric plant on the Des Moines River, near Harvey, to cost about $270,000. Bids, it is understood, will be called for after the first of the year. The Fargo Engineering Company, Jackson, Mich., is engineer.

NOVINGER, MO.—The plant and holdings of the Merchants' Power & Light Company have been purchased by the Edina (Mo.) Light Company. The local plant serves the towns of Novinger, Green City, Queen City, Greencastle, Greentop and Tipperary.

ST. JOSEPH, MO.—Negotiations are under way between the City Council and the St. Joseph Railway, Light, Heat & Power Company for furnishing electricity to operate the municipal electric system. If carried through, the municipal generating plant will be closed down.

PORTAL, N. D.—The International Light & Power Company will rebuild the portion of its local power plant recently destroyed by fire.

LEOLA, S. D.—Bonds to the amount of $28,000 have been issued for the installation of an electric light plant and sewer system.

ALLIANCE, NEB. — The Chicago, Burlington & Quincy Railroad, Chicago, Ill., will erect a power house, 48 ft. x 65 ft., at Alliance and will also build an addition to its power house at Lincoln.

ELMWOOD, NEB.—The city will build a transmission line from Elmwood to Murdock, about 8 miles, for municipal service.

MANHATTAN, KAN.—Bids will be called early in September for extension to the ornamental street-lighting system. F. F. Frazier is engineer.

WICHITA, KAN.—Plans for the proposed new high school and manual training building provide for a one-story power house, 60 ft. x 80 ft. The cost is estimated at about $1,000,000.

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Southern States

FAYETTEVILLE, N. C.—Arrangements are being made by the Carolina Power & Light Company, Raleigh, for the erection of a 100,000-volt transmission line from Laurinburg to Fayetteville. This line will connect the city with the Blewett Falls plant.

LENOIR, N. C.—Arrangements are being made to change the motive power of the Lenoir Cotton Mill and the plants of the Hudson (N. C.) Cotton Manufacturing Company from steam to electricity. Both are operated by the management.

WINSTON-SALEM, N. C.—The Reynolds-Lybrook Farm Company will construct an electric power plant at its dairy.

WINTERVILLE, N. C. — The town of Winterville has entered into a contract with the Water and Light Commission of Greenville whereby the latter will supply electricity here for a period of five years. A transmission line will be erected to connect with the municipal electric plant at Greenville. The local distribution lines will be rebuilt and a new street-lighting system installed.

DAWSON, GA.—Extensions to the ornamental lighting system are under consideration by the Council.

MIAMI, FLA.—The Pennsylvania Sugar Company, Delaware & Shackmaxon Streets, Philadelphia, is erecting a new sugar mill near Miami. The plans provide for a power house.

HUNTINGDON, TENN.—The Board of Aldermen has decided to purchase a new electric generating unit for the municipal electric plant, to cost from $3,500 to $4,000.

MOBILE, ALA.—Bids will be received by the United States Engineer Office until Sept. 18 for one 1,000-hp. one hydraulic turbine, with governor.

PARRISH, ALA.—The Alabama Power Company is planning to extend its service to Parrish for which an appropriation of $10,000 has been made. A 2,200-volt transmission line will be erected from the substation of the Railway Fuel Company, near Parrish.

PELAHATCHEE, MISS. — The installation of a municipal electric light plant and waterworks system, to cost about $40,000, is under consideration. Swanson-McGraw, Inc., United Fruit Building, New Orleans, La., is consulting engineer.

DE QUINCY, LA.—The Council has called a special election to vote on the proposal to issue $120,000 in bonds for a municipal electric light and power plant and waterworks.

LEESVILLE, LA.—The Council is considering the installation of a municipal electric light and ice-manufacturing plant. E. T. Archer & Company, Shreveport, are engineers.

NEW ORLEANS, LA.—The New Orleans Railway & Light Company, recently purchased by a stockholders' committee for a consideration of $14,500,000, is being reorganized. Plans are being considered for extensions and improvements.

BRADY, TEX.—The Council has authorized the purchase of equipment for an ornamental street-lighting system in the business district.

CORPUS CHRISTI, TEX. — The Gulf Coast Power Company contemplates the erection of a transmission line from Corpus Christi to Victoria and Cuero, connecting at those places with the transmission system of the Texas Central Power. The company is erecting a transmission line from its local plant to Kingsville, via Robstown, Driscoll and Bishop, a distance of 40 miles.

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Pacific and Mountain States

KELSO, WASH.—The Long-Bell Lumber Company contemplates the construction of a large mill on the peninsula between the Cowlitz and Columbia Rivers. The plans provide for a 10,000-kw steam-driven electric generating plant. The mill will be equipped for electrical operation.

PUYALLUP, WASH.—The installation of an ornamental lighting system on Meridan Street is under consideration.

SEATTLE, WASH.—The Puget Sound Light & Power Company will make extensions and improvements to its machine shop and service building at 619 Post Street.

SEATTLE, WASH.—The Council is arranging an appropriation of $500,000, to be used in connection with the Skagit hydro-electric power plant.

SEATTLE, WASH.—An ordinance has been passed by the City Council providing for the improvement of University Way, including the installation of a street-lighting system.

TACOMA, WASH. — The Council has authorized an appropriation of $35,000, of which $25,000 will be used for the purchase of transformers and $10,000 for the purchase of incandescent lamps.

TROUT LAKE, WASH.—The local electric lighting system has been purchased by C. E. Stead. Improvements to the plant, it is said, are under way.

CANBY, ORE.—The City Council has decided to purchase the plant and system of the Mollalla Electric Company.

SUBLIMITY, ORE. — Preparations are being made by C. E. Taylor for the construction of a power plant on a site between Stayton and Aumsville to supply electricity in this district. Mr. Taylor has been granted a franchise to furnish electricity in the town of Sublimity.

AUBURN, CAL.—The City is negotiating for the purchase of the power plant and system of the Bell Electric Company. If taken over by the city, extensions and improvements will be made.

HANFORD, CAL.—The City Council is considering establishing a municipal electric distribution system. It is proposed to purchase energy from the Southern California Edison Company.

LOMPOC, CAL.—The City Trustees have approved plans for an ornamental lighting system in the business section.

LONG BEACH, CAL.—The Council has authorized plans for an ornamental lighting system on Anaheim Street between Loma and Temple Avenues.

LOS ANGELES, CAL.—Plans are under way for the installation of an ornamental lighting system on Satsuma Avenue and Royal Drive.

MODESTO, CAL.—Bids will be received by the Board of Supervisors for the sale of the electric franchise for the Turlock Irrigation district.

OAKLAND, CAL. — The Pacific Gas & Electric Company will build a one-story substation at Lake Temescal, Oakland.

PASADENA, CAL.—The City Directors are planning to install an ornamental lighting system on Los Robles Avenue.

RIVERSIDE, CAL. — Arrangements are being made by the San Gorgonio Power Company, recently organized, for the construction of three large hydro-electric plants on the south slope of Mount San Gorgonio, near Riverside, to cost about $2,500,000. The company has signed a contract with the Southern Sierra Power Company to furnish electrical energy for distribution in the Imperial Valley. R. R. Scarborough, Los Angeles, is president of the company.

SACRAMENTO, CAL.—Application has been made to the State Water Commission by C. E. Pollock, 1231 G Street, for permission to construct a hydro-electric plant on the Cosumnes River, to cost about $300,000.

SAN BERNARDINO, CAL.—Plans are being drawn for an ornamental lighting system on E Street, to cost about $20,000. C. E. Johnson is city engineer.

TURLOCK, CAL.—Contracts for the erection of an electric transmission line from the Don Pedro dam to Turlock has been awarded by the directors of the Turlock Irrigation district.

Canada

WINNIPEG, MAN.—Plans, it is said, are under consideration for the electrification of the Canadian National Winipeg-Grand Beach line, about 70 miles long. The Manitoba Power Company is reported to have offered to furnish power to operate the railway.

LONDON, ONT. — The Bell Telephone Company is considering placing its wires in underground conduits, at a cost of about $40,000.

RIVERSIDE (VIA WINDSOR), ONT.—The installation of an ornamental lighting system along Riverside Drive, a distance of 4½ miles, is under consideration. The cost is estimated at about $50,000. W. Code, City Hall, Riverside (via Windsor), is engineer.

TORONTO, ONT. — The Hydro Electric Power Commission is receiving bids for three 86,000-hp. hydraulic turbines, to operate under 320-ft. head, for the Queenston plant, to cost about $1,000,000. F. A. Gaby is chief engineer.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 15, 1922)

1,425,755. Polyphase Controlling Device; Edward I. Deutsch, Milwaukee, Wis. App. filed May 9, 1917. Single electromagnetically operated device responds to low-voltage and phase reversal.

1,425,781. Conduit-Coupling Device; Homer G. Knoderer, Englewood, N. J. App. filed Oct. 27, 1920. Adapted for boxes of separable hub type.

1,425,784. Plastic Composition and Articles Formed Therefrom; James P. A. McCoy, Milwaukee, Wis. App. filed Aug. 30, 1920. Insulating body made from mixture containing a phenolic condensation product and polymerizable cumaron resin.

1,425,818. Reactive Volt-Ampere Meter; John W. West, Lynn, Mass. App. filed Dec. 20, 1919. Scheme for integrating value of the reactive volt-amperes by use of integrating watt-hour meters.

1,425,837. Dispensing Apparatus; D. H. Clark, Orangeburg, N. Y. App. filed July 2, 1921. Electrically heated for drug stores, etc.

1,425,843. Casing for Electrical Apparatus; W. O. Dwyer, Pittsfield, Mass. App. filed Oct. 22, 1920. Main casing for transformers, etc., completely filled with oil, with auxiliary tank providing for expansion.

1,425,853. System of Electrical Distribution; C. H. Giroux, Schenectady, N. Y. App. filed Oct. 2, 1920. Auxiliary dynamo-electric machine to carry the overload of system.

1,425,858. Temperature-Compensated Regulator; J. H. Hunt, Dayton, Ohio. App. filed Sept. 16, 1920. Electromagnetic device compensates for increased resistance in windings.

1,425,890. Automatic Reversing Control; W. L. Merrill, Schenectady, N. Y. App. filed Oct. 14, 1921. Limit switches for controlling reversing switches normally closed and only one temporarily opened at each limit of operation.

1,425,912. Condenser and the Method of Making Same; R. T Staples, New York, N. Y. App. filed Aug. 17, 1920. Treating telephone condensers so that their electrical constants are quickly brought to a permanent value.

1,425,917. Method and Means for Producing Oxide of Zinc; J. Thomson, Brooklyn, N. Y. App. filed March 16, 1921. Uses electric furnace.

1,425,918. Method and Means for Producing Oxide of Zinc; J. Thomson, Brooklyn, N. Y. App. filed May 5, 1921. Produced in electric furnace by redistillation of metallic zinc.

1,425,921. Typewriting Machine; John Waldheim, Elizabeth, N. J. App. filed Aug. 7, 1919. Return carriage operated by motor.

1,425,924. Storage Battery; T. A. Willard, East Cleveland, Ohio. App. filed Sept. 16, 1918. Terminals carried out through side walls.

1,425,935. Process of and Means for Recovering Silver from Photographic and Other Baths; N. B. Aikerman, Lakewood, Ohio. App. filed May 31, 1919. Electrocouple in solution with resistance medium to receive electrodeposition of metal.

1,425,958. Sanitary Mouthpiece; Nathan Gelb, Newark, N. J. App. filed March 15, 1922. Apertures in wall with grooves in outer side with annuli in grooves.

1,425,963. Electrically Actuated Permutation Mechanism and Circuits Controlled Thereby; J. B. Heller, Wilkinsburg, Pa. App. filed July 11, 1919. For closing one or more electric circuits on motor-driven vehicles.

1,425,968. Induction Water Heater; A. J. Holmes, Tacoma, Wash. App. filed May 6, 1919. Circular metal tube for passage of water surrounded by heating element.

1,425,977. Telephone Hand Set; W. C. Kiesel, New York, N. Y. App. filed Dec. 8, 1919. Conducting strips embedded in insulated handle for mechanical strength.

1,425,983. Electric Soldering Iron; F. Kuhn and L. H. Thomas, Detroit, Mich. App. filed March 20, 1922. Tubular body for receiving soldering point surrounded with insulated resistor.

1,426,001. Frequency Changer and Generator of Alternating Current; N. Oboukhoff, Harbin, China. App. filed Feb. 28, 1917. Two or more dynamo-electric machines mounted on common shaft with primary and secondary windings interconnected.

1,426,015. Electric Press Iron; A. J. Shirk and S. Cohen, New York, N. Y. App. filed April 15, 1920 Iron heated only when on stand.

1,426,065. Insulating Flat-Wire Conductors; J. A. Heany, New Haven, Conn. App. filed Nov 16, 1918. Process and apparatus for winding onto conductor.

1,426,071. Arrangement in Electrolytic Tanks with Diaphragm Cells, G. Haglund, Christiania, Norway. App. filed Sept. 10, 1920. Liquid removed from diaphragm cells without intermixing with liquid outside.

1,426,105. Commutator Segment Mounting; W. E. Richter, Toledo, Ohio. App. filed Aug. 8, 1917. Improved means for mounting commutator segments in place.

1,426,123. Motor-Control System; E. R. Stoekle, Milwaukee, Wis. App. filed March 24, 1919. Control of direct-current railway motors with mercury-arc rectifiers placed on train.

1,426,132. Electrical Measuring Instrument; F. N. Waterman, Summit, N. J. App. filed March 23, 1917. Direct reading of decrements of damped oscillations and wave lengths.

1,426,133. Apparatus for Preventing Static Interference in Radio-Signaling; R. A. Weagant, New York, N. Y. App. filed Dec. 12, 1917. Static upon one part of antenna system neutralizes static on another part, while signal waves act cumulatively on receiving instrument.

1,426,137. Radio-Goniometer; G. M. Wright, Chesterfield, England. App. filed April 16, 1921. Double search coil with its two windings in planes making an angle of 45 deg.

1,426,141. Process and Apparatus for Electroplating, W. E. Belke, Chicago, Ill. App. filed March 15, 1922. Means for filtering out of solution of dirt and dust.

1,426,166. Electric Heater; T. M. Feder, Brooklyn, N. Y. App. filed Dec. 7, 1921. Radiant heater screwed into lamp socket and adjustable to any angle.

1,426,187. Method of and Means for Vaporizing Fuel for Internal-Combustion Engines; W. M. Harrison, Chesthunt, England. App. filed April 21, 1921. Electrical heater which can be applied to induction or air-inlet pipe.

1,426,210. Junction Box for Electric Conductors; R. S. O'Neil, London, England. App. filed Sept. 23, 1920. Airtight and watertight case.

1,426,228. Hand Mirror and Lighting Means Therefor. Nathan and Max Sloane, Brooklyn, N. Y. App. filed Nov. 29, 1921.

1,426,245. Electric Resistance Heater for High Temperatures; B. Bauer, Zurich, and A. von Zeerleder, Geneva, Switzerland App. filed Dec. 10, 1919. Material not affected by high temperatures and electrodes are of similar material.

1,426,293. Method of Manufacturing Electrical Collectors, Commutators, Controllers, or Interrupters or Equivalent Devices; H. Herrmann, Paris, France. App. filed July 14, 1920. Manufactured by molding.

1,426,311. Method of Soldering; J. Moreau, Chicago, Ill. App. filed April 15, 1921. Method for use by jeweler for local soldering.

1,426,323. Connector; H. R. Saxon, Toledo, Ohio. App. filed March 10, 1916. Made from single metal sheet having focusing arm struck out from sheet.

1,426,334. Selective Reception of Alternating Currents; F. E. Pernot and L. J. Rich, Washington, D. C. App. filed March 30, 1922. Separates currents differing in frequency without mutual interaction.

1,426,337. Signaling Apparatus for Detecting Submarines; E. A. Sperry, Brooklyn, N. Y. App. filed July 9, 1917. Net utilized to actuate signal.

(Issued Aug. 22, 1922)

15,436 (reissue). Automatic Fire Alarm; F. A. Swan, Cliftondale, Mass. App. filed Aug. 25, 1920. Thermo-electric couples with differentiating thermo-electric battery.

1,426,340. Cushion for Telephone Receivers; O. W. Aagaard, Chicago, Ill. App. filed Jan. 19, 1922. Consists of soft-rubber shell.

1,426,360. Electric Lighting Fixture; Le Roy G. Clark, Detroit, Mich. App. filed Dec. 27, 1920.

1,426,367. Portable Electric Motor; O. P. Erhardt, West Haven, Conn. App. filed Feb. 26, 1918.

1,426,384. Method of and Means for Detecting Defects in Paramagnetic Materials; W. E. Hoke, Washington, D. C. App. filed June 23, 1919. Body subjected to action of magnetic field in presence of finely divided magnetic medium.

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The Homage Due to Edison

THE United States, like many other nations, has produced men of renown in the field of electrical science and invention. Some possessing remarkable attainments and gifts, like Franklin, Morse, Henry and Bell, received praise and honor from beyond the seas. Their work was for the world and their fame was a tribute to their eminence.

No man in electrical science, however, from Thales of Miletus to Steinmetz, gained a wider fame than Edison, and the forty years which have elapsed since he founded the new art of electric generation and distribution have added to rather than modified his extraordinary popularity and repute. The more his accomplishments and achievements are studied, the more clearly is his greatness established and the world's indebtedness to him enlarged. His genius and labor have reflected glory upon his country, and his name has become part and parcel of our national heritage and treasure.

DISREGARDING his work outside the electrical industry, but pausing to mention that even there his inventions of the phonograph and of the motion picture entitle him to immortal fame, let us contemplate his benefactions to civilization in the narrower channels of electricity alone. When Edison invented the incandescent electric lamp and produced on Pearl Street, New York, the prototype of the modern electric central station he subjugated all the various elements to one idea, making not a patchwork, but a complete and unified system. And in that creation we have proof of his genius and vision, for not one of the essential principles in the generation and distribution of electrical energy as they exist today was lacking in the original system. To be sure, such a feat involved a great deal of work and study, for a new art was being born. It also called for faith, courage and determination. Many skeptics insisted that the thing could not be done. It was done, however, and in its accomplishment Edison ushered in the electrical age and laid the foundation of one of the most wonderful developments the world has ever seen.

EVOLUTION in the art then followed very rapidly. Not less marked was the influence of the electrical industry on older and well-established ones. Water power, which was used thousands of years before the Christian era, assumed an entirely new aspect and began to be developed with skill and efficiency. In fact, it was only when long-distance electrical transmission became a fact that most water powers became serviceable to man at all.

Steam-engine design was revolutionized. The small slide-valve engine gave place to the Corliss engine, only to be supplanted by the steam turbine, which in less than a decade grew from 5,000 hp. to 60,000 hp. Electric power stations grew larger and larger. Engineering practice was standardized and developed. Illumination took on a new meaning. Transmission voltages have increased to 220,000 volts, and with every refinement in generation and transmission have come economies in utilization. Most wonderful of all has been the phenomenal growth in the use of labor-saving household and other devices. Thus an industry unknown less than twoscore years ago now, thanks to the genius of Edison, ranks among the most important in the world, with an output in this country this year of approximately fifty billion kilowatt-hours.

Thomas A. Edison

The most widely known man in all the world, in practical genius the greatest and in invention the most fertile, who conceived and executed in detail forty years ago a new art and a new industry

Editorial Comment

Electrical World, September 9, 1922
Volume 80 Number 11

Past, Present and Future

FORTY years is a short term in human affairs. At that age men are still counted young and few have done their best work. Yet could one go back for that space of time and look about the world he would find himself in another era; for two score years of electricity have transformed material civilization as no period of like length ever did before, and in externals 1882 bore a far closer resemblance to 1842 than 1922 does to 1882.

Forty years ago was still the era of steam and gas, before either had been put on its mettle by the springing into being of the double-functioned giant that challenged both. Meanly lighted streets aided crime. Few women ventured upon them after nightfall, and in some districts of the large cities even muscular men hesitated to go. In their homes the people injured their eyes as they read by open-flame gaslights, and in newspaper offices and other places of night work the toilers ruined theirs. Chinese lanterns were the main resource for illumination on festive occasions. In the factories and workshops ponderous steam engines roared and pounded amid stifling heat. On the rivers and streams crude hydraulic machinery utilized an infinitesimal fraction of the power running to waste. Horse-drawn cars dragged slowly along the streets, and the elevated railways of New York, driven by small steam locomotives coupled backward, were the wonder of the nation. The telephone was still a novelty of which the ordinary citizen's home was as innocent as it was of all the electric labor-saving devices that every progressive housewife boasts today.

So much for the past. The present speaks for itself, and of Edison and all his co-workers in the transformation may be said as the memorial tablet in St. Paul's Cathedral says of Sir Christopher Wren: "Would you see their monument, look around you." A hundred large cities and innumerable small ones in North America alone depend on their electric light and power company as on no other single institution for both the necessaries and the luxuries of life. Electricity turns the wheels of industry in ever-increasing proportions, and over dark streets and dim towns and even little frontier settlements in the Far West it has spread its radiance as if in obedience to the creative edict, "Let there be light!" To the workingman's flat in the crowded town and the isolated farmhouse alike have come through its agency comfort and help undreamed of forty years ago. What is true of America is true in greater or less degree of other lands, even the remotest and the most backward. Electricity has penetrated to the outposts of Siberia, the villages of interior China, the islands of the South Seas and the frozen zone of the Arctic Ocean.

What will another forty years bring? Will 1962 show no further advance over 1922 than 1882 showed over 1842? Is electrical development approaching its zenith, and will it display henceforth only a slow rate of growth and be applied in few new ways, if any?

No man imbued with the spirit of the electrical industry will believe so. We shall not indulge in specific prophecy. It would be rash to predict that some new discoverer is going to find a way to convert electrical energy into heat at a cost which will make the householder forever independent of mine owners and mine workers. It might not be safe even to aver that before 1962 steam will surrender its last independent fortress, already besieged, and transportation by rail be universally electrified. But if these things do not come, others will. In the approaching days, when unwired buildings will be things of the past, humanity will be aided in ever-increasing degree by the youngest and greatest of its invisible servants. No other result is possible from the research, the enterprise and the industry of those to whom electricity is more than a business, an art or even a science—to whom, indeed, it is hardly too much to say it has become a religion.

Present Improved Status of the Code

IN THINKING back over the forty years of active evolution in the electrical industry the development of the National Electrical Code is not one of the least interesting details. For the code has stood for a desire to make the installation and use of electricity safe, and as the utilization of electric service has become more diverse and extensive, so has the code grown and become particularized. C. M. Goddard's story in this issue of the origin and growth of the code is an interesting sidelight on the early days. Working only by moral suasion and without any applied authority, it is remarkable perhaps that the code has become as influential as it is today, with all the inconsistencies that continue in inspection standards and irritate electrical men so sorely at times. But this clear statement of the manner in which the code operates is impressive proof of the opportunity that there is for electrical men to exert a constructive and liberalizing influence by contact and co-operation with local boards of underwriters and inspectors.

The recent acceptance of the code by the American Engineering Standards Committee should impart a very helpful impulse toward the more practical standardization of code requirements as locally interpreted. Until now the code has had no legal status. There was no police power behind it. It could not be enforced save as a regulation of insurance companies under which rates might be raised or policies withheld. It was, after all, an insurance code, and though state and municipal inspectors have the power of government behind them and their laws and ordinances are enforceable, the insurance inspector was free to apply his own interpretation, and enforcement of the code could go no further than recommendation or objection. But now that code has become an American standard backed by the official recognition of all the dominating authorities, it is another matter. Provisions and extensions will be effected by amendments adopted by speciallly appointed committee "sections" representative of all the interests concerned—engineering, labor, government and so on. This official code should be enforceable in court, and any local inspector who elects to disregard it should be enjoinable. The influence of all this on the standardization of safety regulations will be tremendous.

Engineers Will Form Friendships at Rio de Janeiro

ENGINEERS are more fortunate always than other mortals in that they speak a common language and have developed similar habits of thinking whereby they act in unison in developing their work. This circumstance warrants the prediction that the International Congress of Engineering to be held at Rio de Janeiro from Sept. 14 to Sept. 21 will be successful in every way. South American engineers, whose native language is Spanish or Portuguese, are naturally more likely to be familiar with French than with English, but they are beginning to see the value of a greater familiarity with engineering practice in the United States as a guide in the new era of expansion now under way in their countries.

South America is particularly fortunate in that it can take and build upon the engineering experience of other nations which have more largely developed their industrial resources. Of all nations this country most nearly parallels the conditions existing among its southern neighbors, and therefore it can offer helpful examples of engineering developments.

Whatever experience or knowledge our engineers have which might prove of value to their South American confrères will be freely given at the congress with that open-handed spirit so prevalent among the engineering fraternity. The Rio de Janeiro gathering, we feel sure, will form new links in the chain of international engineering friendships.

High Standards of Service Will Qualify Any Store

THE inevitable conquest of fact over theory seems to be indicated in advices from California that the State Association of Contractor-Dealers has recognized the department store and similar agencies as legitimate distributors of electrical wares. The association at its annual convention at Santa Cruz adopted a resolution wherein it was frankly admitted that present-day tendencies lean toward the broadening of distribution channels through means other than the contractor-dealer. This action was followed by the outlining of a tentative program on the part of the advisory committee of the California Electrical Co-operative Campaign to invite department stores, hardware stores and other independent agencies into the campaign, provided these agencies live up to the standards to be prescribed by the campaign.

Herein is a most interesting admission on the part of the contractor-dealer of his own inability to handle the enormous growth of sales in electrical appliances, doubly significant coming as it does from a state where merchandising activity has reached such an advanced stage. Statistics, of course, show that even now fully 50 per cent of the merchandising of electrical appliances, is passing through hands other than those of the electrical dealer.

If this is the forerunner of a national awakening to the broadening of the channels of distribution of electrical wares and if these other agencies are actually to become the principal merchandisers, a new responsibility devolves upon central-station men—as a matter of fact, upon all men of the electrical industry as a whole. The continued good will of the public toward electric service depends upon the continued good and standard performance of the apparatus and appliances in the homes of consumers. The only way to maintain high standards of service and performance with such broadened channels of distribution, in the hands of those not primarily interested in or conversant with the electrical industry, its troubles and its aspirations, is to define standards of service in words that are easily understood and to educate these new distributors to the necessity of living up to them.

The maintenance of high standards of service is a duty which cannot be shunned, and the stamp of approval, carrying with it the full power and prestige of the electrical industry, should be given to every competent agency that engages in the merchandising of electrical appliances and adheres to these standards. For such standards will in fact qualify any store.

Reminiscences of a Veteran

THERE are comparatively few men who have been forty full years in active central-station work, thus going back to the very beginning of the art, but Etienne de Fodor, whose reminiscences we publish this week, is one of this little group. He is further distinguished by having consistently kept on the firing line of progress through all the various phases of advance. Moreover, he has made a distinguished success as a central-station operator, and it is with particular pleasure that we realize his still continued activity after all the terrible stress of war to which his country has been subjected. He is a contributor to the *Electrical World* of at least thirty years' standing, for about as long ago as that we published an account from his pen of the central station in Athens, Greece, of which he was then manager.

Looking back over the years which his reminiscences cover, one is struck more forcibly than ever with the really prodigious work which Edison and his little band of associates did in the early eighties in laying the foundations of the central-station industry. A great many things that are perfectly simple and obvious today were then mysterious and demanded unlimited hard work for the solution of the many problems connected with them.

It was even less in the incandescent lamp than in the development of a complete line of entirely new and necessary auxiliaries that Mr. Edison's genius for hard work showed with the most telling effect, and these early struggles were on just at the time of which Mr. de Fodor writes, when not only the lamp but the dynamo and the whole system of distribution had to be worked out from the very start. Forty years ago nobody had any proper conception of an electrical network and the feeder system that made distribution possible. Only by the development of these fundamental ideas was it possible to distribute light at the pressure of 110 volts, then regarded as the maximum. A little later the three-wire system came to lessen the burden of investment in copper. The 110-volt lamp, in fact, held on until it became rather a fetish, and it is a little hard now for Americans to realize that their country is the only one in which the distribution service of 110 volts to 120 volts still remains practically the standard.

Forty years has made great changes in the details of the art of distribution, and it does not in the least dim the luster of the early achievements that those engineers who had learned to have faith in low-tension distribution hung on to it beyond the time when its rightful claim to continued existence had been vigorously disputed. It is well to remember, too, that even respectably good insulated copper wire was scarce in the early days of which de Fodor speaks, and that simultaneously with the incandescent lamp came the storage battery and the beginning of electric traction. The next ten years placed the electrical arts firmly on their feet, the period of trial was over, and all the story of that decade of struggle still lingers in the memory of the group of pioneers, not yet old, though veterans, of which Etienne de Fodor is an active member.

Testing a Factor in the Development of the Industry

THE importance of reliability and efficiency early brought home to both manufacturers and operating companies the need for research, investigation and testing. As a result of their broad-minded recognition of this need the development of the art has undoubtedly been accelerated. Where dictated by community of interest on the part of operating companies, there is a growing tendency to co-ordinate testing activities, bringing them under the supervision of a technical committee of the industry which administers the testing in the interests of all concerned. Where this practice has been followed notable advances have been made, and the growing recognition of the need for such testing and the obvious economies to be effected through consolidation of testing activities will bring about further co-ordination of the work in the interests of the rapid advancement of the art.

Proper Credentials Essential to Obtain Information

REQUESTS for information addressed by representatives of the public to utility managers deserve courteous consideration and completeness of reply unless such inquiries transcend the limits of good breeding. The modern well-managed utility has nothing to conceal from honest inquiry, and in countless instances companies have more than "gone the limit" to open their books, plants and papers to even hostile investigators employed by petitioners to reduce rates, change service practices or alter capitalization plans. The amount of information which some companies have prepared at the request of their opponents in commission proceedings cannot be measured, and if at times executives suggest that their employees should not be expected to devote inordinate amounts of time to facilitate the attacks of others upon the properties involved, reasonable men will agree that this position is just. By going about nine-tenths of the way to supply data many managers have found that the impression made upon the public as to the open-mindedness and fairness of their companies is worth a great deal. When individuals seek varied and special information for their own purposes, a more cautious policy is warranted, and unless such self-constituted investigators produce proper credentials, managers will do well to "put the soft pedal" upon their co-operation. Out of sheer good nature great abuses are sometimes permitted, and it is no cause for criticism if executives insist on knowing with just whom they are dealing before turning their affairs inside out.

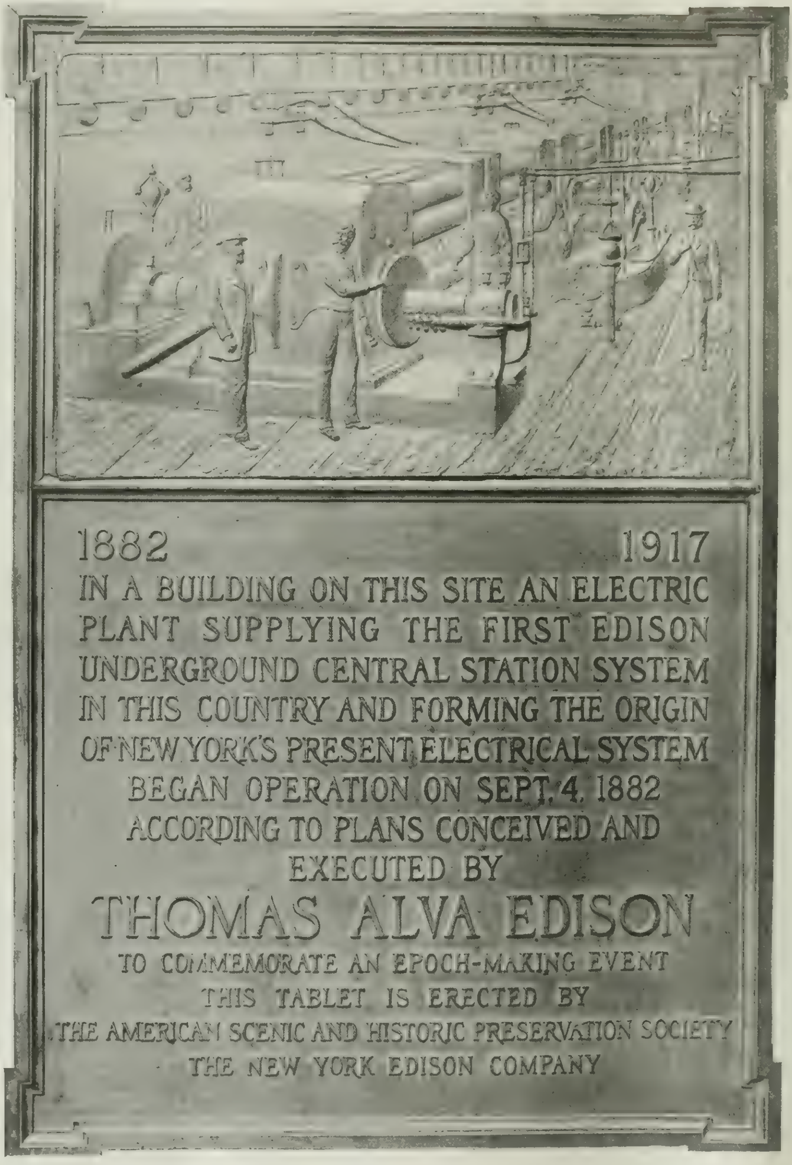
On the Threshold of Commercial Progress

COMMERCIAL evolution in the electrical industry has been unique, for it has reversed the usual sequence. In a word, the electrical business has been built backward. Most industries have originated with barter and trade and have progressed from the cottage stage into larger and larger production to meet growing demand which has been developed by selling activity and an increasing popularity. But the electrical business began with large-scale production. The engineer conceived the possibility of manufacturing electric power in quantity and had confidence in the opportunity for its profitable sale. So he proceeded to generate this unknown power, expecting that it would be—not sold, but bought.

And it was bought promptly and eagerly. People saw the advantages of electric light and wanted it. The demand came first from stores and factories and then from homes. From one town to another the engineers proceeded building generating stations and transmission systems, and the public came and asked to be served. There was a natural unsatisfied demand that absorbed all the output until well up to the year 1900, when the central station began to approach perceptibly the point where this voluntary ready demand slackened and the industry awakened to the fact that electric service would have to be sold.

Meanwhile the engineer, fascinated with the wonders of electricity, had been inventing one appliance after another. Fans, flatirons, percolators, chafing dishes—almost the full assortment of small domestic heating devices that we have today—were devised in the late "eighties" or the early "nineties" as ingenious demonstrations of what electricity would do. And the electrical man thought that the public would welcome and adopt them promptly. But the householder looked upon them as curiosities, luxuries, extravagances, and did not buy.

We stand today on the threshold of a great era of electrification. The spirit of utilization will dominate it. Only one-third of the homes of America and a part of our business buildings are wired as yet, but the conquest is proceeding with ever-increasing rapidity, and the idea of complete equipment is firing the minds of electrical men to recognition of the fact that business development offers the key to a great prosperity. The industry at last is constructing a commercial organization and a commercial purpose on a more adequate scale, with the attention of manufacturer, jobber, contractor-dealer and central-station executive focused on the common objective. In short, the long-neglected sales department of the entire industry is being built up into balance with the other two fundamental elements of production and finance. We may safely say that from the business sense our formative period is past.



1882 1917

IN A BUILDING ON THIS SITE AN ELECTRIC
PLANT SUPPLYING THE FIRST EDISON
UNDERGROUND CENTRAL STATION SYSTEM
IN THIS COUNTRY AND FORMING THE ORIGIN
OF NEW YORK'S PRESENT ELECTRICAL SYSTEM
BEGAN OPERATION ON SEPT. 4, 1882
ACCORDING TO PLANS CONCEIVED AND
EXECUTED BY
THOMAS ALVA EDISON
TO COMMEMORATE AN EPOCH-MAKING EVENT
THIS TABLET IS ERECTED BY
THE AMERICAN SCENIC AND HISTORIC PRESERVATION SOCIETY
THE NEW YORK EDISON COMPANY

Tablet on Site of Original Central Station

The historic Pearl Street station was destroyed by fire in 1890. On the structure now occupying the site is the plaque reproduced above, commemorating the beginning of central-station operation in this country

The Birth of an Industry

Forty Years Ago Electric Central-Station Service Began in New York City Under Edison's Own Direction with About Fifty Customers—An Auspicious Start Followed by Gigantic Strides

By John W. Lieb
Vice-President New York Edison Company

NO POLITICAL convulsion, great war or extraordinary public happening marked the year 1882. None the less, it deserves to be recorded forever among memorable dates, for it saw the birth of the electric central station. The incandescent light, theretofore little more than a display or a curiosity, then became a commodity; scoffers and skeptics were confuted, and the knowledge that another great and beneficent discovery, with inherent possibilities beyond computation, had been made was brought home to intelligent persons everywhere.

The younger generation of today has, of course, no remembrance of the Pearl Street revelation. To its members, as they journey about the country, the stacks that rise not ungracefully from innumerable steam power houses of attractive design, the pipe lines that carry to huge waterwheels the impounded energy of swift streams, and the conductors that stretch across whole states, conveying light, heat and power to mammoth factories and humble homes alike, are as commonplace as the railroad and the telegraph; but to older men, whose memory goes back for two score years, these things are visible evidences of the miracle wrought within the span of a short life.

The enormous difficulties with which the pioneers in the art had to contend are not always realized today. Without precedents to follow, without manufacturers to produce the requisite machinery, early central-station work was largely a pioneering effort, an endeavor to meet instinctively or by the expenditure of personal energy and resourcefulness the unexpected problems which daily presented themselves and which often needed instant solution.

NO PUBLIC SENSATION ATTENDS OPENING

When the epoch-making event took place it attracted wide interest, but can hardly be said to have caused a sensation commensurate with its importance. The New York newspapers, which were then all in the district served by the pioneer central station, gave extended accounts of the novel lighting system and praised the quality of the product, but none of them prophesied that a new industrial era had begun. Even the predecessor of the *Electrical World*, the *Operator*, whose field had expanded from that of a telegraphic organ to take in the newer manifestations of the electrical art, devoted less than ten inches to the subject, most of which was taken up by a report of Mr. Edison's own comments. "His countenance showed that he was greatly pleased," observed the reporter, and the inventor was quoted as saying:

"I have accomplished all that I promised. It was not without some fear that I started the machinery this evening. I half expected that some new phenomena would interfere with the working of the light. But it has been entirely successful. You will see that we have only one engine running now. It supplies 800 globes with light.* We have six engines which will all be in successful operation before the end of the winter. We expect to have three running next week. We have a greater demand for the light than we can supply at present, owing to the insufficiency of men to put down the wires. We have to educate the men to the use and management of our machinery. We have only one experienced engineer here now."

FIRST SYSTEM OF EXTENSIVE DISTRIBUTION

The power house thus opened at 3 p.m. on Monday, Sept. 4, 1882, in a converted warehouse at 257 Pearl Street, New York City, embodied the first system of extensive distribution of electrical energy, the first attempt to generate electricity in bulk and supply it underground for lighting and power purposes to scattered customers. It was the fondly recalled privilege of the writer, who was then electrician of the plant, to close at Mr. Edison's direction the switch which first connected one of the "Jumbo" dynamos to the station bus which in turn supplied energy to the feeders of the underground network. Prior to this time (on July 5) the dynamos had been operated to light a large bank of test lamps in the station. It is true that eight months earlier the Holborn Viaduct central station had been opened in London to feed four circuits extending for half a mile from Holborn Circus to the General Post Office. This system embraced 164 street lamps rated at 32 cp. and 774 8-cp. and 16-cp. lamps scattered in about thirty buildings. Eventually the number of lamps was raised to about 3,000. The plant was not operated on a commercial basis, being largely a public demonstration of the system. In 1884 it was abandoned. It has been confidently asserted also that two weeks before the opening of the Pearl Street power house a little station at Appleton, Wis., operated by water power, had energized 250 10-cp. incandescent lamps, using for that purpose an Edison "K" dynamo; but a careful investigation has revealed the fact that this station was not put into service until the latter part of September.

ONLY ISOLATED PLANTS BEFORE PEARL STREET

There had, of course, been numerous isolated plants supplying individual customers before the Pearl Street station was open. The first of these, involving sixty platinum-filament incandescent lamps lighted by a man-power dynamo, was installed in the middle of 1879 on the ill-fated steamship Jeanette which went down in the Arctic seas. Another installation went into opera-

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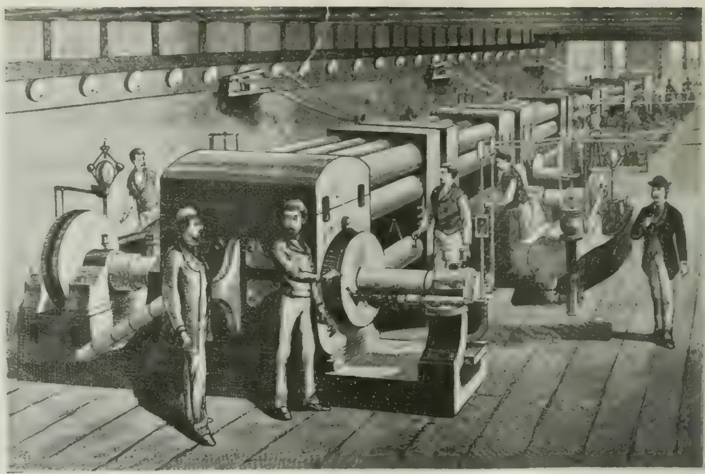
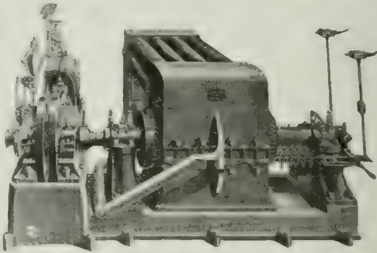
*Evidently a reportorial slip. The number was 400.

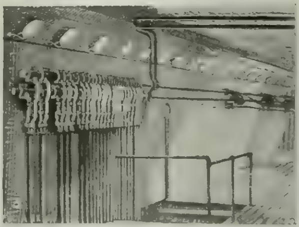
Pearl Street Was the Father of Them All

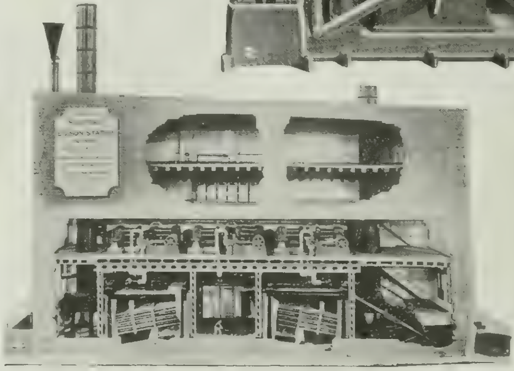
Nos. 1 and 6 show artist's drawings of the Pearl Street Station generators and switchboard control rheostats. No. 2 shows the Armington & Sims unit used in the station with a blower on the engine which gave forced ventilation on the generator. No. 3 shows the busbars and the connections to the underground tubes. No. 7 shows the first generator disconnect switch. No. 4 shows a model layout of the original station which was planned on the basis of large power per unit of floor area.

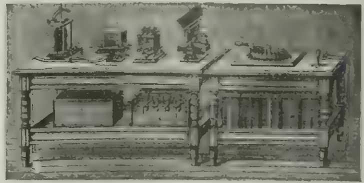
No. 5 was a photometer used to determine whether the voltage was of proper value for lighting the lamps, and No. 8 was the first automatic voltage regulator.

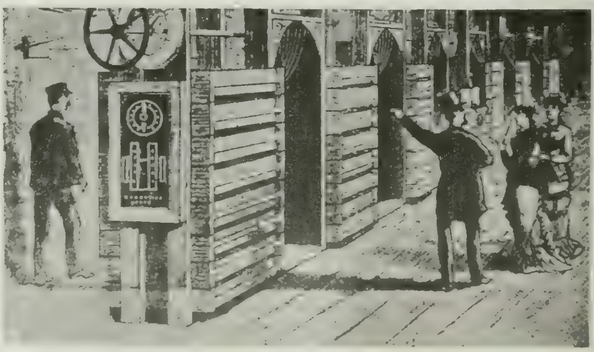


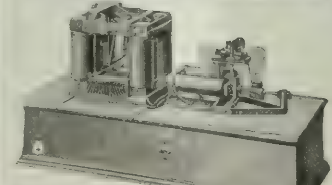




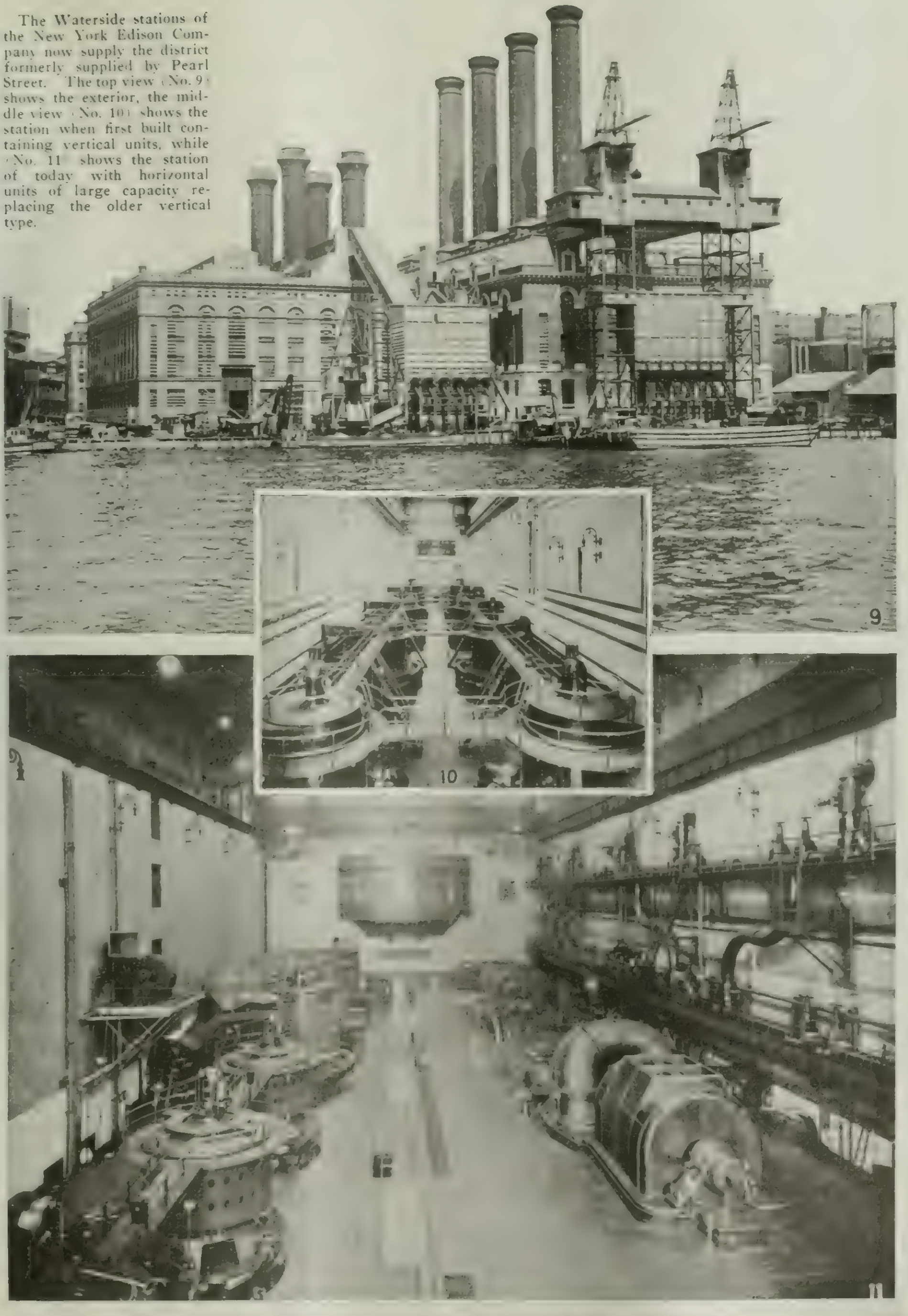








Waterside Is the Son of Pearl Street



The Waterside stations of the New York Edison Company now supply the district formerly supplied by Pearl Street. The top view (No. 9) shows the exterior, the middle view (No. 10) shows the station when first built containing vertical units, while (No. 11) shows the station of today with horizontal units of large capacity replacing the older vertical type.

tion in May, 1880, on board the steamship Columbia, belonging to the Oregon Railway & Navigation Company, which sailed from New York to Portland, Ore., fitted with three separately excited 100-volt constant-potential dynamos built at Edison's Menlo Park laboratory. Each dynamo was capable of supplying sixty 16-cp. lamps. In January, 1881, a dynamo of the old "Z" type had been placed in the establishment of Hinds, Ketcham & Company, lithographers and printers of labels and show cards, at 449 Water Street, New York. This was the first land plant, and the ease of distinguishing colors with the incandescent lamp was the reason for its adoption. In September of the same year a mill plant had been started in the woolen factory of James Harrison, Newburgh, N. Y. A month later the Blue Mountain House, in the Adirondacks, put in a plant of two "Z" generators to energize 332 lamps, including the first ever placed in an elevator car. In 1881, too, the residence of J. Hood Wright of New York City was lighted from a private plant—possibly the first dwelling to be thus illuminated, though that distinction has also been accorded to the residence of J. Pierpont Morgan. The Everett House in lower New York City adopted the new lighting system in February, 1882. About the same time James Gordon Bennett lighted his yacht, the Nanouma, by 120 lamps rated at 8 cp. each. The Fall River Line steamer Pilgrim had the largest of all the isolated plants, with 802 lamps in circuit.

Details of the Pearl Street Plant

All these plants, however, and all the other pioneer installations, reaching in September, 1882, a total of 123, supplied, as already stated, individual customers from individual plants. Distribution of energy from a central plant on a commercial basis actually began in Pearl Street, and it is a noteworthy fact that it began with underground conductors and on a plan which in its essentials is that of the vastly greater central stations of today. From fifty to two hundred and fifty men had been employed for many months by the Edison Electric Illuminating Company in laying the mains and installing the machinery. The district served extended from Nassau Street to the East River and from Wall Street on the south to Ferry and Spruce streets on the north—an area of about 2,000 ft. in each direction, or approximately one-sixth of a square mile. The distribution system, including feeders and mains, measured about 14 or 15 miles. The total number of buildings in the district which it was possible to reach by the company's wires was about 1,300, including banks, office buildings, newspaper offices and warehouses.

The Pearl Street station lighted 400 incandescent lamps before the first night's work was over, and by the end of September served fifty-nine customers, who had 1,284 lamps in circuit. At the end of the next month the station was serving ninety-four customers, wired for 2,323 lamps. By the end of the year it was serving 231 customers, wired for about 5,328 lamps. At the beginning of November, 1883, 508 customers in all were wired for 12,732 lamps, of which 10,664 were actually in circuit.

Dynamos and Conductors

The power house was a four-story brick building, divided into two parts by a fire wall. One part was used as a storehouse and repair shop. In the other part of the station were the six historic Edison "Jumbo" dynamos. These were the largest that had yet been made and weighed with their engines and base plates about 30 tons apiece. The engines were rated at 125 hp. each. Four boilers, with a total rating of 1,000 hp., were installed in the basement. Each of the six dynamos, direct-connected to an engine operating at 350 r.p.m., was capable of supplying energy to 1,200 16-cp. lamps at 110 volts, each lamp consuming 0.75 amp. The dynamos were numbered from 4 to 9, three earlier machines having been shipped to Europe, No. 1 to the Paris Exposition of 1881 and Nos. 2 and 3 to the Holborn Viaduct station in London to which allusion has already been made.

At first the underground system of conductors was a two-wire so-called "feeder and main" system. Workmen began to lay it in the fall of 1881, and, in spite of the lack of competent mechanics deplored by Mr. Edison, it was virtually completed in July, 1882. In this work 20-ft. Edison tubes were employed which contained two half-round conductors† of various sizes, depending on the load to be served. These tubes and inclosed conductors were completely assembled at the tube works prior to their installation by supporting the conductors at first with heavy cardboard and later by rope while hot asphaltum compound was forced into the interstices. After the tubes had been laid in the trenches which were dug for them, the conductors in abutting tubes were connected and inclosed by coupling boxes. Filling of these boxes with hot asphaltum compound completed the operation of installation. It is interesting to observe that substantially the same character of tubes and couplings are used today in new installations.

Lamps and Meters

The wiring of buildings and erection of the machinery proceeded simultaneously with the laying of the mains. The original "diagram of dynamo connections"—the first plan of electric power-station connections ever drawn—is still in existence and has a unique interest of its own, particularly to the writer, who prepared it. The lamps themselves, of which the commercial manufacture had been begun at Menlo Park in November, 1880, embodied the method described in the patent which had finally assured to Edison his deserved triumph as the discoverer of the long-sought method to "subdivide the electric light"—ridiculed as an *ignis fatuus* by many contemporary scientists. As every electrical student knows, the lamps consisted of "a carbon filament of high resistance in an all-glass globe, conductors sealed into the glass, all inclosed in an exhausted glass globe."

Electric metering was almost unheard of forty years ago. Edison, however, had invented a chemical meter to go with his incandescent lamp system. This consisted of an extremely accurate electrolytic cell containing a solution of zinc sulphate with zinc plates for electrodes or terminals. When a continuous current was passed through the solution metallic zinc was removed from one plate and deposited on the other, the change of weight of the plates affording a measure of the lamp-hour or ampere-hour consumption. A definite part of the current supplied to the consumer—less than one-thousandth—was diverted through the electrolytic cell, which was protected against variations in registration by a compensating resistance spool and against freezing by a lamp controlled by a thermostat. The original charging for light in the Pearl Street district was

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†Later, with the introduction of the three-wire system, conductors of circular cross-section were employed.

1.2 cents per lamp-hour, and consumers were invited to check the accuracy of the charge based on the meter by multiplying the price by the total number of lamp-hours used.

A TEMPORARY HITCH

When the long-desired moment for operation at last arrived only one generator (No. 9, which was nearest the Pearl Street front) was cut into service, and, as already mentioned, it carried a load of only about 400 lamps. Everything went smoothly, and Mr. Edison and his assistants, who had been working for months without any regard for time or rest, snatching sleep in the plant as best they could, felt that complete success was at once to crown their self-denying labors. But not yet; for when after a little while a second generator was started and connected with the busbars in multiple with No. 9 the two machines began to "hunt," the engine governors first cutting off and then giving full steam admission and causing the machines to seesaw alternately between standstill and a terrific rate of speed. The second machine was at once disconnected from the line and stopped, and for some time the station was operated with only one.

Dashpots were applied to the governors with no practical success. Finally, Edison overcame the difficulty for the time being by means of a complicated system of pivoted rods, levers and shafting by which the governors of all the engines at any time in operation were mechanically connected together rigidly so that any tendency of a governor to race its engine was communicated to and absorbed by the governors of all the other engines. Subsequently the Porter-Allen engines with their sensitive governors that had been used in the station were removed and Armington & Sims engines with more powerful and less sensitive governors substituted; thus the necessity of tying the governors together disappeared.

SPLENDID QUALITIES OF "JUMBO" MACHINES

The excellence of the materials, design and workmanship in the machines was signally demonstrated by an endurance test lasting from March 10 to 27, 1883. One of the "Jumbos," driven by an Armington & Sims engine and in normal commercial operation, ran continuously day and night for these seventeen days and showed not the slightest wear or need for overhauling. Subsequently one of these engines was operated continuously for nearly a year without a moment's stoppage.

As the number of customers and the connected load of the system increased the district too was extended, and toward the end of 1883 there were 95,000 ft. of mains and feeders. Two additional "Jumbos" were installed in the basement next door to the original generators in the spring of 1884, and in that year the first electric motors on customers' premises were connected to the wires and power service was born.

For more than seven years the Pearl Street station continued in successful commercial operation. Then, on Jan. 2, 1890, fire broke out, and when it was extinguished all the dynamos save No. 9 were found to be ruined. The boilers, however, were intact, and service was resumed with belt-driven engines and generators. But, in the words of Charles L. Clarke, chief engineer of the Edison Electric Light Company from 1881 to 1884 and now a consulting engineer with the General Electric Company, "the glory of the old Pearl Street station, unique in bearing the impress of Mr. Edison's personality and, as it were, constructed with his own hands, disappeared in the flame and smoke of that Thursday morning fire." The station was dismantled and sold in 1895, and nothing remains of the old station to distinguish it from the neighboring warehouses but a bronze plaque on its front. (See reproduction on page 522.)

"Jumbo No. 9" still survives and has been shown at several electrical exhibitions. It is a relic of the puissant youth of the central-station industry well worth preserving till that distant day when its massive frame shall fall apart from sheer decay. It will be exhibited with many other memorabilia of great historical interest at the historical exhibit of the electrical industry and the museum of Edisonia to be shown at the electrical show to be held at Grand Central Palace, New York, early in October.

PRESENT AT THE BIRTH

Before leaving the topic of Pearl Street it is right that the names of the men present on the memorable afternoon that saw the birth of central-station service should be again recorded. Besides Mr. Edison those actually present at the start or who dropped in during the day included E. H. Johnson and Charles L. Clarke, engineers of the company; John Kruesi, F. R. Upton, S. Bergmann, Samuel Insull, Charles S. Bradley, Dr. Schuyler Skaats Wheeler, F. A. Scheffler, Calvin Goddard, W. H. Meadowcroft, Julius Hornig, engineer in local charge of station construction, and his assistant, H. M. Byllesby; W. A. Anderson of the Board of Fire Underwriters, Charles Dean of the company's Goerck Street machine shops, Joseph Wetzler, J. H. Vail, H. A. Campbell, W. S. Andrews, John Langton, "Jack" Hood and the writer, who claims the distinction of having been the first electrician of the plant. Many others, whose names cannot be recalled, were on the premises. Unfortunately Charles Batchellor, who was, as it were, Mr. Edison's right-hand bower, was in Europe at the time, as were William J. Hammer and Francis Jehl.

Some of these men rose to eminence in the central-station industry. Every one of them must have felt great pride in after years that he was present on so extraordinary an occasion, for then and there was demonstrated not only the practicability but also the commercial success of the Edison electric light system—that series of inventions all springing from one brain which included the dynamos and regulators, feeder and main system, underground distributing system, safety fuses, cut-outs, switches, sockets, meters and last, but not least, the crowning achievement—the incandescent lamp.

NEW YORK EDISON COMPANY PAYS TRIBUTE

"From the beginning," says the New York Edison Company in a commemorative announcement published in the New York newspapers of Sept. 4, paying tribute to Edison's genius and all-embracing foresight, "coal and ashes were handled by machinery, engines and dynamos were coupled together as a single unit, electrical and mechanical appliances of original conception were introduced to prevent variation in voltage and candlepower, safety fuses protected the entire system from generators to customers' lamps. Edison then introduced his system of feeders, upon which the stability and control of the system depends. Underground conductors were used, a method previously considered by the best scientific minds impossible of attainment. Further, the customer's service was measured by a scientifically accurate meter—another invention of greatest importance, and the only medium by which essential fairness could be assured to the public."

Other Pioneer Installations

The successful inauguration of central-station service in New York was followed by the establishment in rapid succession of Edison companies and plants in all parts of the country. A few of these deserve special mention as the first in which some new device or method was tried.

At Sunbury, Pa., the pioneer three-wire station went into operation on July 4, 1883, Edison starting up the two "L" 150-light dynamos that supplied the energy. Only 100 lamps were connected at the start. A larger three-wire plant was started at Brockton, Mass., on Oct. 1 of the same year under Edison's supervision. Here there were three "H" dynamos, the third being so adjusted that by means of a break-down switch it could supply both sides of the system during light loads. This station was able to supply about 1,600 lamps, though only about 200, rated at 10 cp., were at first connected. The Brockton installation was quickly followed by similar ones at Lawrence and Fall River, Mass., and Newburgh, N. Y.

At Roselle, N. J., an overhead plant showing the possibilities in illuminating small towns was started in the fall of 1882. A 330-volt dynamo and a two-wire multiple system with three lamps in series in each branch supplied stores, hotels and some residences and continued in operation for ten years. It was the only representative of its kind, a system designed to supply small towns and villages where the lighting is very sparse.

The first example of the lighting of large spaces by incandescent lamps was in connection with the Louisville exposition of 1883. A plant on the three-wire plan was started in August of that year with its full capacity of 5,000 16-cp. lamps. During the hundred days of the exposition there was never a failure of the lighting, and four medals were awarded to the Edison company —for the best incandescent light system, for the best dynamo, for the best electric lamp and for the best incandescent light. This successful illumination of a floor space of 14 acres, including an art gallery 800 ft. from the main building, gave a tremendous impulse to the growth of incandescent lighting.

A similar success was scored at Boston a month later when 1,500 lamps lighted the "foreign fair" of 1883, in addition to several hundred strung in a great Christmas tree.

Seven-League Strides Begin

By 1885, it is estimated, there were in the country fifty or sixty Edison central-station systems distributing electrical energy twenty-four hours all the year around. Such systems were at this early date greatly outnumbered by the series-arc lighting companies, of which there were between three and four hundred. The three-wire system, reducing greatly the cost of distribution, caused the Edison plants to undergo a tremendous expansion, and about 1889 stations began to be built in great numbers throughout the world. Modern types of vertical marine engines, condensing and non-condensing, simple, compound, triple and quadruple expansion, were developed and were first installed in the New York, Chicago and Milwaukee stations. Rotary converters had their first practical application in Chicago, Brooklyn and New York.

The introduction of the alternating-current system of generation and its facile transmission and distribution to cover large areas from one source of power, the growth of the vast central-station systems in the cities just named and in Philadelphia, Boston, Baltimore, St. Louis, Detroit (which won early electrical fame by its spectacular method of general street illumination throughout the city by means of arc lamps mounted on high towers), Denver and a score of other large cities, the tremendous hydro-electric systems of the Pacific Coast, the harnessing of Niagara, the great power companies of the South and Middle West—all these are "other stories" to tell which adequately would require many special issues of the *Electrical World*, which, for that matter, has been faithfully recording their history year by year for a generation.

Contrast Between "Now" and "Then"

For the purpose of this article the contrast between "now" and "then" may be pointed in a few short paragraphs, conveying a slight idea of the tremendous progress of the industry.

In the first days of operation in New York City 1,284 incandescent lamps were connected with the Pearl Street generators. In corresponding units the present installation of the New York Edison Company exceeds 21,500,000.

In 1882 the customer paid 1.2 cents for a 16-cp. lamp-hour. Now he obtains for the same price nearly 150 candle-power-hours. Today one pound of coal burned in the central station develops in the lamp twenty-five times as much illumination as in the days of "old Pearl Street."

In 1882 there was one electric light and power company in the United States, serving one-sixth square mile of territory. In 1922 there are nearly 5,700 operating companies, serving approximately 15,000 communities.

In 1882 central-station service was launched with fifty-nine customers. Today there are in the nation nearly ten and a half million consumers of electrical energy, of whom eight and a half million live in wired houses.

In 1882 the only commercial central station in the nation supplying a general underground house-to-house service had a total generating capacity of about 600 kw. In 1921 the total generating capacity of the central-station plants of the United States was 14,500,000 kw. and the output was 43,100,000,000 kw.-hr.

Nor is this to be regarded as the completed achievement, to be proudly looked back upon, of an industry that has attained its full stature in a nation ever ready to absorb more and more electrical energy. It is, on the contrary, merely the evanescent mark, to be superseded tomorrow, of an industry still pulsating with youth and vigor, continually translating into commercial service the never-ceasing developments of a still growing art, and appealing for billions of new capital that its benefits may become not merely widespread but universal and that every man, woman and child in this broad land may have a share in the enjoyment of the comforts and conveniences that electricity has conferred upon mankind.

Thus in the starting of the Pearl Street station by Mr. Edison, his associates and assistants we see the vigorous germ of the electric light and power companies as we know them, the solid foundation on which the great development of today has been built.

An Interview with

The Father of the Central-Station Industry

By L. W. W. Morrow
Associate Editor *Electrical World*

"TAKING everything into consideration, I found that the subdivision of the electric light must be done by the multiple system or not at all, so I worked on that plan only," said Mr. Edison. The statement typifies the man in that it shows the power of his analytical mind and the strength of his determination to secure results.

Sitting at his desk in his West Orange laboratory, Mr. Edison cheerfully gave the interviewer some recollections of the old days when the electrical art was in its infancy. His keen analysis of past and present conditions, combined with his sense of humor, his friendly welcome and his enjoyment of an idle hour, was convincing evidence that the master inventor was still actively engaged in doing things for the benefit of mankind.

In the opinion of Mr. Edison, the Pearl Street station marks the birth of commercial activity in electrical enterprises. It was built solely because Mr. Edison was convinced of the commercial feasibility of electric lighting and had the strength and courage to overcome all opposition.

The art of telephony gave him no experience by which to establish a light and power system, and the existing arc-lighting companies fought the introduction of the incandescent lamp by competitive commercial practices. The gas companies fought the plan in every possible way, and yet they gave Mr. Edison a good idea. "I found that one gas company used a feeder," he said, "and this gave me the idea of electrical feeders."

The engineers and scientists opposed the installation in every way and scoffed at its possibilities. As Mr. Edison put it, "They put themselves on record after I knew experimentally that I was right, therefore I encouraged them to go on record."

The scientists said Mr. Edison needed five megohms insulation resistance per mile, but "I was happy to get one ohm per mile. A little study of the energy used by a lamp, that used in line loss and that used in the engine and generator led me to conclude that the cost of coal would be very small and that the system was economically sound even if the insulation resistance was only a few ohms," said Mr. Edison.

HE ESTIMATED THE LOAD

Mr. Edison knew the monthly gas bill of every customer south of Canal Street. He put "spotters" out who tabulated the number of gaslights burning on each customer's premises each hour of the twenty-four. He was able to predict from these studies the economic results of the Pearl Street installation.

"We had little money, and I picked the Pearl Street location because I thought the property could be purchased for about $10,000 a lot as it was in a slum district. I wanted a plot 50 ft. x 100 ft. and was stunned when they quoted $75,000 a lot. This led me to use direct-connected units which I wished to run at high speed. I wanted a great amount of generating equipment on a small plot because real estate was so expensive," said Mr. Edison.

In order to convince those interested that his system would work, and in order to secure experimental data, Mr. Edison said he reproduced his distribution system on a miniature basis by laying out a german-silver wiring diagram on the side of a wall and connecting the lamps. He measured the actual voltage drops on this experimental circuit in order to fix his feeder sizes.

"I had familiarized myself with the balance sheets of the gas companies, and knew I was up against stiff competition, so I used all available labor-saving devices for handling coal and ashes in the plant," said Mr. Edison. "The whole question was in my mind one of economy and reliability, for I knew the system would operate satisfactorily."

THOSE FIRST ENGINES

Let Mr. Edison tell about his first engines: "When I started there were no high-speed engines on foundations except a few small ones invented by Charles H. Porter which operated at 300 r.p.m. All the larger stationary engines ran at from 80 r.p.m. to 125 r.p.m. I couldn't see why I couldn't build an engine to run at 300 r.p.m. on solid foundations when locomotives of 500 hp. were running successfully on such a poor foundation as a railroad track. But every engineer I approached gave reasons why it couldn't be done, with the exception of Mr. Porter, who agreed with me. I asked him to build a 175-hp. engine to operate at 700 r.p.m. This Porter refused to do unless I paid him in advance. I paid. The engine was built and brought to Menlo Park and placed on its foundations. The throttle valve was controlled by a long chain running outside through the window of the engine room. We started the engine, but at 300 r.p.m. it shook the building. For three weeks we kept at work balancing the parts and increasing the speed until at last it operated at 700 r.p.m., but still vibrated badly. Everybody said it would never be practicable. I then slowed it down to 300 r.p.m., and it ran so quietly one could hardly hear it or detect any vibration. I then told the boys that all I was after was 300 r.p.m. Several of this type were built and put into the Pearl Street station."

After the units were built they operated very well until the first attempt was made to parallel two machines. Mr. Edison laughed heartily over that exciting episode, because, as he said, "I never anticipated or expected such a performance." First one unit would increase its speed to about 700 r.p.m. and the other slow down; then conditions would be reversed with respect to the two units. The loud noise, the smoke and the molten copper thrown around the room created great excitement."

This experience showed that the Porter-Allen gravity governors would not hold, so Mr. Edison tried to improve operations by mechanically connecting the governors, using a solid iron rod more than 60 ft. long. This helped, but there was sufficient torsion in the rod to give bad operation. Mr. Edison then gave a capital example of his ingenuity when a practical difficulty arose. "I took the solid rod and placed it inside a gas pipe. I then twisted both in opposite directions until all the torsion was taken up and pinned the ends of the rod and gas pipe together. This device worked splendidly, although over 100 ft. long." Not long after this the Armington & Sims engine with its centrifugal governor replaced the older units.

"I investigated the available boilers," said Mr. Edison, "and decided to use the B. & W.; by the way, I tried to burn powdered coal under a boiler about this time, but only succeeded in burning fire brick walls because the combustion chamber was too small. Our coal at Pearl Street was anthracite, which, as I remember, cost about $5.50 per ton. We used 28 lb. to 32 lb. of water per horsepower in the old plant."

WHY THE UNDERGROUND SYSTEM

"I adopted the underground system of distribution," said Mr. Edison, "because I knew that the public never would approve of a wilderness of overhead wires and also because the electrical system, so similar to gas lighting, could only be made reliable through underground distribution.

"I used 120 volts, so that safety was not a factor in the problem. I was after reliability."

This consideration of reliability is the chief reason why the winter of 1881 saw Mr. Edison supervising the laying of the underground system. He snatched about two hours' sleep in the twenty-four, and this usually on top of a pile of gas pipes in some dark basement room. He was fought tooth and nail by the gas companies, and then to add to his worries the Commissioner of Public Works sent for him. "You are laying tubes down there and the city will have to furnish inspection," said the Commissioner. "Five men will report to you Monday, and you will pay each of them $5 a day."

Still more remarkable was the dry statement of Mr. Edison to the interviewer: "None of those inspectors ever appeared to inspect, but they all appeared, however, at the office each Saturday to get their pay." So, in spite of all the troubles and the presence of the existing pipes of the gas companies, the tubes were installed.

The educational side of the problem was also important. A demonstration was given to the Board of Fire Underwriters of all the ways in which a short circuit could be caused. Hundreds of restrictive rules and regulations had to be changed to conform to the new conditions, and these little troubles caused more worry to Mr. Edison than many of the larger technical problems.

"Copper cost was a big item in those days, and in studying how I could save copper and increase the area of distribution I figured out the three-wire system," said Mr. Edison. "But it seemed too good to be true, and I believed it only after I tried it out. It was an amusing experience we had in trying to explain the system to a group of scientists. They argued and attempted to prove by mathematics it was impossible in spite of the fact that we said it was working in New York. At last John Hopkinson said there was something in it, and the session ended by the scientists proving by mathematics that the system was sound."

AMUSING ANECDOTES

Some rather amusing episodes were mentioned by Mr. Edison in connection with the early days of lighting. The superintendent came into his office one day and said: "Mr. Edison, a saloonkeeper down on Nassau Street is trying to age eight barrels of whiskey by burning three lights day and night in the barrels where the whiskey is kept." "Very well," said Mr. Edison, "let him try anything that uses our lights." A month afterward the superintendent came rushing into Mr. Edison's office with the announcement: "That whiskey aging works, Mr. Edison. I tasted the liquor and all the shudder was out of it."

Upon another occasion a witty Irish customer had his first bill in July. This amounted to $10. The next month his bill was $20. This increase continued as the nights lengthened until his December bill was $52. The Irishman called in the superintendent and said: "Say, sixty dollars is my limit; if you go over it, take the whole outfit away from my house."

After the successful operation of the Pearl Street station the industry grew by leaps and bounds. The use of belt-driven units in many following installations was explained by Mr. Edison. He stated that lack of capital handicapped the small towns so that the cheapest installation was the low-speed engine with belt drive.

THE FUTURE TREND

In the generation, transmission and distribution of energy Mr. Edison thinks electricity will have no competitor. He believes transmission and interconnection will continue and advocates mouth-of-mine stations in coal districts at least to supply the peak loads. He believes such plants could burn low-grade fuel and help materially by feeding into power systems.

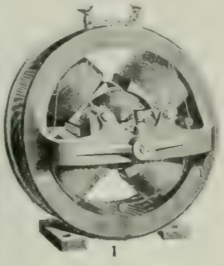
An original suggestion was made by Mr. Edison which he said would have to be worked out to see if there was any value in it. This was to pump back into reservoirs the water which escapes in most hydraulic developments during off-peak load periods. He stated that the storage battery is too expensive for the storage of electricity in large quantities, but that there might be some economy in off-peak water storage by using highly efficient pumps.

In the opinion of Mr. Edison, the future will see a development of electrical labor-saving devices on a par with the past. "There is no apparent limit to the development of labor-saving equipment through the use of electricity," he declared.

In the presence of the great inventor, surrounded by mementos of his past accomplishments and enthused with his spirit of optimism, one could not but feel that the electrical industry was still growing by leaps and bounds under the continued stimulus of a great personality.

Pictorial Section of *Electrical World*
September 9, 1922

Evolution of Electric Power Equipment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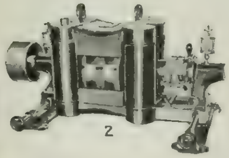
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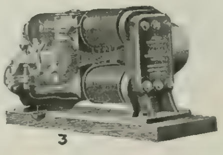
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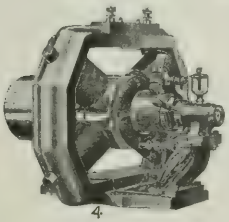
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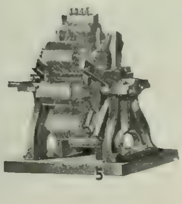
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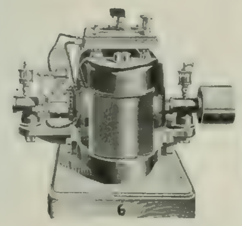
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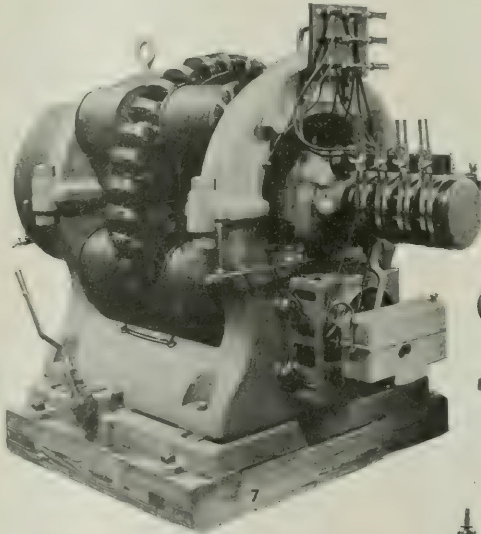
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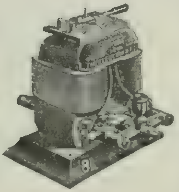
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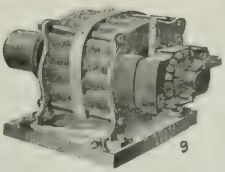
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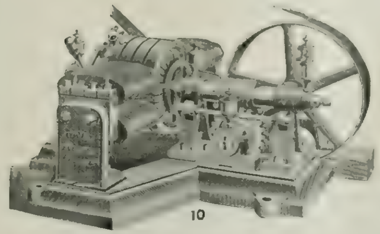
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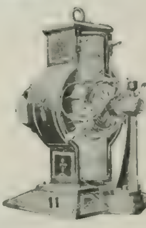
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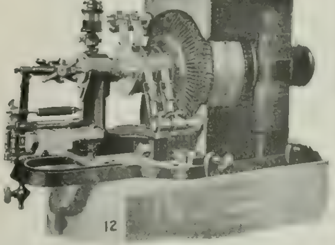
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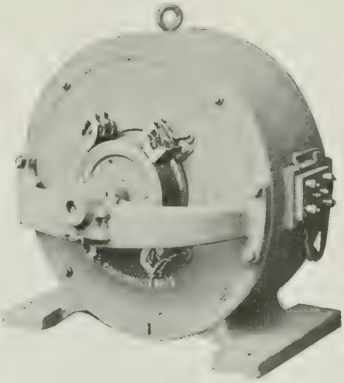
Early Direct-Current Machines Differed Greatly

No. 1. Gérard type generator, 1884.
No. 2. High speed Detroit motor, 1889.
No. 3. Weston generator, 1884.
No. 4. Standard generator, 1889.
No. 5. Klimenko arc generator, 1884.
No. 6. Kester motor with open coil armature, 1889.
No. 7. Brush four circuit arc generator, 1889.
No. 8. Perret motor, 1889.
No. 9. Oppenheim generator, 1884.
No. 10. Daft elevator motor operated in New York in January, 1884.
No. 11. Excelsior generator operated both arcs and incandescents in 1884.
No. 12. Cincinnati motor operated on an arc circuit, 1889.



Odd Units Excite Interest as Types

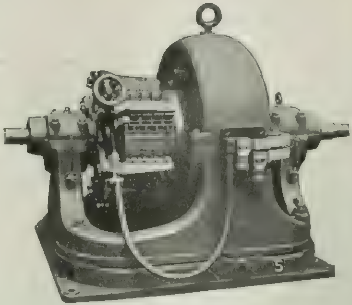
No. 1. A motor of 1895; No. 2, one of 1896; No. 3, motor of 1897, and No. 4, motor of 1922. These show the diversity in design changes for one company only.

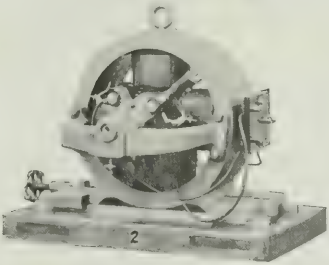
No. 5. A generator of 1900 type compares favorably with the one shown in No. 6, which is of modern interpole design.

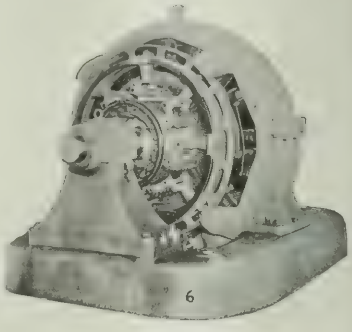
No. 7. An old motor of 1893.

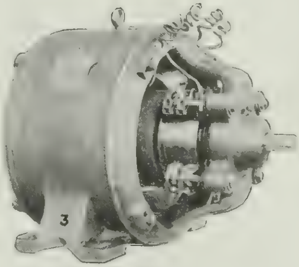
No. 8. Two 110-volt d.c. generators of original design.

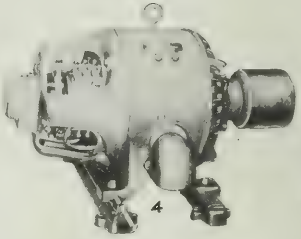
No. 9. An early type of motor generator set with a single-phase commutator motor with centrifugal forces utilized to remove the brushes when speed is attained.

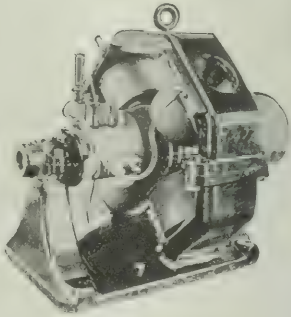


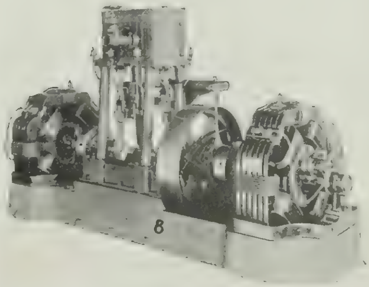


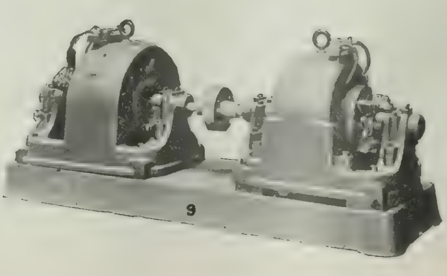


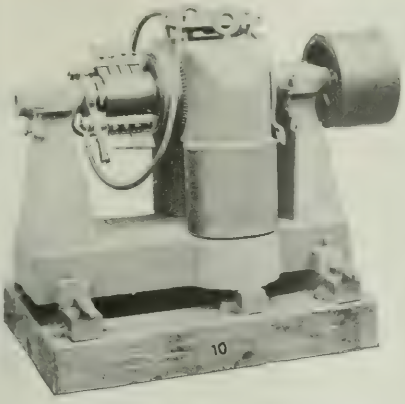












Changes in Design Improve the Appearance

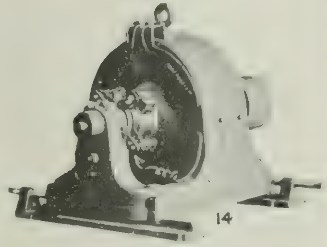
Nos. 10, 11 and 12. An evolution in design —No. 10, 1891; No. 11, 1901, and No. 12, 1922. All were built by the same company.

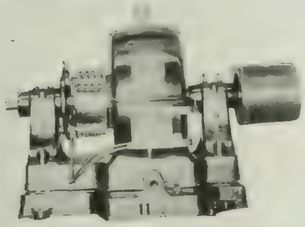
No. 13. An engine type generator of 1913.

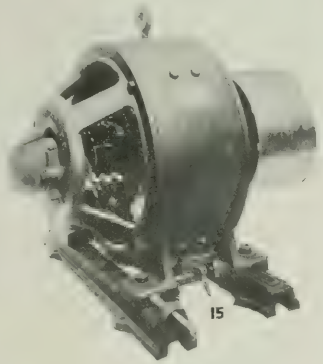
Nos. 14, 15 and 16. Another company shows the evolution in its motor design. No. 14, 1893 to 1901; No. 15, 1902 to 1911, and No. 16, 1911 to 1922.

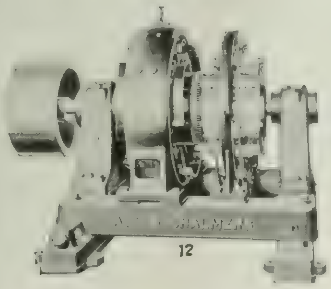
No. 17. A 20-kw. generator of 1904 for use with a turbine.

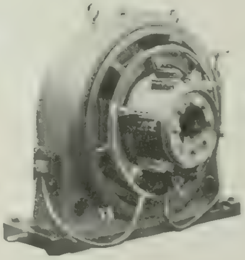
No. 18. A 1915 generator for direct connection to a turbine.

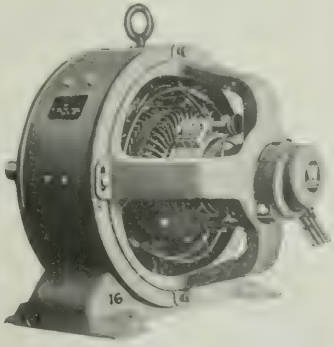


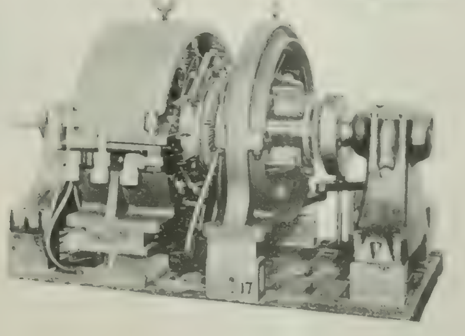


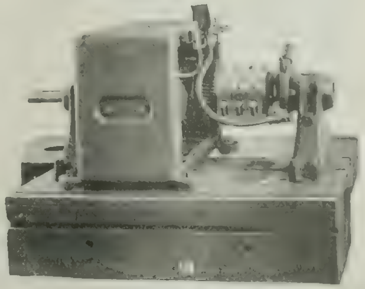


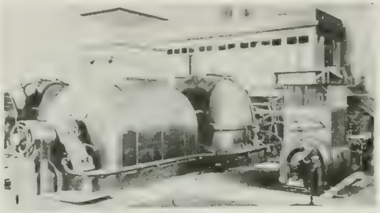


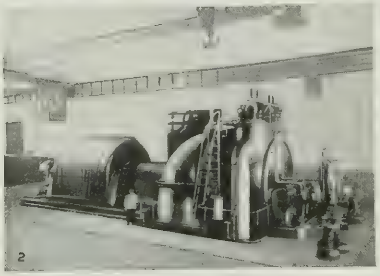












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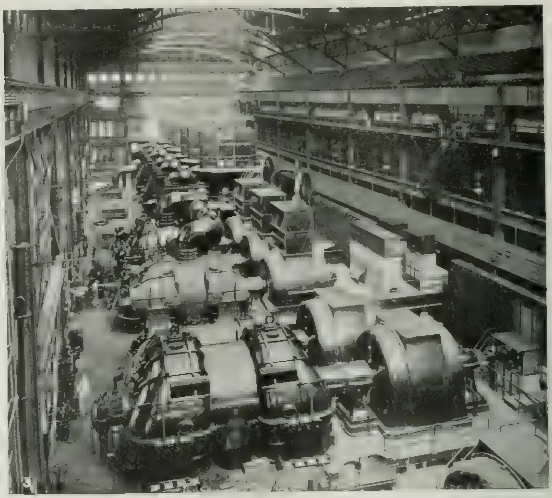
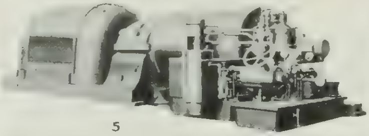


Steam Turbo-Generators Monopolize the Central-Station Field



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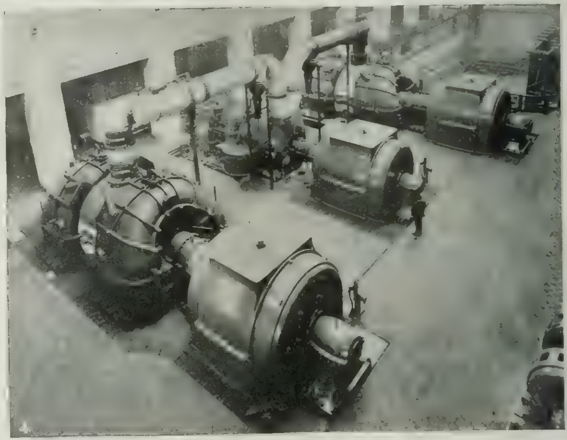

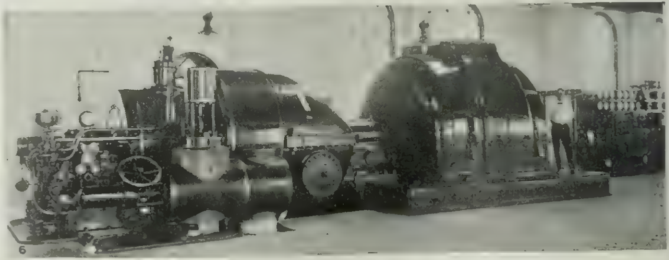

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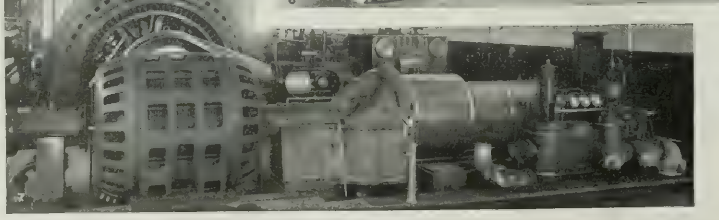
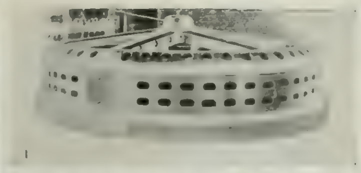


No. 1. Hell Gate, 40,000 kva.
No. 2. Goldenburg, 60,000 kva.
No. 3. Interborough, 60,000 kva.
No. 4. Colfax, 60,000 kva.
No. 5. A design of 1907; No. 6 of 1913, and No. 7 of 1922, all by the same company.

Waterwheel Units Develop Rapidly After the Installation at Niagara Falls in 1895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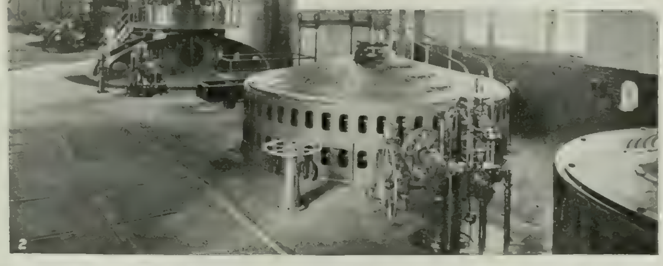
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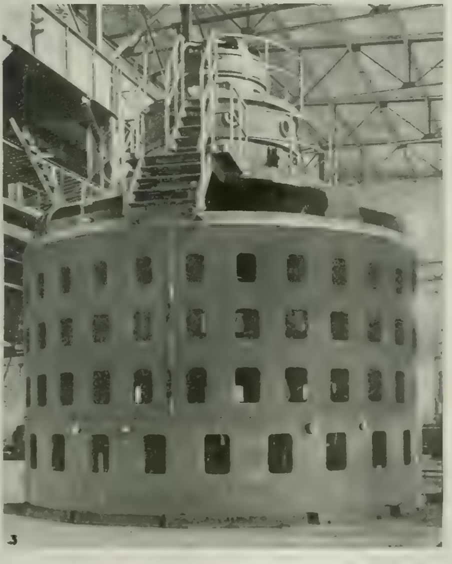
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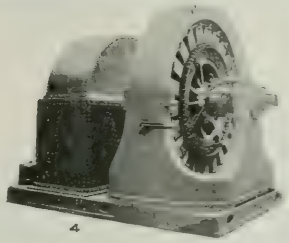
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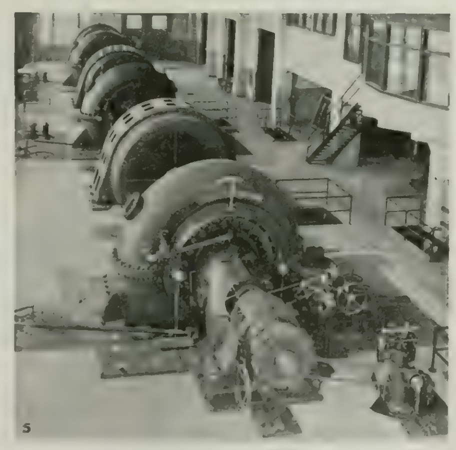
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No. 1. A vertical type generator of 1905.

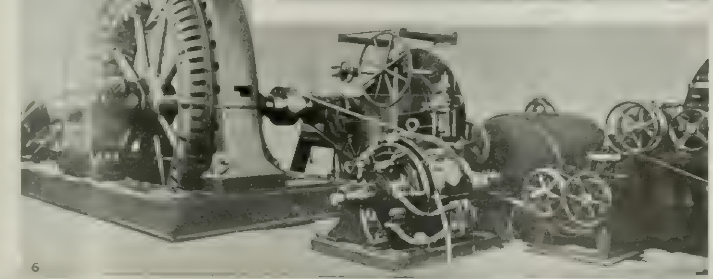
No. 2. A modern installation of vertical units in New England.

No. 3. One of the largest vertical units, 1921, at Niagara Falls.

No. 4. A direct-connected unit of 1895.

No. 5. A modern installation of horizontal units on Puget Sound.

No. 6. A 1903 installation gives an appearance of complexity and crude arrangements for control.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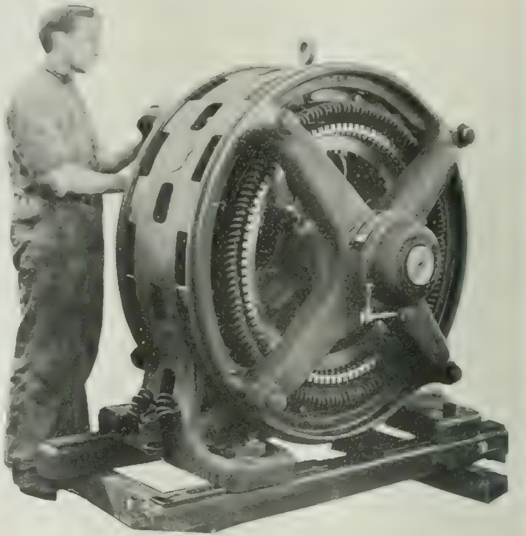
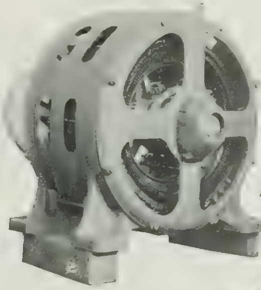
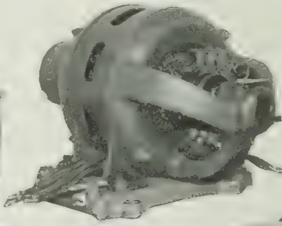
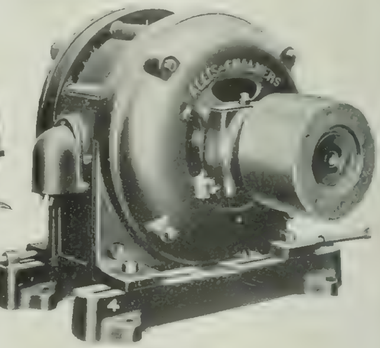
Induction Motors Popularized Alternating-Current Systems for Power Purposes

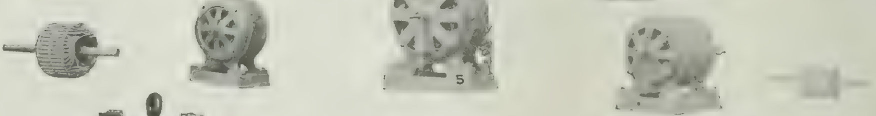
THE commercial use of the induction motor was due largely to the American engineers. It added a simple and convenient motor to the many transmission and generation advantages of the alternating-current system and has made it possible for central stations to secure isolated plant loads located at great distances from the stations. The low cost of the motor and its operating advantages please the users.

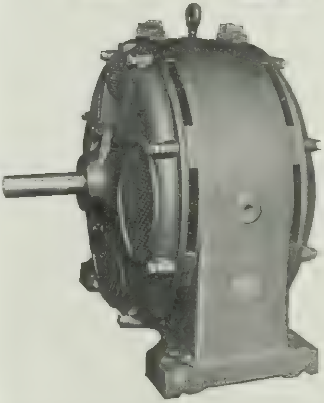












No. 1. A squirrel cage type of 1895.

No. 2. A slip ring type of 1906.

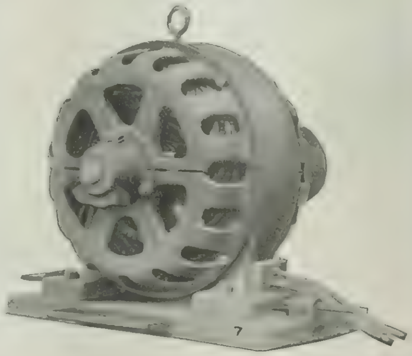
No. 3. A modern slip ring type.

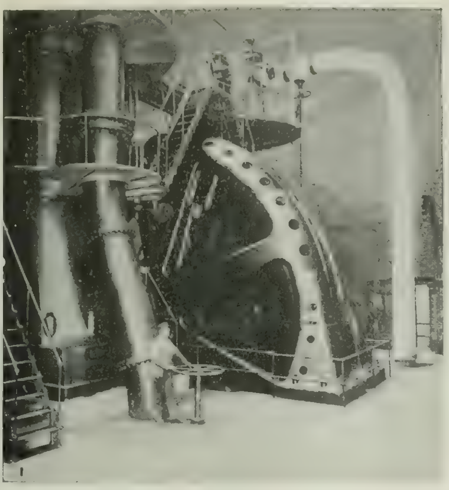
No. 4. A modern squirrel cage type.

No. 5. Early Tesla motors and parts

No. 6. Type of motor that was used from 1896-1907.

No. 7. Type of motor dating 1907-1912.

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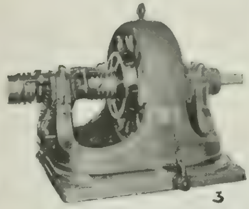
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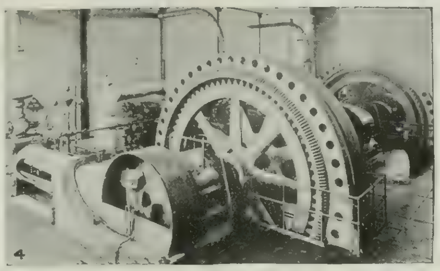
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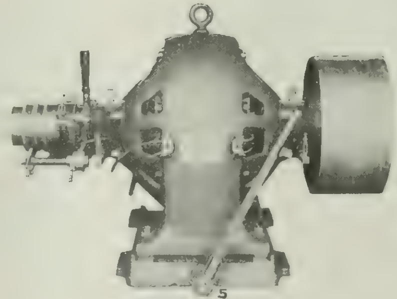
Early Alternators Used Magnets for Excitation

The heavy flywheel type of alternator is shown as of 1895 in No. 1, and as of 1908 in No. 4. Small belted alternators of a type used in 1890-1895 are shown in Nos. 3 and 5. The bracket and pedestal types of bearings had their respective advocates and great differences occurred in the treatment of the terminals.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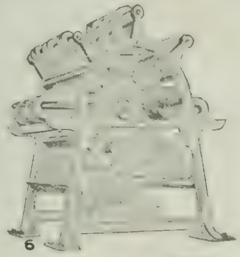
No. 6 shows one of the earliest Alliance types which used permanent magnets for excitation and was used to supply lighthouses. No. 7 is a more modern belt-driven machine. No. 8 is a self-excited alternator of 1889.

No. 9 is a Gérard machine of 1884 and No. 10 a De Meritens alternator of a magnet type of 1884.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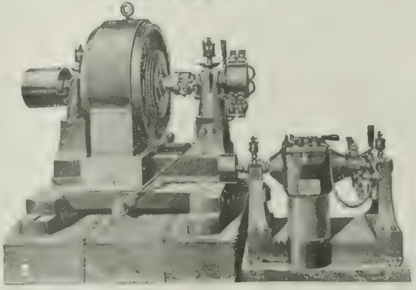

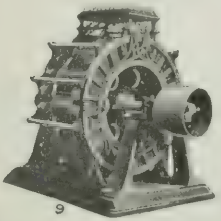
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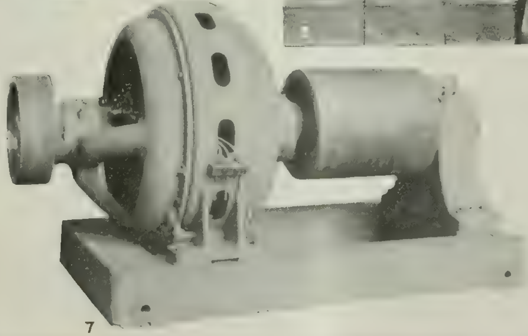
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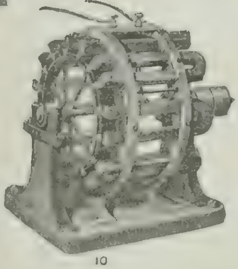
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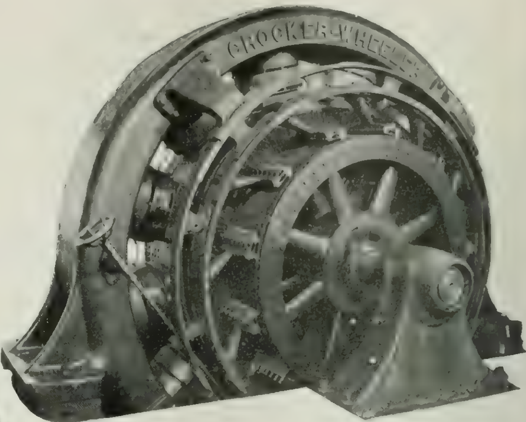
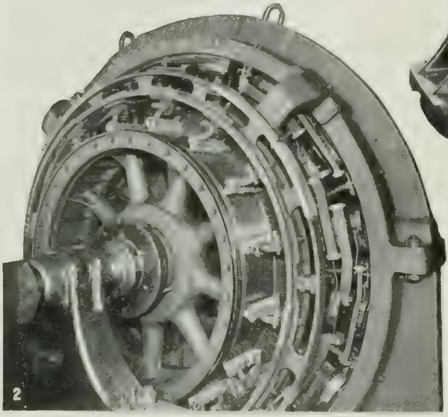
Engine Type Generators Contrasted Show the Greatest Changes Occur in Materials

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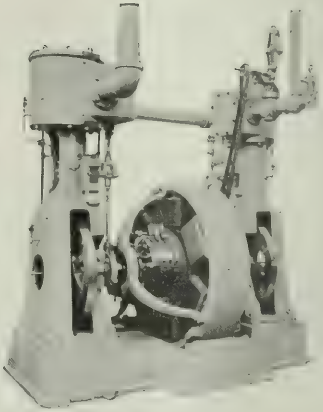
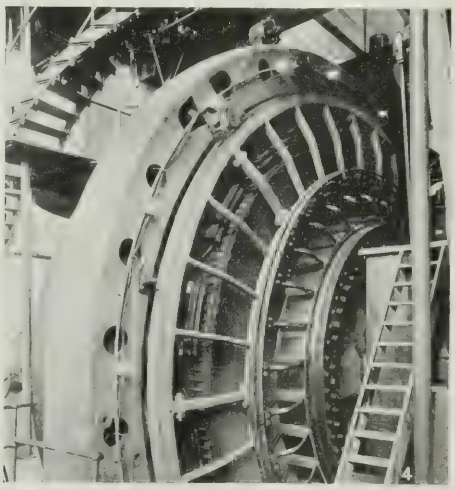
A comparison of Nos. 1 and 2 shows the change in design of one company between 1899 and 1920. The interpole apparently adds to the complexity.

Another comparison is indicated in the lower figures where No. 3 dates back to 1895, No. 4 to 1907 and No. 5 to 1921.

The use of cast-steel, the interpole, and better systems of ventilation enabled designers to reduce the bulk of materials required per unit of capacity.

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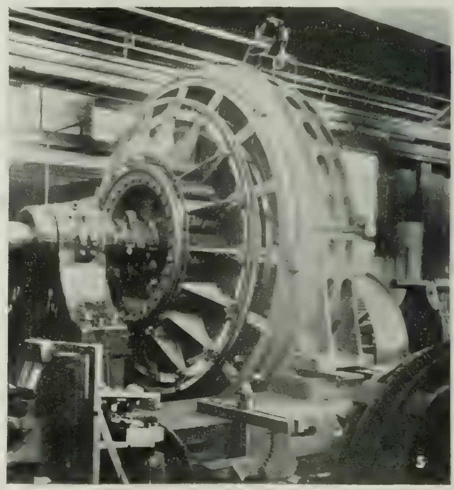
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The Term "Subdivision of the Electric Light"

By Elihu Thomson

WERE it not that there seems to have arisen a misconception of what was meant in the early days of our art by the term "subdivision of the electric light," there would have been no occasion for writing what follows.

It is not far from fifty years ago that "the electric light" when spoken of or written about meant the electric arc light, the luminous source, constituted, as now, of a current passing the gap between separated electrodes, generally of carbon. It was the manner in which electrical energy from the dynamo then best known, the historic Gramme, was made to yield light of high efficiency, the superior in brilliancy, color and even in economy (per candle) of all other sources of illumination except the sun. It was the electric light, but unfortunately it was inherently a large-unit source, and it was known that the economy of light production for the power increased as the energy in the arc increased more than in direct proportion. The desirability of cutting up such an admirable source, the *electric light*, the only one known, gave rise to the discussion among interested persons, even scientific men, of the possibility of subdivision. Hence the term "subdivision of the electric (arc) light" was two or three years before Edison brought out his incandescent lamp.

Now the fact is that the problem, such as it was—the cutting up of an admirable source into bits of that source or into smaller units retaining the economy and characteristics of that source—has not in the fifty years of discussion really been solved, and under its terms never will be solved, as its solution would violate physical principles. In spite of all that has been said and written about the problem, there has been no solution of the "subdivision of the electric light" without shifting the original meaning to something different, the shift consisting in substituting for division of the *light* division of the delivery of the *energy* into small bits to work an entirely different light source, the later incandescent not included or regarded as the electric light to be subdivided.

EDISON INVENTS INCANDESCENT

In the midst of the discussion in 1878 Edison began work on the platino-iridium wire incandescent as a small unit whose efficiency of light production per horsepower expended was confessedly only a fraction of that of the electric light, the arc. It was the announcement of this platinum-wire lamp which caused that phenomenal drop in London gas shares, well remembered as a sort of tragio-comic effect; for, indeed, those who did not know thought the problem had been solved. Two years of further work on such lamps without much avail was succeeded by the production in the fall of 1879 of the first high-resistance carbon-filament vacuum lamps, exhibited at the Menlo Park Laboratory in December, 1879, about six to eight lights of gas-jet (not Welsbach) power requiring an expenditure of a horsepower. There was no "subdivision of the electric light" here. On the contrary, to Edison's credit, it may be said that he did not ruminate on the question of subdivision of a something already existing, but set about to secure a small source, boldly accepting and wisely accepting the low economy as a sort of tax to be paid for the smaller units distributed, thus creating a new system of lighting, distribution, etc., which, with the improved lamps evolved in later years and culminating in the drawn-wire tungsten and the gas-filled half-watt units, bids fair to make electric incandescent lighting, except for special units and purposes, well-nigh universal. In connection with such a development there is no appropriateness in the use of the term "subdivision of the electric light," which historically and actually has a meaning altogether different from the production of a small light unit entirely different from the electric light in question, which was the arc light) and the subdivision of the energy to feed such units.

Given the small unit, the incandescent lamp and the subdivision of the energy, a new problem was solved. The two came together, it is true, but they have no necessary connection, as is witnessed by the working of single incandescent lamps by dry batteries or other sources of electricity.

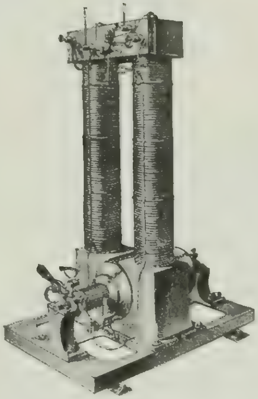
The arc light was originally run as a single light from a single dynamo. The running of a series of arcs from one dynamo was no more a "subdivision of the electric light" than the running of one or more incandescent lamps in parallel was a "subdivision of the electric light" in the sense of the original and later historic use of the term.

HOW CONFUSION AROSE

It is certainly true that in the early discussions much confusion arose, and errors of judgment were made even by some of the scientific men concerning the general subject. They did not always apparently bear in mind just what the term "subdivision of the electric light" meant, and they were drawn into discussions of irrelevant matters which for a time passed under the same heading. I think that those men who had a practical working knowledge of the conditions—and there were such men—were less likely to get tangled up in discussions of this character, and their absence from the discussions indicates that they were not ready to commit themselves or to be drawn aside from the real original meaning of the term "subdivision" in this connection. However, no matter whether the reasoning used was correct or incorrect, the conclusion was that the division of the application of electrical energy to work a number of small lights instead of one large arc light could only be done by a heavy sacrifice of efficiency

There is another aspect of the matter which should not be neglected. In those early days electricity developed from power was regarded as considerable of a luxury, not to be wasted. The engines themselves were not highly economical, and the dynamos also were low, relatively, in efficiency. The plant, compared with a modern plant of the same output, was simply gigantic, involving an immense capital expenditure. The machinery too was costly. Thus it was natural that there would, as it were, be focused on any electric proposition a certain regard for the economical use of power and the economical use of the capital invested. Even to consider that the output to be obtained was only, say, eight to ten 16-cp. lamps per horsepower expended in driving a dynamo was, in itself, a staggering circumstance; and if there be added to this the cost of the lamps themselves and the cost of the copper required for the mains and the short life, one can but admire the courage which led to the establishment of the early station distributions of incandescent lighting.

Construction Methods and Equipment of 1882 Are Still Followed in Principle



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No. 1. The early Edison generators were made in five sizes for supplying 15, 60, 150, 250 and 1,200 16-cp. lights. The illustration shows a sixty-light machine built in 1884.

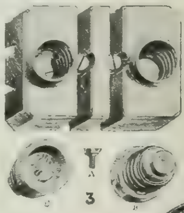
No. 2. The laying of tubes in 1881 was a delicate operation which required the active aid of Mr. Edison.

No. 3. An Edison safety cut-out of 1884. The first fuse plug was placed in the hardwood cut-out.

No. 4. A hinged bracket fixture invented by Edison in 1884.

No. 5. Magneto testing of tubes for insulation breakdown in 1884.

No. 6. The Edison electrolytic meter had its plates weighed once a month in order to measure the energy used by the customer.



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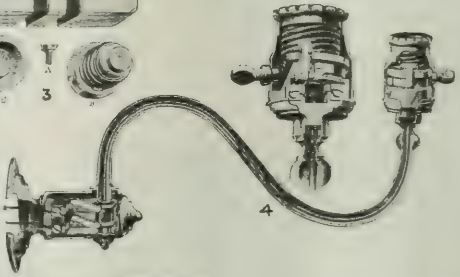

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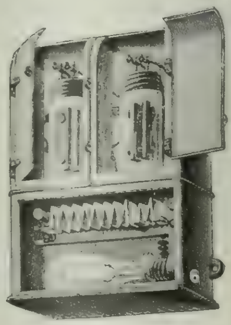


Early Days with Edison

By Arthur Williams

New York Edison Company

YOU have asked for a brief personal contribution to the event we are now celebrating—the completion of forty years of Edison service in New York City. My connection with the Edison work there began in August, 1884, when as an office boy I entered the office of Rennie & Smith. These gentlemen composed a firm of electrical contractors occupying an office in the front of the first floor of the old Pearl Street station. Arthur H. Rennie, now a minister doing fine work in his parish on Long Island, was a brother-in-law of Charles E. Chinnock, the superintendent of the New York Edison Company and its first dividend record maker, while Harry J. Smith afterward became general operating superintendent of the company, a position he held when he met his death by a fall from the rafters of his barn in New Jersey. In February, 1885, Mr. Chinnock's offer to me of a position as assistant in the meter department of the company brought me into it less than two years after the station was opened, at a time when it was full of relics and traditions of Edison's own work—a legacy which has since served as our guide.

One of these traditions was the disregard of time in its relation to work—either day or night—because that was the way Edison worked. The historic bedroom provided for Mr. Edison's convenience is not a myth. However, any story that he frequently used it would be a myth. According to common report, he more often slept on a pile of Edison tubes on the first floor of the building than in his bedroom on the third floor. As for us, in one instance when the connecting feeder at Wall and Broad Streets which supplied the Morgan offices and the Stock Exchange burned out we worked sixty consecutive hours to repair it. The movement of the hands of the clock or the position of the sun, whether above or below the horizon, meant nothing to an Edison man worthy to be called by that name.

As early as 1885 the impression of greatness made by Edison upon all who came in contact with him is proved by the pleasure with which customers recalled that they had seen, met or shaken hands with him. For example, a customer would point to a chair in which the great Edison had sat discussing matters with him, thus betraying something of the feeling that one finds today in Europe, where in one of the larger cities a window may be seen upon which has been inscribed: "The great American, Thomas A. Edison, once looked through this window." Indeed, there is ample testimony to the fact that the fine quality, the genial temperament and the devotion to the work in hand, regardless of consequences to himself, characteristic of the Edison of today were easily discernible then.

How Edison's Personality Helped Others

Another impression left on my memory is the extent to which Edison's personality inspired self-development in others. He possessed the power, whether conscious or subconscious, of selecting potentially big men, and it is significant that the men then chosen by him became the master minds, in the best sense of the word, of our great industry. Many of the men who began their careers with him then have retained their mental and physical powers and still seem young men after forty years of continuous and strenuous effort.

Were I asked what has impressed me most during my years of acquaintance with Mr. Edison, I think I should say his almost indescribable warmth of personality. I have besides been greatly impressed by his concentration upon and ability to analyze essentials, his apparent forgetfulness of self and his complete absorption in the matter in hand. Things that seem of great importance or very troublesome to others he passes over with a wave of the hand, an expression of the face or a casual word which places the matter in its proper relation. I have heard men eminent in different ways mention interviews with Edison during which he displayed an astonishing grasp of the fundamentals of subjects in which they had specialized. I have never heard of a case where a technical problem presented to him had not already been given consideration, and from every angle.

Choate and Edison Meet

It was my privilege to bring Mr. Edison and Joseph H. Choate together. One morning Mr. Choate called with a large check for a fund for the blind upon which we had been working together. While the great lawyer was in my office one of our photographers looked in, and I asked Mr. Choate, then sitting beside a bronze bust of Mr. Edison, if he would allow us to take his photograph in that position. He willingly assented, and the picture was so successful that I sent a copy to Mr. Edison, who, in his acknowledgment, replied he had always wanted to meet Mr. Choate and asked if a meeting could be arranged. I sent the letter to Mr. Choate, who immediately responded that he would go anywhere at any time to meet Mr. Edison.

At the invitation of Mrs. Edison, both Mr. and Mrs. Choate went to the Edison works at Llewellyn Park. Later in the day their son joined the party. When we were ushered into the library Mr. Edison was seated at his desk in a distant corner, talking with some of his people. I had given some thought to the manner of introduction of these two great Americans, but an introduction proved unnecessary. The moment Mr. Edison was informed of Mr. Choate's arrival he dropped everything, rushed across the floor and without formality grasped Mr. Choate by the hand, telling him that he had always wanted to meet him but had never had an opportunity. It was a greeting of deep appreciation and warm hospitality, to which Mr. Choate responded, with his magnetic smile and a hand on Mr. Edison's shoulder: "I never turn out at night the light at the head of my bed without blessing the name of Edison." After a wonderful day, Mrs. Edison entertaining the party at luncheon, not only did Mr. Edison speak of the great pleasure which the visit had given him, but later, before we reached the city Mr. Choate declared that it had been the red-letter day of his life and that he felt, after meeting "the great Edison," as if he had looked in upon another and a greater world.

One of Edison's first inventions, long before the beginning of Marconi's work, was in the field of wireless telegraphy; yet one can never forget his message to Marconi on the night of the dinner which commemorated the first message across the ocean without wires. No suggestion of his own previous work in that field was contained in the message. It was simply a word of compliment and congratulation to "the young man who had the audacity to first span the Atlantic Ocean without the aid of wires"—if, after all these years, my memory is correct.

Development of Arc Lighting

Although Not the Originator, America Made Many Valuable Contributions—Improved Electrode Feed and Current Regulation, Inclosure of Arc and Production of Luminous Arc Constituted Important Developments

By Elihu Thomson

WHEN, at almost the beginning of the last century, Sir Humphry Davy, in London, used charcoal electrodes with his many-hundred-cell battery and drew the first carbon arc, he had no conception of the great future of this arc in lighting. It was to him a scientific discovery in the form of a "glorious experiment" having no relation to practical illumination. Up to the time of the invention of suitable dynamos for generating electricity from power the electric arc was seldom seen. It remained much of a curiosity, notwithstanding that arc lamps in simple form were invented even for use, at large expense and great inconvenience, with batteries furnishing the current. Besides this, the magneto machines of Holmes and the Alliance machines, which were, in fact, alternating dynamos, were in some isolated cases applied to run single arcs in lighthouses. Indeed, a single carbon arc from a single dynamo was the rule, even when dynamos began to be developed, some years before the Centennial Exhibition was held at Philadelphia in 1876, and at that exhibition there were only two exhibits of arc lights, namely, of the Gramme and the Wallace-Farmer types, consisting of single large arcs each run from the current of a single dynamo separately.

Arc lighting on a more extensive scale, especially in streets, may be said to have begun with the use of the "Jablochkoff candle" in 1878 in Paris, the Avenue de l'Opéra being so lighted, but the "Jablochkoff candle," owing to its expense and complexity, was a form of arc lighting which was very short-lived and soon disappeared. It should be mentioned, however, that in the same year, which was that of the Paris Exposition, there was in operation at the Gare St. Lazare in Paris a circuit of six or eight lamps in series, run from a dynamo.

Charles F. Brush in those early years was building single arc lights and single dynamos to run them, and not until 1879 was the Brush system so developed as to involve the running of a number of arc lamps in series. But from that time the arc lamp began to be a commercial factor in lighting, especially for streets and large spaces.

FIRST SERIES ARC MACHINE

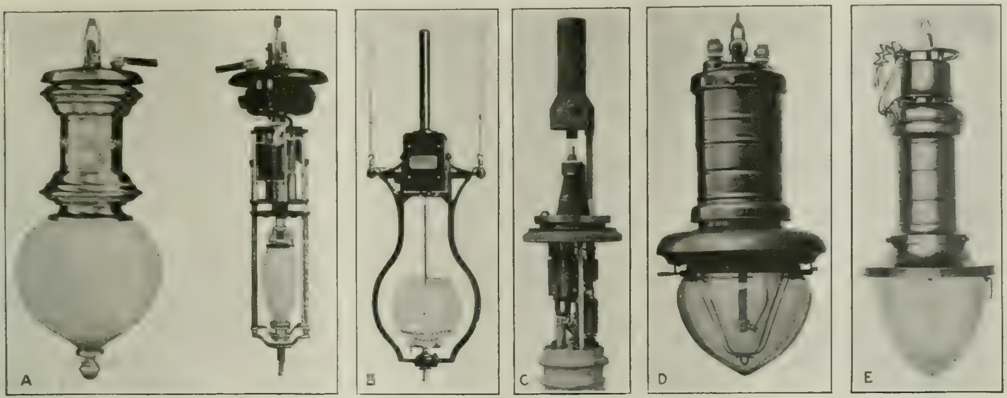
Early in the same year the first Thomson-Houston arc dynamo was built in Philadelphia. It was a machine which ran its lights in series, one which would carry a maximum of nine arc lights. It is interesting to mention that in this case there was no forerunner in the shape of a single arc from a single dynamo. The system sprang into existence with series connections of the arcs, and the first machine had a capacity of nine arcs with about 10 amp. of current flowing. It was on the subsequent development of this type of apparatus that the Thomson-Houston Electric Company was built up, and it afterward acquired the Brush Electric Company of Cleveland.

In the early days the applications of the carbon arc to lighting the lamps, which were often called "regulators," because they regulated the supply of carbon as fast as it was consumed and tended also to regulate the current in the circuit, were frequently based upon the clockwork principle of feeding the carbons by means of a set of clock wheelwork, such as racks, pinions and escapements. It is significant that the arc lamps which reached the greatest extension of application entirely discarded clockwork, the separation and feed of the electrodes being by means of clutches. In the case of the Brush arc lamp the famous ring clutch was supplemented in its action by a glycerine dashpot inside the upper holder, making it essential that the lamp should never be turned on its side or upside down. The clutch was controlled by the differential magnet, which was a double solenoid wound with series and shunt windings opposed to each other.

The original Thomson-Houston arc lamps made by the American Electric Company in New Britain, Conn., were also clutch lamps, the clutch being of a special type, and the control was by a differential system, in which the series magnet pulled oppositely to the shunt magnet, its smoothness of operation being insured not by a long glycerine dashpot, but by a simple mechanical slow-feed device which gave the lamp a great advantage in its installation and operation. This was known as the type D lamp, but on the removal of the works to Lynn it was replaced by another type of lamp, called the M & K, in which the carbons were separate at the start and were brought together and then separated to form the arc, the regulation of the length of the arc depending on a shunt magnet around it. The slow-feed device was retained, however, as well as the clutch.

All of these lamps had, of course, open carbon arcs with the carbons exposed to the atmosphere, and the consumption of the electrodes was comparatively rapid. There was considerable advantage found in the use of the shunt-controlled feed of the carbons in the M & K Thomson-Houston lamps as compared with the former differential types, of which the Brush lamp was a good example. The advantage consisted in the fact that the separation of the carbons was, in a sense, independent of the current on the line, so that a leaky line would not spoil the effect of the lights by causing the carbons to approach too closely together during burning.

The problem of regulation of current to a standard or constant value was accomplished in the Thomson-Houston system by the provision of an effective regulator on the dynamo. This regulator not only kept the current in the lights at a constant value during the



operation, but also allowed any number of the lights on the circuit to be extinguished without affecting the current traversing the remaining lights, so that any lights which were burning (if only a fraction of the capacity of the dynamo) were maintained at the same standard brilliancy or were operated under standard conditions. This regulating system was a very valuable adjunct and undoubtedly gave the Thomson-Houston system its great prominence in its early arc operations.

There were other unique features which contributed in a measure to the same result of enabling the series arc system to meet the conditions for great expansion. This expansion began to take place in the early eighties, when cities and towns, municipalities everywhere, as well as some of the largest stores, railway stations and other buildings, adopted the open carbon arc as a means of illumination. The pioneer work of the time had, in fact, laid the foundation for a very great business, of which the Brush and Thomson-Houston companies obtained by far the largest share.

It was frequently the case in the early days that the arc lamps were hung and operated without any protection around the arc, especially in the open spaces. As we may say now, the lamps had bare arcs. It became customary, however, to surround them with glass globes, thus conducing to the steadiness of the arc in the wind and also preventing sparks and trouble caused by hot carbon particles falling from the arc in stores.

THE COMMERCIAL DEVELOPMENT OF THE SERIES ARC WAS MARKED FIRST BY RAPIDLY CHANGING EXPERIMENTAL TYPES AND LATER BY ATTEMPTS TO SECURE ORNAMENTATION

The glass globes themselves oftentimes were made with ground surfaces or of opal glass for the better diffusion of the light. The development of the arc lamp and arc-lamp illumination remained in about this form, with minor improvements naturally, until new demands arose. One of these, in particular, was the desire to apply the arc lamp upon the then expanding constant-potential circuits at 110 volts. In some cases two arcs in series were connected across the mains, but this method had its limitations.

There came into existence, however, what was called the "enclosed arc," an arc the carbons of which were surrounded at the location of the arc by a small thin-glass opalescent enclosing globe with a gas cap or cover on the top, through an opening in which the upper or positive electrode was fed. By so enclosing the arc with a limited supply of air the oxygen within the small glass enclosure was soon consumed and the rate of combustion of the carbon was very greatly diminished, so that the life of a pair of electrodes was extended a number of times as compared with burning in the open. At the same time, the ends of the carbons at the arc burned square across, and the arc itself could be elongated so as to have a drop of, say, 75 volts to 80 volts between the carbons. Considerable application was made of this type of enclosed lamp, and, in fact, some series circuits were established with enclosed arc lamps, besides those run in parallel from 110-volt circuits.

The economy of the production of light in this manner was nowhere equal to that of the open arc, but the cost of trimming the lamps was greatly reduced because fewer visits were necessary. The method was afterward extended to alternating-current arc-lamp operation, the enclosed alternating-current arc being the next step. This method was applied to alternating-current circuits and can hardly be regarded as having been a step in advance, for the light production was at such a low economy as to be scarcely better than the carbon-filament incandescent lamp then used. These various types of carbon-arc lamps were brought into service, one after the other, and commercial examples of each of them were found in operation for about ten or twelve years after the first introduction of arc lighting.

The General Electric Company, which was formed in 1892 by the consolidation of the Edison General Company, whose special business was the supply of machinery and appliances for incandescent lighting by carbon-filament lamps, and the Thomson-Houston Company, had besides its own business acquired that of the Brush Electric Company. These two companies had supplied and installed by far the greater number of the arc lamps in use, and there arose an opportunity for continuing development in all the phases of electric lighting, as well as the other industries, such as electric railways, electric power and electric service generally. It may be said that the engineers and the business men who were gathered into the consolidation had contributed in the largest way to the extension of the different types of electric lighting.

Flame Arc Enters the Field

Then came the period when the development of the flame arc gave a new impetus to the business of electric arc lighting. The advantage may be briefly characterized as follows: In the carbon-arc lamp used up to that time in its several forms the major source of the light was the highly heated ends of the carbon electrodes themselves at the arc, while the flame, though countributing to the lighting effect, did not do so in very large measure. With the flame arc, however, the current in passing from one electrode to the other raised enough vapor to produce a highly luminous flame, and the electrodes became entirely secondary and negligible as a source of light, while the flame became the important source. The flame arc depended upon the volatilization of material, generally of a character to condense and form smoke, and some of the early developments of this type of arc lamp consisted in providing for the condensation and escape of the smoke from the arc without detriment to light emission.

There was soon developed what is now known as the direct-current "magnetite arc," consisting of an arc between electrodes one or both containing largely magnetic oxide of iron, with other admixtures to improve the economy of light production and the steadiness of the light. As an example of such admixtures titanium oxide and titanium carbide may be mentioned. These flaming arcs, or luminous-flame arcs, came to be substituted for the carbon arcs largely because of the economy of light production, together with a longer burning of the arc, the electrodes wasting away so slowly as not to require any attention for many days. At the same time, the mechanism of the arc lamp itself was modified in order to insure the best possible regulation as to feeding and separation of the electrodes to form the arc.

The arc flame itself in these later types of arc was much longer than the flame at the separation of the original carbons in the carbon arc, and the arc itself was more sensitive to drafts of air, or even to the character of gas surrounding it, so that it was necessary to provide a much more effective inclosure of the arc than was formerly the case. Since the electrodes in burning were not converted into invisible gas, as in the case of the carbons in the carbon arc, there has always remained a necessity for taking care of the smoke or fumes.

Along with these changes in the arc and the arc flame itself, the details of which must necessarily be omitted here, came into existence other methods of supplying the current for working them. Since the large stations were generating alternating current almost exclusively, the distribution being made at comparatively high voltages through transformers, there was need of transformers for supplying series arc lights instead of the arc dynamos formerly used. This led to the development of the constant-current transformer, which originally took the name of the "tub system," and this particular type of transformer, coupled with the mercury-arc rectifier developed in connection with it, supplied a rectified direct current to series arc lamps of the magnetite type and soon reached a very extended application throughout the country, especially in street lighting.

These improvements and developments were substantially the outcome of the laboratories of the General Electric Company and the engineers working therein. The most striking evidences of this development are to be found in the arc lamps used in what is known as "white-way lighting." There will, without question, be other important developments in the future, but the major part of the work may, perhaps, be said to have been accomplished. The open carbon arc still survives in searchlamps, especially those of large capacity. It is likely to remain as the lighting source in the many applications such as searchlamps and lighthouses that demand a concentrated, fixed source of relatively small size and high intensity which can be manipulated by reflectors or lenses. The special form of arc lighting known as the mercury arc, giving a greenish illumination, finds its own applications, especially as a source of ultra-violet rays for sterilization and other purposes.

In conclusion, it may be asserted that the arc lamp in its various forms has been characterized by a quality of light which approached closely to a white light. It has not been possible to run any form of incandescent lamp at such a high temperature as to give the characteristic of a white light or to produce a spectrum which represents very nearly that of solar radiation. Approximations to this result have been produced only by absorbing a considerable quantity of superabundant rays, such as red and orange, by tinting the inclosures of incandescent lamps. It is also recognized that a pure white tends to afford a superior visual contrast, assisting visual clarity, as compared with any light which has a distinct color or tint.

In this brief review of the developments in arc lighting, especially in the United States, limitation of space has prevented reference to the work of many of the early contributors to the art, names familiar to those who were at the beginning, such as Wallace Farmer, Weston, Wood, Hochhausen, Sperry and others, and later to Stanley, who started the Westinghouse company in this field.

Nor has there been any space to refer even briefly to the developments abroad, such as those of Crompton, Siemens and Halske and numerous others engaged in the development and utilization of electric arc lighting.

The truth is that no brief account can be more than a bare outline. It would require a considerable work devoted to the subject to present an accurate and competent history. It has been only possible to touch lightly those matters which had a profound effect upon the growth and successive modification of the arc in lighting.

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Electrical Development the Key to Prosperity

A Glance at the Early Days When Faith Triumphed Over Ridicule—Great Objectives Which Led On to Progressive Development

By Arthur S. Huey

Vice-President H. M. Byllesbv & Company, Chicago

LOOKING back over thirty-eight years of work in the electrical industry, the thought uppermost in my mind is the enormous amount of energy expended in inducing the public to use electricity. A child of today might well suppose that this wonderful force was eagerly seized upon by the people. This was not the fact. One generation has but little conception of the problems, trials, doubts and efforts of that preceding it, and the effort which has been entailed in convincing men and women of the values and advantages of the various applications of electric service is past calculation. How to overcome the sales resistance is one of the great problems of the industry.

FIRST MINNEAPOLIS INSTALLATION

It was through the novelty or advertising value of electric lighting that we first got a foothold in Minneapolis. A clothing store put in a small generator and a few lamps. The brilliant new-fangled lights drew the crowds, but the majority of the sightseers were skeptics. Many were unreserved in their ridicule. Offhand the average citizen could give you many reasons why electricity could never succeed.

However, I suppose that the clothing merchant—E. H. Steele it was—did a larger business because the crowds came to see his electric lighting system. At any rate, other stores took up the innovation, more to show that they were up to date than through any conviction of the illuminating value of electricity. In due time a central station was built to serve the first handful of customers to whom, somehow or other, we had sold the new idea.

The ridicule aimed at electricity as a source of lighting, however, was mild compared with the shafts aimed at the claims advanced for this new force as a means of traction or motive power. I must confess that there were some grounds for the arguments of the unbelievers. We had to sell the electrical idea and electric service largely on vision and faith. We frankly didn't know so very much about it ourselves, but we knew enough to *feel* most intensely that infinite possibilities were latent in this new force. We didn't know much about the sizes of wire required to carry a given load, but we were confident that if we could only get people to use the service and to pay for it, all technical obstacles would somehow be surmounted.

In those days it seemed that only a limited few saw a future in electricity. The rest of the crowd merely exhibited an inclination to laugh and "be shown." I am sure today that the future uses of electricity are not even dreamed of by the average person. There is no doubt that eventually transmission lines will extend continuously from coast to coast. Electricity will be the universal agent of power and lighting for virtually all purposes in all well-established sections of the country, and as it becomes more plentiful it will grow cheaper. It is destined to be the greatest conservator of natural resources, the greatest saver of human drudgery and animal toil and the key to vast areas now unpeopled and unproductive.

The value of the work which electricity will do for the people is so great that questions of who shall build and nominally own the generating plants and transmission lines are comparatively unimportant details. The main thing is to get the job done as rapidly as possible. Save every possible ton of coal and every possible gallon of oil. Get rid of the waste, grime and confusion of steam-operated railroad trains. Bring cheap power to the factory in the small town, energy for pumping water to make the desert bloom and to replace the human labor in mine, forest and on the farms. Those are the objectives.

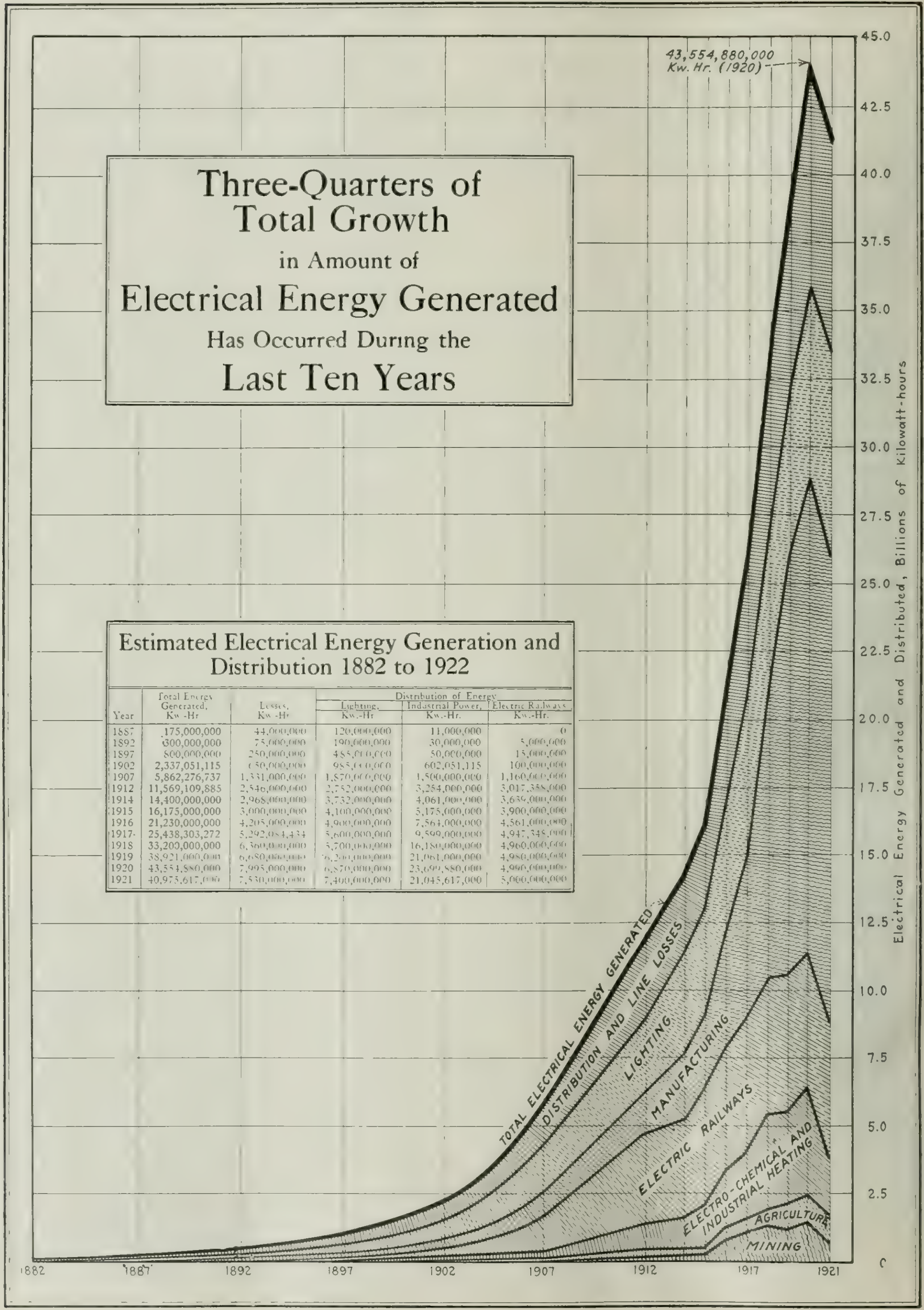
During the first forty years of electricity this public utility has helped to increase the size of our cities and to add vastly to the welfare and comfort of urban existence. The next cycle will probably build up the small communities and the rural districts. The same force which has made possible city crowding and congestion will unmake a condition already grown intolerable.

More than fifty years ago the great flour mills of Minneapolis were built there because of the water power of the Saint Anthony Falls in the Mississippi River. The wheat fields were close by; railroad transportation of the finished product was cheap; coal and power were expensive. This was before the age of electricity. Today great central stations—both steam and water-power—and transmission systems have made the cost of power and the means of producing it no longer a controlling factor.

FINANCE AND PROTECTION

Just as we fought hard to get people to use electricity in the early days, we who earn our living in this industry must fight for the development which we know will mean inestimable things for the prosperity of our country and the welfare of its citizens. Controversies over government, state or municipal ownership mean but costly delay. What is necessary in physical construction will call for such astounding amounts of capital that the method of development will solve itself. Only by the investment of the savings of great numbers of citizens can the development outlined be possible.

While governmental bodies debate and theorists talk or write the needs of mankind persist. Energetic men will build to satisfy those needs, just as they have in the past. Already our utility systems are becoming owned by vast numbers of the plain people. These direct investors and owners will continue to multiply. When America has reached a measurable period of electrical development the people will own the power plants and distributing systems in a manner which will serve as a perpetual bulwark against the "cohesive force of public plunder."



Three-Quarters of Total Growth in Amount of Electrical Energy Generated Has Occurred During the Last Ten Years

Estimated Electrical Energy Generation and Distribution 1882 to 1922

Year	Total Energy Generated, Kw.-Hr.	Losses, Kw.-Hr.	Distribution of Energy		
			Lighting, Kw.-Hr.	Industrial Power, Kw.-Hr.	Electric Railways Kw.-Hr.
1887	175,000,000	44,000,000	120,000,000	11,000,000	0
1892	300,000,000	75,000,000	190,000,000	30,000,000	5,000,000
1897	800,000,000	250,000,000	485,000,000	50,000,000	15,000,000
1902	2,337,051,115	650,000,000	985,000,000	602,051,115	100,000,000
1907	5,862,276,737	1,331,000,000	1,870,000,000	1,500,000,000	1,160,000,000
1912	11,569,109,885	2,546,000,000	2,752,000,000	3,254,000,000	3,017,358,000
1914	14,400,000,000	2,968,000,000	3,732,000,000	4,061,000,000	3,639,000,000
1915	16,175,000,000	3,000,000,000	4,100,000,000	5,175,000,000	3,900,000,000
1916	21,230,000,000	4,205,000,000	4,900,000,000	7,564,000,000	4,561,000,000
1917	25,438,303,272	5,292,084,434	5,600,000,000	9,599,000,000	4,947,348,000
1918	33,200,000,000	6,360,000,000	5,700,000,000	16,180,000,000	4,960,000,000
1919	38,921,000,000	6,680,000,000	6,200,000,000	21,061,000,000	4,980,000,000
1920	43,554,880,000	7,995,000,000	6,870,000,000	23,699,880,000	4,990,000,000
1921	40,975,617,000	7,530,000,000	7,400,000,000	21,045,617,000	5,000,000,000

The Edison System in Europe Forty Years Ago

By Etienne de Fodor
Budapest, Hungary

Reminiscences of One of the Pioneers Who Introduced Edison System Into Europe Forty-one Years Ago—Recalls Work that Laid the Foundation of Present-Day Service

THE year 1881 was full of important electrical developments which were the immediate precursors of the birth of electric light and power supply. Until that year the only electric illuminant known was an unsteady, flickering arc between two carbon electrodes, which were regulated by complicated and unreliable clock mechanisms. The Siemens construction dominated Germany and England, the Gramme design France, and the Brush lamp America. The idea then was to concentrate as much power and light as possible in one lamp, to imitate the sun or a bright full moon. For that reason extremely high towers were erected in the attempt to illuminate entire city areas with a few high-power arc lamps, an individual power house rated at from 15 hp. to 20 hp. being installed for each. A high-speed rotating-cylinder steam engine of the Brotherhood type, running at about 750 r.p.m., was usually directly connected to the generator.

SEEKING TO SUBDIVIDE THE LIGHT

More and more, however, the desire was felt to subdivide the source of light and to provide one generator for a number of lamps. To have a circuit of six to eight lamps was then the highest European ambition. Brush in America ignored this limitation and by 1881 already operated as many as forty arc lamps in series. This required currents of high voltage, and he was the first to build dynamos of 2,000-volt tension, transmitting light over a distance of 6 miles. The year 1881 therefore saw also the birth of high-voltage transmission.

The Russian Jablochkoff was the first to succeed in the building of a small arc lamp, obviating at the same time any regulating mechanism. He used two small carbon rods, placed in close parallel to each other and separated by a sort of plaster of paris. A small piece of conductive and volatile material, called "Colombine," started the arc. The Avenue de l'Opéra in Paris was illuminated by several series of these Jablochkoff "candles" during 1881. Their unsteady light, varying from dark purple to brilliant white, and the frequently occurring break of the arc in one candle, causing the failure of the entire series, did not warrant the general adoption of the system.

The ambitions of Edison in America to develop an incandescent lamp became known in Europe as early as 1880, but were ridiculed even by serious-minded scientists, who found out that many such attempts had been made in the past by Maxim, Swan, Sawyer, Fox and others, with no practical results. But Edison's untiring efforts were finally rewarded by success, and in 1881 Bergmann in New York City carried a full stock of electric incandescent fixtures to compete with the gas fishtail burner then used everywhere. Illustrations of these very first electric fixtures may be found in the 1881 volume of the *Scientific American.*

While Europe was still arguing about arc lamps a book by Sawyer appeared in New York, on the electric illumination of homes, including even metering devices.

All achievements of an electric nature were to be exhibited and the competition between the arc and the filament was to be settled at an international fair, the like of which the world had never seen before. At the end of 1881 the "International Electrical Exposition at Paris" was to be opened. This was announced in October, 1880, and invitations were sent out broadcast. Edison's ambition was aroused, and he was among the first to send a staff of men to Paris. These men, of whom the author was one, began the installation of his incandescent lamps at the fair grounds in the Avenue des Champs Elysées. Copper wires of low conductivity, covered with a layer of guttapercha and protected with a zinc-oxide impregnated layer of cotton, were offered in the European markets. Their high ohmic loss proved to be prohibitive. Edison therefore asked his friend Wallace of the Ansonia Copper Company in Connecticut to produce some electrolytic copper wires for this exposition. Much of the success of his lamps was due to this "Ansonia wire." The wires themselves were held in place by staples, cleats and wooden moldings. The slow progress made by the Parisian carpenters forced the Edison staff to take the making of the moldings into their own hands. All the joints in the wires were insulated with friction tape, invented in the Edison laboratories and used ever since the world over. Short circuits did not entail any danger for the Edison staff, as they brought with them another detail, of greatest importance then and of greatest importance today—the fuse plug, another development of Edison's laboratories. Already in those early days the advantage of using two plugs at each branch point was realized. The Edison staff comprised but a few men, but with Edison's slogan "Hard work and little sleep" we accomplished the large task in schedule time. Of the many exhibits no doubt Edison's "home-lighting plant" attracted the widest attention. It proved that his system of light distribution which in the meanwhile was used in the first central station—on Pearl Street in New York City—was no dream, but a technical possibility and a financial success. This deadened all ridicule, which soon gave way to envy.

The exposition itself was an immense success, crowded day and night by an international throng. It was the meeting place of all the electrical men of those days, such as Siemens, Deprez, Bell, Gramme, Hughes, Pacinotti, Planté, Thomson, von Alteneck, Becquerel, d'Arsonval, Crookes, Preece, Ferraris, Jablochkoff and others. An international congress of electricians was held at the exposition, the most important result of which was the establishment of the electrical units, the ohm, the volt, the ampere, the coulomb and the farad. These units, too, have reached their forty-first birthday.

With the distribution system the era of large generators also began. Edison exhibited a dynamo for 1,200 16-cp. lamps, consuming about 200 hp. The huge size of this dynamo will be appreciated when it is mentioned that all of the electric devices exhibited did not require more than about 20 hp. Edison had to build his own generator as no existing machine was large enough for his purposes. His machine with drum armature was quickly announced as an imitation of Siemens' dynamo, but upon closer investigation it was found to differ from it materially. The German machine was built with a very small amount of iron and with high armature resistance, resulting in about 50 per cent efficiency. Edison's dynamo had much iron, only 0.0039 ohm. armature resistance, a solid copper bar winding with 146 bars, 43 in. long and of 0.2 sq.in. cross-section. The commutator, with its seventy-three mica-insulated segments, was a great mechanical accomplishment, the original construction being used today with negligible changes in the mechanical design. His 200-hp. dynamo showed 90 per cent efficiency. The lamination of the iron to prevent eddy currents also originated in Edison's laboratories. Great surprise was caused by Edison's suggestion to regulate the voltage of his machine with a resistor in the field circuit.

PLANS FOR PEARL STREET STATION EXHIBITED IN 1881

The plans of the Pearl Street station were exhibited and aroused never-ending comments. The question of transporting the generated current, whether in wires overhead or in cables underground, was a great problem in those days. On account of the high cost it was considered out of the question to use cables. Gutta-percha and caoutchouc were the only known insulators which could be considered. Edison finally decided for the underground system and used two semi-circular copper bars, placed against each other, their flat sides facing, insulated by a strip of pressboard. This circular combination was placed in wrought-iron pipes filled out with a specially invented compound. These conductors were made in 20-ft. lengths, joined in a square metal boxes.

The second question of importance was that of necessary copper cross-section. Until then only the so-called "tree system" was known, starting with a heavy conductor at the station and diminishing the cross-section as the line progressed, like the branches of a tree. Aside from the enormous voltage drop of such a system, its cost of copper for a larger station was considered insurmountable. Edison, who tried the "tree" system at his Menlo laboratory, discarded it and put in its place the network system with feeders. The cost of the copper for the Pearl Street station would have amounted to $201,000 for the "tree system," while his feeder network required only $25,000, the price of copper being 25 cents a pound. On Aug. 4, 1922, it was just forty years since Edison applied for a patent on the feeder system. Two years later he applied for the protection of his "three-wire system," cutting the copper cost down 60 per cent.

A large impetus was given to the new electric light by the famous French architect C. Garnier, who insisted upon changing the gas illumination of the Parisian Opera House to electric light. Several exhibitors at the fair were therefore invited to install their systems in the Opera House. To Wedremann fell the vestibules, to Brush the large stairway, to Jasper the refreshment rooms, to Jablochkoff the inner salon, to Swan the chandeliers of the large hall, to Maxim the two small foyers, and to Edison the large foyer. On the outside of the Opera House were erected small sheds containing the generating plants of these firms. The Edison shed had two 30-hp. locomobiles, driving each a belted dynamo. The first tests showed a very brilliant but also very flickering illumination from the arc systems, in comparison with which the mellow light of our lamp bulbs almost vanished. Fortunately the architect decided to eliminate the arcs entirely, restricting the tests to the glow lamps. This decision of Garnier was actually the launching of the victorious progress of the incandescent light. The great evening of the final test came, and everything was in entire readiness. Two stokers and an Irish machinist by the name of Green were stationed at the locomobiles. "Mat" Force, an American, and the author held watch over the dynamos. A buzzer signaling set was in operation between our shed and the main foyer. Voltmeters or ammeters were not in use at that time. The voltage was merely estimated according to the brightness of a lamp.

As soon as the test started signals came from the foyer for "more pressure" and "still more pressure." The locomobiles began to groan, belts began to slip, the commutators sparked badly, and the copper-wire brushes, with their soldered ends, threatened to melt. Wet waste was laid on the machine bearings to keep them cool. And still the signals came for "more pressure." The steel springs pressing the brushes onto the commutator began to lose their temper and softened. We had to "waste-cool" them too. Each of those waste applications was accompanied by severe electric shocks. Finally we had to hold the brushes by hand against the commutators to insure proper collection. "More pressure for a few more minutes" the buzzer announced. Making almost superhuman efforts, our little force held out to the last second. My fingers were roasted, and our bodies ached, but we had won the battle. Garnier was delighted with our lights, and Edison's system had established its practicability.

Soon after the success in Paris Edison was called upon to electrify the illumination of the large railroad station in Strassburg, and the work was finished on Christmas, 1881. This was the first European use of incandescent lamps on a large scale.

It was no easy task to meet the severe competition which the electric light found in gas illumination, and a bitter fight was waged between the gas and electric companies. When Auer von Welsbach introduced the incandescent gas light the battle for electric light seemed almost lost. Just in the nick of time, however, the tide was turned by the introduction of a practical and energy-saving metallic-filament lamp.

We therefore returned to the old idea of the metallic filament, tried long before the advent of the Edison lamp. It may not be generally known that Edison applied as early as 1879 for a patent on a metallic-filament lamp covering several metals of high melting point, such as platinum, iridium and tungsten. He actually built 25-cp. platinum lamps, burning in a vacuum, with a wire 30 in. long, consuming only 1 watt per candle. These lamps were, however, so sensitive against any rise in voltage that it was found necessary to use an iron resistor in series with them. This made the lamps rather unhandy to use, and Edison gave up the idea of the metal filament and turned his full attention again to the carbon-filament lamp. Nevertheless, we may celebrate also the forty-first birthday of the metallic-filament lamps.

Electric traction dates back also to 1881, being successfully installed in that year on a 1½-mile stretch near Berlin. Passengers were transported on scheduled trains at a speed of 12 miles per hour. In the same year Sir William Thomson and Marcel Deprez, the pioneers of the electric motor, published their papers on the technical feasibility of long-distance transmission of electric power.

It is also of great interest to mention that the French engineer Faure announced in 1881 his invention of the improved storage battery. Up to that year the storage battery, invented in 1860 by Planté, was used only in laboratories. In July, 1881, the first Faure storage-battery operated bus made its appearance in the streets of Paris. Sir William Thomson suggested in the same year the transmission of power from Niagara Falls for 300 miles at a direct-current voltage of 80,000. At the receiving station 40,000 storage-battery cells were to be charged in one series and discharged in groups of fifty in series.

It has thus been shown that many fundamental achievements date from 1881, and many are the men whose names gained luster at that time. So many new ideas appeared in that year that it is difficult in some cases to distinguish between the property of different inventors. But let us also remember the unnamed co-workers of those days whose untiring work and perseverance were essential to the success achieved by the famous inventors.

Public Relations Then and Now

Good Will of Customers Has Been Sought Since the
Early Days of Electric Light and Power—
Service in Its Broad Sense

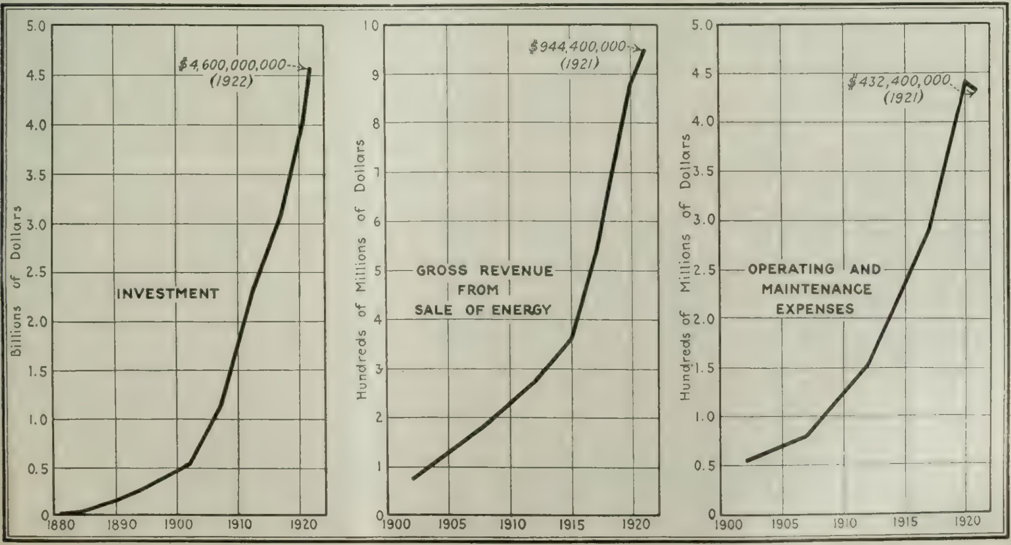
By William H. Atkins
General Superintendent
Edison Illuminating Company of Boston

THE fortieth anniversary of the establishment of the Pearl Street station in New York offers an opportunity for those long associated with central-station development to look back to the old days and to compare them with the new. At the request of the editors of the *Electrical World* some of the activities carried on here in Boston with the hope of making our customers our friends will be commented upon, in the belief that similar efforts were made by the central-station industry in general.

Obtaining the good will of the public has been one important factor in the central-station business through the long history of its development. The main business of the electric utilities is to supply electric service to the consumer, but if a company did no more than simply to supply service it would render a poor account of its stewardship. Even in the early days of the industry service had a far broader meaning than the delivery of electrical energy twenty-four hours a day with good voltage regulation and freedom from interruption. I am sure that even if the central-station men of the earlier days did not put into words their conception of service as we know it today, they none the less laid the foundations of future success upon a willingness to do much more for the customer than was agreed to in his contract.

Personal acquaintance with customers was a matter of course in the early days. For some time we knew

The Central-Station Industry in the Aggregate Has Never Reported a Decreased Yearly Revenue



them all, practically speaking. At that time it did not cost three or four thousand dollars to write a letter to each of our patrons. From the start, however, electrical energy supply was run as a business, and while some things were done (such as free wiring for a few months in 1886) which modern practices would instantly throw out of consideration, the need of making real profits was never lost from sight. Back in 1887 our rate was 1¼ cents per lamp-hour, equivalent to 25 cents per kilowatt-hour. Until 1892 the annual output was unrecorded.

In those days competition was keen, and there were many isolated plants in the territory we served. The Boston Electric Light Company was our chief competitor. To get business it was often necessary to offer discounts which ranged from 10 to 60 per cent, and stores and factories were our principal customers. We had no public relations problem as such in those days, our task being to maintain service and keep our customers satisfied. As the use of electricity increases, the tendency can be seen for the public relations problem to merge into that of customer relations.

Permits to open streets and lay conduits were to be had for the simple asking in those days. At one time we learned that a group of men were planning to establish a competitive plant in the Back Bay residential district. The situation was promptly met by a visit to City Hall, where our representative received licenses granting the company the right to excavate streets and lay conduits in a large area of the district in question. Conduit and tube equipment which had been purchased for downtown service were at once laid in the Back Bay. The proposed plant as a competitor never materialized. Relations with city officials were upon a friendly, man-to-man basis, and formalities were few and far between.

In 1901 the Suburban Electric Light & Power Company was acquired and in 1902 the Edison company* purchased the Boston Electric Light Company. Two years before that the retail price of electricity had been reduced 1 cent per lamp-hour to 18 cents per kilowatt-hour, and in 1903 the purchase of electric companies at Milton, Dedham, Natick, Framingham and Canton really started the growth of the Edison system into the suburban territory, which has resulted in striking reductions in the price of service and remarkable improvements in its quality throughout a great area still but partially developed from the commercial electrical standpoint. This period of consolidation of companies was also marked by a standardization of rates. Motor business started with the coming of the direct-current electric elevator and of small shop electrifications.

MERCHANDISE HAS HELPED PUBLIC RELATIONS

For many years past the Boston company has merchandised appliances. We exhibited appliances at Head Place as far back as 1889, showing flatirons, fans and other devices. The business friendship between the company and the public has been strengthened year by year through the opportunities which have been given to customers and others to visit displays of the latest electrical conveniences at our offices and to purchase them on liberal terms. There is no question that the commercial departments of the company have had a powerful influence for good in the development of sound public relations. As our suburban stores have been established the same efforts to practice courtesy and good will have been put into effect.

It is obviously no longer possible for the executives of the company to be personally acquainted with any large percentage of our customers. As the system has grown a lot of hard work has been done to keep the company from becoming a huge, impersonal organization looked upon by both employees and the public as a mere machine for the supply of electric service. Within the company a bureau devoted to the welfare of employees was established some time ago and has proved very successful. From the day the applicant for employment enters the office to the day when he receives his diamond service pin representing thirty-five years of faithful work under the Edison banner, a personal interest is taken in his individual progress and welfare. The Edison Employees' Loyalty Committee, composed of men below the rank of division head, functions without advice or instructions except as to policy matters, seeking to dispel the idea that this company is merely a business structure run for profit alone without regard for the varied interests of individuals and communities.

IN PERSONAL TOUCH WITH CUSTOMERS

Recently a number of district managers were appointed with authority to do everything possible in their respective towns to help the customer and the public at large in any dealings they may have with any department of the company. In other words, in the territory far removed from the central office of our company the customer and the public may deal with the company in a close personal way just as they would were they doing business with the main office. These district managers associate themselves with every public activity in the town in which they are stationed.

This procedure has developed to the extent where the district manager is a close personal friend to most of our customers in the city or town which he lives, and this assignment of ten employees to devote practically their entire time to improving and strengthening the relations of the company in our more isolated territories indicates a determination on the company's part that, regardless of the size of its organization, its daily endeavor shall be to gain the good will and friendship of the public it serves. One man in our office also devotes his entire time to improving the relations of the company with other branches of the electrical industry.

As far back as 1907 all our customers were asked by a personal letter from our president if they were satisfied with the service. Criticisms were invited and thoroughly investigated, all suggestions being carefully studied with a view to their practical application. For many years our publicity matter in the local newspapers has been brief but interesting, one subject usually being discussed at a time. In the "Friendly Glow" advertisements, a series which has been running for two years, the company is telling the story of its aims and business fundamentals, always inviting constructive —yes, and destructive—criticisms from the great public which it is serving. As a result of these efforts we believe that the individual customer is becoming more and more friendly with the men and women of our organization, and that he is gradually coming to appreciate some of the larger problems that we encounter in our business.

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*The Boston Edison Company was organized Dec. 26, 1885, and the first station, consisting of a 90-hp. engine driving two Edison generators capable of supplying 800 incandescent lamps, began operation Feb. 20, 1886. The number of customers in 1887 was 260, and the generating equipment had a total rating of 1,320 kw.

Today there are about 2,300 men and women in this organization, which serves more than 600 square miles in eastern Massachusetts, supplies nearly 160,000 customers and has a generating station capacity of about 175,000 kw., besides interconnections with adjoining systems.

The Evolution of the "Code"

A Record of the Origin and Gradual Development of the National Electrical Code and Some Influences Which Have Assisted in Its Progress

By C. M. Goddard
Secretary New England Insurance Exchange

THE evolution of the electrical code dates back practically to the year that saw the opening of the Pearl Street station in New York, the first central station established. Electric light had been used in a small way, a very small way, but so largely was this use a matter of experiment that no need for any standard rules governing the installation of wiring had been felt. Fuse blocks, switch bases and other mountings were made of wood, and in each case the man who put in the wiring exercised in large measure his own ingenuity in working out the method of installing the wires and fittings.

This the men of that day were in a good position to do, for they were picked men, selected by the lure of the new mystery of electricity from the ranks of the handy craftsmen whom we call "jacks-of-all-trades." It was these ingenious minds that had been dabbling with bell wiring and playing with batteries. They were fascinated with the new idea of electric light and began to experiment with it whenever opportunity offered, and they displayed a high degree of versatility in working out the many new mechanical problems involved.

Influenced by Early Fire Hazards

The first use of electricity for interior illumination on any large scale came with the introduction of arc lights among the textile mills of New England, and the operation of these novel lighting systems was immediately followed by a number of fires. People were very much surprised. This was in 1881, and there were sixty-five installations of electric lighting in factories insured by the Manufacturers' Mutual Insurance Companies of New England. Within a period of six months this company suffered twenty-three fire losses due to electricity, and the insurance interests naturally became very much alarmed over the hazardous nature of electric light.

The insurance men at once got in touch with the leading electrical authorities and began a series of experiments which repeated in so far as possible the condition of those fires and out of it developed new methods of installation which would give safety. Dr. Charles F. Brush, Prof. Elihu Thomson, Thomas A. Edison, Edward Weston and others assisted in these investigations and the first set of rules to govern the installation of electric wiring was the result. These rules were originally intended to be applicable only to the textile mills and not for general use, but other rules more general in character followed, and rule making came to be the order of the day. Municipal boards made rules, commercial bodies and manufacturing companies made rules, and an organization of salesmen was actually formed for the purpose of drawing up regulations for wiring.

Naturally the electrical interests were very much disturbed by these conflicting influences. What was demanded by one group was prohibited by another. Sometimes requirements would specify the use of supplies not in the general market, some interested person having framed this particular set of rules for local use near the point of manufacture. But the fact that there were no means of enforcing these rules saved the situation, and those who worked at the electrician's trade used their best judgment and went ahead.

All this evidenced clear recognition of the need for rules and a trend toward the development of a practical code of wiring that would make electric light safe. The use of the arc light, of course, increased and spread. Then series incandescent lamps became available in 1882, which gave new impulse to the demand. I remember it well, for my own experience dates back to the early eighties, when I first saw electric lighting in an office in New York City supplied with energy from a small plant in the basement of the Equitable Building.

Incandescent lamps in series of four or seven were lighted from circuits run in duplicate, so that when the lamps went out the trouble could be taken care of by throwing the switch and lighting the other side of the chandelier. And this was an almost daily necessity. I became very much interested in the new industry and went into contract work in Plainfield, maintaining the city fire-alarm system and wiring buildings for light. Here in 1886-87 the first alternating-current plant was built by the Westinghouse company as a show plant to demonstrate the new system of lighting.

The first printed resolution ever sent out by any insurance company governing the use of electric lighting was issued on Oct. 19, 1881, by the New York Board of Fire Underwriters. It read:

> Resolved, That the committee on police and origin of fires is hereby directed to notify the owners and occupants of all buildings in which uncovered electric light wires or in which arc lights with open bottoms or without globes are found that the wires must be covered and the lamps altered to conform to the rules of this board within ten days from date of notice and request that the lights shall not be used until the alterations are made; and in case the alterations are not made within said time, the committee is hereby directed to notify the members of the board of said failure, and the companies insuring said property are hereby recommended to give notice to the owners and occupants of such buildings that unless the request is complied with and the alterations made within a reasonable time the insurance on said property will be canceled.

First Co-operation with Underwriters

It was the very next day when the Manufacturers' Mutual Company in Boston sent out its first warning, which it followed the next year with its first set of rules, and the New York board also adopted rules a few months later, which in turn were established by the National Board of Fire Underwriters. Then in 1885 came the first act of definite official co-operation between organizations of insurance men and the electrical industry to construct a code. Two insurance men went that year to the convention of the National Electric Light Association in Baltimore and discussed rules for wiring, but nothing came of it until the following year, when a joint conference was held and a set of brief though comprehensive regulations was formulated. Again in 1890 the more complete rules were developed by the underwriters of Philadelphia, Boston and the Pacific Coast and another joint conference committee was appointed by the insurance men and the N. E. L. A. It adopted a new code that had been prepared and published by the National-Electro-Insurance Bureau. But no effort was made to influence the general acceptance of these rules, and different companies and different communities continued to use their own.

It was really not until 1892 that any real attempt at standardization was undertaken. In that year an invitation was sent out by the New England Insurance Exchange inviting the electrical inspectors of the various industrial organizations of the country to a meeting in New York City, where, taking the N. E. L. A. code as a basis, a revision was made and the body formed itself into an organization known as the Underwriters' National Electric Association. A further meeting was held a few months later which represented practically the whole of the United States and a large part of Canada. The revised rules were issued in printed form, and a permanent body was established consisting of electricians in the employ of the insurance interests whose duties were the care of the rules, the making of tests and the giving of information and advice to members of the association.

The rules themselves had, of course, undergone many changes both as to the extent of their application and the assurance with which they were fashioned. I have a copy of the first printed rules issued in this country, dated Oct. 19, 1881. They are not overdefinite. For instance, four of them read:

> Wires to be thoroughly insulated and doubly coated with some approved material.
>
> All wires to be securely fastened by some approved non-conducting fastening.
>
> When it becomes necessary to carry wires through partitions and floors they must be secured against contact with metal or other conducting substance in a manner approved by the inspector of the board.
>
> The conducting framework of chandeliers must be insulated and covered the same as wires.

There can be little wonder that there was some lack of uniformity in the interpretation of these rules. Progress was made step by step, often pioneering boldly by demanding some refinement in construction which could not be supplied by current materials. For example, at one time a demand was made for non-combustible hanger boards for arc lights, but there was no such thing available. It was desirable, however, and it came, for porcelain and fiber were provided in time. The wireman used his best common sense in working out new ways of wiring.

I well remember one job where I ran a pair of primary wires carrying 1,000 volts around the framework of a door concealed in a piece of molding that was part of the door trim, which I had removed and hollowed out. Repeatedly we would run through a partition beside a gas pipe, if there was room enough in the hole to pull the wires through.

The underwriters in their code making used their own good sense in trying to follow along and suggest new ways to improve the element of safety and reduce the risk. But the code of 1892 was a great improvement over the one I have just quoted from as is shown by the copy of a letter I have from the Edison Electric Illuminating Company of New York which reads as follows:

> The Edison Electric Illuminating Company
> of New York.
>
> March 30, 1892.
>
> R. R. Bowker, First Vice-President.
>
> Dear Sir: Pursuant to your request we have gone over the proofs of the wiring rules proposed by the National Association of Underwriters and beg to submit herewith our notes and criticisms.
>
> These rules in general are far in advance of any heretofore proposed—so far as we are aware—either here or abroad. They treat very broadly the various electrical systems in use and will undoubtedly tend to raise the standard of electrical work in general.
>
> Respectfully submitted,
> J. Van Vleet,
> Chief Electrician and Consulting Engineer.
> Arthur Williams,
> General Inspector.

By 1894, in less than two years from the first general meeting, these insurance company rules for the regulation of electric wiring had been adopted by nearly every company in the country and uniformity had been secured. In the meantime a bureau for the testing of devices and materials and for the dissemination of information had been established in Chicago in charge of a member of the electrical committee, and the publication of quarterly bulletins was begun giving brief accounts of fires in all parts of the country reported to be of electric origin and the results of tests at the laboratory.

Everybody Voted at Early Meetings

These early meetings which were held for the discussion of wiring methods were all held on the mob-rule plan; that is, they were free to any one who was interested. Electric light men, contractors or wiremen had the freedom of the floor and could vote, for it was felt that it was a job for the application of common sense primarily and a diversity of viewpoint would tend to bring balance to the judgment of the meeting. Naturally, however, the insurance men, the insurance background and the insurance interest predominated, and in 1895 it was decided to broadcast a general invitation for suggestions for the improvement of the rules. Many were sent in. Then a call was sent out for a conference to represent the following bodies: American Institute of Electrical Engineers, National Electric Light Association, American Street Railway Association, American Society of Mechanical Engineers, American Institute of Architects, National Board of Fire Underwriters, Underwriters' National Electric Association, Factory Mutual Fire Insurance Companies, International Fire Chiefs' Association, American Bell Telephone Company, Western Union Telegraph Company, Postal Telegraph Company, General Electric Company and Westinghouse Electric & Manufacturing Company.

From this meeting the National Conference on Standard Electrical Rules was organized. A code committee was appointed to amend and recodify the standard electrical rules. After many meetings and the embodying of many suggestions, it completed its work and the resultant rules received the approval of the N. E. L. A. at its annual convention in June, 1897.

Through these fifteen years, of course, the electrical industry grew and expanded with tremendous speed. Multiple incandescent lights, electric motors for industrial power and the various applications of electric heat followed one another. Constant progress in the popular use of electricity brought continually new extensions of the wiring system and laid new demands upon it. The code grew from a few simple rules printed on a single page until today it makes a sizable book. The history of the code is virtually the history of the industry in so far as its scope is concerned. Many changes have come as knowledge has broadened. The matter of grounding secondary circuits as an example has seen a complete reversal. In the early days the rules read that all circuits "must test free from grounds," while the present rule requires grounding of practically all ordinary low-tension systems. There have been numerous other interesting trends.

Code of Tremendous Benefit

That the influence of the code has been of tremendous benefit to the electrical industry goes without saying. It has maintained a degree of safety which would not have been realized without some such regulatory guidance. It has tended toward standardization of many methods and materials which have speeded the advance of the art. It has served as a safe anchor to keep the head of the fast-drifting industry to the wind. One of the great problems has been and still is to secure intelligent and progressive interpretation, administration and enforcement of the code by all the numerous inspection departments, both insurance and municipal, for the code has never been mandatory upon the inspector.

It is not generally understood that to the various boards of underwriters throughout the country very great latitude in the matter of detail methods is of necessity given, independent of interference from the fire insurance companies themselves. They are composed of men connected with the insurance business in the localities which they supervise and are supposedly much more familiar with the needs of the locality than the distant company officials. Therefore, although the companies in the national board have the undoubted moral right to demand absolute compliance with the code, yet business policy makes this method impracticable, and the more effective though slower influence of moral suasion has been adopted. The code is provided for their guidance, but it must be remembered that the management of the local board is seldom in the hands of electrical men. They must rely on their electrical inspector for advice. He is supposed to know it all; at any rate he knows more than any one else on the board. That is why he is employed and his interpretation of the code is usually accepted.

In addition to this we have the influence of municipal regulation, which is a local law unto itself. Every city electrician can usually procure the incorporation of his own ideas into an ordinance and need yield these ideas to no one. It is profitless for the local underwriters to compete and contend with the city regulations, so as a rule they fall in with them, this being the only practical course to pursue, although they do not as a rule actively require those things demanded by the city but not specified by the code. This, of course, introduces new inequalities in the standard of construction.

In the matter of enforcement the same obstacles present themselves. Suppose an inspector finds work not in accordance with the code and requests a correction but the owner refuses to remedy the defects. If the violation is not a vital one, the board finds that if the rate is advanced non-co-operating companies stand ready to take the risk at the old rate. Vital defects are under control because the central station will not cut in the installation if it is unsafe, but for the enforcement of the other requirements of the code moral suasion must again be resorted to lest member companies who are supporting the board suffer too much loss of business. At the same time, however, every effort is made to secure the rigid observance of the code, not only as a measure of safety, but as an act of simple justice to the electrical contractor who by building in accordance with the code loses jobs if competitive work is passed at less than code standards.

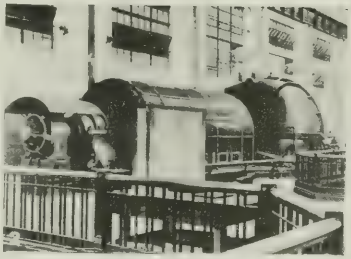
But in spite of all these difficulties steady progress has been made and continues to be made. After its establishment as a national electrical code in 1896 the code was in the hands of a committee composed of insurance inspectors representing the boards of underwriters of different districts until 1910, when the work was taken over by the National Fire Protection Association and delegated to a committee now consisting of twenty-nine members representing not only the insurance interests but also all of the allied interests having membership in the association.

Now an American Standard

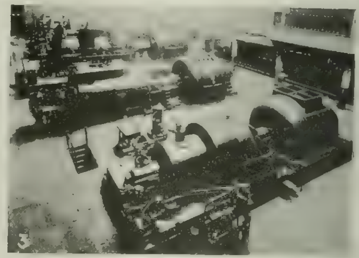
The most recent step which has been taken in the evolution of the code is among the most interesting, for within the year it has been officially indorsed by the American Engineering Standards Committee, which is impartially representative of the following bodies: American Electric Railway Association, American Institute of Architects, American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers, American Railway Association (Engineering Division), American Society of Civil Engineers, American Society of Mechanical Engineers, American Society for Testing Materials, Association of American Steel Manufacturers, Electrical Manufacturers' Council (representing Electrical Manufacturers' Club, Electric Power Club and Associated Manufacturers of Electrical Supplies), the electric light and power group (Association of Edison Illuminating Companies and National Electric Light Association), the fire protection group (Associated Factory Mutual Fire Insurance Companies, National Board of Fire Underwriters, National Fire Protection Association and Underwriters' Laboratories), the gas group (American Gas Association, Compressed Gas Manufacturers' Association and International Acetylene Association), the safety group (National Safety Council and National Bureau of Casualty and Surety Underwriters), Society of Automotive Engineers, and the United States Departments of Agriculture, Commerce, the Interior, the Navy and War.

As a result, the code becomes truly an American standard, sponsored by the committee, and as such it gains a very definite standing questionable in public opinion.

So the code is today a reflection of the status of the industry, just as it has evolved with the industry step by step from the first groping effort until today. It has more than once been accused of restricting free progress. It is naturally and inevitably a restraining influence on hazardous experiment, but its purpose is clear-cut to protect the electrical industry from the incalculably greater costs of fire and the loss of public confidence that would most surely follow.



Four Other Pioneer Edison Companies



FOLLOWING closely on the heels of the old Pearl Street station of the Edison Electric Illuminating Company of New York, four other similar systems were founded that have grown to remarkable proportions. They were established in Boston, Brooklyn, Chicago and Philadelphia, the first starting in December, 1885, the second in March, 1887, and the third in 1888. In many respects these plants were similar, containing Armington & Sims high-speed engines to drive the old Edison bipolars.

In the early nineties triple and quadruple expansion marine engines directly connected to generators were substituted by most of them. As the territories demanding service expanded the Edison systems were supplemented by alternating-current distribution and the companies went through the mechanical and electrical development which is familiar to most of us.

Last year these four companies had a total output of more than 3,500,000,000 kw.-hr. No. 1 shows L Street Station, Boston; No. 2 a turbo-generator in the new Calumet station, Chicago; No. 3, remodeled Gold Street station, Brooklyn, and No. 4, new Delaware station, Philadelphia, with its surrounding load district.

Development of an Alternating-Current System

Incidents in the History of The United Electric Light & Power Company, Which Started Alternating-Current Service in New York Thirty-five Years Ago

By Frank W. Smith
Vice-President and General Manager The United Electric Light & Power Company,
New York City

THE crowded history of electric service from its crude beginnings down to the present time covers so short a period that the older officials and employees of every company that has been in existence for thirty or forty years can personally recall its successive stages of development and look back on a series of significant happenings, including many amusing incidents. Among such recollections possibly none are more interesting than those which cluster around the growth of The United Electric Light & Power Company of New York, which was so closely associated with the first commercial electric service system in this country. The history of this company is bound up with the history of the development of alternating current, and its experiences parallel closely those of other companies which early adopted that system.

Starting in 1887 with no precedents on which to base its operating practices and development policies, the United company, then called the Safety Electric Light & Power Company, entered the early period of its alternating-current operation with some trepidation. At first the board of directors was even skeptical of making the alternating-current system a commercial success. However, with improvements in operating methods and changes in the design of generators, switching and protective equipment, distribution methods and metering apparatus, the company surmounted the various obstacles which arose and has brought its system to its present high stage of development, now shared by other progressive companies. In its details the history of electric service development is more absorbing than that of the automobile, since it started with a less understood form of energy and yet has progressed to an extent excelled by no other activity. The accompanying article, of course, does not purport to give a detailed account of the technical progress of alternating-current service in New York, but to touch in anecdotal fashion on outstanding events.—*Editors.*

BEFORE the introduction of the alternating-current system in New York the United States Illuminating Company and the Brush Electric Illuminating Company were doing a considerable series-arc lighting business, and the first-named company had already introduced the incandescent system. Just prior to the introduction of alternating current the total gross revenue of the United States Illuminating Company for series-arc and multiple direct-current incandescent lighting service, including plant rental—at that time part of the business consisted of the rental of dynamo machines and lamp equipment — amounted to approximately $340,000 per year. A step forward came when, in 1887, the United company was incorporated under the name of the Safety Electric Light & Power Company for the express purpose of developing the alternating-current system. Two years later it changed its name to the present corporate title, The United Electric Light & Power Company. The alternating-current system was brought to the attention of the company by the Westinghouse Electric & Manufacturing Company, provision being made whereby the operating company would acquire this system under a license agreement. It is amusing to quote from a report submitted by the then president of the operating company to the board of directors setting forth at length the details of the Westinghouse proposition. At one point the report read: "The machine has been run from time to time, but from results obtained I am not able at the moment to say just how far we shall be able to adopt this system, for the reason that it has not yet had a fair opportunity to be tested for efficiency. The converters, however, do seem to hold the current."

George Westinghouse, the pioneer in the commercial development and application of the alternating-current system, had by this time satisfied himself "as to the great merit of the system and its tremendous possibilities, realizing that the alternating-current system was the solution of the problem of economically transmitting energy long distances, if it could carry large quantities in the form of high voltage and low amperage — the transformer supplying the means for locally readjusting the voltage to the requirements."

At this time the Edison system was making great progress and afforded the greatest source of competition, as evidenced by a quotation from the records of a meeting of the board of the company in 1888, as follows: "As you are doubtless aware, it is by this method (alternating current) of supplying incandescent lights that we expect to hold our customers in the districts now threatened by an early and bitter competition with the Edison system." Nevertheless, the direct-current interests in those days did not consider the alternating-current system very seriously. As an instance of this a paper read in 1888 before the Association of Edison Illuminating Companies deserves citation. In it the alternating-current system was alluded to as a failure because: "They cannot make it safe. They cannot make it reliable. They cannot make it run twelve 16-cp. lamps per horsepower. They cannot make its lamps even. They cannot make its lamps last a reasonable time. They cannot make it run motors. They cannot make it sell by meter." It must be said that at that time a number of these indict-

A PICTURE OF MR. EDISON AND SOME FRIENDS TAKEN DURING THE DEDICATION OF THE PLAQUE ERECTED ON THE SITE OF THE PEARL STREET STATION

ments were "true counts" against the alternating-current system. Great opposition to alternating current naturally developed. Assertions were made as late as 1889 that the system was dangerous and deadly and that its use should not be permitted commercially.

In spite of the opposition the alternating-current system was pushed with great energy and skill by the Westinghouse and Thomson-Houston companies and by the United company. All of the distribution was by overhead lines, and the operation of this system was an exciting and even a nerve-racking occupation.

The first alternating-current machines for local commercial service were purchased from the Westinghouse company in 1889 and were the so-called "1,500 and 3,000 lighters." Rotating surface-wound armatures designed for 1,000 volts and 133 cycles, single-phase, were employed, being driven from a steam engine by belting. The armature windings were retained in place by numerous bands, which would frequently come loose, allowing the armature to shed its windings in small pieces over the whole neighborhood.

Parallel operation of these old alternators was practiced occasionally, but it was a dangerous proceeding, not because the machines could not be operated in parallel, but because the methods of synchronizing and paralleling were crude.

The defects of the surface-wound type of armature of the first alternator led to the development of the so-called toothed type of armature, in which there was a single large tooth per pole. This permitted the substitution of machine winding for hand winding and allowed the use of 2,000 volts and even 3,000 volts between terminals.

In 1895 the Twenty-ninth Street station was equipped with the reconstructed "World Fair" machine, completed by the Westinghouse company in 1893. The engines were of the double-acting steeple compound type; the generators, which were 60-cycle, polyphase machines, marked the transitions from 133 cycles to 60 cycles, which has been retained as the standard frequency. Each alternator in the first machines consisted of two armatures and fields side by side, with the armatures displaced half a pole pitch. Each armature was wound for single-phase, but two could be used together to furnish polyphase energy. Two of these units with a rating of 1,500 kw. occupied the same floor space as one of the present 22,000-kw. turbo-generators in the Sherman Creek station. Later the capacity of the station was increased by the addition of three 500-kw. Westinghouse generators of more modern type, which were belt-driven by Corliss compound engines.

It is interesting to note that the first large turbo-generator contracted for in this country was available about 1898. This was a 1,500-kw., six-pole, 1,200-r.p.m. machine directly coupled to a Westinghouse-Parsons turbine. It was built for the United company, but was finally installed at Hartford, Conn.

The first commercial parallel operation of alternating-current direct-connected generators was successfully begun in the Twenty-ninth Street station in March, 1896. When it became necessary again to obtain additional generating capacity, motor-generator sets were installed at this station, which was supplied from the Waterside station of the New York Edison Company's 25-cycle system.

With the abandonment of the Twenty-ninth Street station in 1907, brought about by condemnation proceedings instituted by the city of New York, it became imperative to effect immediate plans for the generation of 60-cycle energy. As a temporary expedient 60-cycle generators were purchased and placed on the same shaft with the 25-cycle generators of the Edison service at the Waterside station. The motor-generator sets already mentioned were removed to the substations of the company. Two of these motor-generator sets are still in operation for emergency purposes. This arrangement made it possible to take care of the immediate requirements of the 60-cycle system with relatively small investment by using the steam equipment in the Waterside station.

Although storms played havoc with the early overhead lines and city authorities insisted on removing the overhead circuits, the operating companies viewed the use of underground circuits with great concern, because cable for this work was more or less unknown, the operation of underground high-tension circuits had been untried, and the total gross business was not sufficient to offset the subway rental demanded. Grave doubt existed as to whether an underground system could be successfully employed. Furthermore, the company questioned the right of the city authorities to compel the use of underground construction. The operating company was persistent in its demands that it be allowed to demonstrate by trial under actual service conditions the adaptability of the subway system before it was compelled to abandon or remove the overhead system. Nevertheless, in 1890 drastic steps were taken by the city authorities to remove the poles and overhead wires, the Commissioner of Public Works with a large force of men undertaking their demolition.

By 1895 135 miles of subway ducts were under rental and in use by the operating company, of which a considerable part was for the alternating-current system. At that time the company service did not extend north of Fifty-ninth Street and the gross revenue amounted to slightly less than $500,000 per year. A year later the extension of service beyond Fifty-ninth Street was commenced, and gradually it worked its way north to the Harlem Ship Canal. The company now operates more than 2,000 miles of cable of various kinds and sizes throughout Manhattan.

In the early days virtually every installation was a primary point, with individual converters for each customer rated at ten, twenty, forty and up to eighty lamps. During the days of overhead circuits the converters were mounted on poles or on the sides of buildings, whereas after the introduction of underground service they were placed in the basement.

Early service installations consisted of a Shallenberger meter, a single-throw, open-knife switch on the primary side of the surface, and a snap switch on the secondary or customer's side. This meter, which was developed in 1888 and operated on the induction principle, afforded such a simple and satisfactory method of metering that it enabled the alternating-current system to compete seriously with the direct-current system in the field of incandescent lighting. Energy was then sold on the ampere-hour basis. Soon after the watt-hour became the commercial unit of energy the Thomson and Shallenberger watt-hour meters appeared.

Series-arc lamps were originally furnished for illumination. Later multiple-series direct-current lamps were used, and still later the alternating-current type were installed. An early feature of the introduction of incandescent lighting service was free wiring, including complete installation of wiring fixtures and lamps without cost to the consumer. This practice was considered necessary at that time to introduce the company's service in competition with that of the Edison company, but it was later abandoned and never resumed.

For some time after the alternating-current system had been fairly well established for incandescent service and to some extent for power service the system was still incomplete because of the fact that no satisfactory arc lamp was in existence. Finally, however, a system was developed by William Stanley in which the Westinghouse company took an interest, spending considerable money for its development. Broad, flat carbons were used, and the lamps were operated in series in groups supplying the various customers from a common transformer in the basement of one of the premises. With the development of the inclosed multiple-circuit arc lamp the alternating-current system was able to compete in a more general way with the direct-current system.

Between 1907 and 1913 the Waterside station supplied all of the primary service for the United company. At the end of this period the Sherman Creek station of the United company was completed. This station, which was described in the *Electrical World* at the time, is now completely equipped with eight units and has a capacity of 151,000 kw. During the year 1921 it generated nearly 500,000,000 kw.-hr. and supplied consumers as far as 30 miles away. The generating voltage was originally 7,500, but a change has recently been made—13,200 volts, 60-cycle, three-phase, now being the standard. From the generating station the current passes through three-conductor feeders to the substations, where it is transformed to 2,500 volts, two-phase, for distribution to central distributing points throughout the city. These centers of distribution are determined by the connected load in the district and are shifted from time to time as conditions require. From these points primary distributing mains radiate, conveying energy to individual service transformer banks which further reduce the voltage to 110, single-phase, for lighting and 220, two-phase, for power.

The company now operates seven substations throughout its territory. Its Ninety-seventh Street substation, which is the latest addition to the system, is supplied by three-phase feeders instead of two-phase, but the lighting service is still single-phase and the power service two-phase as heretofore. This change in feeder service to the substation is a part of a general program which is intended to apply to the entire system when conditions permit of a greater load upon the existing generating transmission and distribution facilities.

Manhattan Island is divided into seventy separate sections, each of which is supplied by a separate 2,500-volt distributing feeder. Each area is controlled by a separate feeder, although the sections are interconnected by means of switches at strategic points, placed either in subway manholes or at the transformer banks. It is thus possible in the event of trouble to interconnect adjacent territories, confining troubles and interruptions of any duration to very small areas.

At the present time there are about 250 switching points throughout the city, making it possible to transfer a section from one feeder to another. In the larger and more important installations double service facilities are provided by independent feeders. Automatic switches are used in the more important installations.

The growth of business in New York is indicated by the fact that the Sherman Creek station is now supplemented by the Hell Gate station (described in the *Electrical World* of April 29, 1922), finished this year at an expense of $18,000,000.

Scoffings of Scientific Men

How Many Prominent Authorities in Europe Viewed Edison's Claims About His Incandescent Lamp System

NEITHER Mr. Edison nor any one else can over-ride the well-known laws of nature, and when he is made to say that the same wire which brings you light will also bring you power and heat there is no difficulty in seeing that more is promised than can possibly be performed. The talk about cooking food by heat derived from electricity is absurd.—*John T. Sprague, London.*

Much nonsense has been talked in relation to this subject. Some inventors have claimed the power to "infinitely divide" the electric current, not knowing or forgetting that such a statement is incompatible with the well-proved law of conservation of energy.—*Dr. Paget Higgs, London.*

Knowing something of the intricacy of the practical problem, I should certainly prefer having it in Mr. Edison's hands to having it in mine.—*John Tyndall, England.*

I think that any system of electric lighting depending on incandescence will utterly fail from an economic point of view and will be the more uneconomic the more the light is subdivided.—*Prof. Sylvanus P. Thompson, London.*

The subdivision of the light is an ignis fatuus.—*Sir William H. Preece.*

The subdivision of the electric light is impossible of attainment, and the disintegration of carbon when made incandescent rules it out of consideration for small burners.—*Fontaine, Paris.*

Development of Rates for Electric Service

Rate Systems Have Changed and Are Changing Because They Attempt to Reconcile Many Conflicting Economic and Human Elements in a Simple Formula

By E. W. Lloyd
General Contract Agent Commonwealth Edison Company

ABOUT thirty-five years ago the central-station industry depended very largely for the majority of its meter readings on the old Edison chemical meter, and electricity was generally charged for on the lamp-hour basis. The 50-watt carbon lamp burning for one hour was a standard. The electric motor was just beginning to be used, and in many instances the electricity consumed by motors was determined by taking ampere and voltage readings. An experienced man would then determine the number of hours a day the motor was used under average load conditions, and from these calculations the kilowatt-hours were determined.

Some Historical Papers

During this period the rates for electricity approximated 20 cents per kilowatt-hour for light and 10 cents for power. Electricity was charged for in blocks or steps, and in some cities at flat rates with discounts for quantity. This condition of affairs led to innumerable hot discussions on the cost of electricity supply at the early conventions of the National Electric Light Association, and it was not until 1892 that a very definite step forward was taken. Then Dr. John Hopkinson, the English engineer, presented as his presidential address to the Junior Engineers' Society of England a paper on the "Cost of Electricity Supply." This paper was a classic at the time and is still counted among the famous rate papers of the industry. In it he brought forward distinctly the different factors which have to do with the determining of rate charges in many large supply systems today. He recognized that rate charges should be divided into two distinct parts, one a demand charge covering the fixed charges to the customer, taking care of the investment factor of the cost, and the other an energy charge covering the cost of manufacturing the electricity and delivering it to the consumer.

In 1896 Arthur Wright, president of the Municipal Electrical Association of England, read a paper on cost of electricity supply before the convention of Borough Electrical Engineers at Brighton, England. In this paper he advocated a system of charging which has since become known as the Wright demand system and applies to that method on which a maximum price per unit is charged for a certain amount of energy and one or more reduced prices per unit are charged for the balance, on the block principle, in accordance with a schedule based upon the use of the maximum demand.

In May, 1900, Henry L. Doherty read a paper before the National Electric Light Association at Chicago entitled "Equitable, Uniform and Competitive Rates." This paper first established what has since become known as the Doherty or three-charge rate, which consists of a customer charge (a charge per customer or per meter) plus a demand charge plus an energy charge.

Electricity charges today are practically based on the foregoing rate systems and a few other methods, such as straight-line meter rate, which is equivalent to a flat price per kilowatt-hour; the step meter rate, which indicates that a certain specified price per unit is charged for the entire consumption, the rate depending on the particular step within which the total consumption falls, and the block meter rate, in which a certain specified price per unit is charged for all or any part of a block of such units and reduced prices per unit are charged for all or any part of succeeding blocks of such units, each such reduced price per unit applying only to a particular block or portion thereof.

The term "flat demand rate" applies to a charge for electricity based upon the customer's installation of energy-consuming devices or on the measured maximum demand. This is usually so much per watt or per kilowatt per month or per year.

Commonly Used Forms

The most commonly used of these various systems today are the block rate, the Hopkinson method and the Wright demand method.

There was no well-defined effort to encourage those in the central-station business to make more uniform the different methods of charging for electricity until 1910, when a paper presented by S. E. Doane on "High-Efficiency Lamps, Their Effect on the Cost of Light to the Central Station," encouraged the then president of the association, W. W. Freeman, to appoint a committee on rate research. The first report of this committee. of which John F. Gilchrist, Chicago, was chairman. appears in the *Proceedings* of the National Electric Light Association's New York convention, 1911. This committee has reported annually since that time, and the vast amount of data collected and made available to central-station companies by it has resulted in a very distinct movement toward uniformity of rate systems and expression.

In the report of this committee in 1912, at which time the writer was chairman, the conclusion was arrived at that there existed a "great necessity for adopting, as rapidly as possible, uniform methods of charging for central-station service. It is not alone sufficient," the report said, "that some general policy of rate making be recognized by the several companies, but it is very desirable that the actual forms in which the rates are placed before the public should be as nearly alike as possible."

Rates Becoming More Uniform

As a result of further recommendations of this committee, the weekly *Rate Research* bulletins have been issued by the National Electric Light Association ever since, and they are highly valued by every one connected with the business and interested in rate matters. This committee was also responsible for the production of the National Electric Light Association "Rate Book," which is republished annually, with corrections quarterly. In this publication are enumerated in detail the rates for cities having a population of 20,000 or more. An examination of its contents indicates the great good which has been accomplished by the work of the rate research committee in making the rate system throughout the country more uniform.

It is to be hoped that the slow progress made during the past twenty years in bringing into effect greater uniformity in rate systems will be accelerated. It seems possible that rate systems of the future could be confined to the following well-defined methods without very much difficulty: Block meter rates, flat demand rates, Wright demand rates, Hopkinson demand rates and three-charge or Doherty rates.

These methods have had sufficient trial to stabilize them, and it does not now seem necessary to add to them. In developing a rate system for any company it is extremely desirable to consider the relation of rates to different classes of service, so that in applying the various rates of the company to different quantities and hours' use of electricity there will be no conspicuous steps or jumps where the quantity and demand approximate the same at certain points in the scale. Many companies, for example, use two systems of rates, one applying to residential and small commercial lighting service and another applying to larger commercial uses. In such instances it would seem desirable that the rate steps should run into one another gradually where the smaller schedule leaves off and the larger schedule begins.

DISCOUNT LOGICAL FOR OFF-PEAK SERVICE

A logical modification of a rate system in common use is a discount applied in one way or another in cases where the customer uses energy off the central-station company's peak. Such modifications tend to improve the average load factor in systems which may have normally a poor load factor, and frequently they have resulted in reducing cost supply. There are undoubtedly cases where off-peak rates could not apply, but these modifications are mentioned as possible examples of accomplishing the ultimate aim of central-station companies to produce energy at the lowest possible cost. Load factor has a large influence on this situation.

In building up the electricity supply business class rates are often used until such time as sufficient experience shall have been had with the time use and conditions of demand in industries depending in a large measure for their profitable existence on favorable rates. The development of artificial ice making, the electrochemical industries, carborundum, graphite, electric steel, enameling and the heat treating of metals are examples. Ultimately such rates are merged in a general rate system, but their use, when fairly applied, is justified because of the ultimate advantage in the improvement of the load factor of a system.

ONE-RATE SYSTEM IDEAL

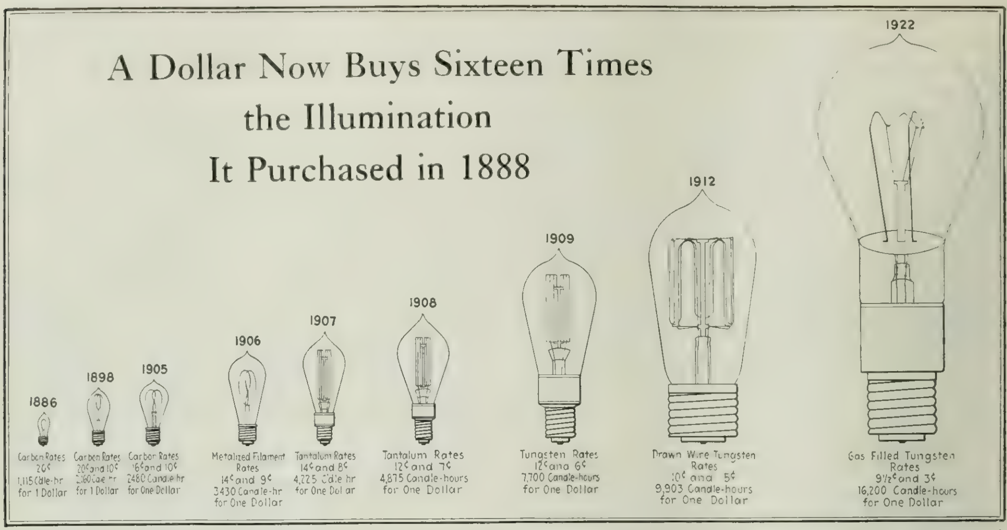
Another factor to be considered is diversity, and diversity of use by individual customers has a great deal to do with the load factor of the system, so that high individual load factors of customers plus diversity factor finally result in high system load factors, a happy combination which makes for low cost. Unquestionably, the ideal to be attained is that of a one-rate system for a company. The public is mystified to a great extent by almost any rate system now in existence for measuring electricity, and any move forward either in uniformity of expression, uniformity of system or the reduction to one rate system with reasonable modifications to take care of the exigencies of the business will go a long way toward removing the difficulties now experienced.

As we look into the future it would seem inevitable that rate methods will be constantly modified to the end that the lowest costs may be obtained. Through the constant study of new methods of use in industry and elsewhere our intelligence as a nation in realizing the necessity for the economy obtainable by time of use—in other words, the betterment of diversity and load factors—will bring about a situation where the most economical point of generation will be reached. As this study proceeds simplification will undoubtedly follow. Any complications in rates today are the results of our attempts to build up a business which is still young and the future of which is unknown.

To encompass the desired results the experience of the past must be utilized to the full and further laborious experimentation and analysis will be required. Yet every indication points to a successful solution of the rate problems confronting the industry. Not the least element in the situation is the necessity for full publicity about rates and an educational campaign to acquaint the public and the industry with the basic elements in the rate problem.

Milestones in the Early Development of Electricity

1745—Electric charge isolated; Leyden jar—Von Kleist.
1800—Primary battery—Volta.
1803—Storage battery—Ritter.
1805—Electroplating—Brugnatelli.
1810—Carbon arc—Davy.
1815—Electric furnace—Pepys.
1819—Electricity from magnetism—Oersted.
1821—Electromagnetic rotation—Faraday.
1823—Thermo-electricity—Seebeck.
1825—Electromagnet—Sturgeon.
1831—Magnetism from electricity—Faraday.
1832—Permanent magnet generator—Pixii.
1832—Rotary magnet motor—Sturgeon.
1832—Electromagnetic telegraph—Morse.
1834—Electric boat—Jacobi.
1835—Electric car—Davenport.
1840—Incandescent lamp—Grove.
1844—Arc lamp—Foucault.
1856—Shuttle-wound armature—Siemens.
1863—First commercial alternator—Nollet.
1860—Lead storage battery—Planté.
1860—Telephone—Reis.
1870—Ring armature—Gramme.
1873—Stanley generator; Thomson generator.
1873—Drum armature—Rowland.
1875—Arc lamp and generator—Brush.
1876—Jablochkoff candle.
1876—Commercial telephone—Bell.
1879—Carbonized-paper filament lamp—Edison.
1882—Commercial generating station, Pearl Street; three-wire system—Edison.
1884—Alternating-current system acquired by Westinghouse.
1884—Transformer—Stanley.
1886—First regularly operated alternating-current generating station, Greensburg, Pa.
1886—Electric welding—Thomson.
1887—Richmond street railway—Sprague.
1888—Shallenberger meter and induction motors of Tesla and Ferraris.
1890—Polyphase transmission in Colorado.
1890—Electric automobile.
1891—Automatic telephone in Chicago—Strowger.
1895—Niagara Falls, 25-cycle generators; stationary armatures and revolving fields.
1895—X-rays—Roentgen.
1895—Radio—Popoff.
1896—Radio system—Marconi.
1900—1,500-kw. steam turbo-generator in Hartford.
1903—First all-turbine central station at Fisk Street, Chicago.
1906—Radio telephone—Collins.
1906—New York Central Railroad electrification.
1907—Tungsten-filament lamp—Langmuir.
1907—New York, New Haven & Hartford electrification.
1913—Gas-filled lamp—Langmuir.



Development of Electric Lamps

The Growth in the Use of the Incandescent Lamp Has Stimulated the Use of Electricity for Power Purposes

By J. R. Colville
Engineering Department, National Lamp Works

ELECTRIC lighting, in an experimental way, was an accomplishment of more than a hundred years ago. Nearly sixty years, however, after the introduction of the electric arc (1810) it still remained for some one to develop a practical lighting unit which could be universally applied to all lighting purposes, both commercial and domestic. The year 1875 marks the beginning of the development of such a unit, and with the introduction of Edison's first incandescent lamp in 1879 the electrical industry was really started. With our present knowledge of the many accomplishments in electric lighting during the past forty years, a reference* taken from Mr. Edison's personal notes made in the early days is of particular interest as an indication of the vision of the man. It was his object "to effect exact imitation of all done by gas, so as to replace lighting by gas with lighting by electricity; to improve the illumination to such an extent as to meet all requirements of natural, artificial and commercial conditions."

It would be impossible here even to mention all of the problems that were solved and the obstacles that were overcome in bringing the incandescent lamp to its present state of development.

Some idea of the growth of the electric lighting industry can be gained from the fact that during the year of the introduction of the carbonized bamboo-filament lamp 25,000 were made and sold. In recent years the annual consumption of incandescent lamps in this country has passed beyond the two-hundred-million mark.

This popularity has not been due alone to the fact that light has become increasingly easier to obtain as improvements in lamp quality are recorded, nor to the constantly decreasing cost of electrical energy, but to the fact that the real value of good lighting has been gaining ever greater recognition. The higher efficiency of the modern incandescent lamp has of necessity brought about an increase in the brightness of the lamp filament which has made it very important to guard against the harmful effects of glare. With the several types of diffusing bulbs and accessories now available. light can be used in abundance without the discomforting effects of brightness. As an indication of the increasing use of light in the many fields in which the incandescent lamp is found today, the chart at the top of this page gives conditions for the period 1888 to 1922.

LUMENS PER WATT INCREASE

It would be only natural to suppose that with the many improvements in lamp efficiency, and with the increased efficiency with which electrical energy can be generated and distributed, the cost of light today must be only a fraction of what it was forty years ago. In 1885 the 16-cp. carbon lamp was sold for $1. The cost of energy was in the neighborhood of 20 cents per kilowatt-hour. Based on these figures, the consumer of that day received only 98 lumen-hours for one cent.

Between the years 1885 and 1906 the cost of energy decreased from 20 cents to about 11 cents per kilowatt-hour; the price of the 16-cp. carbon lamp decreased from $1 to 20 cents, and the efficiency of the lamp improved from 2.5 lumens to about 4 lumens per watt. The result of these developments was a decrease in the cost of light such that in 1906 it was possible to get 302 lumen-hours for 1 cent.

After the introduction of the "Gem" lamp (5 lumens per watt) and a further decrease in cost of energy, this figure was raised to 385 lumen-hours just before the tungsten-filament lamp came into the market. The tantalum lamp was so quickly superseded by the more efficient tungsten-filament lamp that no data are given for it.

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*John W. Lieb, Brooklyn N. E. L. A. *Bulletin*, May, 1915.

During the period following the introduction of the tungsten-filament lamp until the war period decreases in the cost of lamps and energy and increases in lamp efficiency all contributed to further phenomenal reductions in the cost of electric light. By the end of 1916, with an average energy cost of about 8 cents per kilowatt-hour, a price of 27 cents for the 40-watt "Mazda" lamp and a lamp efficiency of 9.5 lumens per watt, the consumer got 1,098 lumen-hours for 1 cent. This was more than eleven times as much as in 1885.

Now, in 1922, the cost of light is again on the downward trend. Although the average cost of energy is still at 1920-21 levels, some increase in lamp efficiency, combined with decreases in lamp cost, make it possible for the consumer to obtain about 1,138 lumen-hours for 1 cent, which makes the cost of light with the 40-watt "Mazda" lamp less than at any other time in the history of incandescent lamps.

Great Advances Made in Meters

Starting in 1872 with Magnetically Regulated Clock Meter, Development Has Proceeded Along More than 190 Lines—Greatest Development in Last Twenty-five Years

By P. H. Bartlett

Engineer Meter and Instrument Department, Philadelphia Electric Company

"'MEASURE for measure' has ever been the underlying principle of the trade of the world. Where values cannot be measured we demand averages based upon long experience. Where it is possible to measure goods delivered the ingenuity of man is untiring until some means is found adapted to the uses of all the traders of the world. It is only so far as we can draw from nature's limitless supply of necessaries and blessings 'without money and without price' that we fail to find in these days a meter check upon our consumption. As long as people live in civilized communities water and artificial light will represent somebody's labor, and as they come to be more and more generally used they must be more and more accurately measured."

The foregoing excerpts from a paper on "Electricity Meters" written by W. J. Jenks in 1888 express in a few words the reasons for a development which has kept pace with, and exceeded perhaps in some respects, the advances made in many of the other branches of the industry. The demand for an accurate method of measuring electricity was contemporaneous with its availability as a marketable commodity, and this demand presented the problem of measuring a commodity invisible and without mass. It has been said that more than 190 different electrical, electrochemical and electromechanical lines of approach have been utilized in the attempt to create an electricity-measuring device which would be accurate and also rugged and inexpensive. The millions of electricity meters in use at this time are silent witnesses as to how well this work has been accomplished over a comparatively short term of years.

Progression in the earlier development of electricity meters followed, generally, three distinct operating principles. These were (1) the application of electricity to vary the speed of otherwise uniformly driven clockwork or actually to impart motion to a clock mechanism, (2) the chemical effects of electricity upon various liquids, either in altering the weight of previously standardized electrodes or (3) through devices translating chemical action into mechanical work.

All of the above operating principles have given place to the motor type of meter wherein the electromagnetic force of the current is translated into rotating motion suitably limited and made to drive a registering mechanism. While these are the fundamental lines along which invention has proceeded, many other principles have, of course, been utilized with more or less unsuccessful results.

First Meter Had Clock Mechanism

The first electricity meter in which electromagnetic action was utilized in connection with a clock mechanism was the integrating meter for which a patent was issued to Samuel Gardiner in 1872. This meter was composed of a spring-driven clockwork with a train of dial gears which were locked in place except when an electromagnet in series with the line was energized, releasing the stop. This allowed the gears to rotate and the meter to register. The meter, therefore, indicated the duration of current flow rather than the quantity, but as the early electrical installations were not subdivided into branch circuits and all the lamps were used at the same time, the quantity used could be calculated from the meter readings, provided that the number of lamps and the energy taken per lamp were also known.

An alternating-current variation of this meter was patented by J. B. Fuller in 1878, consisting of a polarized armature vibrating under the influence of an electromagnet in such a manner that the vibrations were recorded upon a suitable dial. Devices similar to these were patented by William E. Sawyer in 1878 and J. Finney in 1880, but they did not develop them commercially.

These meters probably filled the needs of the period, as the commercial utilization of electricity was still very limited, although rapidly growing. This growth, combined with improvements in utilization devices and transmission, soon created a keener demand for meters, however, and from 1880 to 1885 such men as Hudson Maxim, S. De Mott, H. M. Byllesby, R. P. Diehl and Edward Weston in America, Jules Canderay in Switzerland and C. V. Boys and S. Ferranti in England were busy developing clockwork devices for the measuring of electricity.

The majority of these devices operated by electromagnetically oscillating a pendulum or balance wheel geared to a spring-driven clock movement to which was connected a train of registering gears, or else the rate of oscillation of a pendulum was electromagnetically altered. This was usually accompanied by solenoid control and resulted in a corresponding alteration in the speed of the clock mechanism. Variation in this scheme, as in the Aron meter (1887), consisted of comparing the speeds of two pendulums, one oscillating at a constant predetermined speed, the other having the period of vibration accelerated through the agency of an electromagnet in series with the line. Vibrations from the more rapidly moving pendulum were translated into rotary motion through differential gearing and transmitted to a ratchet and pawl mechanism, advancing a dial train. In another of the same general form, which was perfected by S. De Mott in 1885, the length of the pendulum, and consequently its vibration period, was decreased according to the rate of current flow in a series electromagnet.

CHEMICAL METER WAS FIRST COMMERCIAL SUCCESS

In 1881 Thomas A. Edison produced the Edison chemical meter for direct current, this being the first meter which was commercially successful on a large scale. This meter consisted of an electrolytic cell containing copper electrodes in a copper-sulphate solution, and the principle of operation depended on Faraday's law of electrolytic deposition. Metal was removed from one plate (anode) and deposited on the other (cathode) in amounts proportional to the rate and duration of the flow of current. The meter was, therefore, strictly speaking, an ampere-hour meter, and the quantity of electricity used was determined for each month or billing period by replacing the electrodes and determining the change in weight of the electrodes removed.

Prior to the perfecting of this meter Edison had invented three others, of the electrochemical type, which he called "Webermeters." One was arranged as a tilting beam in which, owing to the decomposition of metal, the heavier end sank, closing an electrical contact and righting the tube. This motion was transmitted to a train of gears. In another meter water was decomposed under a bell jar, the resultant gases causing the jar to become buoyant. On rising in the liquid in which it was floated it closed a contact which advanced a dial train through an electromagnet. From 1881 Edison took out several patents on electrochemical meters in which decomposition of water was made to alter the weight of the container and the consequent loss of balance was translated into mechanical work by oscillating and rotating members. In 1883 he changed the composition of the electrodes and also the electrolyte of the Edison chemical meter from copper and copper sulphate to zinc and zinc sulphate, and this was the final form in which many thousands were manufactured and used. Other inventors who designed meters depending upon electrolyte or electrochemical action were J. Green, Elihu Thomson, Johnston and Vanderpoel in America and S. Ferranti in England. The Bastian meter, which decomposed water, the amount of current flow being determined by the amount of liquid left undecomposed, was also of this period and was also commercially successful, but not to the same extent as the Edison meter.

All of the types enumerated up to this time were ampere-hour meters, and, further, the majority of them, particularly the chemical type, were suitable only for direct current. From 1886 on the development of alternating-current machines and systems had progressed to the point where this form of energy began to come into commercial use, and the development of the alternating-current meter naturally followed.

In 1888 the forerunner of our modern types of alternating-current meters, the rotating induction meter, was invented by O. B. Shallenberger. This meter consisted of a metal disk rotating in a magnetic field, produced by a cell in series with the line, combined with that of a fixed short-circuited secondary. The speed was kept proportional to the rate of current flow by means of an air-vane or fan damping system.

Edison in 1881 had invented a motor meter of the commutator type, without iron, for use on direct current, and George Forbes in London in 1886 developed a novel meter in which a delicate fan was rotated by the currents of air arising from a heated conductor directly underneath it, the heating, and consequently the air currents, being proportional to the rate of current flow. This last was applicable to either direct or alternating currents. The use of the Edison motor meter was not encouraged by its inventor, and the Forbes meter was not a commercial success on account of its delicacy and extreme sensitivity to disturbing outside influences.

In 1889 the Thomson recording wattmeter, with which nearly all electrical men are familiar, was patented by Elihu Thomson. This meter is a motor type with a wound armature connected across the line and with series fields carrying the line current. The current in the armature is kept in proper direction to insure continuous forward rotation by means of a commutator and brushes. The speed is controlled by eddy or Foucault currents generated in a disk rotated by the shaft of the meter between the poles of permanent magnets. This meter was the first true wattmeter and was for a long time used on both direct and alternating current, but the later rapid development of the induction-type watt-hour meter for alternating currents and in a less expensive form soon limited the Thomson meter to the direct-current field, where it is today, in its later modifications and improvements, one of the leading types of modern meters.

Improvements in the induction ampere-hour meter of Shallenberger, made over a period of years and by many engineers of different manufacturing companies and consisting of the utilization of a shunt and series coil, producing a rotating magnetic field, the substitution of damper magnets for the air vanes and the use of a single disk for the double purpose of driving and damping, converted this meter into a true watt-hour meter. These and other improvements and refinements in design and manufacture have gradually resulted in the production of a highly accurate, lighter and less expensive meter with a greatly improved appearance over the early models.

The improvements both in direct-current and in induction meters are due to the work of such men, among others, as Shallenberger, W. Stanley, Thomas Duncan and M. M. Slattery in America, H. Aron in Germany and S. Ferranti, Faure and Forbes in England.

DIFFERENT PRINCIPLE APPLIED

In 1886 F. Borel and E. Paccand, in Switzerland, developed a new rotating meter using a different principle from any so far utilized. This was based on the fact that a current-carrying fork will rotate if suspended above a bar electromagnet in such a manner that one branch is pivoted and the other is free to rotate around it, the current being conducted to this latter branch through a mercury bath. Edison in 1887 experimented with this meter, but S. Ferranti in England patented in 1886 what was undoubtedly the forerunner of the mercury type of meter as known today. It consists of a disk immersed in mercury and caused to rotate by passing current through it while the disk is subject to the influence of a magnetic field. Ferranti made several later improvements to the meter, and in 1904 the Sangamo company placed on the market a line of meters based on the same principles, a method still employed, although refinements in design and modern manufacturing and testing methods have greatly improved the product.

Some Unusual Types Developed

Many of the early inventors resorted to most complicated measures to obtain their results. Among the most interesting of these are the St. George Fox meter of England (1883), in which the flow of water through an orifice was controlled by a valve operated by a solenoid in series with the line; the Patterson meter in 1886, which utilized a spot of reflected light from a galvanometer mirror to a uniformly moving strip of sensitized paper (which was probably the forerunner of our modern graphic meters), and the Hansen meter of 1889, in which an hour-glass containing sand was employed, the flow being solenoid-regulated proportionately to the rate of current flow.

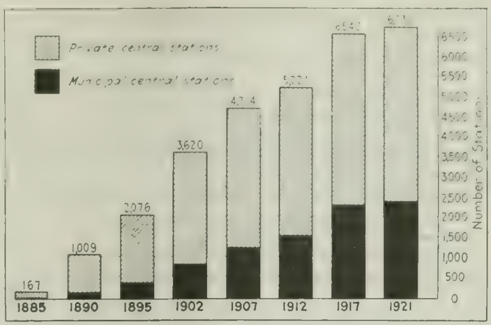
In the time which has elapsed since the earlier meters were made there have naturally been many types produced for special purposes, such as the two-rate, prepayment and so forth, and the development of the polyphase naturally followed the single-phase meter. All of these have, however, been merely modifications in construction of the standard designs. While the development noted has occurred over a period of fifty years and while the fundamental principles on which this development centered were evolved thirty to forty years ago, the refinements in design and detail by which electricity meters have reached their present state of perfection have taken place only in the last twenty-five years. The present types of alternating-current meters, for instance, have been in production for only seven or eight years, and standardization among the manufacturers and improvements in detail of construction are still proceeding.

Further improvements may no doubt be anticipated until the claim already made—that it is questionable if there is today any commercial measuring device which equals from the viewpoint of accuracy the modern electricity meters—will be unquestioned.

Growth of the Electrical Industry Must Continue

IT IS probable that no primary industry in the country can present such an array of figures of growth as are to be found in the accompanying diagrams and others in this issue concerning the electric light and power industry. The infant among industries has grown until at the present time it is second in invested capital among manufacturing industries.

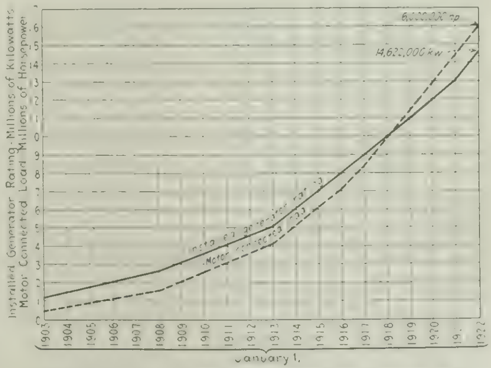
The energy generated has almost quadrupled during the past ten years, owing very largely to the growth in the use of electrical energy for industrial power purposes. From 1882 to 1902 the energy distributed by central stations was used mainly for lighting, but since that date the industrial load and the electric railway energy consumption have rapidly grown until in 1921 the energy consumed for lighting was only about 23 per cent of the total sold to all classes of customers. In 1920 more than twenty-three billion kilowatt-hours of electrical energy were sold to industrial power customers alone, which is more than the total amount of energy generated by all the central stations for all purposes during 1917. Almost every month of the present year has witnessed record central-station operations, and it is probable that when the totals are available at the end of the year the fifty-billion kilowatt-hour output mark will be found to have been passed.



PRIVATELY OWNED CENTRAL STATIONS HAVE ALWAYS OUTNUMBERED MUNICIPAL PLANTS

The capital invested in the electric light and power industry was only about $5,000,000 in 1885, or three years after the establishment of the first central station. At the end of 1921 this figure had increased to $4,600,000,000, and it will probably total about $5,000,000,000 by the end of the present year. The gross revenue last year reached $933,000,000 and without doubt will pass the billion-dollar mark in 1922.

With all this wonderful growth behind the industry the field is far from crowded. Only about one-third of the people of the country are enjoying the luxuries of electric light and electric labor-saving devices in their homes, and more than one-third of the people of the country are living in districts not reached by central-station service. Less than two-thirds of the primary horsepower of the manufacturing plants of the country is electrical, and only about 58 per cent of electric motor rating is at present being run by central-station energy.



GROWTH IN TOTAL INSTALLED GENERATOR RATING HAS AVERAGED ABOUT 10 PER CENT PER YEAR

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

What Benefits Can Be Expected from Laminated-Frame Arc-Welding Generators?

To the Editors of the Electrical World:

The majority of phenomena met with in electrical engineering practice result from magnetic fluxes interlinking with electric circuits and varying more or less rapidly in intensity, direction or both. For example, in the oscillating current circuits of radio telegraphy the term "rapidly" may mean several hundred thousand cycles per second. In industrial apparatus 100 cycles per second is a relatively high frequency, and, compared with variations occurring in direct-current circuits as results of changes in load resistances, switching apparatus on or off, etc., 25 cycles per second is a high frequency.

The fact that the expression "rapidly changing flux" is a relative term is not given due consideration in the design of certain types of machines, considerable expense being incurred to meet conditions which are not actually encountered. Thus, in the publications of some manufacturers of arc-welding generators we are informed that laminated frames permit a very rapid change in the amount of "magnetism" or "flux density," and this in turn makes it possible for the electric current to adjust itself almost instantly to any demand. The idea which it is intended to convey probably is that a rapid change of flux permits a rapid change of terminal voltage so that a substantially constant current can be maintained when the resistance of the arc circuit varies rapidly. Therefore, the statement obviously applies to the so-called "variable-voltage" or "constant-current" generators only.

In these types of generators the terminal voltage varies to a greater or less extent in opposite sense to the current in the arc circuit, the object being to overcome the inherent instability of the arc. In general there are two ways in which this voltage regulation is accomplished. One method is to use the main current in some way or other to modify the magnetic field so that the terminal voltage will decrease as the current increases and vice versa. The other is to use variations in the resistance of the arc to accomplish the same purpose. A combination of both may also be employed. The object of laminating the frame is then to avoid the well-known damping effect of eddy currents which would flow in a solid frame when the flux changes and thus cause sluggishness in response to variations in the external circuit.

In most arc-welding generators on the market the former method of voltage regulation is used, the demagnetization in a great many being effected by a differential series field. With this arrangement there is obviously no tendency for the flux to change until the main current changes, and it follows that whatever tends to retard current changes in the arc circuit will also cause the flux to become more sluggish in response to changes. That is to say, in this respect a reactor in the arc circuit has the same damping effect as eddy currents in a solid frame, and it seems evident that when a reactor of appreciable size is used, because of its capacity to store energy, lamination of the frame is an entirely needless precaution.

That the benefit gained by laminating the frame is in many instances greatly overestimated is shown by the following paragraphs taken from a catalog:

"As an aid to obtaining quick response to circuit conditions the complete magnet structure of both generator and converter is laminated."

"In the generator, as regulation is obtained by distortion of flux in the interpolar space surrounding the armature, under immediate response to the armature current variations, and as the flux in the poles and field ring remains substantially undisturbed, no damping action results from currents circulating in the field windings or solid masses of iron in the magnet structure; therefore a pronounced freedom from lag exists during the welding operation."

It seems self-evident that when the magnetic conditions are such that no damping action results from currents circulating in the solid masses there is no need of laminating the frame.

To derive any substantial benefit from a laminated frame certain conditions are obviously essential. If the magnetic field depends on the arc current there should be no external devices tending materially to retard current changes in the arc circuit. All other possible closed circuits, such as may be formed by the rivets and laminations in the poles, must be avoided. The generator-field circuits must be designed to have very large time constants.

If designers of such generators would give a little more explicit explanation as to what extent beneficial results can be reasonably expected from a laminated frame, it would be of great interest to users of such machines as well as engineers in general.

K. L. HANSEN,
Electrical Engineer

Milwaukee, Wis.

Differential Protection

To the Editors of the Electrical World:

The Merz-Price balanced protective gear, which is most commonly used in England to isolate electrical equipment when faults occur within the apparatus, has some defects which cause delay or uncertainty in operation. The current transformers which are inserted in each phase winding do not give protection in the case of a fault developing between different turns of one phase. Eventually a short circuit to another phase or to earth takes place, and the circuit is opened, but by the time this happens much damage may have occurred.

Difficulties also arise owing to the differences in the magnetic characteristics of the transformers, but these can be eliminated by a modified system in which the two ends of a phase winding are passed through the core of a single transformer. The first difficulty still remains unsolved, and protection is incomplete. However, a method has been advanced which removes the dangerous effects of both sources of trouble. It involves the use of potential transformers or reactance coils across each phase and current transformers in the leads connecting the midpoint of the generator with mid-point tappings on the reactances. The device has not yet been tried on large machines, but has given satisfactory results in the laboratory tests.

Liverpool, England.

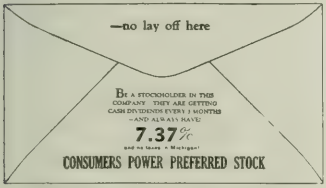
MARK MEREDITH.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Every Envelope Aids Stock Sales

ON THE back of each envelope mailed by the Consumers' Power Company of Jackson, Mich., attention is called to the advantage of the company's preferred stock as an investment. Thousands of these envelopes sent out keep the customer ownership idea constantly in mind.


—no lay off here
Be a stockholder in this company they are getting cash dividends every 3 months —and always have!
7.37%
and no taxes in Michigan!
CONSUMERS POWER PREFERRED STOCK

COMPANY MAIL ADVERTISES PREFERRED STOCK

◆

Denver Company's Trouble Department Eliminates Delay

THE Denver (Col.) Gas & Electric Light Company by a system of trouble dispatching has developed a highly efficient method of handling trouble calls in that city. This has been accomplished through a service department which has been so organized as to eliminate as far as possible any lost motion or delay between the time a customer calls in to report trouble with his service and the arrival of a repair man on the customer's premises.

All trouble or complaint calls are referred by the telephone operator to the service department in the main office, and the employee answering the call inquires fully regarding the nature of the trouble so as to be able to refer the call at once to the proper department.

Electric complaint and trouble orders are classed under two general heads, namely, electric trouble and appliance trouble. Electric trouble orders are referred to the trouble department and appliance trouble orders to the appliance repair and adjusting department, the latter being an adjunct to the new-business department.

The trouble department personnel consists of both inside and outside troublemen, all of whom report to a trouble dispatcher whose office is at the company's warehouse in the wholesale district of the city. Inside troublemen report at the warehouse only when going on duty and subsequently report by telephone from stations located in the district within which they operate.

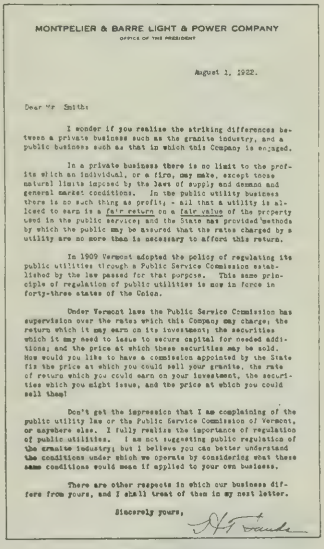
The city of Denver covers an area of approximately 58 square miles, and at present it is divided into four general districts. Police stations and gas or electric substations are used by the inside troublemen in making telephone reports, and when all outstanding orders are executed one of these places is used by the troubleman as his headquarters awaiting further orders.

The inside troublemen at present rectify or clear trouble within the customer's premises only and do not attempt to do any pole work. It is hoped that at some time in the future these men can be trained to take care of line as well as inside trouble. The outside troublemen report and make their headquarters at the warehouse and are sent on only such calls as appear to require a lineman.

The present personnel of the trouble department consists of four outside troublemen, six inside troublemen and two trouble dispatchers. The working hours of these men are so arranged that during the afternoon two men work within a district ordinarily covered by one man during the morning hours. The working schedule of the outside troublemen is so arranged that two men are on duty during the afternoon and evening. With this arrangement the company is able to give very satisfactory service without great expense. The period of the individual outage has been materially reduced, and customers appreciate that the company is trying to render service as near 100 per cent as possible.

Explaining the Public Utility to Another Industry

THE president of the Montpelier & Barre (Vt.) Light & Power Company, H. T. Sands, is a firm believer in the policy of telling the utility story to the public. Not long ago the Montpelier company sought to increase its power rates because of increased costs of operation, but this was disallowed by the state commission following extended hearings in which representatives of the granite industry appeared in opposition to the company. Instead of concluding that nothing further could be done, Mr. Sands decided to go straight to the granite industry and tell it the story of fundamental economics upon which the company is obliged to function, with the idea of then presenting its needs to the commission and seeking a rate readjustment on the basis of a better understanding on the part of the dominant industry of the locality.



MONTPELIER & BARRE LIGHT & POWER COMPANY
OFFICE OF THE PRESIDENT

August 1, 1922.

Dear Mr Smith:

I wonder if you realize the striking differences between a private business such as the granite industry, and a public business such as that in which this Company is engaged.

In a private business there is no limit to the profits which an individual, or a firm, may make, except those natural limits imposed by the laws of supply and demand and general market conditions. In the public utility business there is no such thing as profit; - all that a utility is allowed to earn is a fair return on a fair value of the property used in the public service; and the State has provided methods by which the public may be assured that the rates charged by a utility are no more than is necessary to afford this return.

In 1909 Vermont adopted the policy of regulating its public utilities through a Public Service Commission established by the law passed for that purpose. This same principle of regulation of public utilities is now in force in forty-three states of the Union.

Under Vermont laws the Public Service Commission has supervision over the rates which this Company may charge; the return which it may earn on its investment; the securities which it may need to issue to secure capital for needed additions; and the price at which these securities may be sold. How would you like to have a commission appointed by the State fix the price at which you could sell your granite, the rate of return which you could earn on your investment, the securities which you might issue, and the price at which you could sell them!

Don't get the impression that I am complaining of the public utility law or the Public Service Commission of Vermont, or anywhere else. I fully realize the importance of regulation of public utilities. I am not suggesting public regulation of the granite industry; but I believe you can better understand the conditions under which we operate by considering what these same conditions would mean if applied to your own business.

There are other respects in which our business differs from yours, and I shall treat of them in my next letter.

Sincerely yours,
H T Sands

ONE OF A SERIES OF LETTERS TO POWER CUSTOMERS

A series of letters, one of which is reproduced here, was therefore prepared and sent to about 110 leading concerns. While the granite industry has since been greatly disturbed by labor troubles, much interest in the company's presentation has been noted. A better understanding of the company's position now exists in the territory, and the comparisons between the public utility and the private business with which the letters largely occupy themselves have brought home to thinking business men the vital necessity of maintaining a prosperous electric utility for their service and for the service of the general public.

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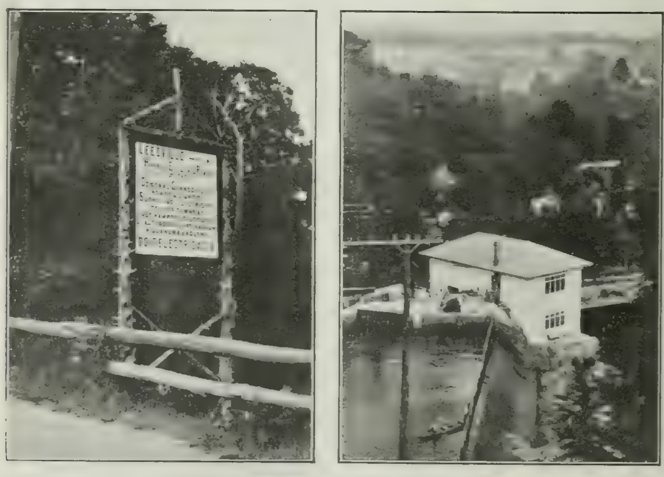
Advertising Electric Service Along the Highway

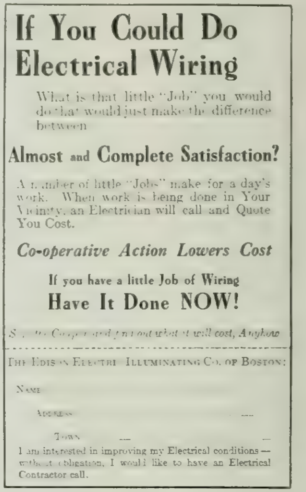
IN A GORGE below the highway the hydro-electric plant of the Central Connecticut Power & Light Company at Leesville, Conn., can be seen through an opening in the trees, as in one of the accompanying illustrations, and to inform passersby about the station and the company's service the rustic sign is in use. This sign is double-faced and calls attention to the communities served by the company besides carrying the well-known slogan of the Society for Electrical Development. On the wooded hillside behind the station a second effective sign is installed, featuring the two main divisions of electrical supply from the system. L. P. Perry is general manager of the company.



RUSTIC SIGN CALLS ATTENTION TO HYDRO PLANT LOCATED IN GORGE

Aiding Customers to Install Convenience Outlets

MANY persons go without needed outlets in their homes bcause they do not know what they will cost and hesitate to call in a contractor for an estimate on a small job. To make it easy for its customers to find out without obligation what the installation of convenience outlets or extensions to their wiring will cost, the Edison Electric Illuminating Company of Boston has sent out the card shown here inviting requests for estimates.



If You Could Do Electrical Wiring

What is that little "Job" you would do that would just make the difference between

Almost and Complete Satisfaction?

A number of little "Jobs" make for a day's work. When work is being done in Your Vicinity, an Electrician will call and Quote You Cost.

Co-operative Action Lowers Cost

If you have a little Job of Wiring

Have It Done NOW!

S[illegible] the Coupon and find out what it will cost, Anyhow

THE EDISON ELECTRIC ILLUMINATING CO. OF BOSTON:

NAME

ADDRESS

TOWN

I am interested in improving my Electrical conditions—without obligation, I would like to have an Electrical Contractor call.

POST CARD INVITING REQUESTS FOR ESTIMATES ON WIRING JOBS

This is an interesting and valuable form of service to customers and should result in greater residential consumption of energy and a consequent increase in revenue for the Boston Edison company.

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What Other Companies Are Doing

Lexington, Ky.—Another indication of the volume of new business which is being secured by central-station companies is seen in the merchandise sales of the Kentucky Utilities Company, which for the week ended July 29 amounted to $12,374. Included in this amount were fixture contracts for four residences at Glasgow and for a new hotel at Middlesboro, Ky. Twenty-four fans, thirty-six irons, two washing machines, one electric range, four electric signs, two transformers and two pumps were sold.

Dayton, Ohio. — The Dayton Power & Light Company has for some time kept a record of the service of its meter readers, showing the number of meters read and the number of errors made. Lee Wehkamp during the year 1921 read 65,949 meters and made only eleven errors. This is the best record that has ever been made in that organization. The record for the year 1922 to date is held by Chas. O'Brien, who read 5,762 meters during the month of April with only one error. The Dayton Power & Light Company maintains a premium-penalty plan of meter reading which has worked out very satisfactorily.

Chicago, Ill.—An analysis of the 13,000 stockholders of the Public Service Company of Northern Illinois shows that 35.6 per cent of the total stockholders are women and that they own 28.58 per cent of the total stock. Comparing this with the 61.72 per cent of stockholders who are men and who own 56.64 per cent of the stock, it is readily seen that a good proportion of the owners of the company are women. Stocks owned by trustees, estates and joint owners are only 2.58 per cent of the total number of owners. One out of every eleven men, women and children of the town of Worth, Ill., owns some stock. Although this town has a population of only 250, it appears that the public ownership idea of utilities is well established in the minds of the residents.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Heat Losses from Bare and Covered Wrought-Iron Pipe at Temperatures up to 800 *Deg. F.*—R. H. HEILMAN.—Heat losses from pipes under high-temperature conditions are of importance. This paper presents the finding of an experimental investigation conducted in the Mellon Institute of Industrial Research of the University of Pittsburgh. Losses from bare pipes have been measured for temperatures up to and including 800 deg. F. and have been carefully studied for pipes of various diameters. Empirical formulas are presented whereby the loss from insulated pipes of any diameter may be readily calculated.—*Mechanical Engineering*, July, 1922.

Vibration and Critical Speeds of Rotors.—C. RODGERS. — The critical speed of rotors can be calculated with sufficient accuracy for practical purposes, and as a rule the running at speeds not in the neighborhood of that indicated by the calculation is free from vibration. But cases occasionally arise where troubles from vibration occur at speeds above or below the calculated critical speed. The author discusses the various subsidiary causes which might lead to unsatisfactory running at other than the usual calculated critical speed. The basis of the article is a physical one, but the treatment is largely mathematical. The author confines himself to a single-part rotor, rigid as regards bending and mounted on an elastic shaft running in rigid bearings. Some effects of non-rigidity of the rotor and bearings and of alterations in the thickness of the oil film in the bearings are considered.—*Philosophical Magazine*, July, 1922.

Heat Balance and Electrical Equipment in the Gennevilliers Station.—R. H. ANDREWS.—In connection with the electrical equipment and heat balance of this station the following features are of particular interest: Cooling of the generators is performed by air moving in a closed circuit with provision for use of this waste heat in the first stage of feed-water heating; a high-tension switch house, equivalent to an American outdoor switchyard, is inclosed in a remarkably light reinforced-concrete structure, and all auxiliaries except the boiler-feed pumps are electrically driven from station buses fed by the main bus. In this plant the feed water is successively heated by generator-cooling air and the oil coolers, steam bled from the seventh and eighth stages of turbines, exhaust steam from boiler-feed pumps and steel-tube economizers. The stage bleeding and the use of air preheaters in the boilers are outstanding features of this large French station.—*Power*, Aug. 15, 1922.

Generation, Control and Switching

Considerations Relating to the Design of Oil Circuit Breakers.—D. R. DAVIES. —The generation of explosive pressures is investigated and approximate data are given in this article, which is the third of a series. Constants, together with the explosive limits, are also determined for a given analysis of gas. The explosive pressure produced in a breaker is considered under three headings—(a) the pressure produced in the tank simultaneously with the sudden formation of a comparatively large volume of gas in a confined space, (b) the pressure in the chamber due to the gas from the arc rising, and (c) the pressure due to the ignition of the explosive mixture present above the oil level.—*Electrician*, July 28, 1922.

Switching of Direct and Alternating Currents in Inductive Circuits.—R. RÜDENBERG.—The author discusses in the first part of this paper, using mathematical and graphical methods, the opening of direct-current circuits with the aid of resistance switches and with arc switches. The time relations between current and voltage are derived, and the switching energy is calculated. All mathematical conclusions are illustrated with oscillograms from actual tests. The second part deals with alternating-current air and oil switches and covers investigations similar to those with direct current. The second installment particularly should prove of interest to designers of high-voltage switches. — *Bulletin of Association Suisse des Electriciens*, June and July, 1922.

Transmission, Substations and Distribution

Economical Transmission Line Construction.—ERNEST V. PANNELL.—The author shows the influence of different types of conductor material on the layout of a 130-kv. transmission line carrying 60,000 kw. over a distance of 150 miles. Copper, aluminum and aluminum-steel conductors are compared, each being strung on the most appropriate span length, and the estimated construction cost is tabulated in each case. The general conclusion is in favor of the use of aluminum-steel cables.—*Journal of the Institute of Electrical Engineers of Japan*, June, 1922.

Substation Layout of an Ohio Railway.—R. P. MEILY.—The installation of three automatic railway substations which operate in conjunction with two manually operated stations has recently been completed by the Columbus, Delaware & Marion Electric Company in Ohio. A transmission line parallel to the railway supplies both power and railway loads at 15,200 volts, three-phase, 60 cycles. The equipment of the different automatic substations is identical and consists of a 500-kw. synchronous converter and a three-panel automatic switchboard on which is mounted all the metering and switching equipment except the alternating-current oil circuit breaker. Some of the details of design and construction of these stations are given.—*Electric Railway Journal*, July 29, 1922.

Ionization Point of Cables. — M. HÖCHSTADTER.—The significance of the Clark and Shanklin ionization point with high-tension cables is investigated, and recent results of research, both European and American, are employed in discussing the nature and magnitude of the dielectric losses in the type of material used for impregnating paper cables. The effects of voltage-frequency temperature and physical state on the losses are considered, and it is demonstrated that well below the transition region dielectric losses consist of hysteresis losses, while above this region they are in the nature of current losses.—*Electrician*, Aug. 18, 1922.

Units, Measurements and Instruments

Electrostatic High-Voltage Indicator. —A. PALM.—In the middle of a long tube of insulating material is suspended a light metallic needle, which by means of a delicate helical spring points about 15 deg. off the main axis of the tube. At the upper end of the tube a metallic cap is attached and at the bottom another one. The former is connected to the line, the latter being grounded. If the line is alive, a potential drop will exist along the tube from full voltage to zero. As the length of the needle covers a considerable portion of this voltage gradient, its two ends will be electrostatically attracted toward the axis of the tube, with the result that if the line is alive the needle will align itself with the tube. To protect the delicate needle, the middle part of the tube with the needle is surrounded by a glass cylinder. For a voltage of, for example, 60,000 the tube is made 83 cm. long. The instrument is made for 6,000 volts to 80,000 volts. —*Elektrotechnische Zeitschrift*, July 17, 1922.

Low Power Factors: Their Prevention and Their Remedy.—The problem of low power factor is on many alternating-current systems becoming most acute. In England the growing importance of power factor is evident from the formulation of acts stipulating that any charges for energy may be based upon and vary with (a) the consumer's load factor, (b) the power factor of his load, (c) the total consumption of energy during any stated period, or (d) the hours at which the supply of energy is required. With regard to special metering arrangement or tariffs for checking bad power factor the various practices throughout England are stated.—*Electrical Times*, July 22, 1922.

Illumination

Scientific Methods and Architectural Requirements for the Lighting of Public Buildings.—E. H. Rayner, J. W. T. Walsh and H. Buckley.—The experiments described, arising out of a request for information on the lighting of public buildings in England, aimed at the provision of an average illumination of about 4 foot-candles. Data were obtained by a variety of different methods, semi-indirect lighting being generally employed. The particular problem under investigation was the lighting of very large rooms that were to be used by a large clerical staff. The results show that estimates of resultant illumination with a given consumption of energy can be foretold with sufficient accuracy, though some latitude in this respect must be allowed. Experiments on the natural lighting of picture galleries were also carried out for the purpose of avoiding the inconvenient reflections of light in the glass of pictures. The method suggested, while occasioning some loss of daylight, seems to effect a material improvement in this respect.—*Illuminating Engineer* (London), Vol. XV, No. 4.

Fundamentals of Projection.—L. C. Porter.—The purpose of this bulletin on projection is to set forth the elemental theory of various projection devices now in use. It covers the phenomena of reflection and refraction, the use of parabolic reflectors, spherical mirrors and other reflecting devices, and considers the spherical and chromatic aberration of lenses.—*Bulletin L. D. 138 of Edison Lamp Works, General Electric Company.*

Motors and Control

Performance Calculation of an Induction Motor.—S. Aoki.—For calculating the performance of an induction motor the author introduces a modifying coefficient (1 + exciting admittance × primary impedance). This method is shown in detail. A method is also shown for properly determining the calculating constants from the test data. The application of the modifying coefficient to the solution of other electrical engineering problems, such as voltage regulation and other characteristics of transformers, transmission lines, etc., is discussed.—*Journal of the Institute of Electrical Engineers of Japan*, July, 1922.

Location and Identification of Motors.—A serial motor number, a building location number and a building column number form the basis of an effective scheme of motor identification and location records employed in the extensive plant of the Crane Company, Chicago. The serial motor number is painted in white on the motor frame as soon as it is received from the plant. The building location numbers include two letters and a numeral so chosen that the complete number tells the location of the building on the property and the floor of the building under consideration. The building column numbers include one or more letters and a number. By thus combining the motor number and building location number a complete motor identification is made. For example, C2-F 124 indicates the location of motor No. 124 as being in building C2 on the first floor. The system employed is quite complete and helps maintain safety, reliability and continuity of service. — *Industrial Engineer*, July, 1922.

Heat Applications and Material Handling

Technology of the Carbon-Electrode Industry. — Charles L. Mantell. — Grinding, mixing, molding and extrusion are the important steps in production as carried out in modern electrode plants, and they receive critical attention in this article. Special reference is made to effects produced by various types of equipment. To obtain greatest density and highest tensile strength in the finished electrode, it is necessary for the pulverized material to be graded properly, that is, to be composed of a mixture of large and small particles in a definite proportion rather than of uniformly sized particles. The factors affecting the quality of the finished carbons are reviewed. Inspection and grading of electrodes is also covered.—*Chemical and Metallurgical Engineering*, Aug. 9, 1922.

The Electric Furnace for the Foundry.—C. W. Francis.—The 3-ton furnace is best adapted for foundry use in making the average run of jobbing steel castings. In cases where larger capacity is needed it is better to install two units of 3 tons each instead of one 6-ton unit. The question of the use of acid or basic operation is a vital one, and the choice of one or the other is dependent on a large number of factors. For alloy-steel castings it is almost imperative to use basic refractories, while the acid furnace is particularly adapted to light work in the foundry where clean and hot metal is essential.—*Iron Age*, July 27, 1922.

Electrophysics, Electrochemistry and Batteries

Prevention of Corrosion of Metals by Water in a Closed System.—Perry West.—Some of the latest developments in commercial apparatus for eliminating dissolved oxygen are described with the purpose of preventing corrosion. There are two methods by which this is done, and each of these is explained. The first is the deoxidizing method, in which hot water is allowed to pass into a deactivating tank, where it is brought into contact with thin sheets of specially prepared metal. The water exerts its corrosive activity on the comparatively cheap and easily replaced metal rather than on the piping system. The second is the deaërating process which removes the free dissolved gases from the water by heating, by vacuum or by a combination of both, while the water is sprayed over baffles in a deactivator. The latter process removes nitrogen, carbon dioxide, etc., as well as oxygen. The prevention of corrosion by the removal of free oxygen applies to brass as well as to iron and steel.—*Journal of Industrial and Engineering Chemistry*, July, 1922.

Traction

Choice of a System for Electric Traction on Main-Line Railways.—L. Thormann.—Basing his findings on ten years' European experience of single-phase traction, the author analyzes the continuous-power system to determine if it has done what was expected of it and in what points other systems might perhaps be advantageous. Technical rather than economical matters are chiefly considered, though in some cases the two are inseparable. The author claims that under no circumstances can the continuous-power system be pronounced superior to the single-phase system. From a purely technical standpoint both systems can satisfy fairly well the requirements of main-line traffic. On the other hand, with continuous current the cost will be considerably higher in consequence of the less favorable conditions of distribution.—*Engineering*, July 7, 14 and 21, 1922.

Swedish Railways Increase Use of Diesel Engines.—In sparsely populated districts and in countries where the railway mileage per inhabitant is high there must necessarily be a keen demand for light passenger equipment. This is being met in Sweden by the use of motor cars with Diesel engines and electric transmission to the driving wheels. The success of small cars of this type has led to the introduction of cars with capacities of 160 hp. and 250 hp.—*Electric Railway Journal*, Aug. 5, 1922.

Telegraphy, Telephony, Radio and Signals

Radio Stations in Ecuador.—The extreme height of the Andes, reaching nearly 20,000 ft. in the Chimborazo Mountain, makes it practically impossible to build and to maintain telegraph lines between the main cities of Ecuador. It is chiefly for this reason that three of the most important cities—Guayaquil, Quito and Esmeraldas—have each been equipped with a 5-kw. radio station for public use. French 1,000-cycle generators, driven by gasoline motors, with 300-ft. umbrella-type antenna, are in use at these posts. The government of Ecuador is also making experiments with radio-telephonic communication between these stations.—*Radioélectricité*, July, 1922.

A Critical Résumé of Radio Science.—A. Press.—This résumé treats of the influence of Lodge's work, Kelvin's formula in radio work, difficulties of the stationary-wave antenna theory, the law of effective radiation characteristic, and proper requirements for dummy antenna representation. — *Electrician*, July 14, 1922.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

World Metric Standardization: Urgent Issue

Compiled by Aubrey Drury in collaboration with other members of the World Metric Standardization Council. San Francisco: World Metric Standardization Council. 513 pages. $5.

The organization known as the World Metric Standardization Council is purely voluntary and the members are persons who urge the adoption of the metric system in the United States.

The book recently published by this council contains an enormous amount of data and arguments in favor of the use of the metric system.

Various chapters contain reports of many scientific, commercial and independent associations and individuals, which set forth cogent reasons for the universal adoption of the metric system. One very important chapter treats of the probable cost in and to the United States of change from the present system to the metric. To those who already use the metric measure this book will supply a world of proof as to why they should continue to use it. Those whose minds are open on the subject it will do much to convince that the metric system is superior to any other. With those whose opinions are fixed by previous study against the metric system it will have little avail. In any event, it is principally for the ones who have not taken a definite position in favor of or against the metric system.

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Elements of Radio Telephony

By William C. Ballard, Jr. New York: McGraw-Hill Book Company. 132 pages.

The title "Elements of Radio Telephony" does not convey a very definite idea of the method of presentation, but the preface of this book leads one to assume that the presentation is such as to be easily understood by the man of limited technical attainment. This proves to be the case.

The author has tried to stimulate the interest of this group in the physical phenomena involved and their applications by a brief, simplified discussion of what happens when messages are transmitted by radio. It is unfortunate that more space was not given to certain of the topics, even though this would have necessitated the omission of others.

The graphical comparison of wire and radio telephone systems—Chapter I—makes clear that there is no great difference in the way they function, except for the fact that one uses guided waves and the other free waves.

In Chapter II mention is made of the fact that spark and arc systems are not suitable for radio telephony. The possibility of using high-frequency alternators is pointed out but is not discussed to any extent. The book is largely devoted to an explanation of the use of vacuum tubes as oscillators, modulators, receivers and amplifiers.

The discussion of space charge and grid control, while brief, is very good.

The treatment of the subject, on the whole, is quite satisfactory.

H. M. Turner.

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Principles of Electrical Engineering

By W. H. Timbie and Vannevar Bush. New York: John Wiley & Sons. 498 pages, 244 illustrations.

This introductory text for students of college grade, which presumes a knowledge of physics and calculus, presents with technical exactness and at the same time in understandable form the basic principles of electrical engineering. The book is a radical departure from other introductory texts in three respects: (1) The electron theory is used to arrive at quantitative results, the authors arguing that the electron theory is essential to coordinate electrical phenomena; (2) electrolytic conduction, thermionic emission, conduction through gases, the dielectric circuit and certain high-frequency phenomena are treated in a detailed and rigorous manner; (3) electrical machines receive a minimum amount of space and no types are treated in detail. Five hundred problems are included which make a very valuable addition to the book. The chief criticism that suggests itself is that too great reliance is placed on mathematical developments of principles, visualizations and physical conceptions being minimized, so that the book is rather abstract for an introductory engineering text. The authors do not use the unit-pole theory in their treatment of the magnetic circuit at all, holding it to be too artificial. Another criticism that might be made is that there is little co-ordination between the chapters, which take the form of assembled units, each dealing with its own topic, rather than that of sections of a whole. The relative weight given the different principles is open to objection also; for example, the direct-current electric circuit and the growth and decay of transient currents are treated in detail, but no appreciable space is devoted to the alternating-current electric circuit of normal frequency containing the usual properties. Nevertheless the book, which is splendidly arranged and printed, is a welcome contribution to electrical literature.

L. W. W. Morrow.

Electricity: Science in the Service of Man

By Sidney G. Starling. New York: Longmans Green. 245 pages, illustrated.

The editor of this year book anone of the best, to co-ordinate and interpret the developments in electricity and magnetism and set the story before the public in an instructive and acceptable manner. The whole may be characterized as done from the standpoint of the physicist, and in dealing with the later advances it is limited by the difficulty that so much of all which dates from Maxwell, Kelvin, Kohlrausch and Rowland down to Steinmetz is quite mathematical. But Dr. Starling has a fine gift of comprehensive explanation and shapes his story admirably in demonstrating "that reaction between pure and applied science which is vital to the life of both." Each chapter of the book is complete in itself, so that while there is first of all an excellent historical summary, the individual topics, under their respective heads, deal with the evolution of the subject from the beginning of its separate identity as a novel field of investigation and engineering. All that is best as well as latest is here summed up in a way to meet approval and serve usefully, even with students of a more exacting class than the general reader.

T. C. Martin.

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Mexican Year Book, 1920-1921

By Robert Glass Cleland, Ph.D. Los Angeles: Mexican Year Book Publishing Company. 524 pages.

The editor of this year book announces that his purpose is to meet the demand for unbiased and systematized information concerning Mexico, prepared to suit American needs and having no official Mexican patronage. The subject is considered under seven heads: History and Geography; Politics and Government; Travel and Transportation; Commerce and Manufacturing; Natural Resources, Public Finances, Currency and Banking; Labor Conditions and Educational Systems.

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Books Received

The Properties of Electrically Conducting Systems. By Charles A. Kraus. New York: The Chemical Catalog Company, Inc. 408 pages, illustrated.

Publicity Methods for Engineers. The proceedings of the first national conference on public information. Chicago: American Association of Engineers. 186 pages, illustrated.

Standard Lighting. Information of practical value to the purchaser and installer of lighting equipment. New York: H. C. Cushing, Jr. 208 pages, illustrated.

Corso Teorico-Pratico Elettrotecnia. Volume II. By Luigi Lombardi. Milan: Dottor Francesco Vallardi. 458 pages, illustrated.

Testing of Transformers and Alternating-Current Machines. By Charles F. Smith. London: Sir Isaac Pitman & Sons, Ltd. 88 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

Soft-Coal Crisis Past

Transportation and Not Mining Labor Is Now the Main Factor in Fuel Situation

With the resumption of work in the soft-coal mines of the nation production has shot upward almost as suddenly as it plunged downward five months ago. Between 9,100,000 and 9,300,000 tons are reported as having been mined in the week ended Sept. 2. The main factor in insuring an adequate supply of fuel to utilities and industries is now one of transportation rather than mining labor. The first response of the railroads for coal cars was adequate, but whether they can maintain the present rate of coal movement when the surplus of cars caused by the strike has been exhausted remains to be seen.

Many of the states are taking action in the direction of apportioning the supply of fuel to their citizens and preventing profiteering. Governor Miller of New York has appointed William H. Woodin, president of the American Car & Foundry Company, as fuel administrator. He will have sweeping powers under the emergency legislation passed by the State Legislature at a special session. The Ohio Legislature is to meet in special session on Monday to take similar action, and the executives of other Eastern and Middle Western states are taking steps to control the situation in their communities. The State Fuel Administrator of Massachusetts has informed Fuel Distributor Spencer that his state will require no further supplies of emergency coal. Urgent requests from some of the Southeastern States are reported.

Senate Still Deliberates

The United States Senate is still debating the bill to create the national office of Coal Distributor and to authorize the Interstate Commerce Commission to refuse cars to coal profiteers. A bill introduced into the Senate by Senator Reed of Missouri would compel mine operators and brokers engaged in interstate commerce to report to the Secretary of Commerce every fifteen days the price at which they are selling coal.

Secretary Hoover, asserting that the chief sufferers from the strike were powerless to end it and had no voice in its settlement, declared his conviction that a plan must be found "under which the public may have a rightful voice in aid of justice and in its own protection."

The agreement in the anthracite strike proposed by the Pennsylvania Senators has been accepted by the operators and is almost certain to be accepted by the miners.

The railroad strike remains unsettled, its sensational feature being the sweeping temporary injunction procured by Attorney-General Daugherty against union propaganda. This, it is thought, is likely to be modified when application to make it permanent is heard.

Planning for 70,000-Ton Ships with Electric Drive

Chairman Lasker of the United States Shipping Board has made a statement to the press in which he asserts that an American company with a capital of $30,000,000 is being organized to build in this country monster ships to engage in the transatlantic passenger business. The plans, he says, call for ships 1,000 ft. long and surpassing in tonnage the largest ship afloat, the White Star liner Majestic, by more than 13,000 gross tons. They will have accommodations for 3,000 passengers. According to Mr. Lasker's statement, these vessels will be propelled by electric motors, with power supplied either by turbines or Diesel engines.

Indiana & Michigan Electric Company Sold

Controlling interest in the Indiana & Michigan Electric Company of South Bend, Ind., has been sold by Homer C. Henry, K. Chapin and Lowell Chapin of Chicago to the American Gas & Electric Company, which operates in six states. The sale figure is reported to be close to $10,000,000. The three thousand small stockholders in the company will be fully protected and their interests even strengthened, according to an announcement from F. A. Bryan, president of the Indiana & Michigan Electric Company. The company will retain the same officers with two additional vice-presidents—Thomas English of Muncie, Ind., vice-president and general manager of the Indiana General Service Company, and George Tidd, vice-president of the American Gas & Electric Company.

Recently the Indiana & Michigan acquired the Benton Harbor & St. Joe Railroad & Light Company, and it now operates in South Bend, Mishawaka, Elkhart and Ligonier, Ind.; Buchanan, Berrien Springs, St. Joseph, Benton Harbor, Niles, Three Oaks and New Buffalo, Mich., and smaller communities.

For Wider Retail Channels

The California Co-operative Campaign Will Recognize Distributors Other Than Contractor-Dealers

Further electrification of the home and the broadening of the channels of distribution were outlined as the tentative program to be carried out by the California Electrical Co-operative Campaign at the meeting of the advisory council of that organization held in San Francisco on Aug. 25. Particular activity in pushing the convenience outlet and emphasis upon the adequate wiring of the home for ranges and heaters were suggested as the best method of increasing the scope of the merchandising field and of providing the proper outlet for the surplus power which will be made available through the extensive development now under way in the state.

In presenting the solution of the contractor-dealer problem as the major work of the campaign for the year the chairman, Earl Fisher, offered the following principles for discussion and adoption by the advisory council: "No small division of the industry can expect to control or direct in any manner whatsoever the channels of distribution nor to bear the burden of educating the public or the men within the industry. Those benefiting from the educational work now being carried on and to be carried on must pay a just pro-rata share of the expense; in other words, the campaign should build up a greater source of revenue by enlarging its contributors, with the distinct understanding that those contributing meet the campaign's requirements as to policies and ethics. This will permit both the establishment of a broad constructive program which will recognize the legitimate distributors of electrical appliances and the financing of an educational program among all electrical contractors, which will be financed to a very great extent by retail distributors of merchandise not now bearing their portion of the expense."

Favored by Contractor-Dealers

This principle of recognizing a broader channel of distribution for electrical appliances was acted upon by the California State Association of Electrical Contractors and Dealers at their Santa Cruz convention when they adopted a resolution calling the problem to the attention of the co-operative-campaign members and urging that body to take action looking toward a solution of present difficulties. It was the consensus of opinion at that meeting that the trend of the times in the widening of merchandising channels could not be disregarded and that the new conditions should be frankly recognized by the electrical dealers.

Final action on the program thus outlined, which opens the way for the welcoming of retail establishments other than those purely electrical into the co-operative campaign upon their acceptance of its principles, has been referred to the constituent bodies represented upon the advisory council.

New Hydro-Electric Project for Southern California

Following the signing of a contract to supply the Southern Sierras Power Company of Riverside with 30,000,000 kw.-hr. annually for distribution in the Imperial Valley, the San Gorgonio Power Company has announced that work will begin in the near future on a hydro-electric project to cost $2,500,000, on the south slope of Mount San Gorgonio, near Riverside. The project consists of a series of three plants to be built on property purchased from the Consolidated Reservoir & Power Company two years ago. The contract which has been signed extends over a period of thirty years.

The San Gorgonio Power Company was organized a year ago with a capital stock of $1,000,000. It is headed by the following group of power men: R. R. Scarborough, president; W. T. McAllister, M. S. Hazen, A. W. Hazen and J. A. Lamour, directors.

Seattle and Tacoma Refuse Power Company's Offer

The offer of the Puget Sound Power & Light Company to furnish the cities of Tacoma and Seattle with an interconnected service for their lighting plants for a consideration to be agreed upon has been refused by both cities, and interchange of energy will be accomplished over a line owned and operated jointly by the two municipalities. The offer by the power company was made after both cities had awarded contracts for the work and purchased materials and supplies. It was intended as a substitute for the proposed construction.

President A. W. Leonard informed the city councilmen that his company now owned and operated four lines between the two cities capable of accommodating any interchange of power desired. Mr. Leonard offered the city of Seattle the use of these lines at a saving of 25 per cent less than the cost of interest and maintenance charges on its proposed investment of $75,000, the same offer being made to Tacoma. J. D. Ross, superintendent of the Seattle light department, told the Council that the proposed line was a necessity and urged that it be not abandoned. Under the interconnection agreement of the two cities Seattle will be able to sell its surplus hydro-electric power to Tacoma in the winter months and will be able to purchase power from Tacoma during the summer.

N.E.L.A. Divisions and Other Bodies Meet

Good Fellowship of Telephone Companies Marks the Bedford Springs Convention of Pennsylvania Association—New England Men at New London—Electrical Leagues Confer

THE fifteenth annual convention of the Pennsylvania Electric Association (Eastern Geographic Division of the National Electric Light Association) was held at Bedford Springs, Pa., on Thursday, Friday and Saturday of this week. A feature of the convention was the spirit of co-operation and good fellowship that was displayed by the telephone companies of Pennsylvania, which not only provided the necessary speakers to make a symposium on inductive interference most interesting and instructive but in addition had present every one of the fifteen division superintendents.

Following the custom of geographic sections, the work of the convention was split up into four divisions, technical, commercial, accounting and public relations. The association now has more than 2,000 individual members in addition to almost every privately owned electric light and power company in the state. Forty-two committees are actively at work on definite programs for association work.

PRESIDENT CANTLIN'S ADDRESS

In his presidential address A. H. S. Cantlin of Allentown called attention to the change that has taken place in the electric light and power business since it has been publicly regulated, and suggested that possibly other industries, such, for instance, as the coal industry, would find it advantageous to be under some sort of public regulation also. As indicative of the trust reposed in regulated business, President Cantlin told of the appointment by the State Fuel Commission of a public utility advisory committee composed of four members of each of the four associations, through which committee all matters pertaining to coal priorities are handled. To the members at large President Cantlin delivered this recommendation: "Make your rates and service and treatment of the public such that not only shall we ourselves be satisfied but the public also. Don't wait to be forced by the regulating body."

PRIZE PAPERS PRESENTED

During the week three prize papers were read as follows: "More Business Through Better Lighting," by G. Bertram Regar of the Philadelphia Electric Company; "Ways and Means of Overcoming Inductive Interference," by J. C. Damon of the West Penn Power Company, and "Inspection of Lines and Equipment as a Means of Preventing Breakdowns," by L. W. Heller of the Duquesne Light Company. The public policy meeting which is always a feature of the conventions of the Pennsylvania Electric Association was held on Thursday night. The speakers included Walter H. Johnson of Philadelphia, W. D. B. Ainey, chairman of the Pennsylvania Public Service Commission, and M. H. Aylesworth, executive manager of the National Electric Light Association.

New England Men Convene

The annual convention of the New England Geographical Division of the National Electric Light Association opened at the Hotel Griswold, New London, Conn., on Wednesday last, under the presidency of Charles L. Edgar of Boston. On Thursday the technical committees of the association held a round-table discussion of their year's work. A report of the convention will appear in next week's *Electrical World.*

Electrical Leagues Emphasize Local Co-operation

It is the judgment of the first national gathering of electrical leagues that co-operative activity by the electrical men of an individual city offers the greatest opportunity for immediate business development and that upon the central-station company in each town rests the responsibility of leadership.

Representatives of electrical leagues operating in cities from coast to coast gathered on Tuesday of this week at Association Island, Henderson Harbor, N. Y., at the invitation of the Society for Electrical Development. Boston, New York, Albany, Philadelphia, Syracuse, Rochester, Buffalo, Cleveland, Pittsburgh, Cincinnati, Toledo, Warren (Ohio), Dayton, Chicago, St. Louis, Denver, Salt Lake City, Boise, San Francisco and Los Angeles all sent one or more delegates from local electric leagues, clubs or development associations.

There were also men from fifteen other cities interested in organization co-operative activities, making an attendance in all of 125, including members of the Joint Committee for Business Development, manufacturers, jobbers, the electrical press and others eager to assist in the further organization of more and better local co-operation.

Camp Co-operation was formally opened with the traditional island ceremony under the big elm, taking the names of the original conference when the society was organized in 1913. W. E. Robertson of Buffalo related the history of the island as an influence for co-operation in the electrical industries. F. M. Feiker of the McGraw-Hill Publishing Company, E. W. Lloyd, E. W. Rockafellow and W. L. Goodwin discussed present conditions in the electrical business and the place of the local leagues in developing further progress. Then followed a session in which men from the leagues sketched the experiences of the local organizations and the plans of the movement for business development which the joint committee and the society are leading. It was the purpose of the concluding sessions to pick out of these plans and experiences the fundamental principles involved and crystallize from them definite guidance for league activities, making plain the vital function which they must fill in the further commercial expansion of the industry.

Central Division Jobbers Meet at Chicago

Subjects ranging from house organs and trade associations to the effect of radio on the industry at the expiration of the Marsh patents were discussed at a two-day session of the Central Division of the Electrical Supply Jobbers' Association held in Chicago on Sept. 6 and 7. V. G. Eastman, sales manager of the Erner & Hopkins Company, spoke on the value of house organs for building up good will. He felt that a house organ issued by any company would return a value in increasing sales proportional to the effort put into it. He considered that the primary reason for failure where it occurred was the absence of a supervised mailing list and of control by a constructive editorial policy.

George A. Hughes, speaking on the effect on the industry when the Marsh radio patents expire in February, declared that he felt nothing was going to happen. Undoubtedly the number of manufacturers would increase, but since the present market was purely a competitive one, Mr. Hughes thought that this increase in manufacturers must be dealt with along economical lines. Manufacturers of "quality" products, he felt, need have no qualms as to what the future may have in store.

Alex Dow Addresses National Safety Council

"The aim of safety work is the reduction of preventable accidents and illness that results in injury to the human body in order that something may be added to the sum total of human happiness," said Alex Dow, president of the Detroit Edison Company, in beginning his speech at the joint luncheon of the Public Utility and Electric Railway Sections of the National Safety Council at Detroit last week. He asserted that there was no room for discussion of aims but that there was a wide field for the discussion of methods, warning his hearers that the fixation of methods in the form of law or codes may hinder rather than advance safety work.

Mr. Dow expressed his lack of patience with the man who balances life and limb against expense accounts and declared that industry must carry its own accident bill. In any movement there are errors of judgment, and the benefit of the doubt must be given in favor of human life and welfare. As a remedy for the prevalence of carelessness in industrial establishments he advocated a heavy charge to cover the cost of compensation to those injured in accidents and a minimum of state interference in the form of codes and inspection. The hope in the future for safety work, he declared, lies with the children.

Arthur W. Brady of the Indiana Union Traction Company declared that the street railways of the country come into more intimate contact with the public and therefore are more interested in safety work than any other industry. As one of the hopeful elements in the situation he pointed to the 20 per cent decrease in the number of fatal accidents in the street-railway field in the years 1920 and 1921.

In the separate session of the Railway and Utility Sections reports showed that the electric railway membership of the National Safety Council had increased during the year from 109 to 113 and that of the Public Utility Section from 120 to 142. The committees in making their reports called attention to the small portion of the total number of utility and railway companies represented in the National Safety Council.

Two Edison Pioneers Revisit Pearl Street

On Monday of this week, at exactly 3 p.m., just forty years to the hour from the time when John W. Lieb pulled the switch which started Edison lighting service, Francis Jehl and Frank A. Wardlaw, two Edison pioneers, celebrated the birthday of the central-station industry by making a pilgrimage to 255 and 257 Pearl Street and hanging beneath the bronze tablet which marks that historic spot a wreath of laurel.

Earlier in the day Mr. Wardlaw and Mr. Jehl had sent to Mr. Edison the following telegram:

"Two loyal Edison pioneers still on the job will pilgrimage to the old Pearl Street station at 3 o'clock to-day, its fortieth birthday, to place a laurel wreath on the building consecrated by your marvelous genius. Congratulations and deep affection to you."

"How different it was then from what it is to-day!" said Mr. Wardlaw to a New York *Herald* reporter who witnessed the simple ceremony. "We were all half crazy with excitement as the hour for throwing the switch approached. Out in the street there were a lot of people, many of whom had come down here expecting to have a good laugh when the thing proved a fizzle. Mr. Edison had us all set our watches alike in order that none of us would miss being on hand when the current went on. We all left our jobs—few of us had any specialized work in those days; you might be working around the dynamos one day and digging trenches the next. Some of us remained at the station, but a lot of us went down to the offices of J. P. Morgan at the corner of Broad and Wall Streets, where there were several lamps. And then the light came on and there was more excitement than ever."

Timber on Dammed Rivers

Federal Engineers Insist on Provisions for Floating Timber That Hamper Water-Power Financing

THE application of the Clarion River Power Company for a license for one of its three prospective developments on the Clarion River has precipitated renewed discussion of just how far the government should go in protecting the interests of a few to the possible detriment of the many.

The Clarion River taps a region in which there is some low-grade timber. Most of this is second growth, and it is probable that the time will come when the river could be used to advantage to float that timber to market. During the past fifteen years there has been no navigation on the river. The Corps of Engineers' district engineer has recommended that a provision be inserted in the license requiring the power company to construct a sluiceway to permit the passing of forest products over the dam whenever the Secretary of War may decide that the interests of navigation demand it. The district engineer indicates that the sluiceway should be 50 ft. wide and have a slope of one on ten. He puts the maximum cost of such sluiceway or other facility for handling floating forest products at $150,000, which would add a capital cost of $30 per horsepower on the average power developed by the dam. It is contended that this is too heavy a burden to place on the power user and that the prospective commerce in no way justifies so heavy an expenditure.

A Question Constantly Met

This question is met in almost every case where the commission is called upon to issue a license. The officials of the Corps of Engineers and of the Forest Service look at the situation from an angle entirely different from that of those who must obtain the capital to develop the power. In the opinion of those interested in water-power development, the importance attached to potential commerce on some streams is so exaggerated as to be ridiculous.

In the same way the Forest Service, where it has jurisdiction, wants all licenses to provide for the construction of logways and the use of reservoirs for the storage and transportation of logs, if the Secretary of Agriculture should deem it necessary. Such provisions are sometimes very burdensome. In one case in the Sierra Mountains the stream has such a steep slope and such a rough channel as to preclude its use for the transportation of logs. The applicant proposed to store almost the entire run-off and to divert most of the water through long tunnels to plants with heads of 2,000 ft. or more. The loss of a cubic foot of water for sluicing logs would mean the loss of an unusually large amount of power. To insist on providing for log transportation in this particular case seems entirely justifiable, in the opinion of those who wish to develop power sites.

Weeks Complains of Lack of Power Board Personnel

The handicap imposed on the Federal Power Commission by its being prevented from employing its own personnel was emphasized very recently in a letter sent by the Secretary of War to the Federated American Engineering Societies in support of the efforts of that body to obtain the necessary legislation to remedy the situation. An extract from Secretary Weeks' letter follows:

"The commission has had placed upon it the greatest task with respect to water powers the government has ever had at a time when the utilization of water power is more necessary than ever before. The act made a definite pronouncement of a national policy in water-power development. It created a commission to carry out that policy, but it gave it no means to do so. The commission has been obliged to depend exclusively upon such assignments from the several departments as these departments were willing to spare. The departments have had their own forces out to a point where they are unable to perform either in Washington or in the field the work required of the commission under the act; and even if they had the numbers and the funds to pay them they do not have employees with the training or experience required for the performance of certain of the duties of the commission. As a necessary consequence the commission has been forced to omit altogether action upon important matters which the act requires of it. Furthermore, with no personnel of its own and with no control over the personnel of the departments engaged upon its work, except for the small number directly assigned to its Washington office, it is not possible to organize the work on an effective basis or to make the most economical use of the personnel actually engaged on the commission's work or of the funds actually expended for such purposes."

In its first annual report the commission said:

"What is seriously needed in the interest of adequate administration of the act is a small organization of trained and experienced men capable of meeting intelligently the important and perplexing engineering and economic problems which are constantly arising and upon the correct solution of which will depend the value of the legislation and, in no small degree, the future of the electric power industry."

Nothing has happened since to alter the situation.

New Orleans Ordinances Are Adopted

The three enabling ordinances introduced two or three weeks ago by Commissioner Maloney of the Department of Public Utilities, New Orleans, looking to the reorganization of the New Orleans Railway & Light Company were adopted on Sept. 3 by the Commission Council of New Orleans. Mayor McShane cast the only dissenting vote. The ordinances were adopted as originally introduced, carrying the option clause under which the city is privileged to acquire the public utilities by purchase at any time, together with other points of agreement formulated between the city and the company.

Hydro-Electric Enterprise in Alabama

Permission for a hydro-electric power development of great magnitude in Alabama is being sought from the Federal Power Commission by the Alabama Power Company. Plans call for the construction of four dams on the Tallapoosa River to provide a total potential capacity of approximately 140,000 hp., or more than the primary power eventually to be developed at Muscle Shoals.

According to a statement by Thomas W. Martin, president of the company, the power from the Mitchell Dam now under construction on the Coosa River will be entirely absorbed a year or two after completion, and for that reason development will begin on the Tallapoosa River.

The four dams on the Tallapoosa, with their total rated output of 140,000 hp., will give 20,000 hp. more than the Mitchell Dam, which is to give 120,000 hp., and 30,000 hp. more than the dam at Lock 12, which gives 110,000 hp. With the completion of the four dams on the Tallapoosa the company's installed power in Alabama will be 435,000 hp. This includes 50,000 steam horsepower at the Gorgas plant and 15,000 steam power at Gadsden.

The Tallapoosa River is a non-navigable stream, but application was made to the federal authorities because of the river's relation to navigation on the Alabama River. The Alabama Power Company is already regularly serving other states than Alabama in times of necessity.

Federal Departmental Reorganization Not Abandoned

Word comes from Washington that there has not been the slightest surrender on the part of the administration of its intention to bring about practical reorganization of the executive departments of the federal government. A tentative report was laid before the President several months ago. Were the report to be sent to Congress without the indorsement of certain of the department heads, it is recognized that the possibility of obtaining the necessary legislation would be lessened. Moreover, the legislative situation since the report was submitted to the President has been such as to preclude action on reorganization. In addition, if the report were made public in its tentative form and before unanimous indorsement by department heads had been obtained, there is a feeling that it would invoke non-constructive criticism and arouse agitation which delay may avoid.

Sweden to Erect Great Radio Station Near Gothenburg

A contract for a new wireless station in Sweden, which will insure direct communication between that country and the United States, has been awarded by the Swedish government to the Radio Corporation of America, according to a recent announcement from the headquarters of the Radio Corporation in New York. The entire plant will cost more than $2,000,000 and will be one of tremendous power. The American firm won the contract in competition with French, British and German concerns.

Sweden now has one station, that at Karlborg, but it has been found unreliable for transoceanic work. The new station, which will be two and one-half times as powerful as the old, will be situated in the vicinity of Gothenburg, on the west coast of Sweden, and the contract with the Radio Corporation of America calls for the installation of two 200-kw. Alexanderson alternator equipments, which, when associated with the multiple-tuned antenna, will each deliver to the antenna a current of 600 amp. The receiving equipment will consist of two complete and independent modern sets, composed of tuners and the necessary amplifying apparatus, and will be used in conjunction with receiving aerials devised for the reduction of static disturbances.

British Engineers Form Joint Council for World Peace

Following the receipt of a message from M. Mowat of London, secretary of the British Institution of Mechanical Engineers, Charles F. Rand. chairman of the Engineering Foundation, announced a few days ago that the leading engineering societies of England had formed the Engineering Joint Council, which will work with the engineers of the United States and of Canada and other British possessions to bring about concerted action for world peace and the advancement of engineering ideals "for the good of mankind."

Coincident with Mr. Rand's statement, Dean Mortimer E. Cooley of the University of Michigan announced that the Federated American Engineering Societies, of which he is president, had appointed a committee on affiliation with engineering societies outside of the United States. The chairman is Gardner S. Williams of Ann Arbor.

The question of the affiliation of the Engineering Institute of Canada and the Engineering Society of Czechoslovakia was, Dean Cooley said, to be taken up at a meeting of the executive board of the American Engineering Council to be held in Boston on Friday and Saturday.

Numerous other international matters were to be considered at the Boston meeting, including the International Congress at Rio de Janeiro, the Pan-Pacific Conference and a projected trip of American engineers to China.

N. E. L. A. Southeastern Division Selects Speakers

Speakers who will address the convention of the Southeastern Division of the National Electric Light Association, which will be held in Atlanta Sept. 12 to 15, inclusive, have been announced by Charles A. Collier, secretary of the association. They include: Frank W. Smith, president N.E.L.A. M. H. Aylesworth, executive secretary N.E.L.A.; H. A. Lane, chairman Joint Committee of Business Development; P. S. Arkwright, president Georgia Railway & Power Company; T. W. Martin, president Alabama Power Company; W. J. Meyers of the United Electric Light & Power Company; C. Murphey Candler, chairman Public Service Commission of Georgia; H. M. Addinsell of Harris, Forbes & Company, New York; C. G. Adsit, executive engineer Georgia Railway & Power Company; C. W. Stone, manager lighting department, General Electric Company, and F. G. Vaughn of the meter department, General Electric Company.

Among the features of the meeting will be a trip to the Tallulah Falls power development projects of the Georgia company.

California's Attitude on the Boulder Dam Project

An informal statement of the attitude of southern California upon the regulation and control of the proposed forty-five-million-dollar Boulder Canyon Dam was made recently at a conference held in San Diego by the southern branch of the California League of Municipalities. The policy indorsed by the conference embraced the following points:

1. Provision should be made for organization of a permanent commission for regulation and control of the project, giving the commission ample authority and means to function.

2. "Beneficial use" should be the measure and limit of rights to be acquired (that is, appropriation of water could be made only where it would economically serve such purposes as agriculture, river control, domestic uses, mining, manufacturing, etc.).

3. Priority of appropriation shall govern, regardless of state lines, except as modified by the provisions of equitable division. In times of possible scarcity, pending the completion of conservation or regulation works, the supply should be prorated while awaiting appropriations.

4. The commission in control should maintain an office centrally located in the basin to be served by the project.

In regard to possible demands from other states for water or power from the project it was agreed that southern California representatives should "go as far as possible toward satisfying those demands without jeopardizing the interests of California."

Britons to Have Big Electrical Exhibition in 1924

The British Electrical and Allied Manufacturers' Association is making plans for the "electrical and allied engineering section" at the huge British Empire Exhibition to be held in 1924. The space at the disposal of this section is about 220,000 sq.ft., which is rented at the rate of £1 per sq.ft., with a discount of 12½ per cent on large spaces. Collective exhibits of domestic appliances are contemplated, and possibly of heavy equipment as well, in view of the expense to smaller manufacturers of maintaining their exhibits for more than six months, this being the period of the show.

The world power conference already referred to in the *Electrical World* (April 22, page 795, and July 1, page 37) will be held in connection with this exhibition under the auspices of the British Electrical and Allied Manufacturers' Association and other bodies.

Twin State Company Starts to Build Hydro Plant

A new hydro-electric generating station to deliver about 1,400,000 kw.-hr. annually from the Great Works River at South Berwick, Me., has been begun for the Berwick & Salmon Falls Electric Company, a subsidiary of the Twin State Gas & Electric Company of Dover, N. H. The project includes a dam 28 ft. high and 185 ft. long, with a highway bridge directly above and a reinforced-concrete station to house two generating units of 425-kw. and 200-kw. rating. A pondage of about 40 acres will be created above the dam, and the generating station will be built under one end of the highway bridge. The plant will be of the automatic type, and it is estimated that it will save the Twin State company about 33⅓ per cent of the energy which it is obliged to purchase from outside sources. R. M. McGillivray is manager of the Dover division of the company.

All War Loans to Utilities Repaid Save Two

A statement of the present status of all loans made to public utility corporations under the war finance act has been prepared by the War Finance Corporation at the request of the *Electrical World*. It is as follows:

Appalachian Power Company, New York	$1,000,000	Paid in full
Aurora, Elgin & Chicago Railroad Company, Cleveland	219,000	....
Brooklyn (N. Y.) Rapid Transit Company	16,566,900	Paid $22,200
Central Power & Light Company, St. Louis	60,000	Paid in full
Charleston (S. C.) Consolidated Railway & Lighting Company	350,000	Paid $13,006
Columbus (Ohio) Railway, Power & Light Company	642,000	Paid in full
Commonwealth Power, Railway & Light Company, Portland, Me.	4,800,000	Paid in full
Interborough Rapid Transit Company, New York	11,937,500	Paid in full
New Orleans Railway & Light Company	1,000,000	Paid in full
United Railways Company of St. Louis	3,222,000	Paid in full

Utility Commissioners Postpone Convention

The National Association of Railway and Utility Commissioners announces that its annual convention, originally set for Sept. 26, has been postponed because of the coal strike. The meeting will be held on Nov. 14 in Detroit. James B. Walker, secretary, explains that so many commissioners have been appointed fuel administrators that it has been decided their duties during September will not permit of their attending.

Two "round-table" conferences, on rural extensions of electric light and power service and state and federal regulation in connection with depreciation, are scheduled as part of the association's program.

Brief News Notes

Niagara Falls Company Gives Use of Land to City.—Free perpetual use of 58 acres of land belonging to the Niagara Falls Power Company has been offered to the City of Buffalo for park purposes provided that the city is able to acquire the rest of the land needed to carry out the plan favored by the promoters of the new park.

Customer Ownership in Central Illinois Company.—The growth of the customer-ownership movement is reflected in a striking way by the record of the Central Illinois Public Service Company. During the last two years the stockholders in this company have increased from 249 to 2,947, or more than 1,000 per cent.

Growth of Electric Service in Birmingham, England.—The great increase in the use of electricity in Birmingham, England, due to its ever-increasing employment in industrial processes, is strikingly shown by the fact, recently published, that whereas in 1900 only 3,000,000 kw.-hr. were sold, at present the total consumption is 111,000,000 kw.-hr. a year.

Lighting Mexico's Caves.—Plans for a hydro-electric plant in the State of Morelos for the purpose of lighting the famous caves of Cacahumilpa have been submitted to the government by Richard H. Ludlow, representing an American company. The hydro-electric plant will also supply the towns and industries of that region with light and power, according to its promoters.

Colorado River Commission Meeting Again Postponed.—The scheduled meeting of the Colorado River Commission at Santa Fé, N. M., which has been twice postponed, will not be held until after the November elections, owing to the necessity of Secretary of Commerce Hoover remaining in Washington until the fuel and railroad crisis is past. Nov. 15 has been tentatively selected as the date.

France Loses Money by State Ownership of Utilities.—Nearly 300 members of the French Chamber of Deputies are reported to have signed a bill in favor of transferring the telephone system of the nation to private hands. On three public services owned by the state—the postal, telegraph and telephone systems—there is a loss of about six hundred million francs annually, according to the *Wall Street Journal.*

Extensions in West Texas.—When the extensions of the power transmission lines which are now being constructed by the West Texas Utilities Company at Abilene are finished its system will be in position to supply electric power and light to towns and industries within a radius of more than 100 miles and the lines will have a total length of more than 250 miles. Work is now in progress extending the power lines to Haskell, Tuscola and Albany. Extensions to Sylvester and Cisco are finished.

Earnings of Alabama Power Company.—Gross and net earnings of the Alabama Power Company for the past month and year show improvement over the preceding month and year. July gross was $438,000, an increase over July, 1921, of $82,000. July net after taxes was $232,000, an increase of $51,000 over last July. Twelve months gross was $4,913,000, an increase of $432,000 over the preceding year, and year's net after taxes was $2,256,000, an increase of $305,000.

Special Radio Set for Submarines.—It is announced that the Navy Department has ordered fifty-nine sets of a special radio-telegraphic transmitting and receiving apparatus developed by the department's engineers for use on submarines. These sets are said to have a radius of 200 or 300 miles in ordinary daytime communication, and as they are to be constructed by remodeling surplus apparatus and making use of parts of the present equipment, nearly $300,000 will be saved as compared with entirely new sets.

Irrigation District Seeks to Purchase Power Lines.—The Turlock irrigation district has filed a petition with the California Railroad Commission asking the latter to fix just compensation for the electric distribution systems of the Pacific Gas & Electric Company and the Sierra & San Francisco Power Company in the district. The Turlock district is engaged in developing its own electric power in conjunction with an extensive irrigation project, and this application follows its recent decision not to wholesale power but to handle its own distribution at retail.

Campaign for St. Lawrence Development Opens in New York State.—A campaign to convert the people of New York State and Governor Miller to a belief in the St. Lawrence River as a source of power supply has been begun by the Northern New York Development League, which sees in the plan a prevention of fuel shortages and freight congestion. A statement issued by the league puts the cost of the proposed improvement at $252,000,000 for a waterway of 25 ft. depth and about $270,000,000 for one of 30 ft. depth. This estimate, it says, includes the total expense together with the building of power houses at the Long Sault dam, which would be equipped to deliver 1,500,000 hp.

Westinghouse War Memorial Scholarship Winners.—M. W. Meade, Jr., H. C. Klingenschmitt and Frank J. Schaer, all of Pittsburgh, and William A. Lewis, Jr., of Los Angeles, were the winners in the recent competitive examinations for the Westinghouse war memorial scholarships. These scholarships were established in 1919 to perpetuate the memory of employees of the Westinghouse Electric & Manufacturing Company and its subsidiary companies who lost their lives in the world war. Each scholarship carries with it the annual payment of $500 for a period not to exceed four years, the payment to be applied toward an engineering education in any technical school or college selected by the successful candidates and approved by the scholarship committee.

Fire Chief Corrects Reporter.—Two issues of the Glens Falls (N. Y.) *Times and Messenger* of recent date point the moral and adorn the tale of the reporter's propensity to blame fires on the electric wires. A fire occurred in a local hotel just before a thunderstorm, and the newspaper man promptly announced that "lightning came in on the light wires." Citizens read the report and some of them became apprehensive for the safety of their own houses; but their anxiety, it may be hoped, was dispelled when a central-station man called up the fire chief and the latter caused a correction to be made. Electricity, it appeared, was to blame only in the very remote degree involved by some one having dropped a lighted match into a box containing bulbs packed in excelsior while searching for a new lamp to replace one burned out!

Hydro-Electric Development in Quebec.—Announcement is made that the provincial government of Quebec is soon to begin to build a dam on Lake Kenogami at a cost of $2,000,000 for the purpose of creating a reservoir. The project has already received legislative autorization. The new dam will supply 70,000 hp. by raising the water level 15 ft. In recent years, E. Haldeman Dennison, United States Consul at Quebec, reports, the government of the province has given ever-increasing attention to the development of hydro-electric energy. Quebec is obliged to import every pound of coal it uses, and the continued rise in the price of this commodity has encouraged the provincial government to adopt a progressive policy concerning water storage. Two important storage dams have already been built. The larger of these made possible the Gouin reservoir, on the St. Maurice River, one of the largest reservoirs in the world, its capacity, when full, being 160,000,000,000 cu.ft. and the water area 300 square miles.

Associations and Societies

Arkansas Utilities Association. — A convention of this association will be held at the Eastman Hotel, Hot Springs National Park, Ark., on Oct. 9 and 10.

Society of Industrial Engineers.—The Society of Industrial Engineers will hold a three-day national convention in New York beginning Oct. 18. "Economics of Industry" will be the general topic of the convention, which will be attended by leading industrial engineers and members of the faculties of leading universities. The engineers will meet at the Hotel McAlpin. On the evening before the convention there will be a joint meeting of this society with the Taylor Society and the A. S. M. E.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

N. E. L. A. Geographic Divisions—Rocky Mountain, Glenwood Springs, Col., Sept. 11-13 (for program see issue of Aug. 19, page 393); Southeastern, Atlanta, Sept. 12-15; Great Lakes, French Lick Springs, Ind., Sept. 27-30 (for program see issue of Aug. 19, page 393.)

Colorado Electric Light, Power and Railway Association—Glenwood Springs, Col., Sept. 11-13.

Association of Iron and Steel Electrical Engineers—Cleveland, Sept. 11-15. J. F. Kelly, Empire Bldg., Pittsburgh, Pa.

Pennsylvania State Association of Electrical Contractors and Dealers—Philadelphia, Sept. 13-14.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 19-22. Herbert Smith, 211 Hobson-Pritchard Bldg., Huntington.

American Electrochemical Society — Montreal, Sept. 21-23. A. D. Spillman, Columbia University, New York City.

Illuminating Engineering Society—Swampscott, Mass., Sept. 25-28. Samuel G. Hibben, 29 West 39th Street, New York. (For program see issue of Aug. 5, page 292.)

American Institute of Mining and Metallurgical Engineers—San Francisco, Sept. 25-28. F F. Sharpless, 29 West 39th Street, New York.

Indiana Electric Light Association—French Lick Springs, Ind., Sept. 28-30. Thomas Donohue, Lafayette, Ind.

Telephone Pioneers of America—Cleveland, Sept. 29-30.

American Electric Railway Association — Chicago, Oct. 2-6. J. W. Welsh, 8 West 40th Street, New York.

Empire State Gas and Electric Association —Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.

Electrical Supply Jobbers' Association, Atlantic Division—Philadelphia, Oct. 6. E. Donald Tolles, 165 Broadway, New York.

Arkansas Utilities Association — Hot Springs, Ark., Oct. 9 and 10. R. I. Brown, Little Rock Ry. & Electric Co., Little Rock.

Society of Motion Picture Engineers Rochester, N. Y., Oct. 9-12.

Association of Edison Illuminating Companies — White Sulphur Springs, W. Va., Oct. 11-14. Preston S. Millar, 80th St. and East End Ave., New York

National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St., New York.

Public Utilities Association of West Virginia—Charleston, W. Va. Oct. 13-14

Electric Power Club—Asheville, N. C., Oct. 30. S. N. Clarkson, 506 Laclede Gas Bldg., St. Louis

Ontario Association of Electrical Contractors and Dealers—Toronto Nov. 13-14 J. A. McKay, 24 Adelaide St. W., Toronto.

National Association of Railway and Utility Commissioners—Detroit, Nov. 14. J. B Walker, New York Transit Commission, New York

Commission Rulings

Right to Wholesale Consumption Rate.—An attempt by a company owning a building divided into stores to force the Public Service Electric Company of New Jersey to grant it a wholesale rate covering all the electrical energy furnished to the building and allow it to resell to the tenants at the regular retail rate has been thwarted by the New Jersey Board of Public Utility Commissioners, which declared: "The plan of the building as submitted by the petitioner clearly indicates separate and distinct stores with separate entrances and with nothing in common except the fact that they are under a continuous roof. They should, therefore, be treated as individual customers and supplied at the filed schedule rate for such customers."

When Property of Utility Should Not Be Represented in Rates.—In a decision of the New York Public Service Commission on petition of the Elmira Water, Light & Railroad Company the commission has held that consumers should not pay in rates for property not presently concerned in the service rendered, unless there is a probability of immediate future use or it is maintained for reasonable emergency or substitute service. Other points covered in this decision were that deduction should be made for accrued depreciation, that the burden of proof to establish "going value" was upon the company, and that the federal income tax, which it was held would make no appreciable difference in the rate arrived at, should be included as an item of operating expense.

Electric Utility Forced to Reconstruct Lines Causing Inductive Interference.—The Michigan Public Utilities Commission recently ordered the Economy Electric Company to reconstruct lines which were causing excessive inductive interference with telephone circuits previously built, the requisite distance between the conductors of the two companies being fixed by the commission at at least 6 ft. The commission remarked that the metallic circuit of the telephone company was not maintained in the best manner, the grounding of its lines making it very susceptible to inductive interference, but observed further: "Although the telephone company and the electric company have equal rights to the use of these highways, the telephone company having first constructed its line, the electric company should have constructed its line so as to cause the least possible interference. Had the electric company complied with the law of Michigan and filed its map showing where and how the new line was to be constructed, this commission or its predecessor might have required this company to construct its line differently. The electric company, having disregarded the law, cannot now object to the reconstruction of its line because of the necessary expense." This case differs from one recently decided in the Washington State Supreme Court (see issue of Aug. 12, page 345), because in that instance the power company's line was built in the best manner, while the telephone line had originally no metallic circuit.

Mutual Company Furnishing Light to Its Members Not a Public Utility.—A complaint made by the Community Bank of Dawn, Mo., against one J. M. Decker, who had obtained the permission of the Missouri Public Service Commission to discontinue his electrical service business and had then organized a mutual company for the supply of its members only charged him with subterfuge and the operation of a utility illegally discriminating against patrons it did not wish to serve. The commission found the allegation unproved and the company within the law.

No Deduction for Accrued Depreciation.—No deduction was made for accrued depreciation in a rate proceeding before the Idaho Public Utilities Commission affecting the Grangeville Electric Light & Power Company, the commission explaining: "It is shown that certain theoretical depreciation exists in the plant and system of applicant, but it is also shown that the actual physical condition is good. The applicant has met all demands for replacement and reconstruction and has not only maintained but materially improved the serviceability of the system, and at the present time no known depreciation exists which threatens a continuity of service, while the financial standing of the applicant appears to be such as reasonably to guarantee both continuity and quality of service, and therefore no deduction will be made for depreciation."

Purchase Price Should Be Left to Buyer and Seller.—Disclaiming a desire to regulate the price at which one utility may acquire ownership of another, the Missouri Public Service Commission, in authorizing the sale of utility property to the Green Light & Power Company, said: "It appears that the amount of the purchase consideration arrived at by purchaser and seller in a bona-fide sale of utility property should be left largely to the discretion of the participants in such a sale and not made a question for determination of this commission, unless such consideration is so grossly excessive as to endanger the future ability of the purchaser to render service to the public at reasonable rates. This is particularly true where the purchaser is a corporation of the character of the Green Light & Power Company, where any financial loss incurred in the purchase of the property at an excess price must fall on the stockholders, who are themselves the responsible corporate officers who enter into the purchase transaction."

Recent Court Decisions

Only Those Acts of Commission Alleged to Be Illegal Can Be Reviewed by Court.—Refusing to reverse a decision of the Public Service Commission alleged to establish a monopolistic jitney service, the Supreme Court of Errors of Connecticut said (Modesto vs. Connecticut Company): "Where an action of an administrative body involves only purely administrative matters, on a statutory appeal from such a body the court has before it only the question whether the body has acted illegally or has exceeded or abused its powers; otherwise the body's action, involving only an administrative matter, is final." (117 At. 494.)*

Responsibility of Electric Service Company for Death Apparently Due to Overcharge on Secondary Wires.—The Supreme Court of Iowa has sustained a judgment for the plaintiff in Duncan vs. Fort Dodge Gas & Electric Company, in which damages were awarded for the death of a man who was killed while grasping an electric fan with the intention of moving it. The court held that the evidence sustained the plaintiff's contention that death was due to excessive voltage escaping from the primary wires of the company. The court, however, sustained the contentions of the defendant regarding its non-liability for defects in the secondary system, which was not owned by it, and also to the effect that it was bound to exercise only ordinary and reasonable care and that if a person were killed by contact with a voltage of approximately 110 damages could not be recovered. (188 M. W. 865.)

Town Operating Power Plant Held to High Degree of Care as to Employee of Contractors Working for It.—In Loveless vs. Town of Wilton damages of $12,000 were awarded for the death of a workman employed by contractors whom the town had engaged to paint a water tank owned by it. The town, at the request of the contractors, had connected an electric lamp to service wires to illuminate the interior of the tank, and the victim, who was working on the exterior, had come in contact with the connecting wires, falling to the ground and receiving fatal injuries. It was claimed that no notice had been given to the workman that electric current had been turned on. The Supreme Court of Iowa, sustaining the judgment, held that the town was bound to exercise a high degree of care, that the man killed was an invitee as regarded his presence on the tank, and that contributory negligence was for the jury to decide. (188 N. W. 874.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Heston Appointed Western Editor of "Electrical World"

Walter C. Heston, formerly industrial power engineer with the Portland (Ore.) Railway, Light & Power Company, has been appointed Pacific Coast editor of the *Electrical World*, with headquarters in San Francisco. He will assume his new duties on Sept. 15. Mr. Heston comes to the *Electrical World* staff after eleven years of experience in electrical engineering fields and three years' editorial work as the representative of the *Electrical World* at Portland. His early electrical engineering training was received at Benson Polytechnical School at Portland, after which he became identified with the Portland Railway, Light & Power Company. His work with that company has been particularly in the electrical distribution engineering field, where he was for two years superintendent of distribution. In 1919 he became industrial power engineer in the commercial department of the same company, which position he has held until the present time. Mr. Heston served for two years on the hydro-electric and technical committee of the Northwest Electric Light and Power Association and has just completed a term as chairman of the Portland Section of the American Institute of Electrical Engineers. His many years of activity in association work have given him a wide acquaintance among the electrical men of the Northwest.

W. C. HESTON

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E. M. Gilbert has been elected vice-president, to succeed Thomas Cheyne, of the W. S. Barstow Management Corporation, New York, N. Y.

Henry T. Hall of Salt Lake City has assumed the management of the Uintah Light & Power Company, Myton, Utah. For eight years Mr. Hall has been associated with the General Electric Company.

H. F. Scott, formerly connected with the Des Moines (Iowa) Electric Company, in the capacity of electrician, is now associated with the Cambridge (Neb.) Light & Water Company, as manager.

Edvard Svanoe, a widely known Norwegian hydro-electric engineer, will arrive in the United States Sept. 16 to attend the San Francisco meeting of the American Society of Civil Engineers. O. C. Merrill, the executive secretary of the Federal Power Commission, is arranging an itinerary for Mr. Svanoe which will allow him to visit some of the larger hydro-electric developments in this country prior to the opening of the meeting on Oct. 4.

O. C. Merrill, executive secretary of the Federal Power Commission, has returned to Washington after a visit to Niagara Falls and a trip down the St. Lawrence River as far as Montreal. He was impressed particularly with the splendid engineering evidenced in the construction of the tunnel extension to the new power plant of the Niagara Falls Power Company. In addition, Mr. Merrill visited the Salmon River development of the Niagara Falls, Lockport & Ontario Company as well as the Cat Island and Barnhardt sites.

Verne Leroy Havens, editor of *Ingeniería Internacional*, the monthly technical journal in Spanish published by the McGraw-Hill Company, Inc., is now in Rio de Janeiro, Brazil. Mr. Havens is chairman *pro tempore* of the joint committee appointed by the four national engineering societies to consider and act upon all matters arising from their participation in the International Congress of Engineering. This congress will be held in September in Rio de Janeiro in connection with the celebration of the first centenary of Brazilian independence. Upon the termination of the congress, Mr. Havens will visit Uruguay and Argentina before returning to the United States.

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H. L. Wills of Georgia Company on Leave

H. L. Wills, operating manager of the electrical department of the Georgia Railway & Power Company, has secured temporary leave of absence from his duties to complete special work in the interest of the National Electric Light Association and the Georgia Railway & Power Company. T. F. Johnson, assistant operating manager, has assumed full charge of the operating and construction forces of the electrical department. Charles E. Bennett has been appointed electrical engineer and will take charge of all engineering matters in the electrical department.

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Brockett Elected President of Northwest Association

Norwood W. Brockett, attorney for the Puget Sound Power & Light Company of Seattle, Wash., has been elected as president of the Northwest Electric Light and Power Association. Mr. Brockett took his law course at the University of Minnesota and went West upon his graduation in 1900. He followed newspaper work for two years, when he joined the former Snoqualmie Falls Power Company in Seattle as assistant counsel. He remained with that company until its consolidation with the Stone & Webster interests under the name of the Puget Sound Traction, Light & Power Company, when he joined the legal department of the new organization. His service with the electrical industry thus covers a period of twenty years, except for a period of eighteen months when he served in France as captain of field artillery. Mr. Brockett was one of the small group who met to form the present Northwest Electric Light and Power Association, and he served as its secretary during its first five years. He has three times served as vice-president of the association for the State of Washington and has been continuously a member of its executive committee. He has been most active in the public relations and affairs of the association and in handling questions of legislation affecting the industry and has represented the association in legislative matters for the last seven sessions of the Washington Legislature. Mr. Brockett is known in the association as the friend and advocate of the smaller companies.

N. W. BROCKETT

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Development of Electrical Market

Review Shows Eighty Manufacturing Establishments in 1880 Compared With 1,600 in 1922—War Period Brought Out Chief Progressive Measures

By H. M. Cunnington
Trade and Markets Editor, *Electrical World*

THAT the progressive steps in the remarkable growth of the electrical industry depended on the development of sales, and that varying conditions restrained or advanced the whole engineering or commercial fields, are outstanding features of the first review ever published of the electrical market covering the period of 1880 to 1922.

1880 to 1920

A comparative summary of the industry shows that in 1880 there were approximately eighty manufacturing establishments. This number increased to 581 in 1899, to 1,404 in 1919 and to approximately 1,600 in 1922. Fewer than 750 persons were engaged in the industry in 1880, and in 1919 census figures show that 271,912 were engaged in these establishments. Cost of materials in these establishments in 1919 amounted to $425,098,211, and in 1879 cost amounted to $1,116,470. It is known that the value of products in 1880 amounted to about $2,500,000; in 1919 it was approximately $1,000,000,000.

New York is now the leading state in the manufacture of electrical machinery. Ohio, having made rapid strides during the last few years, is second. New York, Pennsylvania, Ohio, Illinois, New Jersey and Massachusetts together produced 80.3 per cent of the total value of products reported by the industry in 1919. These six states employed 78.1 per cent of the total number of wage earners.

In 1909 there were only thirty-one establishments producing machinery, apparatus and supplies yearly to the value of $1,000,000 or more. In 1919 there were 182 establishments maintaining this quota. These, which were 13 per cent of the total number in the industry, employed 79.7 per cent of the total number of wage earners and reported 82.1 per cent of the total value of products.

Value of Products Produced

The following facts show the increase in production during the years showing the greatest progress in developing the industry. Electric measuring instruments produced in 1904 amounted to $5,004,763; in 1909, $7,800,010; in 1914, $8,786,506, and in 1919, $19,322,164.

Generating apparatus and parts produced in 1904 amounted to $11,084,234; in 1909, $14,077,071; in 1914, $17,865,542, and in 1919, $86,266,114.

Storage batteries produced in 1904 amounted to $2,645,749; in 1909, $4,678,209; in 1914, $13,080,964, and in 1919, $60,036,152. Primary batteries produced in 1904 amounted to $1,598,144; in 1909, $5,934,261; in 1914, $10,321,491, and in 1919, $32,427,043.

Arc lamps produced in 1904 amounted to $1,574,422; in 1919, $1,706,959; in 1914, $742,142, and in 1919, $606,771. Observe the diminishing values.

Incandescent lamps produced in 1904 amounted to $6,953,205; in 1909, $15,714,809; in 1914, $17,350,385, and in 1919, $57,646,900.

Telegraph apparatus produced in 1904 amounted to $1,111,194; in 1909, $1,957,432; in 1914, $2,248,375, and in 1919, $12,816,341.

Telephone apparatus produced in 1904 amounted to $15,863,698; in 1909, $14,259,357; in 1914, $22,815,640, and in 1919, $46,214,342.

Switchboards, panelboards, and cutout cabinets for light and power produced in 1904 amounted to $3,766,044; in 1909, $5,971,804; in 1914, $8,989,111, and in 1919, $17,735,780.

Railway switches, signals and attachments produced in 1904 amounted to $1,451,337; in 1909, $5,377,843; in 1914, $6,393,551, and in 1919, $4,466,611.

Fuses, cut-outs, and fuse plugs produced in 1904 amounted to $868,079; in 1909, $1,001,719; in 1914, $1,757,430, and in 1919, $7,895,098.

Insulators produced in 1919 amounted to $6,504,147.

Sockets, receptacles, bases and attachment plugs produced in 1904 amounted to $2,010,860; in 1909, $4,521,729; in 1914, $5,512,609, and in 1919, $15,008,365.

Lightning arresters, choke coils, reactors and other protective devices produced in 1904 amounted to $587,124; in 1909, $940,171; in 1914, $1,188,773, and in 1919, $2,353,416.

Insulated wire produced in 1919 amounted to $66,570,958.

Insulated cable, rubber insulation, produced in 1904 amounted to $34,519,699; in 1909, $51,624,737; in 1914, $69,505,573, and in 1919, $32,520,587.

Insulated cable, paper insulation, produced in 1919 amounted to $26,789,302.

Pole-line hardware produced in 1919 amounted to $9,379,145.

Circuit fittings, not elsewhere given, produced in 1904 amounted to $3,525,446; in 1909, $1,080,287; in 1914, $2,067,683, and in 1919, $5,052,994.

Underground conduit produced in 1904 amounted to $2,416,245; in 1909, $5,098,264; in 1914, $4,874,709, and in 1919, $890,749. Interior conduit produced in 1919 amounted to $18,375,880.

Annunciators and push-buttons produced in 1904 amounted to $185,870; in 1909, $235,567; in 1914, $263,806 and in 1919, $709,941.

Electric clocks and time mechanisms produced in 1904 amounted to $373,926; in 1909, $352,513; in 1914, $410,774, and in 1919, $1,797,909.

Bells, buzzers and signal gongs produced in 1919 amounted to $3,616,281.

Therapeutic apparatus, including X-ray tubes, produced in 1904 amounted to $1,036,962; in 1909, $1,107,858; in 1914, $2,653,098, and in 1919, $8,895,402.

The Story of the Market

In 1916 manufacturers produced to their utmost, yet the market was unsatisfied. Production of electrical goods in 1916 went beyond the five-hundred-million-dollar mark.

There was placed in this year a volume of orders for electrical equipment of about $750,000,000, a large total for an industry that has grown up within the present generation.

Raw-material costs soared rapidly. Manufacturers were forced to make frequent price advances in order to insure profits.

Although prices were higher, profits made by electrical manufacturers in 1916 were in actual percentage less than in 1915.

Labor was a difficult problem to handle in 1916. Not counting bonuses, it is estimated that wages advanced 25 per cent during the year. At the same time it was hard to obtain efficient labor.

In addition to the inefficiency of labor there was a scarcity of all products. The war controlled and in some cases stopped the supply of many products for which electrical manufacturers of this country had depended on for the work of the world.

Production of turbines, both steam and water, was very large, especially the former, of which the 1916 output was about 3,000,000 kw.

The jobbing business was exceptionally large in 1916. Jobbing picked up in the fall of 1915 and has continued very large since that time. The 1916 jobbing business was at least 50 per cent over that in 1915.

Wire, conduits, fittings, fans and household appliances sold very well. Better factory lighting brought the sale of large quantities of lighting material.

Starting from the year 1916 with approximately $250,000,000 worth of unfilled orders, the electrical manufacturing industry in 1917 far exceeded the record set in 1916.

Although the country was engaged in war nine out of the twelve months of the year the industry showed on the whole no diminution of output, but rather a very considerable increase.

Careful and conservative estimates placed the 1917 billing of electrical manufacturers in the near neighborhood of $750,000,000, while unfilled orders at the close of the year were certainly not less than $300,000,000.

Trade acceptances were in greater evidence in the trade, and there was a decided movement, particularly among jobbers, to institute a more general use of this credit system.

Prices, except for raw materials, advanced throughout the year, but not to such a degree as in 1916. Heating appliance prices advanced every few months. Prices of glass and porcelain products increased, as did those of many other staples.

In May, for the first time in the history of the industry, the *Electrical World* started publishing current market prices, and it has continued this work ever since.

THE YEAR 1917 STARTED WELL

Demand for materials, as before stated, was particularly large. Lamp manufacturers for many months found it impossible to keep up with orders. Shortages developed in every section of the country, being particularly acute in the far West and in New England. Every effort was made to cope with the situation, and by the late fall months the manufacturers were able to lay in local stocks in most standard sizes, but still were behind in miniatures.

Wholesale fan stocks were sold out earlier in 1917 than ever before, and, as in 1916, the season closed with the market practically void of fan stocks. The great hot wave in the first week in August, 1916, put into the users' hands almost all fans available.

Turbine production for 1917 was sold out early, and by the first of June production for larger sizes had been booked.

Transformers and motors in large sizes were hard to obtain after six months' time Production had been booked far ahead. In the early fall it was estimated by good authority that manufacturers were 150,000 motors behind orders.

The second-hand market flourished during the year. Dealers found it very difficult to obtain equipment. Much of this was ordered only until such time as the goods could be delivered. In this way some machines were sold and resold many times during the year. The government frequently found the second-hand men to be very valuable when especially quick deliveries were needed.

STARTLING CHANGES IN 1918

Startling changes took place during the year 1918. The industry had gone through a period of maximum production, government control, priorities, etc., and was once more in a free market.

During the months before the signing of the armistice the industry was almost entirely engaged in producing goods for government or allied function. The trade during the larger part of that time was serving only essential demands.

Commercial business was reduced to the barest minimum. It is estimated that this business represented less than 30 per cent of the entire output of the industry for the first ten months of the year. Even domestic appliances had a big war demand.

Following the armistice there were many cancellations of war and other contracts, and incoming business was small. The total output for 1918 was probably no larger than in 1917, which was in the neighborhood of $750,000,000. Throughout the year of 1918 labor and raw materials were the controlling factors. In addition to a very acute shortage of each, labor had been very undependable.

The output of fans was curtailed to 40 per cent less than the 1917 production, vacuum cleaners for six months were curtailed to 75 per cent of six months of 1917 production, production of heating appliances to 50 per cent of 1917 output, and so forth.

For the first time in the year, the price of incandescent lamps advanced. The first increase was on Jan. 1, 1918, and called for 10 per cent. Ten months later vacuum-type tungsten lamps advanced 15 per cent. Miniatures, carbons and gems advanced 10 per cent during July, 1918.

Copper wire was higher at the close of the year than at the beginning, but the average throughout the year was below that for 1917. The increase during the year was due to higher copper prices, higher carbon and higher labor. During December wire base dropped a couple of cents. The highest for rubber-covered wire base was, considering all discounts, 34 cents.

Throughout the year sales of electrical appliances were very large, stocks were short and manufacturers were behind on orders. Washing-machine manufacturers, even though they early in the year had decided to eliminate 171 distinct styles, by the first of June in many plants were 2,000 to 3,000 machines behind in orders.

It seemed almost impossible to get a stock of licensed flat-irons after the middle of the year. Even electric ranges sold better in 1918 than in 1917, reports up to August of 1918 indicate. Sales were mostly in small quantities and in small cities. The big cities having ceased to push ranges during the war.

Fans were sold out early to the trade. The consumer demand was greater than the supply in 12-in. and 16-in. oscillators, but not so good in the small sizes. Government demand was large.

Central-station companies during the year received recognition in the way of a discount and differentials in the distribution of electrical ranges, while the jobber received similar recognition in the distribution of sockets and heating devices.

Large power equipment was hard to get throughout the year. In November six months was quoted on motors of more than 100 hp. Turbines of over 500 hp. were taken under complete government control as to distribution. After the armistice was signed deliveries on large turbines were quoted at four months and longer, depending on the condition of the individual factories. At the close of the year there was still a large volume of unfilled business in steam turbines. In the spring stocks of small power equipment began to appear, and conditions in this line have been getting better and better. The used-equipment dealers, while finding it difficult to take care of inquiries for large equipment, reported the market for small machines dull.

OHIO PRODUCED MOST BATTERIES

During the year 1919 Ohio surprised all the states in the production of storage batteries, followed by Pennsylvania, New York, New Jersey and Indiana, in the order named. The value of battery supplies and parts—storage and primary—increased from $3,265,616 in 1914 to $6,985,780 in 1919, equivalent to 113.9 per cent.

Incandescent lamp production in 1919 showed an increase in value over production for 1914 of $40,296,515, or 232.3 per cent. The tungsten type formed 80.9 per cent of the value of all incandescent lamps manufactured in 1919 and 68.5 per cent in 1914.

PERIOD OF 1920 TO 1922

The feature of 1920 was the large gain in electrical exports. These showed an increase of $4,000,000 over 1919 figures.

Domestic demand slumped. Construction was very inactive and much labor was inactive. Credits and collections became more important.

Stocks of copper wire were plentiful. Bookings during the first few months were double the 1919 rate. Quotations to the trade were as high as $14 per 1,000 ft. in 5,000-ft. lots in New York City. In December the price of $8.50 was reported.

Shortest stocks were noted in conduit. Smaller sizes were depleted because of the added demand in the oil industry.

Lamp sales showed a very large increase in 1920. There were 230,000,000 large lamps sold in this year, compared to 183,000,000 in 1919. Spotty stocks, which were reported, were due to failing transportation and a raw-material shortage. On April 1, 1920, price increases varying from 10 to 15 per cent were applied on the common run of large lamps.

The armored-conductor market was weak during this year. A shortage of steel strip, because of slow delivery, and a shortage of raw material were to blame for the poor showing up to the latter months of 1920.

Pole-line equipment showed much activity. New extensions by central stations on larger scales were responsible for this increase in business. Foreign buying was known to be very heavy. Stocks were only fair owing to unsettled labor conditions.

RECOVERY SHOWN IN 1921

Exports of electrical apparatus and materials during the first months of 1921 were very high.

Resumption of construction during the summer months helped the schedule-material manufacturers. Supplies of raw material were better than in 1920, labor conditions were improved, and some of the producers started operating at capacity for the first time in many months. Price cutting was noted, but this was conservative, it seemed, to prepare for a better period of business.

At the beginning of the year stocks of armored cable were plentiful, but as the year progressed manufacturers received better calls for their product.

Some lamp companies, however, reduced operations because of the lowered demand. During the latter months the market became noticeably better.

Fair sales were reported for smaller appliances. Vacuum cleaners and washing machines also recovered.

Buyers in the wire market were able to obtain many concessions during the early months of 1921. Quotations fell from $8.50 per 1,000 ft. of rubber-covered in 5,000-ft. lots to as low as $6.15. Readjusting in the latter months, prices stiffened.

RUGGED CONDITIONS OF 1922

Strikes, both rail and coal, shortages of materials and the foreign exchange situation have little deadening influence on the present year's good position. Most price changes have been advances.

During the early weeks of the present labor troubles the electrical market experienced only certain shortages of stocks. The amount of orders did not suffer loss. Few districts reporting to the *Electrical World* note anything but progressive strides.

Survey of Business Conditions

Electrical Sign Sales Show Much Improvement

An important manufacturer of signs in Albany, N. Y., says:

"Current sales compared with those of six months ago have greatly improved owing to the general improvement of business conditions. Our deliveries are no longer than normal at the present time. Prices have changed but slightly recently, and we do not anticipate any material change in the near future. The outlook for the next six months in our opinion is continued improvement owing to general business conditions and the improvement of labor conditions."

Toy Sales Running About 25 per Cent Higher

Toy sales are running about 25 per cent higher than a year ago, according to the statement of a leading electrical toy manufacturer of Chicago to the *Electrical World*. Better business conditions have brought about this increase in sales. He says:

"Deliveries are about normal, but we look for a very heavy demand as soon as the dealers really begin buying in the fall. There is no anticipation of price changes unless there is a further increase in the cost of material.

"The outlook for the next six months is good, and, I believe, contrary to the opinion of some buyers, the radio craze instead of decreasing the sale of other electrical toys is going to increase it, because as people become more and more accustomed to electrical toys of all kinds the resistance to electrical toys is less pronounced and they become more popular."

Warns American Business Men of German Frauds

The low price level in Germany has induced a multitude of American business men to make buying trips or to send their representatives to that country on buying tours, Vice-Consul Walk, Hamburg, has informed the Department of Commerce. In many instances, he states, these men have not taken the necessary precautions in dealing with the German firms which had charge of the details of buying and forwarding of the goods and, unfortunately, have been victimized.

German concerns, according to Mr. Walk, will generally insist on making their contracts with Americans in dollars, since, among other reasons, they believe that they can more nearly approximate the world prices for goods if they talk to an American in dollars rather than in marks. "When an American desires to buy in marks and at current domestic prices he is sometimes induced to do this through a German middleman. A case in which this arrangement worked out in a particularly disastrous manner has recently come to the attention of the consulate at Hamburg, the American having to pocket a loss of $2,000 and leave for home without prosecuting the culprit as his business required his immediate return to the United States."

Issue Specifications Relative to Armored Cable Labels

The Underwriters' Laboratories of the National Board of Fire Underwriters, Chicago, have issued a new page relative to the issuance of labels for armored cable or armored cord, as follows:

"The labels are issued in three denominations which vary only with respect to the footage of armored cable or armored cord which they represent. The three denominations are of the following footages: 50 ft., 100 ft. and 250 ft.

"The labels are furnished in strips, one label wide and ten long, with perforations between labels. The labels are of paper with gummed backs and are applied to the tag which is furnished with each coil of armored cable or armored cord. One or more labels shall be so used with each coil that the footage represented by the labels is approximately the same as the length in feet of the cable or cord in the coil. **Variations not to exceed 10 per cent** either way shall be allowed, and it will be assumed that such variations will be compensating in any given period of time with respect to any particular factory.

"The labels as issued are serially numbered, and a record is kept by means of these numbers of the manufacturer to whom they are issued, the date of issue and the approximate date of use.

"It is not expected that two labels for a single coil or reel, even if of the same denomination, will necessarily have consecutive serial numbers.

"The inspector will at each inspection observe and report the lowest serial number of the labels on hand and not attached to product.

"The inspector shall call the attention of the manufacturer to a failure to use the labels in the consecutive order of their serial numbers.

"The price of labels is at present 20 cents per 1,000 ft. This price is calculated to cover the cost of the label itself and a proportionate part of the following: Salaries and carfares of inspectors, salaries and expenses of engineers at Chicago testing station; salaries and expenses of special agents, overhead charges and cost of field follow-up service."

Brass Company Is Readjusting Discount Schedules

The discount schedules of the F. W. Wakefield Brass Company, Vermilion, Ohio, on commercial lighting hangers are being readjusted as of Sept. 1. The lower prices will affect "Red Spot" standard hangers, ornamental hangers and general-purpose hangers of both suspension and ceiling types commonly used in the industry.

Prevailing Conditions Affecting Cost and Volume

Number of Freight Cars Needing Repairs Decrease.—As bearing on the strike situation generally, the Association of Railway Executives has announced that, despite the absence of the striking shopmen from their jobs, the number of freight cars in need of repairs decreased 9,438 between Aug. 1 and Aug. 25, although the total on the latter date was 10,992 above the figure for July 1, when the strike began. The number listed as needing attention on Aug. 15 was 335,575, or 14.8 per cent of the whole number on all lines. The association's statement did not cover the condition of motive power, nor did it show how many of the cars out of commission were of coal-carrying types. It was said at the organization's headquarters, however, that reports from throughout the country indicated that there now were upward of 100,000 surplus coal cars in good condition.

Loading of Revenue Freight Increases.—Loading of revenue freight totaled 856,219 cars during the week which ended on Aug. 19, which was an crease of 3,639 cars over the preceding week, according to reports just received by the American Railway Association from the rail carriers. This was an increase of 41,072 cars over the corresponding week last year, but a decrease of 111,884 cars under the corresponding week in 1920. Merchandise and miscellaneous freight, which includes manufactured products, totaled 555,275 cars, an increase over the previous week of 6,971 cars.

Decrease in Volume of Business.—The volume of business for the week ending Aug. 30, as measured by debits to individual accounts reported to the Federal Reserve Board for banks in leading centres, totaled $7,219,000,000, or $215,000,000 below the total for the preceding week. All of the larger centres, except Chicago and Milwaukee, show smaller figures than the week before. New York City reports a decline of $51,000,000, or of 1.3 per cent, for the week as compared with an average decline of 2.9 per cent for all reporting centers.

Liquidation of $42,000,000 of Loans.—Liquidation of $42,000,000 of loans and discounts, largely of loans against corporate securities, as against an increase of $16,000,000 in investments, is shown in the Federal Reserve Board's weekly statement of condition on Aug. 23 of 791 member banks in leading cities. All classes of bonus show smaller totals than the week before. Changes in the investment account include increases of $41,000,000 in United States bonds and of $8,000,000 in Treasury notes, as against reductions of $19,000,000 in Treasury certificates and of $14,000,000 in corporate and other securities.

Germany Increases Export Duties.—Effective Sept. 3, export duties in Germany are advanced 60 per cent. Effective Sept. 6, number of paper marks required for import duties is advanced to 290 times the gold rates of custom tariffs, against 220 to date and 40 in January.

Speaks of Labor Shortage.—There is a labor shortage throughout the country, according to the *Industrial Digest*, which has canvassed the situation through leading industrial publications. Any one who had predicted a year ago that we were going to have a shortage of labor would have been subjected to ridicule, but we have it now," says the *Digest*. "Complaints from Detroit and other automobile centers, from the building trades, and especially from road contractors, are merely foretastes of what will happen this fall. This shortage applies especially to unskilled labor, and, of course, most wage reductions affect unskilled labor more severely than they do the more strongly organized skilled workmen."

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German Steel Industry Restrained by Decline of Mark

Reviews of the German steel and iron trade point out that in midsummer the export movement fell off heavily because the home movement of German prices had practically balanced the depreciation of the mark, and that when the further decline in the mark occurred, home demands were so largely increased as to make it impracticable for the industry to take large orders for export.

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New England Collections Are Considered Spotty

Uneven collections are a feature of the New England electrical credit situation as the fall begins, but underlying trade conditions are strong and outstanding accounts are usually rounded up within sixty or seventy days. Widespread complaint among dealers as to the slowness of consumers to settle accounts is heard, and this hampers cleaning up credits with the wholesalers.

Public utilities and railroads are paying satisfactorily, but industrial concerns show marked variations in time required to settle bills. One large jobber collected 15 per cent more money in the first half of August than in any corresponding fortnight this year. A decided improvement in business is anticipated this month and better credit conditions should accompany it. Treasurers of jobbing houses are working hard for account settlements, and money is now relatively cheap.

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Strikes Have Not Affected Credit Situation

Coal and railroad strikes have apparently been without effect upon the credit situation, which seems to have been influenced by more fundamental conditions. For many months past increasing commodity prices and a general increase in trade and industrial activity have facilitated the liquidation of many commercial bank loans of long standing.

During the past month, however, the downward movement in the volume of commercial loans has ceased, but the volume of bond investments in banks outside of New York City has continued to increase, presumably as a cumulative effect of the liquidation of the past year and of the continuing imports of gold. The volume of bills discounted by the Federal Reserve banks is at almost the lowest point of the year.

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Metal Market Situation

Copper Remains Quiet with Firm Prices—Consumers Awaiting Further Developments

The copper market during the past week remained quiet with firm prices. Foreign sentiment is better, and British dealers are again trying to buy electrolytic copper, but at slightly under the price of American producers, offering 13.80 cents aside ship, New York.

Consumers both here and abroad seem desirous of awaiting developments in the American and foreign situation before making further commitments. The fuel situation is such that most domestic consumers, while having sufficient coal to last another month or so, feel it inadvisable to lay in more copper until they are more certain of the ability of the railroads to deliver fuel as fast as required.

American copper producers are beginning to realize that for the next few months the future of copper depends more upon domestic consumption than upon export business. The optimism of Judge Gary as to domestic conditions, therefore, has encouraged them greatly. Today domestic consumption of copper is about 25 per cent larger than before the war. Necessity of depending largely upon domestic consumption is making it more evident that no marked rise in the price of copper is to be expected for some time, even if copper is selling out of line with most other metals and commodities.

While there is little indication that there will be any important buying for some time yet, consumption both here and abroad continues in good volume. Owing to the good cash position of all important producers of copper there is little probability that there will be any material weakening in price.

NEW YORK METAL MARKET PRICES

	Aug. 30, 1922 Cents per Pound	Sept. 6, 1922 Cents per Pound
Copper		
Prime Lake	14.00	14.00
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	5.75	5.75
Antimony	5.25	5.25
Nickel, ingot	36.00	36.00
Zinc, spot	6.50	6.50
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00-11.25	11.00-11.25
Brass, heavy	5.75-6.25	5.75-6.25
Brass, light	5.25-5.50	5.25-5.50
Lead, heavy	4.62½-4.75	4.62½-4.75
Zinc, old scrap	3.00-3.37½	3.00-3.37½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

GREAT improvement in the electrical industry is reported from all important districts of the United States. Central-station outputs are showing wide gains over the corresponding period of last year. A fair volume of sales of farm-lighting outfits is noted. Residential and industrial construction nearing completion is holding up the demand for armored conductor. Jobbers have accumulated excellent stocks of portable lamps during the summer months and are expecting a very good season. Popular buying of radio apparatus is increasing somewhat, but the many distributors and retailers absorb the demand easily. Stocks all along the line are being built up in anticipation of a busy season.

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New York

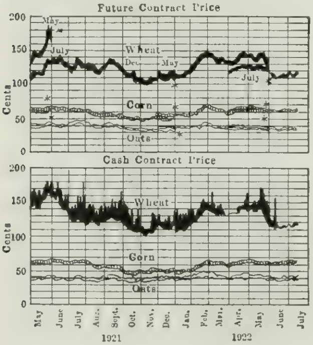
Storage Batteries in Demand—Insulators Selling Well—More Interest in Appliances Shown

Business in the electrical industry is reported to be the most active for some weeks. Conduit sales are holding their own and wire sales are increasing rapidly. Central-station outputs are reported to be gaining and more extensions are noted. Labor conditions are improving.

Storage Batteries.—Excellent demand is reported with fair stocks. Prices are reported firm.

Rigid Conduit.—A slight increase in building has strengthened demand, but some dealers are refusing large orders because of depleted stocks. Prices are stronger.

Porcelain Material.—All insulators are selling in large quantities. Prices are comparatively firm and stocks fair.



DAILY RANGE OF GRAIN PRICES AT CHICAGO. BREAK IN CURVE REPRESENTS CHANGES FROM ONE OPTION TO OTHER BECAUSE PREVIOUS OPTION RUNS OUT. (FROM FEDERAL RESERVE BANK OF CHICAGO)

Appliances. — Washers, flat irons, toasters, vacuum cleaners and percolators are all receiving more interest than a few weeks ago. Stocks are plentiful.

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Chicago

High-Tension Equipment Continues Good Conduit and Armored-Conductor Supply Is Limited

The electrical trade continues its normal stride. The demand for wire and conduit is very good. Dealers in lighting fixtures also report a very good business. Lighting-fixture prices are low at the present time because of the stiff competition in this line. Conduit and armored-conductor stocks are limited. The demand for radio equipment has shown a slight increase.

Wire.—Continued activities in the building program are causing a good demand. The No. 14 rubber-covered is available in 5,000-ft. lots at from $6.10 to $6.35 per 1,000 ft. Bare and weatherproof are moving steadily and prices remain the same.

Conduit.—Jobbers are expecting a further increase in the price of this material because of the present conditions in the steel and copper markets. Demand is very good and supply remains low.

Flexible Armored Conductor.—Business is spotty at the present time, but with the passing of the summer months and the vacation period the demand for this material is expected to increase. Prices remain steady.

High-Tension Equipment.—Manufacturers report a good amount of business, especially in fuses. A number of large orders have been booked by local manufacturers during the past week, among them a sale for furnishing equipment, including a number of indoor switches for an addition to a power station in Davenport, Iowa.

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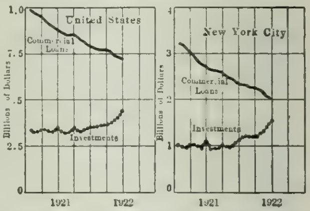
Boston

Good Volume of Business Reported—Credit Conditions in Contracting Field Sharply Followed

Business continued in good volume up to the holiday week end. Interest in appliances is increasing, and the sale of heavier wiring material is active and varied. Building operations are in good volume and the industrial labor conditions in New England are improving. One jobber reports that for the past four years every month has shown increased earnings compared with the corresponding month of the previous year. Deliveries are not so good on rigid conduit, and manufacturers are worrying somewhat over raw-material shipments. Central-station outputs are gaining and more line extensions are being undertaken. Credit conditions in the contracting field are being sharply followed.

Lamps.—Demand holds up well and very active sales are expected as the fall trade opens. Stocks are well-rounded and prices firm.

Wire.—Rubber-covered and weatherproof wire are both moving actively. At $6.25 per 1,000 ft. in 1,000-ft. lots, No. 14 of the former is in good supply. At present the demand for outside wire is such that it is none too easy to build up jobbers' stocks, at least in some cases. Bare wire is very dull, barring sporadic sales for radio aerials and occasional high-tension line work.



CHANGES IN COMMERCIAL LOANS AND TOTAL INVESTMENTS OF REPORTING MEMBER BANKS IN THE UNITED STATES. (FROM FEDERAL RESERVE BANK OF NEW YORK CITY)

Industrial Electric Trucks.—Distributors and agents are much busier on inquiries than a year ago, and actual sales are better. One manufacturer reports that the best sales for several years are now on the books.

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Cleveland

Manufacturers Report Business Is Spotty—Radio Interest Increasing—Cleaners Active

Some manufacturers report business spotty. Building operations have been active up to now, but are slowing down owing to shortage of material caused by the railroad strike.

In general, however, business has been more active than last week, and the receipts are a substantial initiation into the fall season.

Radio Equipment.—An appreciable increase in sales is reported. Business houses are interesting themselves in the possible utilization of radio as a means of communication. Several inquiries have been received and manufacturers have prepared estimates. One radio manufacturer anticipates the resumption of activity with several large orders and has accelerated production to meet the expected demand.

Vacuum Cleaners.—These are held by some to be a seasonal product, and hence the activity in sales is regarded as unusual, although the supply is sufficient to permit prompt deliveries.

Washers.—The end of the vacation season has tended to invigorate sales and a fair market is expected.

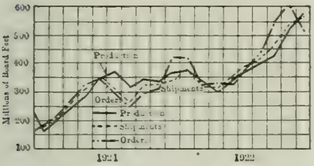
Ironers.—Window demonstrations by jobbers and retailers have stimulated the market in a satisfactory manner, and sales are in accord with the sale of washers.

St. Louis

Pole-Line Hardware Sales Reported in Good Volume—Stocks Generally Are Incomplete

Notwithstanding greater difficulties in conduct of business because of the rail situation, St. Louis jobbers report sales holding up well. Stocks are incomplete. Deliveries are increasingly difficult, resulting in more small orders calling for express shipment. Coal mines are buying in larger quantities, especially for goods used in maintenance work. Prices generally are firm.

Pole-Line Hardware.—Sales continue in good volume, but inquiries show a decline. Stocks are low and in many cases incomplete. Substitutions are the rule and are readily accepted by the purchasers.



Lumber Production, Orders Received and Shipments in Twelfth Federal Reserve District as Reported by Four Lumber Associations. (From the Federal Reserve Agent of San Francisco)

Poles and Cross-Arms.—On account of uncertainty of shipments and previous anticipation of transportation difficulties, orders show a decline. Construction work planned for this season is well under way and heavy buying is not now anticipated before next year. Local stocks are very spotty.

Dry Cells.—A strong demand continues. Local stocks are fairly good, but dealers' stocks out of town are short because of freight delays. The regular is selling for $31.04 per 100 and the igniter for $32.04 per 100, both in barrel lots.

Atlanta

Industrial Conditions Are Reported Unsettled—Fair Stock of Farm-Lighting Outfits

Industrial conditions throughout the section are considerably unsettled as a result of shortage in fuel and an apparent indefinite continuation of the railroad strike. Some of the mills have already shut down because of lack of fuel, noticeably brick and cement plants, while fear is expressed that a great number of textile plants will find fuel exhausted within the next two weeks. Those mills operating on hydro-electric power, of course, will not be affected, as they have accumulated sufficient stocks for heating and slashing.

Farm-Lighting Outfits.—A fair volume of sales is reported, with prospects looking up for fall business when crops are harvested. Good stocks have been accumulated, but deliveries from factory are badly delayed.

Conduit.—An increase of three points in the price of this item is reported this week, with the demand excellent. A shortage in this line is reported, and little hope for better stocks is held until the railroad strike is over.

Salt Lake City–Denver

Agricultural Industry Progressing—Retailers Are Not Stocking Heavily

Reports indicate that the agricultural industry is making a rapid and satisfactory recovery. Financing institutions are now meeting all urgent demands for money, requiring the regular collateral. Wages in a number of lines of work show a tendency upward. Harvest money is circulating freely, giving retail business a decidedly healthier tone. Retail dealers are not stocking heavily but show some signs of preparing for fall trade. Some good orders are being placed for lamps, and greater interest is shown in fixtures and electroliers.

Vacuum Cleaners.—There has been no brisk movement in the summer months, but some aggressive selling campaigns are now under way to stimulate interest in fall cleaning. No price changes have been noted during the past week.

Portland–Seattle

Railroad Strike Is Beginning to Make Itself Felt—Household Appliance Prices Drop—Cleaners Active

The railroad strike is at last beginning to make itself felt in the Northwest. Apple growers are very much alarmed over the situation, and fear is felt that a part of the crop may be lost for lack of transportation to Eastern markets. The lumber industry is also beginning to suffer from the strike. The coal strike is in a fair way to be settled, and it is expected that many mines closed by the strike will resume operation within a few days. Building activity throughout the Northwest continues unabated.

The Seattle lighting department is about to begin on a large program of extensions to its distribution system and street-lighting circuits. The work, which includes new substations, will cost about $2,000,000. Electrical jobbers find business very good. Report comes from Seattle that a shortage in stocks of conduit and wire exists as a result of the coal and railroad strikes.

Household Appliances.—A small drop in price is recorded on practically all flat irons and silver-plated ware. Ranges are in good demand. Stock replacements in Portland are seriously interfered with by the railroad strike. Washers and cleaners are in good demand.

San Francisco

Contractors Have Much Work—Ranges Are Selling Actively—Conduit Advances Are Reported

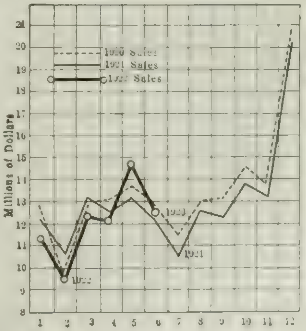
Contractors have all the work they can handle. The expected let-up in construction has not materialized. Payments are rather slow, and credit men are not only vigorously shepherding their own accounts but are finding it necessary to help dealers follow theirs. Few new firms are reported, but there is much reorganization. Sporadic radio firms are disappearing. Local conditions are much better. Fruit shipments are declared almost normal by railroad officials, and packing plants are again operating at capacity except in a few districts. Railroad construction has been rather hindered by strike conditions, but promises to run high during the latter part of 1922. Southern Pacific and Central Pacific separation would mean practical duplication of present terminal facilities and much other parallel construction.

Ranges.—Following a highly successful season, several health resorts, notably Yosemite camps, are planning extensive electrification in the way of heating and cooking equipment. A large San Francisco hotel is installing an electric grill. Household range sales have been greatly stimulated by the "Flying Circus" form of traveling demonstrations sponsored jointly by power companies and manufacturers.

Radio.—Complete reorganization of broadcasting service is demanded within the next sixty days. Present service is spotty in quality. Many inquiries are rife for broadcasting equipment. Sales of complete receiving and amplifying outfits are still rather low. Part sales are good, but radio firms are literally working day and night in constructive advertising and demonstrating, which will surely produce a splendid fall business.

Conduit. — Two recent advances amount to approximately 10 per cent. Local stocks are depleted because of heavy ordering prior to the advance.

Rubber-Covered Wire.—Movement of regular sizes and styles is steady, but not remarkable.



Net Sales of Thirty-two Department Stores (From Twelfth Federal Reserve Bank)

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Westinghouse Company's Springfield Plant Employs 3,800

The Westinghouse Electric & Manufacturing Company now employs 3,800 persons in its Springfield (Mass.) plant, of whom 2,500 are in the automotive equipment division, whereas the total force in all departments—automotive, small motors and radio—on Feb. 1, last, was only 1,300. The increase since then has been continuous and promises to be maintained through the rest of the year. Production of lighting, starting and ignition apparatus is being rushed for the equipment of 1923 motor-car models, including sixty-seven different makes of vehicles. Thirty new Westinghouse automotive service stations have been opened in different parts of the United States, bringing the total number to 301. These stations serve as the principal distributing agencies for replacement parts sold directly to the trade, as distinguished from equipment supplied to car manufacturers.

Imboden Hydro-Electric Power Firm Organized

Announcement of the organization of the Imboden Hydro-Electric Power & Manufacturing Company at Walnut Ridge, Ark., last week has been made.

This concern has a capital stock of $100,000, $25,000 of which is paid in, and it plans to develop 1,500 hp. to 2,000 hp. without the construction of a dam.

The officers of the concern include: President, W. R. Lane, president of the Planters' National Bank; vice-president, L. F. Wheeless, patentee of the Wheeless flexible harrow; treasurer, W. L. Bugg, cashier of the Planters' National Bank; secretary, G. G. Dent.

Wickwire-Spencer Corporation Special Meeting Sept. 8

A special meeting of stockholders of the Wickwire-Spencer Steel Corporation has been called for Sept. 8 in Worcester, Mass., to ratify the purchase of the capital stock of the American Wire Fabric Company and to authorize the sale of $1,775,000 ten-year 7½ per cent convertible gold notes to pay for the stock.

It will also be proposed to change the 250,000 common shares of the Wickwire company now outstanding of the par value of $5 each to an equal number of shares of no par value and to authorize the issuance of 350,000 shares additional of common stock of no par value. A further provision is for the exchange of the 80,000 Class A common shares of the par value of $5 each now outstanding for 120,000 shares of the new common stock and the cancellation of the Class A shares so exchanged.

H. W. Doddard, chairman of the Wickwire-Spencer Steel Corporation, says the new acquisition had earnings in the last nine years averaging $400,000 yearly after taxes and depreciation. Its sales last year amounted to $4,000,000.

Utah Copper Company Producing 10,000,000 Lb. Monthly

Production of at least 10,000,000 lb. of copper a month is indicated in the quarterly report of the Utah Copper Company. This is at the rate of 120,000,000 lb. annually. While rated capacity is close to 200,000,000 lb., the management does not favor an output of more than 60 per cent of normal pending a better price for copper.

Utah Copper is steadily whittling down costs. Final figures for the second quarter averaged 10⅝ cents a pound, including expenses incident to resumption after a year's shutdown. Production amounted to only 22,160,000 lb., of which nearly 50 per cent was made in June.

Production cost is understood to have been under nine cents for the 9,500,000 lb. of copper produced in that month. It is safe to assume that cost in the current quarter will not exceed 9 cents for the 30,000,000 lb. Even on the current metal market of 14 cents, this would permit net profits of nearly $1 a share on the 1,624,490 shares, against current dividends of 50 cents quarterly.

Owen-Dyneto Electric Corporation Formally Organized

Formal organization of the Owen-Dyneto Electric Corporation, Syracuse, N. Y., has been completed. The company will take over the assets of the Dyneto Electric Corporation, manufacturer of generators and electric starting devices for automobiles and lighting systems for motor cars.

Directors elected are Ray M. Owen, New York City; Harry M. Ballard, Chicago; Hamilton Sanford, C. S. Estabrook and James D. Grant, Syracuse. Mr. Owen was elected president, Mr. Ballard and Mr. Grant vice-presidents, Mr. Estabrook secretary and Mr. Grant treasurer.

The Dyneto Electric Corporation failed last year as a result of the business depression. It was placed in the hands of receivers and sold June 30 to Mr. Owen for $205,000. Mr. Owen had large interests in the firm prior to its difficulties.

Cataract Electric Company Is Selling Stock to Employees

In order to secure additional capital with which to seize its rapidly growing opportunities, the Robertson-Cataract Electric Company, Buffalo, N. Y., is offering a limited amount of its treasury stock, common and preferred, to its employees and through them to the public.

No changes in the control or policies of the company are contemplated. Since 1902 the control of a substantial majority of the total issued stock of the company has been in the hands of the Robertson and Sidway families, and according to W. E. Robertson, the general manager of the company, it will remain there after the sale of the present offering.

"In the past," says Mr. Robertson, "our employees have subscribed liberally to both common and preferred stock which has at all times been offered on exactly the same basis as that upon which the officers and directors have purchased."

"Employees' holdings at present amount to $181,300. In giving publicity to this offering it should be understood that there is no radical change in our policy of the past. This is not a new issue created especially for the purpose of raising additional funds, but is an allotment of unissued shares of the treasury stock of the company held in reserve in anticipation of such an opportunity for business expansion as the present offers.

"In selling this stock the only departure from our policies of the past is in respect to permitting the public to subscribe through our employees. This action has been taken because the additional capital that can be used to advantage is in excess of that which our employees can absorb. The stock is being sold entirely through the employees."

The company was founded in 1895 by James D. Robertson. It is the largest distributor of electrical supplies in western New York and one of the twelve largest in the United States. It also handles on a large scale electrical apparatus, appliances, storage batteries, fine lighting fixtures and radio equipment.

Through the ownership of the Robertson-Electric Construction Company as subsidiary, it manufactures switch boards, distributing panels, junction and meter protection boxes and kindred equipment.

The earnings of the company applicable to preferred-stock dividends have never been less than four times the amount required on outstanding preferred stock.

Dividends of 6 per cent or more have been paid on the common stock of the company regularly since its incorporation. Dividends on preferred stock have been paid each quarter since it was issued in 1907.

The company owns the land and buildings occupied by it at the corner of Mohawk and Elmwood Avenues.

"Good Health Week" and Fans

BY H. M. C.

PROMOTION of "Good Health Week," to be observed from Oct. 23 to 30, is being helped by fan manufacturers, who are pointing out the necessity of better ventilation in odorous kitchens, musty bookstores, cattle compartments, shoe stores, factories and other places where dust and smoke are known to be. Heat sells fans in summer; education of the consumer sells them in winter. Is not education wonderful?

"Get ready for 'Good Health Week,'" is the order from the ILG Electric Ventilating Company, Chicago, which apparently is doing the most to educate the consumer in the use of fans for better health. Manufacturers of all kinds of fans, of course, will benefit by the interest created by "Good Health Week." But more advertising is needed; bulletins to salesmen are necessary. The ILG company has many good selling points already covered. Officials of this firm say:

"It is obvious that 'Good Health Week' will start the public thinking, reading and talking good-health measures, and every word spoken, printed or written will create that much more interest in ventilation, sanitation and personal hygiene—which are the basic fundamentals of health since the birth of man."

Thus, a market of wide possibilities is opened for manufacturers of washers, vacuum cleaners and appliances of every description. Talking good health is good business.

Extensive Pension Program by Wire Company Announced

Announcement has just been made by the John A. Roebling's Sons Company, Trenton, N. J., to the effect that all employees who have been with that company a year or longer on Sept. 1, 1922, will be protected by group life insurance and pension plans. By arrangements made with the Equitable Life Assurance Society of the United States the insurance went into force automatically on midnight of Aug. 31.

The insurance is graded according to length of service, all employees more than one year and less than two years with the company to receive $500, increasing $100 each additional year of service until the maximum of $1,500 is reached for eleven years of service and over.

The insurance benefits will be payable to the beneficiary named by the employee, or in the event of his becoming totally and permanently disabled before reaching the age of sixty, it will be paid to him.

The pension plan contemplates retirement at the age of sixty for males and fifty-five for females, and in the event that this class of employee has served twenty years or more, they may request a pension or be retired at the discretion of the company. Any employee, however, who has served thirty years or more, or any male employee fifty-five years of age or female employee fifty years of age whose term of service is twenty-five years or more, may at the discretion of the company be retired from active service and granted a pension.

The plan is further liberalized in that pensions may be allowable in cases of total disability arising from non-occupational injuries and illnesses.

The amount of pension is determined by multiplying 1 per cent of the average annual pay during the ten years preceding retirement by each year of service. A minimum of $25 per month and a maximum of $250 a month has been established and will apply, except in cases where the pension is being paid in cases of total disability above referred to, where the minimum may be less than $25 per month.

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Prima Radio and Tool Works Consolidate

Consolidation of the Prima Radio Coporation, New York City, and the Manufacturers' Tool & Die Works, under the corporate title of the Prima Radio Corporation, has been formally announced. The new corporation is capitalized for $50,000 8 per cent preferred stock, par value $10, and 1,500,000 shares of $1 par value common. There is no bonded indebtedness.

William Schilling is president of the corporation and Andrew E. Puckrin chairman of the board of directors.

The Manufacturers' Tool & Die Works have been engaged in the manufacture of various tools, dies and instruments since 1912. The new corporation's plant is in Brooklyn, N. Y.

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Announce Establishment of Standard Electric Works

W. J. Howard and G. T. Key, Jr., announce the establishment of the Standard Electric Works, 17 Bibb Street, Montgomery, Ala. This firm will specialize in the repair and rebuilding of motors and generators.

G. T. Key, Jr., was master mechanic of the American Agriculture Chemical Company and has had twelve years of experience in electrical and mechanical work.

W. J. Howard was chief engineer for the Durham Public Service Company, a subsidiary of Henry L. Doherty & Company.

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The Charles Parker Company, tool manufacturer, Meriden, Conn., has awarded the contract for extensive changes to its power plant.

Wico Electric Company Awards Contract for Plant Unit

The contract to build the first unit of the Wico Electric Company's plant in West Springfield has been awarded to the Fred T. Ley Company, the building to be a brick monitor, 400x90 ft., to be finished by Jan. 1.

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The Aeolian Company, Meriden, Conn., has let the contract for a one-story addition to its power plant, dimensions 50 ft. x 30 ft. and of brick construction.

The Safety Car Heating & Lighting Company, New Haven, Conn., has taken out permits for the construction of two new factory buildings. One will be an addition one story high, 115x106 ft. The other will be an entirely new structure, one story high and 56x195 ft. These buildings will cost about $100,000. Stovel & Brinkerhoff, 136 Liberty Street, New York, are the engineering contractors.

The Englert Manufacturing Company, 2,131 Carson Street, Pittsburgh, Pa., manufacturer of automobile batteries and operating a general battery repair plant, has purchased property at South Twenty-fifth Street and Jane Streets, 68 ft. x 120 ft., as a site for a new plant. Plans will be prepared at an early date. Harry N. Englert is head.

The Boustead Electric & Manufacturing Company, Inc., Minneapolis, has been appointed Northwestern distributor for the Ideal Electric & Manufacturing Company of Mansfield, Ohio, manufacturer of squirrel-cage direct-current and synchronous motors, alternating-current and direct-current generators up to 1,000 kw., motor-generator sets, electroplating outfits, etc. The Boustead Electric & Manufacturing Company has for years specialized in rebuilt motors and generators and at the present time maintains one of the largest repair shops in the Northwest. The company also manufactures a complete line of switchboards for every purpose.

The American Lamp Company, 25 West Forty-third Street, New York City, has acquired the factory of the former New England Products Company, Stamford, Conn., previously owned by the Borg Products Company, for a consideration said to be about $40,000 and will occupy the plant at once for the manufacture of incandescent lamps, including the refilling of burned-out lamps. The machinery formerly used by the New England company, now installed at the plant, has been purchased from Arthur G. Jessup, receiver for the latter organization. The American Lamp Company is capitalized at $2,000,000 and has plans under consideration for the establishment of similar plants in other cities, including Chicago, Detroit, Philadelphia, Newark, N. J., and New Orleans, La. It is also planned to operate large works at Long Island City.

Foreign Trade Notes

REGULATIONS GOVERNING WATER POWER IN RUMANIA.—With a view of making needful modifications in the present law, as well as to draw up regulations for the use of water power in Rumania, *Commerce Reports* states, the Ministry of Public Works has appointed a commission to be presided over by the general engineering inspector of the Ministry of Communications.

PROPOSED HYDRO-ELECTRIC PROJECT IN ESTHONIA.—A representative of some Belgian industrial concerns, according to *Commerce Reports,* was in Reval early in June negotiating with the Esthonian authorities for a concession to exploit the Narva waterfalls and the Reval electric railway. After obtaining a concession to utilize the water falls, it is stated that it is proposed to construct a large power station in Narva capable of supplying electricity throughout Esthonia.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency and purchase is desired by parties in Italy (No. 3,420) for machinery, electrical material, motors, etc.

A street-railway company in Spain (No. 3,426) planning extensive improvements, for which electrical material will be required, desires to purchase supplies in the United States.

A mercantile firm in Italy (No. 3,430) desires to secure an agency for radio telephones.

THE VICTORIAN ELECTRICITY COMMISSION, 22 William Street, Melbourne, Australia, will receive tenders until Jan. 15, 1923, according to the *Electrical Review*, for four water-tube boilers, each 4,500 sq.ft., with pumps, piping and structural steel work for boiler house. Tenders will also be received until Jan. 23, 1923, for a back-pressure steam turbine, including a 1,500-kw. turbo-alternator.

POWER HOUSE EQUIPMENT FOR SOUTH AFRICAN RAILWAYS.—Tenders will be received until Oct. 18 by the South African Railway Board, according to the *Electrical Review,* for powerhouse equipment in connection with the electrification of the Maritzburg-Glencoe Railway, including coal-handling plant, ash-handling plant and circulating water screening plant. Specifications, forms of tender, etc., may be obtained at the office of the High Commissioner for the Union of South Africa, Trafalgar Square, London, W. C. 2. Merz and McLellan, 32 Victoria Street, S. W. 1, London, are consulting engineers.

ELECTRIC INDUSTRIAL TRUCKS FOR VICTORIAN RAILWAYS.—Tenders will be received by the Victorian Government Railway Commissioners, Melbourne, Australia, until Nov. 29, the *Electrical Review* states, for three electric storage-battery industrial trucks, capable of carrying 4,000 lb. at five miles an hour.

ELECTRIC CRANES FOR AUCKLAND, NEW ZEALAND.—Tenders will be received by the Harbor Board, Auckland, N. Z., until Feb. 1, 1923, according to the *Electrical Review*, for twenty-two electric cranes for Princes Wharf.

New Apparatus and Publications

CIRCUIT BREAKERS. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently brought out an oil circuit breaker of larger capacity, known as type "F-22."

DECORATIVE LIGHTING.—The Reflector & Illuminating Company, 565 West Washington Street, Chicago, is distributing a booklet describing its "Color-O-Lite" film holder and "Spot-O-Lite" equipment for decorative lighting. The company has issued an eight-page leaflet covering its "Pittsburgh" reflector for colorful lighting.

FLEXIBLE COUPLING.—The Steel-Flex Coupling Corporation, Detroit, has recently placed on the market an all-steel flexible coupling, known as the "Steel-Flex" coupling.

INDUSTRIAL APPARATUS.—The Condit Electrical Company, Boston, 27, has issued an "Industrial Hand Book" covering its industrial apparatus. It also gives some handy tables and Underwriters' motor rules.

STREET LIGHTING.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently published a pamphlet on street lighting, known as reprint No. 123.

COAL AND ASH-HANDLING SYSTEM —The Chain Belt Company, Milwaukee, has recently brought out a new pivoted bucket-carrier system for handling coal and ashes for power plants, etc.

RADIO APPARATUS.—A new radio receiving set has recently been placed on the market by the Killark Electric Manufacturing Company, Easton and Warne Avenues, St. Louis.

PHENOL PRODUCTS.—The Redmanol Chemical Products Company, 636 West Twenty-second Street, Chicago, has issued a thirty-six-page booklet listing the various uses of its product, "Redmanol."

STEAM RAILWAY ELECTRIFICATION —"Progress in Steam Railway Electrification" is the title of bulletin No. 44,016 issued by the General Electric Company, Schenectady, N. Y., in which it describes some of the prominent railway electrifications throughout the world for which it has supplied the apparatus.

TRANSFORMERS.—The Kuhlman Electric Company, Bay City, Mich., is distributing bulletin No. 111, covering the "Kuhlman" single-phase distribution and power transformers. Bulletin No. 112 issued by the company describes its three-phase distribution and power transformers.

RADIO TOWERS. — The Milliken Brothers Manufacturing Company, Inc., Woolworth Building, New York City, has issued catalog No. 16, describing the "Milliken" galvanized radio towers.

INDUCTION MOTOR.—The Electric Controller & Manufacturing Company, Cleveland, is putting on the market a squirrel-cage induction motor.

ELECTRIC HOISTS. — Bulletin No. 544-DD distributed by the Northern Engineering Works, Detroit, describes the Northern frame "B," type D electric hoist, which is furnished in sizes from ¼ ton to 1 ton.

PUMPS.—Bulletin No. 48,028 issued by the General Electric Company, Schenectady, N. Y., gives several illustrations of the application of electric motors for driving pumps and general descriptions of motor control.

LUBRICATING SYSTEM. — The Carr Fastener Company, Boston 39, is distributing two leaflets, covering the "Dot" high-pressure lubricator for use in industrial plants, turbines, conveying machinery, etc.

New Incorporations

THE HAWKINS (WIS.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $6,000 by Frank Prochaska, F. W. Lonks, J. Hawkins and others.

THE FRANKLIN (VT.) ELECTRIC LIGHT COMPANY has been incorporated by Charles H. Gates, Rodney D. Gates, R. R. Strait, Frank Peverly and others. The company is capitalized at $30,000 and proposes to generate and distribute electricity in Franklin, Sheldon, Highgate and Berkshire.

THE STODDARD WAVE POWER CORPORATION, New Rochelle, N. Y., has been incorporated by Edward D. Stodder, Guy L. Gleason and Donald J. McLean, all of New Rochelle. The company is capitalized at $25,000 and proposes to utilize the ocean waves to generate electricity, etc.

THE SAN GORGONIO POWER COMPANY has been organized with a capital stock of $1,000,000 to construct a hydro-electric plant in the Whitewater River district, near Riverside, Cal. The directors are: R. R. Scarborough, president; W. T. McAllister, M. S. Hazen and J. A. Lamour, all of Los Angeles.

THE EAST BRUNSWICK MUTUAL POWER & LIGHT COMPANY, 40 Patterson Street, New Brunswick, N. J., has been incorporated with a capital stock of $125,000 for the purpose of furnishing electricity in East Brunswick Township. Klammer Kalteissen is agent.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

SALMON FALLS, N. H. — The Salmon Falls Manufacturing Company has authorized an increase of $200,000 in capital stock, the proceeds to be used for additional water-power development, at its mill, increasing the output from 1,200 to 3,000 hp.

REVERE, MASS.—Plans for the new vocational school, to cost about $250,000, provide for a vocational department.

MERIDEN, CONN.—The Aeolian Company is planning to build a one-story addition to the power house at its local plant.

TORRINGTON, CONN.—A committee of merchants and property owners have submitted a proposal to the Borough Council offering to install ornamental lamp standards on Main Street from Smith Street to City Hall Avenue, provided that the borough would maintain the lamps.

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North Atlantic States

BEDFORD HILLS, N. Y.—The Montefiore Home, Gun Hill Road, is taking bids for the erection of a power house. Robert D. Kohn, 56 West Forty-fifth Street, New York, is architect.

HORNELL, N. Y.—The Hornell Electric Company contemplates the erection of a high-tension transmission line from Hornell to Arkport, 5 miles, to cost about $25,000.

JAMESTOWN, N. Y. — The Niagara, Lockport & Ontario Power Company, Buffalo, contemplates building a power plant in the vicinity of Jamestown and extensions to its system, to cost about $750,000.

LONG ISLAND CITY, N. Y.—Conveying equipment, loading and unloading machinery, elevators, etc., will be installed in the new warehouse to be erected at Long Island City by James Butler, Inc., 391 Washington Street, New York City, to cost about $1,500,000. William Higginson, 21 Park Row, New York City, is architect.

MT. KISCO, N. Y. — The Westchester Lighting Company is preparing plans for a two-story building to be used for general mechanical and operating service. May & Hilliard, 15 East Fortieth Street, New York, are architects.

NEW YORK, N. Y.—The Car Lighting & Power Company, 61 Broadway, has issued $1,000,000 in bonds, the proceeds to be used for plant construction and improvement.

NEW YORK, N. T.—Work will soon be started on the proposed power plant to be erected at Columbia University, Teachers' College, to be used in connection with a new library building on 120th Street near Broadway.

ROCHESTER, N. Y. — The Northeast Electric Company, 348 Whitney Street, is planning to build an addition to its plant, 51 ft. x 90 ft., to cost about $30,000.

ROCHESTER, N. Y.—Plans are being prepared by the Rochester Telephone Corporation for the construction of a service and repair building on St. Paul Street, to cost about $125,000.

ST. GEORGE, N. Y.—The Baltimore & Ohio Railroad Company has plans in progress for the electrification of the lines of the Staten Island Rapid Transit Company, a subsidiary, including power plants, substations, etc.

CLOSTER, N. J.—The capital stock of the Rockland Electric Company of New Jersey has been increased from $200,000 to $300,000.

FLORENCE, N. J.—The Township Committee is negotiating with the Public Service Electric Company to extend its service to Florence.

HACKENSACK, N. J.—Bids will be received by the Hackensack Improvement Commission until Sept. 25 (Contract No. 3) for furnishing pumping equipment, consisting of A. B. Wood patent trash pumps, motors and switchboards to be installed in the structures to be erected for the city of Hackensack under another contract, which is known as Contract No. 1. Lemuel Lozier is engineer of the commission.

JERSEY CITY, N. J.—The new freight house to be erected at the foot of Chapel Avenue by the Lehigh Valley Railroad Company, at a cost of about $650,000, will be equipped with freight-handling, loading and conveying machinery, industrial trucks, etc.

NEW BRUNSWICK, N. J.—The East Brunswick Mutual Power & Light Company, 40 Patterson Street, recently organized with a capital of $125,000, plans to install an electric plant and system in East Brunswick Township. Klemmer Kalteissen heads the company.

WHIPPANY, N. J.—R. B. McEwan & Sons contemplate rebuilding its power house at their paper-board mill, recently damaged by fire. The loss is estimated at about $30,000.

ALTOONA, PA.—The Penn Central Light & Power Company has issued $167,000 in bonds, part of the proceeds to be used for extensions and improvements.

EASTON, PA.—An underground conduit system will be installed in North New Street for an ornamental street-lighting system.

HANOVER, PA.—The Hanover Light, Heat & Power Company has issued $75,000 in bonds, part of the proceeds to be used for extensions and improvements.

HARRISBURG, PA.—Plans are under way for the installation of an ornamental lighting system on Front Street from Market Street north. Clark E. Diehl, city electrician, is in charge.

PHILADELPHIA, PA.—The Philadelphia Electric Company will build an addition to its Ontario substation and to the substation at Susquehanna Avenue and American Street.

PHILADELPHIA, PA.—Electrical and mechanical equipment will be installed in the eight-story printing plant to be erected by the Lutheran Publishing Company, Ninth and Sansome Streets, Philadelphia, to cost about $500,000.

PHILADELPHIA, PA.—Plans have been prepared by Eugene S. Powers & Son, 315 South Fifteenth Street, consulting engineers, for a one-story power house for the St. Joan of Arc School, Frankford Avenue and Venango Street.

SNYDERTOWN, PA.—The Snydertown Power & Light Company recently organized, will install a local distributing system. The company has contracted with the Pennsylvania Power & Light Company for power supply.

STATE COLLEGE, PA.—The Keystone Power Corporation, Philadelphia, has issued $719,000 in bonds, the proceeds to be used to acquire the plant and holdings of the State Center (Pa.) Electric Company and for extensions and improvements.

YORK HAVEN, PA.—The York Haven & Power Company will build a series of generating units to double its present capacity, estimated to cost about $1,000,000.

HARRINGTON, DEL.—The Eastern Shore Gas & Electric Company, Laurel, is negotiating for the purchase of the property and holdings of the Kent County Electric Company, now furnishing service at Harrington, Felton, Frederica and vicinity. Extensions and improvements are planned.

BALTIMORE, MD.—Extensions to the water filtration plant at Montebello, to cost about $1,500,000, are under consideration. New equipment, including electrically operated pumps and other machinery will be installed. Chief Engineer Megraw, Water Bureau, is in charge.

FROSTBURG, MD.—New electric pumping equipment will be installed at the municipal waterworks in connection with other extensions and improvements, to cost about $60,000.

HAGERSTOWN, MD.—The Potomac Public Service Company, a subsidiary of the American Water Works & Electric Company, 50 Broad Street, New York, will build a 30,000-hp. hydro-electric plant on Cacapon Creek, near Edes Fort, W. Va., to cost, including transmission system, about $3,000,000.

GLEN WHITE, W. VA.—Arrangements are being made by the E. E. White Coal Company for the installation of additional electrical and mechanical equipment, to cost about $200,000.

LEEHALL, VA.—An electric plant will be installed in connection with a new garage being erected by S. R. Curtis & Sons. The proposed plant will supply electricity for lighting purposes in Lee Hall and vicinity.

ROANOKE, VA.—The Liberty Light & Water Company, recently organized, contemplates the installation of an electric system in this section. M. C. Hughson is president.

WASHINGTON, D. C.—Bids will be received by the Board of District Commissioners until Sept. 12 for 25,500 ft. of telephone and signal cable for the electrical department.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Sept. 22 for 260,000 ft. silicon bronze antenna wire (Circular PR-12169-2CP); also, until Sept. 25 for two 80-ft. radio towers for use at the Montgomery intermediate depot.

North Central States

DETROIT, MICH.—Parke, Davis & Company have filed plans for the construction of a power plant at their drug factory, Guoin Street, to cost about $75,000.

MUSKEGON HEIGHTS, MICH.—The installation of an ornamental lighting system is under consideration. The cost is estimated at $35,000, and the system will include 190 lamp standards. C. S. Gamble is city engineer.

OMER, MICH.—The Council has authorized the purchase of a site on the Rifle River for a municipal electric light and power plant.

MARYSVILLE, OHIO.—The Marysville Light & Water Company expects to erect a transmission line to the village of Ostrander, a distance of 5 miles, within the next thirty days. Mayne Mackan is superintendent.

LOUISVILLE, KY.—Arrangements are being made by the Louisville Cement Company for the erection of a new cement mill at Speed, Ind., to cost about $500,000. It will be equipped throughout with electrically operated machinery.

NEWPORT, KY.—The Cincinnati, Newport & Covington Street Railway Company is planning to rebuild its local power plant, recently damaged by fire.

NEWPORT, KY.—The power plant of the South Covington & Cincinnati Street Railway Company was recently damaged by fire, causing a loss of about $15,000.

FORT WAYNE, IND.—The Home Telephone & Telegraph Company has applied to the Public Service Commission for authority to make extensions and improvements, including the installation of underground conduits, to cost about $300,000.

INDIANAPOLIS, IND.—A new municipal electric power plant will be erected in connection with the proposed sewage-disposal plant, to cost about $115,000. The Board of Sanitary Commissioners is in charge.

MARION, IND.—The Faulkner-Burge Packing Company is planning to rebuild its power house, recently damaged by fire.

KEWANEE, ILL.—The Consolidated Light & Power Company has submitted a proposal to the City Council offering to sell its plant to the city. Bonds to the amount of $125,000 have been voted to establish a municipal electric plant.

ANTIGO, WIS.—Plans are being prepared by M. D. Robrecht for the erection of a three-story cold-storage warehouse, 40 ft. x 100 ft., which will be equipped with a 150-hp. to 200-hp. power plant and artificial ice and refrigerating unit.

DANE, WIS.—The Wisconsin Power, Light & Heat Company is erecting a 66,000-volt transmission line from Dane to Fond du Lac, a distance of 75 miles, which will deliver energy from the Prairie du Sac hydro-electric plant of the Wisconsin River Power Company to the distribution system of the Eastern Wisconsin Electric Company.

FOND DU LAC, WIS.—The Eastern Wisconsin Electric Company, Sheboygan, has been granted a franchise to extend its transmission line to Van Dyne.

ST. PAUL, MINN.—A two-story power house, 40 ft. x 98 ft., will be erected on Hoffman Street for the St. Johns Hospital.

WILLMAR, MINN.—The City Council has awarded contract to the Power Construction Company, Minneapolis, for the installation of an underground conduit system in the business district.

DES MOINES, IOWA.—The City Council is considering replacing the gasoline lamps now in use in the city public parks with electric lamps.

KANSAS CITY, MO.—The City Hospital Association will build a one-story power house at the city hospital, Twenty-second and Cherry Streets. F. C. Gunn, 1107 Republic Building, is architect.

MARYVILLE, MO.—The Maryville Electric Light & Power Company has been granted a franchise for the construction of a transmission line to Bradyville, Iowa.

HOT SPRINGS, S. D.—Plans are being prepared by the Hot Springs Water, Light & Power Company for the construction of a 150-hp plant to replace the one destroyed by flood. The Hollister Engineering Company, Bankers' Life Building, Lincoln, is engineer.

PRESHO, S. D.—The proposal to issue bonds for the establishment of a municipal electric plant will soon be submitted to the voters.

CORTLAND, NEB.—An election has been called to vote on the proposal to issue bonds for the installation of a municipal lighting system.

DEXTER, KAN.—Preliminary plans are being prepared by the Dexter Helium Company of America, Winfield, for the erection of a new helium plant at Dexter, to cost about $1,000,000. The plans include a power house, mechanical shop, etc.

Southern States

CHERRYVILLE, N. C.—Extensions and improvements are contemplated to the water and light systems. Funds to the amount of $50,000 are available for the work.

FOUNTAIN, N. C.—Bonds to the amount of $15,000 have been approved for the installation of an electric lighting system.

COLUMBIA, S. C.—The Parry-Mann Electric Company is reported to be in the market for a 300-hp. engine and a 225-kw generator, with exciter, switchboard and auxiliary equipment.

LEXINGTON, S. C.—The Lexington Electric Light & Power Company contemplates increasing its capital stock from $10,000 to $30,000.

LOUGHMAN, FLA.—The Everglade Cypress Company will build an electric generating plant for service at its proposed lumber mill.

MARIANNA, FLA.—The Federal Power Commission has granted the Chipola Light & Power Company permission to construct a dam and power plant at Look and Tremble Shoals on Chipola River, 12 miles south of Marianna.

ST. PETERSBURG, FLA.—Bids will be received by the Department of Public Utilities until Sept. 11 for the construction of a municipal electric lighting plant. Bonds to the amount of $300,000 have been voted to establish a municipal plant.

BIRMINGHAM, ALA.—The Lehigh Portland Cement Company, Allentown, Pa., will build a power plant in connection with its proposed local cement mill, to cost about $500,000.

OPELIKA, ALA.—The Alabama Power Company, Birmingham, it is reported, is planning to erect a substation at Aubrey, 5 miles from Opelika.

TUSKEGEE, ALA.—Bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until Sept. 22 for lighting fixtures for the veterans' hospital.

WATERFORD, ALA.—The Houston Power Company, Newton, will soon commence the construction of a hydro-electric power plant here. The Southern Engineering Corporation, Albany, Ga., is engineer.

COLLINS, MISS.—Bids will be received by the Mayor and Board of Aldermen until Sept. 11 for improvements to the municipal electric light plant as follows: Two oil engines directly connected to alternators, switchboards, pumps, one 12,000-gal. oil-storage tank, concrete foundations, new building, etc. Swanson-McGraw, Inc., United Fruit Building, New Orleans, La., are engineers.

UTICA, MISS.—The Council has authorized plans prepared for the installation of an electric light and power system.

POCAHONTAS, ARK.—The Central Power & Light Company, Walnut Ridge, contemplates the construction of a hydro-electric power plant on the Elevenpoints River.

GIBSLAND, LA.—The installation of a municipal electric plant and water system, to cost about $50,000, is under consideration.

ST. FRANCISVILLE, LA.—Bonds to the amount of $20,000 have been approved for extensions and improvements to the municipal electric plant.

MUSKOGEE, OKLA.—The Muskogee Gas & Electric Company will soon begin work on its proposed hydro-electric electric plant on the Arkansas River, to cost about $1,000,000. Transmission lines will be erected to connect with the distributing of the Oklahoma Gas & Electric Company and the Fort Smith Light & Traction Company. The H. M. Byllesby Construction Company, Chicago, is in charge.

NOBLE, OKLA.—Plans are under way for the erection of a transmission line to Norman, to secure electricity for local service.

CLIFTON, TEX.—Bonds to the amount of $35,000 for improvements to the municipal electric light plant have been approved by the Attorney General's Department, Austin.

CORSICANA, TEX.—The Council contemplates the installation of a modern electric fire-alarm system throughout the city

DALLAS, TEX.—The City Commission has given its approval of the proposal of the Dallas Power & Light Company for the construction of a new electric generating station, to cost about $2,180,000.

DALLAS, TEX.—Steps have been taken by the Pacific Avenue Improvement League for the installation of an ornamental lighting system on Pacific Avenue. Harry Olmsted is president of the league.

EL PASO, TEX.—Work has begun on extensions to the electric plant of the El Paso Electric Railway Company, to cost about $75,000. It is proposed to increase the output by 2,200 kw.

SAN BENITO, TEX.—Plans are under way for the construction of a municipal electric plant and water system, for which bonds have been approved.

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Pacific and Mountain States

MONTESANO, WASH.—The Washington Coast Utilities, Inc., Seattle, will erect a 13,000-volt transmission line on the Olympia Highway, about 5½ miles long.

CORNING, CAL.—W. H. Lampson, Corning, and associates have applied to the State Water Commission for permission to build a 125,000-hp. hydro-electric plant on the Trinity River, to cost $5,000,000.

LOS ANGELES, CAL.—The Council has approved ordinances for the installation of ornamental lighting systems on Sixteenth Street, Vermont, Berkshire and Grand Avenues.

SANTA ANA, CAL.—The Council is considering plans for the installation of a lighting system on West Fourth Street from Ross to Artesia Street.

MACKAY, IDA.—The Republic Consolidated Mining & Refining Company, recently organized with a capital of $3,000,000, is preparing plans for a hydro-electric plant to be used in connection with a new cyanide mill. W. P. Barton is in charge.

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Canada

ELKO, B. C.—The Wigman Pulp & Paper Company, Ltd., Victoria, B. C., recently organized, contemplates the construction of a power plant in connection with its proposed pulp and paper mill at Phillips Bridge, near Elko, to cost about $2,500,000.

VANCOUVER, B. C.—The City Council has engaged J. G. G. Kerry, engineer of Kerry & Chace, Ltd., Confederation Life Building, Toronto, Ont., to investigate water power facilities here with a view of establishing a hydro-electric plant.

HAMILTON, ONT.—Contracts will soon be awarded by the Ontario Hydro-Electric Commission, London, for a new hydro station and also for extension of transmission lines along the Beach Road, to cost about $40,000.

ST. THOMAS, ONT.—Plans are under consideration for an electric distributing system and substation in Yarmouth Township, to cost about $28,000. W. C. Caughell, 386 Talbot Street, is township clerk.

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Mexico

NOMBRE DE DIOS, DURANGO—Cesar G. Torres has petitioned the state government for a concession to build a dam across the Chavarria River and a hydroelectric plant. The water will also be used for irrigation purposes.

GUANAJUATO, GUANAJUATO—The transmission system of the Guanajuato Light & Power Company will be extended to a number of towns in the States of San Luis Potosi, Guanajuato, Aguas Calientes, Michoacan and Jalisco as soon as an additional generating unit can be installed at its plant at Elduro.

VICTORIA, TAMALULIPAS—Application has been made by J. J. Healy to the Mexican government for a concession to construct and operate a large hydro-electric plant, transmission system and street railway in the State of Tamaulipas and Victoria, the capital. The plans also involve a reclamation scheme.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 22, 1922)

1,426,388. Current-Collector Contrivance; K. Jacquet, Zurich, Switzerland. App. filed May 2, 1921. For trolley wire suspended over center of rails or midway between two tracks.

1,426,407. Oil-Well Heater; H. Pennington, Wichita Falls, Tex. App. filed Oct. 29, 1920. To heat oil to make it flow more freely.

1,426,411. Electric Heating Unit; C. B. Rogers, Seattle, Wash. App. filed Aug. 16, 1920. Thermostatic control.

1,426,421. Condenser-Cemented Sectional Insulator; S. S. Sonneborn, Brooklyn, N. Y. App. filed Feb. 27, 1917. Sections of insulators separated by metallic filling.

1,426,433. Stove; C. F. Wiley, Taunton, Mass. App. filed July 8, 1921. Combined coal and electric stove.

1,426,465. Variable Resistance; E. G. Danielson, San Francisco, Cal. App. filed Feb. 14, 1921. Mixture of non-conducting material and finely divided graphite.

1,426,478. Universal Cord Circuits; J. E. Hilbish, La Grange, Ill. App. filed Jan. 30, 1919. For interconnecting magneto and common-battery telephone lines.

1,426,490. Electric Lighting Mechanism; H. G. Lewis and W. S. Mayer, Philadelphia, Pa. App. filed March 12, 1920. Automatically closing device for series lighting circuits.

1,426,507. Smelting and Electrolyzing Process; R. Rodrian, New York, N. Y. App. filed March 3, 1922. Recovery of metals from molten mass by electrolytic treatment.

1,426,516. Insulator; L. Steinberger, Brooklyn, N. Y. App. filed April 29, 1918. Provided with strain members to lessen stress and strain within body.

1,426,549. Printing Surface; J. A. Corey, London, England. App. filed March 4, 1919. Produced by electrotyping process.

1,426,603. Electric Vulcanizer; E. J. Rohne, Minneapolis, Minn. App. filed Nov. 21, 1919. For pneumatic tire casings.

1,426,604. Electric Heater; H. E. Roys, New York, N. Y. App. filed Oct. 1, 1920. Attachable to electric fans.

1,426,619. Electrical Measuring Instrument; C. E. Vawter, Philadelphia, Pa. App. filed July 30, 1919. Direct-reading ohmmeter.

1,426,620. Rail-Bond Tester; C. E. Vawter, Philadelphia, Pa. App. filed Oct. 10, 1919. Resistance measurement through bonded section.

1,426,669. Ciphering Device; R. E. Pierce, Larchmont, N. Y. App. filed July 23, 1920. For enciphering and deciphering messages of printing telegraph mechanism.

1,426,703. Electrolytic Treatment of Ores Containing Zinc, Cadmium and Copper; D. Avery, Melbourne, Victoria, and R. H. Stevens and R. T. D. Williams, Risdon, Hobart, Tasmania, Australia. App. filed March 16, 1920.

1,426,733. Method and Means for Preventing Amplifier from Oscillating; R. A. Heising, East Orange, N. J. App. filed Feb. 14, 1918. By properly proportioning parts of circuit.

1,426,734. Method of Manufacturing Audions; W. F. Hendry, New York, N. Y. App. filed April 30, 1919. Production of unitary multiple-surface electrodes.

1,426,743. Electromagnetic Sound-Producing Device; F. J. and W. L. Kaehni, Cleveland, Ohio. App. filed June 9, 1922. Phonograph reproducer consisting of vibratory magnetic member controlled by coil.

1,426,751. Thermionic Regulator; P. K. McGall, West Orange, N. J., and H. R. Menefee, New York, N. Y. App. filed Aug. 13, 1919. Vacuum-tube type for small electrical generator.

1,426,754. Circuits for Electron Discharge Devices; R. C. Mathes, New York, N. Y. App. filed Oct. 23, 1916. Method for compensating for fluctuations in potential of output circuit battery.

1,426,755. Vacuum-Tube Circuits and Method of Operating Them; R. C. Mathes and H. S. Read, New York, N. Y. App. filed May 9, 1919. Multistage amplifier circuits using vacuum tubes.

1,426,757. Acoustic Device; C. R. Moore, Wyoming, N. J. App. filed June 24, 1919. Translates vibrations into variations in electrical circuit.

1,426,768. Printing Telegraph Receiver; H. Ffannenstiehl and E. P. Bancroft, East Orange, N. J. App. filed Oct. 10, 1917. Power-driven mechanism controlled by line impulses.

1,426,769. Process for Plating; G. H. Pinney, South Manchester, Conn. App. filed Oct. 26, 1921. Electroplating tableware.

1,426,775. Auto Transformer; A. D. Riccia, Brussels, Belgium. App. filed Dec. 2, 1921. For supplying two symmetrically disposed secondary circuits.

1,426,786. Storage Battery; J. B. Speed and F. Hutchinson, New York, N. Y. App. filed April 3, 1920. Hermetically sealed storage battery with 1.437 volts between electrodes.

1,426,788. Insulator Strain Member; L. Steinberger, Brooklyn, N. Y. App. filed Nov. 26, 1918. Evenly distributes stresses and strains.

1,426,789. Insulator; L. Steinberger, Brooklyn, N. Y. App. filed Jan. 28, 1922 Bridge portions act as electrostatic stress distributors.

1,426,791. Electric Contol System; H. M. Stoller, New York, N. Y. App. filed June 21, 1921. Used in conjunction with internal-combustion engines.

1,426,801. Repeater for Undulatory Currents; W. Wilson, East Orange, N. J. App. filed March 21, 1917. Reinforcing current waves of any frequency or form.

1,426,803. Printing Telegraph; A. H. Adams, Galion, Ohio. App. filed July 21, 1920. Operation controlled by line impulses.

1,426,807. Method of and System for Testing Transmitters or Receivers; H. D. Arnold and J. P. Minton, East Orange, N. J. App. filed Nov. 12, 1917. Testing diaphragms, granular carbon, etc.

1,426,810. Repeater System; W. E. Beatty, Bayside, N. Y. App. filed Sept. 30, 1918. Two-way telephone operation with reversible one-way repeater.

1,426,811. Electric Switch; R. B. Benjamin, Chicago, Ill. App. filed June 26, 1919. Pull-switch sockets.

1,426,817. Telephone Exchange System; E. H. Clark, Richmond Hill, N. Y. App. filed Dec. 11, 1919. High-resistance relay holds interoffice trunk busy until disconnection.

1,426,818. Telephone-Exchange System; H. P. Clausen, Mount Vernon, N. Y., and C. L. Goodrun, New York, N. Y. App. filed Dec. 28. 1918. Controlling operation of machine-switching system.

1,426,821. Telegraph System; G. C. Cummings, East Orange, N. J. App. filed Dec. 24, 1919. Signals composed of positive and negative impulses.

1,426,826. Electron - Discharge Device Circuits; H. C. Egerton, Passaic, N. J. App. filed July 19, 1917. Unilateral impedance between filament grid providing leakage for positive charge.

1,426,861. Measuring Device; A. Haddock, East Orange, N. J. App. filed Dec. 17, 1919. Thermocouple mounted in evacuated vessel.

1,426,868. Cadmium-Test Device; B. J. Haskins, Kansas City, Mo. App. filed May 10, 1920. Enables operator to note various tests, without changing position of device.

1,426,899. Radiographic Plate Changer: A. Mutscheller and K. Stoye, New York, N. Y. App. filed Feb. 15, 1919. Trayholder for plate in X-ray photography.

1,426,921. Electrical Apparatus; A. R. Smith, Schenectady, N. Y. App. filed May 6, 1919. Switchboard unit for electrical apparatus.

1,426,923. Electrical System; R. Steck, Fort Wayne, Ind. App. filed Oct. 26, 1920. Battery and generator supply current to power and lighting circuit.

1,426,924. Electrical System; R. Steck, Fort Wayne, Ind. App. filed Oct. 26, 1920. Generator and battery apparatus.

1,426,925. Electrical System; R. Steck, Fort Wayne, Ind. App. filed Oct. 26, 1920. Relates to system where several circuits are supplied from single dynamo-electric machine.

1,426,939. Motor Control; J. D. Wright, Schenectady, N. Y. App. filed Jan. 2, 1919. For operating hoists where speed of lowering may be in excess of hoisting speed.

1,426,940. Electrical Apparatus; L. Wulff, Pittsfield, Mass. App. filed Oct. 13, 1920. Retaining windings in predetermined spaced relation in transformers, reactances, etc.

1,426,943. High-Frequency Alternator; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Sept. 23, 1916. Radio-frequency alternators of inductor type.

1,426,944. Radiosignaling System; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Sept. 4, 1917. Multiplex signaling system for transmitting and receiving several messages simultaneously.

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"Men of the Organization"

LITTLE is gained by talking abstractions and technicalities to the public. Those in other walks of life know nothing of the inner workings of a central station. Our terms, our detail problems, the engineering and business phases of the electrical industry are something of small interest in the average household.

But when it comes to men and ideals—that is different. Anybody in the world will give an ear to the story of a man. And people who will scarcely glance at type that tells about a power company and its affairs will read attentively a statement of practical ideals or a record of some personal achievement.

AN APPROXIMATE and interesting application of this simple truth is seen in a series of advertisements which are running now in the newspapers of every city where there is a public utility operated by Charles E. Tenney & Company of Boston. Each advertisement is entitled—"The Men of the Organization Serving You." In it appears the portrait of the chief engineer, or superintendent, or general manager, or some other official of the local company. Below the portrait is a little story of the man and how he serves the utility, so written that it leaves a thought of how the utility in turn serves all the people. It is interesting reading. It is also ingenious publicity.

It is a graceful, pleasing recognition of an employee that gratifies the man himself and is noted with appreciation by all his friends. It is an evidence of human understanding that brings encouragement to the entire personnel and builds a closer family bond within the organization. It is a ready acknowledgment of honest debt for work well done, beyond the basic measure of the wage, that always merits popular acclaim and wins it. It is a "good ad"—only because it is an honest expression of a broad-minded and big-hearted policy. That is the appeal.

CORPORATIONS became unpopular years ago. They had waxed so great that they were quite impersonal. As the organization grew and the activities and representatives of the company became more numerous and various the personality of the dominating man was lost to view. People could no longer say, "Oh, I know him! He is square and honest." There was no man in sight to pin their faith to with full knowledge of his power to serve.

For the thing that wins appreciation for good utility service is the knowledge that some man has cared enough to wish to serve and help and please the customer and the community. And people naturally want to know this man and who he is and what he does. It is just human. And the public service company should be a human institution as well as a corporate one. So its executives should not only personally know the people whom they serve but also make the chief men of the organization known to the community.

Jesse Robert Lovejoy

A leader in electrical business expansion who has created a sales organization that is a monument to his ability.

TO HAVE lived in intimate contact with the marvelous development of the electrical industry in the present generation is an inspiration; to have been a prime mover in its upbuilding and growth is a distinction. J. R. Lovejoy, vice-president of the General Electric Company and a director of the International General Electric Company, was born in Ohio, of New England parentage, and in 1884, before the age of twenty-one, was graduated from the Ohio State University at Columbus with the degree of bachelor of science.

In 1886, in the pioneer days of the industry, Mr. Lovejoy entered the employ of the Thomson-Houston Electric Company at Lynn, Mass., as an apprentice and, choosing between arc and incandescent lighting, selected the latter as promising the greater field for expansion. This initial choice typifies the insight with which from that time forward problems have been faced, correctly gaged and wisely handled during his thirty-five years' activity in the field of electrical development. As construction superintendent for the Thomson-Houston company in 1887, he was brought into contact with the practical side of the business, and he has always been an ardent and persistent advocate of the central station. He gained his first experience at Cleveland, Ohio, where a central station was operating with Thomson-Houston apparatus.

It soon became evident that it was necessary to train more young men for the increasing business of the company, and Mr. Lovejoy was detailed to select men for the testing department. He at that time decided upon certain policies which rule today to a very large extent in the selection of college graduates, so that in this, as in many other directions, he did pioneer work.

As the use of the incandescent apparatus increased, it became more and more necessary to develop a full line of parts now known as "wiring supplies," and it was natural that Mr. Lovejoy should take up this work. For a considerable period he not only had much to do with the development of these supplies but also with the sale of them. This work included special apparatus which was soon needed in the ever-growing electrical business. The first work done for the United States Navy was the manufacture of searchlamps. The business with the navy soon grew into furnishing generating sets, as well as a line of wiring devices for which very rigid specifications had been drawn.

When the General Electric Company was organized in 1892 by the consolidation of the Thomson-Houston Electric Company and the Edison General Electric Company, four commercial organizations were created. On account of his experience with wiring devices Mr. Lovejoy was placed in charge of the supply department and remained manager of that department up to 1900, when he was made manager also of the railway and lighting departments. Later on he became general sales manager. In May, 1907, he was elected a vice-president and in May, 1922, a director.

As vice-president in charge of sales Mr. Lovejoy was much interested in and had much to do with the development of business through the foreign department. He made several trips to Europe, the first in 1890, and when it was found desirable to organize companies for the transaction of business in certain foreign countries Mr. Lovejoy was elected president of four such organizations.

Mr. Lovejoy's best work is the creation of a sales organization frankly rated by other industrial firms as second to none. The selection and training of the personnel of such a large and alert group, widely scattered as its members are, requires patience and a keen knowledge of human nature. Step by step the growth of the electrical industry may be seen reflected in the functioning of this organization, which is more than a milestone in his career—it is a monument to his ability.

Editorial Comment

Electrical World, September 16, 1922
Volume 80 Number 12

End of Coal Strike Brings Relief

THE coal strike in both the bituminous and anthracite fields is now happily a thing of the past. Were it not for the condition of railroad equipment the electrical industry could look forward to the coming winter with feelings of equanimity and calm. There is nothing to be gained, however, by dodging facts, and it is a fact that the rolling stock, particularly that part of it necessary for the transportation of fuel, is in a depleted condition. The best that can be hoped for is that the railroad shopmen's strike will speedily end and that coal cars in abundance will be available before cold weather sets in.

Miners and coal operators have promised an abnormal production of coal, but this must reach the market if it is to be of service, and to do that perfect transportation conditions are essential. Such conditions are not now humanly attainable, so that coal will have to be rationed until next spring. However, it will flow more freely than it did during the strike and its price will not soar so high. For this relief electric public utilities are, of course, thankful. The road is still uphill, but the grade is not so steep. To maintain service against the heavy odds of a combined railroad and coal strike was a herculean feat and one which will stand to the everlasting credit of the industry.

Two Thoughts from the League Conference

FOR the first time in all these years representatives of local electrical leagues have come together for conference and spent three days comparing their experiences and evolving common plans and purposes. The opportunity was thought important enough to bring busy men east from Los Angeles and San Francisco, from Salt Lake and Denver, to a little island in Lake Ontario. Thirty-five cities were represented.

Out of the meeting came several interesting things. The clubs and leagues that these men talked about were of many kinds. Their activities had been varied. Their present plans differ in many ways. But on two points there was absolute unanimity of opinion, although the delegates were drawn from all branches of the industry—central-station men and manufacturers, jobbers and contractors, all present as spokesmen for the electrical men of some city. On these two fundamentals they all thought alike—first, that any ambitious program of market development by the electrical industry must be grounded on organized local co-operative activity by the entire electrical family in each city, and, second, that the position and influence of the central station in each community are such that the light and power company must assume initiative and leadership in the effort if any degree of success is to be obtained.

Had these been all central-station men it would be different. They were not. But be their position in the industry what it may, and without regard to the location of the city, their individual experience has convinced them that without the active help of the utility the job cannot be done in any town. There must be local organized co-operation, they all say, with the central station leading it, if the great plan to "electrify America" now is to go forward.

Why Not a Statue for Edison?

A VERY notable gathering of electrical men and captains of industry met in New York on Monday night of this week to commemorate the fortieth anniversary of the starting of electric central-station service in this country. While the occasion was marked by fitting tributes to Edison and to the Edison systems and was graced by the presence of the noted inventor himself and many who labored beside him forty years ago, the most striking tribute of all was the fact that the twig planted then has grown into an enormous tree with branches spreading to the utmost parts of the earth. It is difficult to honor one who has placed the whole world so deeply in his debt. It is still more difficult to comprehend the limits to which the art and industry he founded will lead us. They have already passed all human calculations. We can but behold them as we behold the heavens and be filled with wonder and awe.

This much the electrical industry can do, however. While Edison is yet alive it can acclaim him and can commission a sculptor to carve his likeness in marble or mold it in enduring bronze. A trifling tribute, to be sure, to so great a genius and benefactor to the human race, but a visible tribute none the less. The execution of such a work should be started at once.

More Liberal Conception of Pure Research Now Had by Manufacturers

IT IS not so very long since activity in the field of scientific research was limited in this country to a small number of university laboratories. Indeed, one does not have to look very far into the past to find a time when even our university research laboratories had not yet made their appearance and the spirit of research was evident only in the work of ardent individuals, such as Joseph Henry, to mention an example in the electrical field only. With the introduction into this country in the seventies of the true university idea, after the European pattern, our university laboratories have rapidly increased in number and resources till now, when American research contributes no small part in the steadily expanding scope of science and knowledge.

The foregoing refers to pure scientific research, to which alone many scientists feel that the word "research" may properly be applied. However, physical science, no matter how pure, cannot escape the problems of its application, and in the electrical field, especially in the early work on the telegraph, the telephone, the generator and the motor, we find electrical engineering research following closely that in the field of pure electrical science. This paralleling of effort has drawn attention to the mutual dependence of pure and applied science and has resulted in the recognition by the great powers of manufacture of the importance of pure research. This in turn has led, through enormous financial outlay for laboratories and staffs, to the remarkable stimulus to the spirit of research found in all industry of today.

Several important elements exist in this heretofore unusual relation between research and commerce as found in the modern manufacturer's research laboratory. Science is free and unselfish—its knowledge open to all. Commerce is selfish and each participant must protect his secrets. How shall these different attitudes be reconciled? Considering the problem of organization of the industrial laboratory, the most vital element involved is that of the freedom of the research worker from restriction. Narrowed as to his field of effort, limited as to the direction it may take, pressed for results or otherwise hurried, harassed by insufficient compensation, or deprived of the opportunity for obtaining through publication recognition for the results of his efforts, even a highly trained research worker finds himself uninspired and unable to use his talents to best advantage and so becomes an unprofitable servant.

Happily many of our large electrical manufacturers appear to have recognized these important elements of the situation. The success of their laboratories and the importance of much of the work reported from them is evidence of the broad viewpoint back of this distinct departure in manufacturing policy.

New Hope for the Commercial Manager

NOTHING has ever happened that has brought more hope and more encouragement to the commercial managers and salesmen of central-station companies than the organization of the joint movement for business development in the electrical industry. It means hard work for them, a faster pace, a more conspicuous job. But it is converting the man higher up—"the boss"—to the importance of commercial organization and market development.

There are still many general managers and presidents of light and power companies whose hearts are wrapped up chiefly in their engineering and financial problems and activities. Theoretically they admit the need for business building, for expanding the use of electricity in the community and extending the service, but the details of the salesman's work seem unimportant. And when the commercial manager submits some scheme that requires the investment of some money or calls for a bit of executive help, they turn it down and say: "It isn't necessary to do this. Just keep right on getting more contracts in the regular way."

It takes more than a tongue and a pair of legs to make a salesman, however. It takes more than selling experience and some ability in handling men to make a commercial manager. It needs imagination, vision and a willingness to gamble something to achieve constructive purposes. Central-station sales plans cannot be measured always on a slide rule nor reduced to proven facts, and very often they require liberal financing as in any other business.

Creative market development is an art, not a science. It needs a heart full of confidence and optimism, fired by a clear view of opportunity and inspired a bit by the man behind. The best commercial manager in the world can't do his best if he must drag along his "boss" like a dead weight behind.

A Code Requirement that Courts Danger

WE HAVE become used to looking to the committee reports from the Commercial Section of the National Electric Light Association for no small amount of practical information regarding not only purely commercial affairs but technical matters as well. One feature of the committee's report to the convention of the New England Division held last week impresses us as of particular importance from the standpoint of safety. This is the comment of the Wiring Bureau with respect to the provisions in the underwriters' code on grounding circuits. The code has long been somewhat notorious for the exhibition of more zeal than discretion in dealing with certain safety precautions. For years it forbade the grounding of circuits, which is the most effective means known for preventing danger to life from high-tension crosses. Unfortunately the life insurance underwriters were not represented in the councils from which the code emanated, and personal safety was pushed into the background in favor of supposed immunity from property risks for which the fire underwriters might be held responsible. The underwriters finally came to realize that grounding was a precaution desirable in the public interest, but it has not yet been discovered by those who formulated the code that in three-wire systems grounding should be solid and permanent.

Up to the present, however, the code insists that the two branch wires from three-wire systems should each have a fuse. This stand is taken notwithstanding the fact that in such branches one fuse—that connected to an outside wire—is suitable and sufficient for safety; the other—that connected to the neutral—on which the code is equally insistent, as this report points out, is an actual source of danger. If the fuse chances to blow, for example, on account of a ground on one side, the current will flow through a certainly improper and very likely risky path to the main ground on the neutral. Still worse, in case of a cross from the primary circuit the blowing of the fuse to neutral removes the only efficient protection to persons. These dangerous fuses, as the committee very properly calls them, are in themselves objectionable as requiring unnecessary construction, but this is of very small importance compared with the actual risks to persons and property which are caused by its presence, although in the aggregate it means a serious loss. That serious damage has not often resulted is mainly due to the fact that this particular fuse is generally made heavy enough to avert the risk of blowing under any circumstances that are likely to arise.

The long and short of the matter is that, despite continued efforts to bring the code to a point of safe and sane efficiency, progress has been very slow, and among other failings there remains this pernicious requirement as to fusing, which certainly should be expunged at the earliest possible moment. It would not be at all surprising if a material proportion of the fires which are ascribed in loose terms to faulty wiring could, if the truth were known, be justly charged to this overlooked danger in the official requirements for fuses.

Telephone Study Should Make Possible Inductive Co-ordination

DATA on the sensitivity of telephone receivers developed by studies at the Bureau of Standards have recently found their way into print. While the investigations were concerned with the sensitivity of telephone receivers for use in radio work only, the results suggest that it may be worth while to pursue the line of investigation with a view to ascertaining the effect of telephone-receiver sensitivity on the problems involved in the inductive co-ordination of light and power and telephone circuits.

A study involving the action of the ordinary commercial telephone receiver under the inductive effects produced on a telephone circuit by neighboring power circuits ought to produce some valuable information as to means of eliminating troubles so caused. Such means might be concerned with modifications of telephone apparatus only, but it is altogether likely that methods applicable to power circuits—probably in the way of limitation of certain factors that are most disturbing and yet which cannot be eliminated altogether—would be suggested. The line of research indicated by the Bureau of Standards' work on radiotelephone receivers is well worth including in any research program covering inductive co-ordination work affecting light and power and telephone systems.

Rural Service an Economic Problem

RURAL service is an economic and not a technical problem. Too much discussion has revolved about the technical features on the assumption that it would be possible to reduce the cost of giving the service by the development of some new form of distribution line or special service equipment. As a matter of fact, the technical problems are exactly those involved in the distribution of energy to any class of consumers. The only changes so far suggested to reduce expense materially would either entail greater operating expense in the future as the result of inadequate construction or else, because of modifications of equipment, would produce trouble if the consumer were to increase his use of energy to a considerable degree.

When all is said and done, it is apparent that the distribution methods that are standard for all other classes of consumers will, intelligently applied, hold in the rural-service field and that there is a cost limit in establishing the service below which it is impossible to go without actually increasing the cost of service by increasing routine operating and maintenance costs and the rate of depreciation. There is only one direction in which hope of developing the service is visible, but in this direction the surface has been hardly scratched. This is the development of the use of the service by the customer. If lighting is to be the only service, then the cost must be on a luxury basis. To assume that lighting is the only use is to disregard the plain facts, for even the small development that has taken place so far indicates the possibility of use that will save the farmer proportionally as much as has been saved by electric service in other industries.

That this is true can be read in the attitude of the farmers who have had the service for a number of years and used it in a variety of ways. With them it has become as much of a necessity in profitable farming as any of the mechanical equipment they use. The estimate they make of its value is astonishing to one who has not investigated. The increase in land values because a farm has electric service is an indication of the real situation. The effort that will bring the solution of the problem soonest, therefore, is that which is directed toward developing the use of the service. When this shall have been accomplished the technical measures to give service and the cost will cease to be a problem.

A Substitute, Not a Supplement

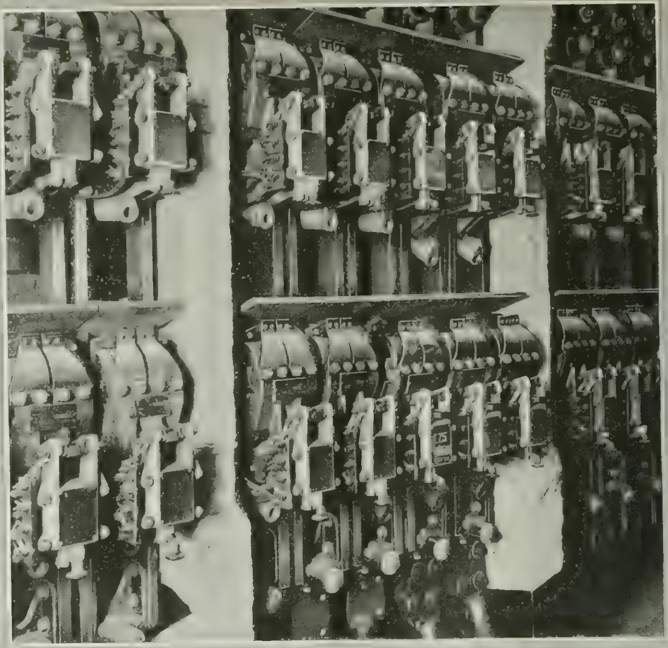
IS THERE any real substantial reason for the sovietizing of the public utility industry in California today? A negative reply that should convince any honest doubter is contained in a thumbnail sketch of the conditions of the industry in California made by E. O. Edgerton, formerly president of the California Railroad Commission. Mr. Edgerton summarized these conditions as "effective governmental regulations with ten years of successful history in which standard accounting had made possible the establishment of the facts concerning the utilities of the state; complete removal of any discrimination between consumers; the growth of an industry which had brought more money into the state than any other agency in a like period; service rendered at cost; all demands and needs of the consumers supplied, and complete co-operation between the present utilities which avoided duplication and permitted operations to be carried on at the highest efficiency of the interconnected system."

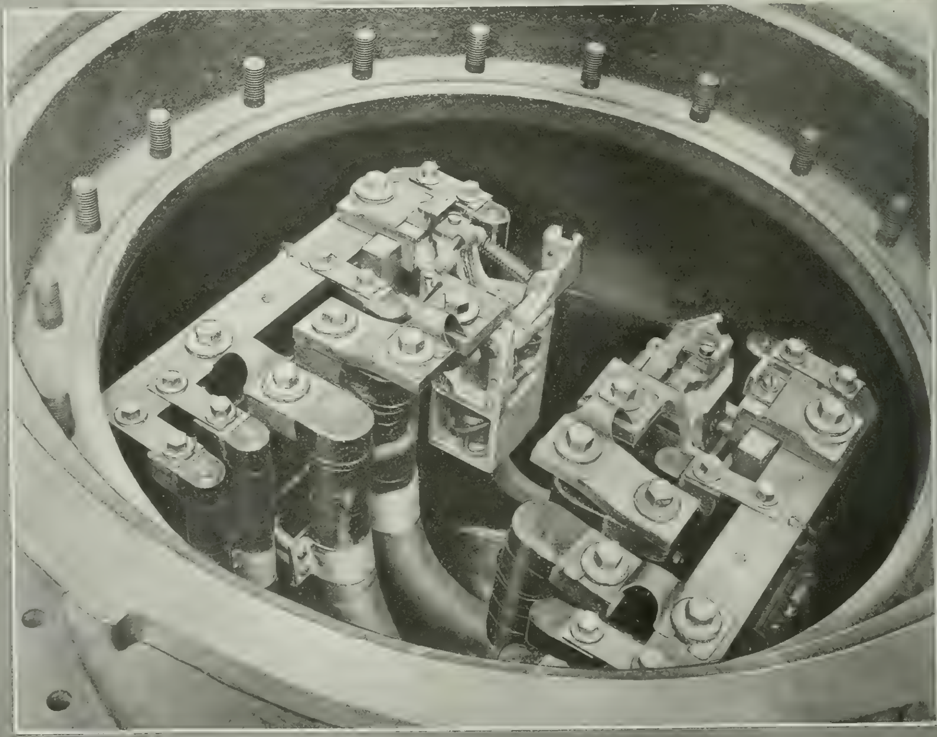
If the socialistic system of state ownership of water and power, as proposed in California, were to be supplemental to the existing utilities, as is claimed by the proponents of the measure, then the state would embark in a tremendously attenuated business to reach out to those few remote districts that have not yet required power on a scale sufficiently large to permit economical service. To serve these would be folly—the demand is too meager; but in this way only would the power enterprise of the state be supplemental to the present utilities. The only alternative is to substitute it for the existing medium of service. It is possible that the people of the state do not recognize that the leading position which the public utilities industry has attained has been achieved largely because of the foresight and initiative of the pioneers. Or do they believe that the expansion of the industry has taken place in spite of private initiative? If such a false doctrine gains credence in California, it is not unreasonable to expect that similar movements will be started elsewhere to the demoralization of the electrical industry throughout the country.

The people should realize that such an enterprise as is proposed in California will not only vastly weaken the borrowing power of the state for enterprises sorely needed for other purposes, but the taxes of the citizens under this duplication of service must inevitably rise.

Apparatus Clears D.C. Faults Before System Disturbance Occurs

JUNCTION-BOX and station circuit breakers have been applied to the direct-current network feeders in New York City to isolate disturbances with very satisfactory results. Feeder faults, and even short circuits, which would undoubtedly have involved entire duct banks have been cleared so quickly that only minor repairs were necessary. Automatic operation is secured by connecting the breakers with the spare pressure wire in the corresponding cable. A ground of the positive conductor on the lead sheath, or a short circuit between positive and negative conductors, almost immediately involves this wire, thereby actuating the circuit breaker. Details of this system and an account of experiences therewith are given on the following pages by Philip Torchio.





Faulty Network Feeders Quickly Isolated by Junction-Box Breakers

This Form of Protection, Supplemented by Station Circuit Breakers, Has Never Failed to Clear Dangerous Faults Since It Was Installed on the Direct-Current System of the New York Edison Company in 1920

By **PHILIP TORCHIO**
Chief Electrical Engineer New York Edison Company

SINCE the fall of 1920, when the initial installation of junction-box circuit breakers was made by the New York Edison Company, not a single failure of the apparatus promptly to isolate faulty feeders from the direct-current network has been experienced. This very satisfying record has been obtained despite the fact that more than two thousand junction-box circuit breakers were in operation during the winter-load period of 1921-1922, and plenty of opportunity to test the effectiveness of this new form of protection was afforded. Faults have occurred which would otherwise have involved the entire duct bank, no doubt; in some instances complete short circuits and grounding of the feeder cables caused by injury of laborers' tools have been isolated so quickly that only minor repairs have been necessary.

The direct-current distribution system of the company comprises a meshed network of mains fed at numerous points by direct feeders from adjacent substations. A portion of the network, with feeders, manholes, junction boxes, mains, distributing boxes and services, is shown in Fig. 1. The mains are single-conductor, lead-covered cables, varying in size from 200,000 circ.mils to 500,000 circ.mils cross-sectonal area. The majority of the feeders are two-conductor, concentric, lead-covered cables of 1,000,000 circ.mils. A portion are 2,500,000-circ.mil single-conductor cables. Cross-sections of these cables are shown in Figs. 2 and 3. Heavy circular cast-iron junction boxes are employed with an inside diameter of 26¾ in. (68 cm.) at the top and 28 in. (71 cm.) at the bottom. The inner cover, a few inches below the outer or street cover, is made watertight by means of numerous bolts and a suitable gasket. The depth of the box under the inner cover is 22 in. (59 cm.). The feeder cables from adjacent manholes enter at the base, through iron-pipe conduits, and are connected to copper busbars of 1-in. x 2-in. (2.5-cm. x 5-cm.) cross-section. The mains are connected to these buses by means of links, which may be easily removed to isolate them for test or replacement.

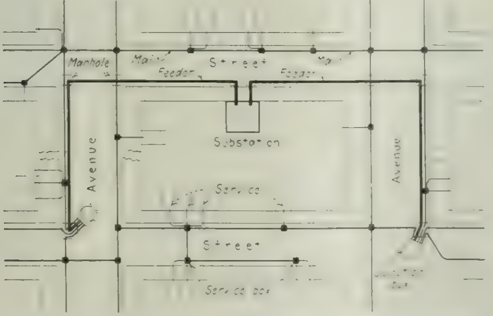
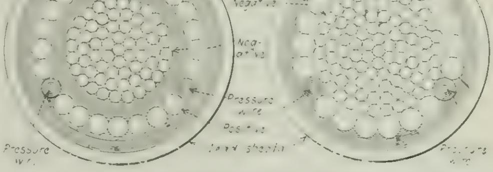


FIG. 1—PORTION OF NEW YORK DIRECT-CURRENT NETWORK PROTECTED BY JUNCTION-BOX CIRCUIT BREAKERS



FIGS. 2 AND 3 — CROSS-SECTIONS OF 1,000,000-CIRC.MIL CONCENTRIC AND 2,500,000-CIRC.MIL SINGLE-CONDUCTOR CABLES

Prior to December, 1919, the feeders were also equipped with links. System troubles experienced at that period prompted the temporary use of copper fuses, the fact, however, being recognized that complete satisfactory operation demanded the use of a circuit breaker of special design rather than a fuse. This circuit breaker had to be non-automatic on overload and automatic only in case of trouble originating in the cable. It was readily seen that the latter feature could be accomplished by employing the spare pressure wire as a pilot or control wire, stranded with the outer or positive conductor, but of opposite polarity. A ground of the positive conductor on the lead sheath or a short circuit between positive and negative conductors would almost immediately involve this wire, thereby actuating the circuit breaker and isolating the fault from back feed from the system mains.

The design of the circuit breaker presented some new problems not readily overcome. The available space for each circuit breaker is approximately 5 in. x 6 in. x 10 in. deep (12.5 cm. x 15 cm. x 25 cm.). The breaker had to be proof against moisture-laden atmosphere approaching the nature of steam under extreme conditions. It had to be proof against the corrosive action of different gases which may find entrance to the junction boxes. In addition it had to trip easily after long periods of idleness under the above conditions

A circuit breaker that would satisfactorily meet these conditions was designed by one of the New York Edison Company's engineers and was manufactured by the Westinghouse Electric & Manufacturing Company.

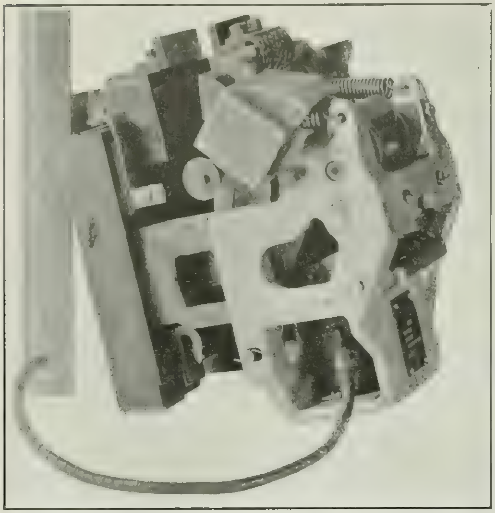


FIG. 4—ONE OF THE CIRCUIT BREAKERS WHICH ARE USED IN THE UNDERGROUND JUNCTION BOXES

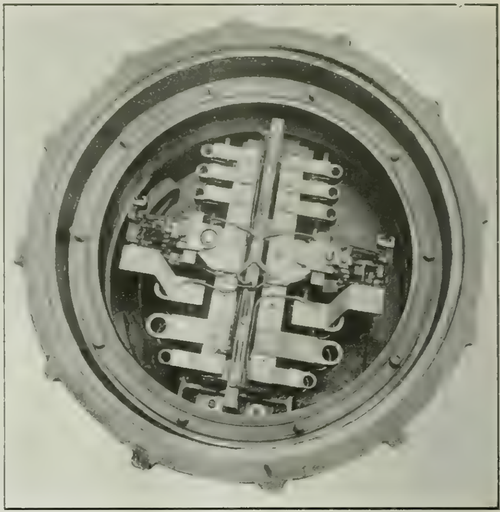


FIG. 5—COMPLETELY INSTALLED 2,400-AMP. JUNCTION BOX WITH COVERS REMOVED

Front and side views of one of the circuit breakers are shown in Fig. 4 and on page 594.

The current-carrying parts are designed for 1,200 amp. capacity at 30 deg. C. rise. The trip coil will open the latch on a suddenly impressed voltage of approximately 20 volts or on a slowly rising pressure of approximately 30 volts. The circuit breaker is manually closed by means of an insulating handle inserted in the vertical rectangular hole in the operating lever. It may be tripped manually by moving this same lever in the opposite direction. The base is of 1-in. micarta plate impregnated with bakelite, slate having proved inadequate for the service. All other parts except the frame and trip-coil plunger are of copper bronze. The iron frame is heavily galvanized and the plunger is copper-plated. The machine-wound trip coils are heavily impregnated. A plan view of a completely installed 1,200-amp. junction box with covers removed is shown on page 594.

More than eighty tests were made on the first sample circuit breakers, with different conditions of short circuit and effective length of pilot wire from junction box, and in all cases the circuit breakers opened as soon as the insulated pilot wire of the concentric cable became electrically affected, either by fire or moisture. It should be remembered that the circuit breaker is not automatic in any way except when the pilot wire in the cable becomes involved in a failure or short circuit within the cable.

A special low-voltage relay has been developed and installed in the substation which is operated by the pilot wire in case of trouble, to signal the operator, by means of telephone drops which indicate the feeder number, so that he can immediately pull the switches on the feeder in trouble. Combined with the relay is a small snap switch the closing of which permits the substation operator to trip the junction-box circuit breakers when desirable. A wiring diagram of control circuits for a complete feeder, showing substation relays, drop, etc., is given in Fig. 7.

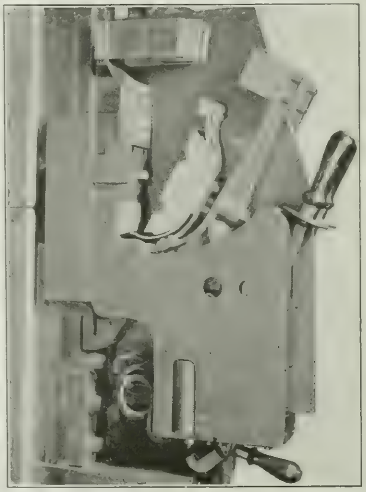


FIG. 6—MANUALLY OPERATED STATION CIRCUIT BREAKER MOUNTED ON SWITCHBOARD

During the last winter load period (November, December and January, 1921-1922), with more than a thousand junction boxes equipped with feeder circuit breakers, there was a total of fifty-two operations wherein feeders were isolated by automatic operation of the circuit breakers. Of this number seventeen were caused by grounding of the control wire on the lead sheaths, fourteen by short circuit of the control wire to the positive conductor, two by defective circuit breakers or wiring, nine by accidental tripping, and ten by unknown causes. Of the last ten many were, no doubt, caused by wiremen as construction work was going on in those substations during the period. In the first two groups there were seven cases wherein the entire cable was involved.

The relatively large number of grounded or short-circuited wires is partly accounted for by the fact that some of the spare wires in old cables had formerly been defective and abandoned. In using these spare wires for circuit-breaker control these defects are now gradually being weeded out as soon as detected by the operation of the feeder circuit breakers.

The 2,500,000-circ.mil feeders are being equipped in a similar manner, the circuit breaker having a rating of 2,400 amp. with a 30 deg. C. rise in temperature. Each of the single conductors constituting the feeder is protected by a pilot wire of opposite polarity, and each feeder, therefore, has two relays. The positive and negative legs operate independently on faults, the operator tripping out the remaining leg when he receives the signal indicating that one side of the feeder is open.

Owing to the increased space required by the cables and circuit breakers, the arrangement of the buses has been modified as shown in Fig. 5, illustrating a completely installed 2,400-amp. junction box with covers removed.

Following along parallel lines with this development, circuit breakers for the station end of the cable have been developed. These are either of the hand-closing type, mounted on the switchboard, or of the electrically operated remote-control type as the station design requires. In either case, however, their trip coils will be actuated in the same manner and at the same time as those of the junction-box circuit breakers of the same feeder. Both types are shown in Fig. 8 and on page 594.

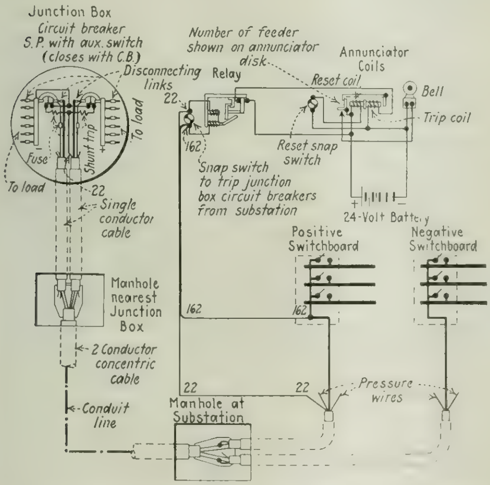


FIG. 7—CONTROL CIRCUITS FOR A COMPLETE FEEDER, SHOWING SUBSTATION RELAYS, DROP, ETC.

This combination of junction-box and station automatic circuit breaker serves to isolate the feeder instantly at both ends upon the first development of a fault in the cable.

The station circuit breakers were manufactured by the General Electric Company and the A. & J. M. Anderson Company. The electrically operated remote-control circuit breakers (page 594) offer the additional advantage of allowing their installation near the station outlet, saving the cost and space of long station cable connections from the operating switchboard, which must be centrally located. Two breakers on each pole are used to select the bus to which the feeder is to be connected, thereby incorporating in the two breakers the features of bus selector switches and circuit breakers. The two breakers are connected to the buses on which the feeder is expected to operate. The location can, however, be changed when required to connect to any two of the three buses by rearrangement of the connecting straps. This open mounting of the circuit breakers, without slate base, aids in securing lowest operating temperatures at contact points and facilitates maintenance.

Simplify the Electrical Home

Millionaires' Row May Have Advantage of Merchandising Psychology, but It Is Time to Demonstrate an Electric Home Within Average Man's Means

By Charles Magee Adams

The electric home is here to stay. There is no question about that. The success of the various demonstrations conducted in every section of the country has proved beyond the faintest shadow of doubt that this latest means of applying electric service to the everyday affairs of the household has not only come through the freak and experimental stage but that there is now every reason for looking forward confidently to the not-too-far-distant day when it will be recognized as standard practice. But, in spite of this success and expectation of further success, it seems necessary to point out now, particularly with business development occupying the attention of the industry, that the electric home idea, though promising and eminently worth while, cannot grow to anything like its proper proportions until the electrical home is put more definitely within reach of the average man.

Any one who has given even passing attention to reports of the various demonstrations must have been struck by the costs of the home used. Personally I can recall only one in the four-figure class, a bungalow in a Western city at $8,000. The rest have invariably run into five figures, and from the average man's viewpoint well into five figures, anywhere from $12,000 to $48,000, with the average gravitating around the twenty-thousand-dollar mark, and these prices have not all included appliances.

Too Eager for "Class"

There is a reason for this, of course. Every one who is familiar with the basic psychology of merchandising knows that high-priced stock is often carried not so much to be sold as to give the establishment an air of distinction and to increase the sale of medium-priced goods by making the cheaper seem more inferior through contrast. This is evidently what was in the minds of the men who have planned these electrical home demonstrations.

They have chosen handsome residences admittedly beyond the means of the average man, not because they have anticipated any quantity sale of such, but to give the electrical home idea an atmosphere of "class" which would make it attractive to the average man and make inferior wiring and appliances so glaringly inferior by comparision that the average man will buy reliable medium-priced equipment and installations. The only difficulty is that this high-priced electrical home has been sold so thoroughly and universally that the idea of high price has become all but inseparably attached to not only the electrical home but to electric service as well.

A woman who had an electric range was describing its performance to an acquaintance. "The only trouble is that it's expensive," she said. "The first month it cost me $103 for current." She lied, of course. A simple calculation was enough to show that her range could not have used that much energy with every element in continuous operation. But she was believed, and her story was told and retold.

A man building a new house was talking to an acquaintance about wiring. "I suppose you're having plenty of outlets put in," the acquaintance suggested. "Everybody is now." "No, sir," the builder replied emphatically. "I can't afford to. I was just reading about one of those electrical homes last week where they put in so many of them, and the house cost $18,000."

These and similar instances, of which a number could be cited, serve to show to what an unpleasant and altogether unfortunate extent the electrical home has come to be regarded as something exclusively for at least the well-to-do.

Four-Figure Houses Needed

This impression is groundless, of course. Any electrical man who is "sold" on the electrical home idea, who has given it anything like careful consideration, knows that the electrical home possesses the economy characteristic so conspicuously common to electric service in its other manifold forms, and that it requires only adaptation to put it definitely within reach of the average man. So there could be nothing more timely or useful in furthering the electrical home movement just now than the demonstration of one within the means of this average man, whose cost runs between, say, $5,000 and $8,000.

This will not build one of the palatial piles on millionaires' row. It might not even make fitting material for a three-color suburban real estate folder, with building costs where they still are. But for this sum, with reasonable attention to design, it should be possible in any accessible section of the country to build an electrical home that, though simple, is nevertheless comfortable, attractive and, above all, within the means of the man with the income of $2,000 who is, in the last analysis, the industry's best "prospect."

Labor-saving appliances do not have a vital interest for the wealthy. Many, to be sure, buy them for the use of servants. But any electrical man who is alive to the situation knows it is the moderate-salaried man, the skilled craftsman and the small business man — the sort whose wives do their own work and who incidentally represent the bulk of our staple purchasing power— who have the keenest and most direct interest in household appliances and to whom therefore electrical homes can best be sold, and just now these people need to be shown practically and concretely that the electrical home is not beyond their reach.

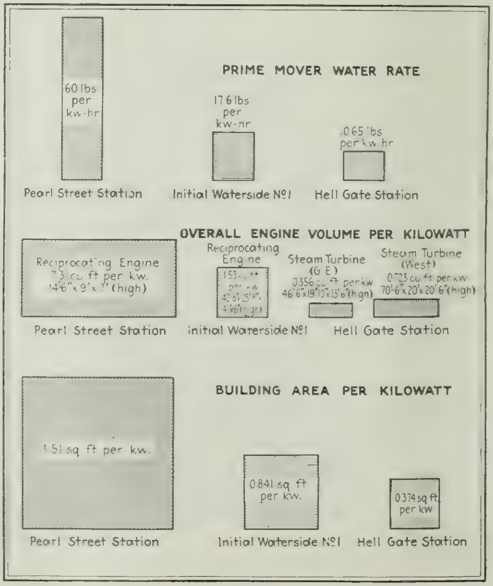
They have seen enough of the quality goods, carried to give the idea of distinction—Roman baths, Oriental rugs and rare porcelains. What they would like to see now is something they can buy—American walnut, plenty of closet room and a light near the furnace.

The home desired would not have to have refinements like motor-operated garage doors. In fact, on the wiring side it would seem almost enough to have it adequately equipped with outlets, and, lest we forget, the industry itself is still far from 100 per cent sold on outlets.

I was talking to the contractor wiring the house of a friend of mine. "What kind of a job is he getting?" I asked. "Crazy," the contractor replied disgustedly. "Why he's having six outlets in his living room. Six! All in one room! I told him that was wrong, but he wouldn't listen." Inquiry developed the fact that this contractor, one who thought himself at least up-to-the-minute, considered a job quite de luxe when it boasted two outlets, one in the kitchen for an iron and another in the living room for a piano lamp.

To digress further, the electrical home movement could be materially advanced if some one would undertake the electrification of houses already wired. There are houses in every city and town, still comfortable and still sound, but wired back in the days when the snap switch was the last word in control, and which are therefore all but hopeless for appliances. Rewiring these for present-day usefulness seems to offer a wide and profitable field to some one willing to undertake some pioneer work in bringing the wiring up to date.

Plant Economy and Space Requirements Greatly Changed Since 1882



But what will speed up the electrical home movement more than any other one thing just now and what can be done by any of the co-operative organizations putting on demonstrations is to get across to the man in average circumstances the fact that he, and not alone the man with the five-figure income, is the man who can have an electrical home.

Demonstrating such a home necessarily presents some problems different from those encountered in the more pretentious exhibits. But they can be solved.

The average American family already knows that household electric service is well within its means. It should not be difficult to convince its members that the electrical home, which in the last analysis is simply a home designed for maximum service utilization, is equally within their means.

Rebuilding a Transmission System

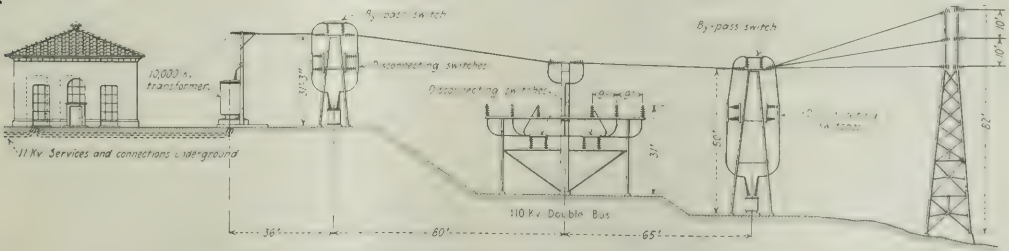
Rapid Growth of the Load and Extensive Additions to the Generating Capacity of the Pacific Gas & Electric Company Have Necessitated Major Changes in the Transmission System

By J. P. JOLLYMAN*
Pacific Gas & Electric Company, San Francisco

FOR nearly thirty years the hydro-electric transmission systems in California have been growing to maturity. This growth has come from the accretion of small generating stations and the construction of new units from time to time as needed. The Pacific Gas & Electric Company, which serves thirty-six counties in the northern part of California, is a typical instance. Although the rate of growth at this immediate time is no greater than in recent years, the total in kilowatts ended in one year is considerable. As all indications point to a continuance of the present rate of growth, it has become imperative that the transmission systems of that company be materially strengthened. Furthermore, the completion of the first station on the Pit River will require means of distributing this power, which will be transmitted 202 miles (325 km.) at 220,000 volts to the terminal substation at Vaca. The first station, Pit River No. 1, will generate 70,000 kva. The physical means by which this power will be distributed and the construction of new lines to care for the growing load is a sizable task.

Power from the Pit River will be used to reduce steam power and to care for the increased demands for energy. To meet these requirements and to reduce the losses in the existing transmission system, the Pit power will be transmitted to the San Francisco Bay region, and the existing plants will feed the districts which lie adjacent to them. The Pit transmission line proper will terminate at the receiving substation at Vaca, which is about 50 miles (80 km.) northeast of San Francisco. Later it is proposed to extend the Pit transmission to a point near the southern end of San Francisco Bay, about 40 miles (64 km.) southeast of San Francisco.

The distribution of the Pit power south of Vaca will be by extensions of the 110,000-volt transmission lines which connect some of the other larger hydro-electric plants to terminal stations in the Bay region. Some existing 60,000-volt circuits of small capacity will be replaced by 110,000-volt circuits of much greater capacity, and new 110,000-volt circuits are being built. The plans include the addition of 99 miles (154 km.) of double-circuit 110,000-volt tower line, of which 53 miles (85 km.) is under construction, the remainder to be built at an early date. Four new 110,000-volt substations are planned, of which two are under construction; the reconstruction of two existing substations is planned, and extensive additions are being made to an existing station.



TYPE OF OUTDOOR SUBSTATIONS FOUND ECONOMICAL ON THE 110-KV. LINES OF THE PACIFIC GAS & ELECTRIC COMPANY

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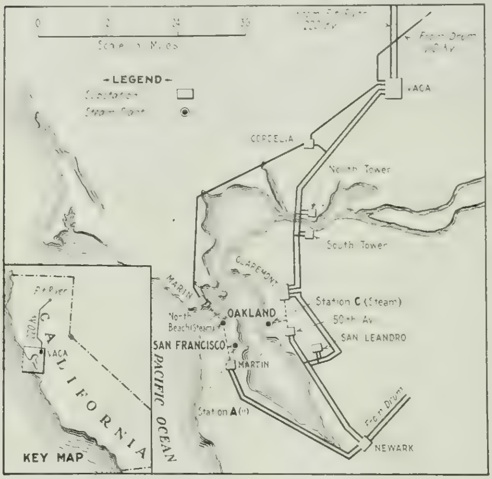
*Chief of the department of hydro-electric and transmission engineering.

The new 110,000-volt lines follow closely the routes of some of the existing 60,000-volt lines and will, when completed, form a partial ring around the Bay regions, the only gap being at the Golden Gate, which is now crossed by two 11,000-volt submarine cables. The Cordelia-Marin line has been in operation for some time. This line is a double-circuit tower line with one circuit in place and is operated at 60,000 volts. Ultimately the second circuit will be added to this line, and it will be operated at 110,000 volts. Then additional, or higher-voltage, submarine-cables will be installed.



THE LOOP AROUND THE BAY IS CLOSED WITH 11-KV. CABLE TIE LINES, INDICATED BY DASHED LINES

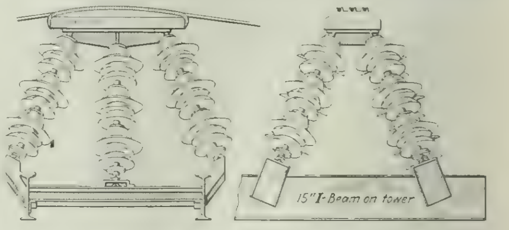
A double-circuit 110,000-volt tower line is being constructed between Vaca and Oakland and Oakland and Newark. From Vaca to Cordelia this line parallels the Vaca-Cordelia tower line, which is the southern part of the Drum-Cordelia tower line built in 1913. From Cordelia to North Tower and from South Tower to a point a few miles from Claremont the new tower line will follow closely the route of the existing 60,000-volt lines. From Claremont to San Leandro the new tower line will follow the existing 60,000-volt lines about half of the distance. From the Fiftieth Avenue substation to Newark a recently built tower line will be used which now has one circuit completed and which is operating at 60,000 volts. From Newark to San Francisco a double-circuit 110,000-volt tower-line will ultimately be built. A few miles of this circuit are now under construction and will be used temporarily at 60,000 volts to provide a direct route from Newark to San Francisco, the present 60,000-volt circuits in that district being fully loaded by the stations near Newark.

All of the new 110,000-volt tower lines are of the company's standard design. The towers are of the two-circuit type with a total height of 82 ft. (24.9 m.). The conductors are spaced 10 ft. (3.04 m.) vertically and the circuits 17 ft. 6 in. (5.35 m.) horizontally. A normal span is 800 ft. (243 m.), and the towers are designed to support conductors up to 250,000 circ.mil. Three different strengths of towers are used. These are designated as "AH," "BH" and "CH" towers. The "AH" towers are for straight-line construction for spans up to 1,000 ft. (305 m.) and are designed to withstand the stresses resulting from three broken conductors on one side of a tower. The "BH" towers are for angles up to 15 deg. or for spans up to 2,000 ft. (610 m.) and will withstand three broken conductors on one side of a tower. The "CH" towers are for angles up to 45 deg. or for spans up to 2,500 ft. (762 m.) and will withstand six broken conductors.

To provide ground clearances greater than 30 ft. (9.1 m.), or for special crossings, special high towers are used, having over-all heights of 131 ft. (39.9 m.), 150 ft. (45.7 m.), 168 ft. (51.2 m.), 196 ft. (59 m.), 224 ft. (68 m.) and 252 ft. (77 m.). The different heights are obtained by adding one or more panels to the base of the 131-ft. (39.9-m.) special high towers. All of the towers are made of high elastic-limit steel. This steel was supplied locally and has an elastic limit not less than 44,000 lb. per square inch (3,216 kg. per sq.cm.), a maximum strength of not less than 60,000 lb. per square inch (4,386 kg. per sq.cm.) and a minimum elongation of 22 per cent in 8 in. (20 cm.). Tests averaged well above these values. The use of this steel permits a marked reduction in weight as compared with towers of standard structural steel. All towers are mounted on concrete footings. Pile foundations capped with concrete are used where necessary to support the footings.

Suspension insulators are used. From Vaca to San Leandro each string will consist of eight 12-in. (30-cm.) units. The other lines will be equipped with eight 10-in. (25-cm.) units per string. At exposed locations nine units are used on dead-ends. Pillar-type insulators used at the stations for switch and bus supports will consist of three sections of a three-part pin-type insulator, the diameter of the upper shell of each section being 17 in. (43 cm.). This type of pillar insulator was selected in preference to that made of individual units similar to the suspension insulator because of its greater mechanical strength. It was also believed that the type selected was better adapted to withstand surface leakage in the foggy districts.

The 110,000-volt lines are transposed by extending the upper and lower arms of a "BH" tower and by dead-ending the conductors at the tower. The transposition is secured by proper connections between conductors. The length of a complete transposition will in no case be more than 18 miles (29 km.). In general at least one complete transposition is installed between important stations. These transpositions are installed to comply with the requirements of the California Railroad Commission relating to inductive interference, to minimize the voltage in a circuit under repair which would be induced by the parallel circuit, and to balance the separation of the three phases of the circuit to equalize the phase voltage.



INSULATORS USED IN COMPRESSION ON 4,400-FT. SPAN

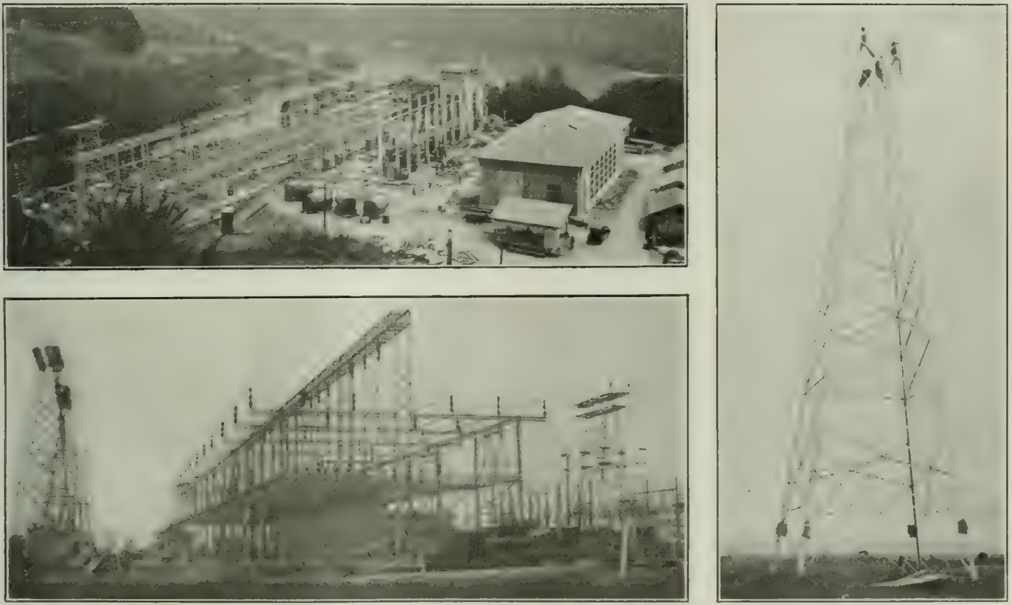
To attain the second result noted above it is necessary to reverse the transpositions of the two circuits at each point. That is, the top wire is brought to the middle position on one circuit, while the top wire on the other circuit is brought to the bottom position.

The existing crossing of Carquinez Straits will be reinsulated for 110,000 volts. This crossing was constructed in 1899 as a part of the original 60,000-volt transmission from Colgate station to Oakland. The total length from anchor to anchor is 6,262 ft. (1,908 m.). The span is supported by three towers, the highest of which is 224 ft. (68 m.), and the free span across the Straits is 4,427 ft. (135 m.) long. The six conductors are ⅞-in. (2.2-cm.) stranded steel cables, and tests have shown that they will carry 200 amp. to 250 amp. without exceeding a permissible rise in temperature. The crossing is now insulated by porcelain in compression, and this plan will be continued when the voltage is raised to 110,000. The supporting insulators will be composed of six units, each consisting of three sections of a three-part pin-type insulator, as shown on page 600. Pillar insulators of this type have a general rating of 165,000 volts. It was desired to insure insulation for the crossing superior to the insulation of the connecting lines, and for this reason insulators having a high rating voltage will be used. The anchor insulators are of the same type and are arranged so that the tension of the conductor, which is about 22,000 lb. (9,980 kg.), is carried by compression of the porcelain.

As the tower at the south end of the crossing is quite close to the anchor, no allowance is being made for any travel of the conductors over the supports. At the north tower, which is 1,385 ft. (420 m.) from the north anchor, a maximum travel of the cable of 8 in. (20 cm.) is being provided for. This tendency to travel arises from the expansion of the unequal lengths of spans on the two sides of the tower. The provisions are made by carrying the cable on a saddle resting on rollers, which in turn are carried on a table supported by the six pillar insulators.

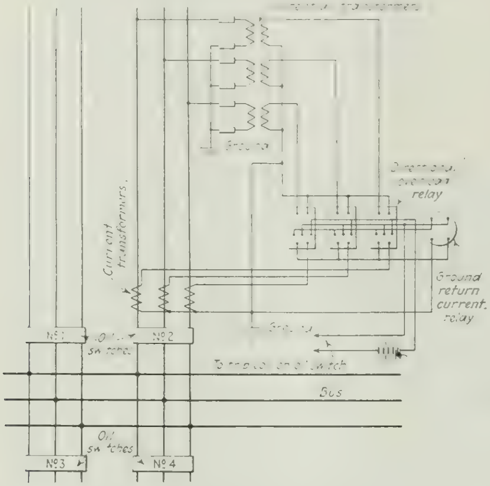
NEW SUBSTATION TO BE BUILT

New 110,000-volt substations will ultimately be located at North Tower, South Tower, Claremont, Fiftieth Avenue, San Leandro, Newark, Martin and Marin. Of these substations, South Tower is being reconstructed from a 60,000-volt substation. Claremont, the chief substation for Oakland, is a new station and is now under construction. It is expected that the substation at Fiftieth Avenue, which will feed the southern part of Oakland, and that at San Leandro will be constructed within a year or two. The Oakland territory includes the cities of Oakland, Berkeley, San Leandro and Haywards, with a population of about 300,000. As in all California cities, the energy consumption per capita is high. Newark substation was built two years ago to transform power from 110,000 volts to 60,000 volts. Extensive additions to this station are now in progress. Martin station was built in 1905 as a 60,000-volt substation to feed San Francisco. A new 110,000-volt station is now under construction at that place. Marin substation was built in 1916 and is operating at 60,000 volts, but can be changed to 110,000 volts at any time.


LEFT—CLAREMONT SUBSTATION WILL SERVE PART OF THE LARGE CITY LOAD OF OAKLAND. RIGHT—TRANSPOSITION TOWERS ARE MADE BY ADDING LONGER ARMS TO STANDARD TOWERS

The new installation at South Tower consists of a bank of three 6,667-kva. transformers and one spare, transforming from 110,000 volts to 60,000 volts and 11,000 volts. The transformation from 110,000 volts to 60,000 volts is by auto-transformation, the windings being connected with a solidly grounded neutral. The 11,000-volt windings are star-connected with a solidly grounded neutral. A tertiary winding of 1,667-kva.

capacity per transformer is provided that will be delta-connected to furnish the triple harmonic components of the magnetizing currents of the transformers. A new 11,000-volt bus with new circuit breaker is being installed to provide for the much larger amount of energy that will be available at this station as compared with existing conditions.



DIRECTIONAL RELAYS WITH GROUND RELAY WILL BE USED TO GIVE SELECTIVE PROTECTION

Claremont substation will have a double 110,000-volt bus with circuit breakers for the two Vaca-Claremont circuits, for the two Vaca-Newark circuits and for two banks of transformers. There will also be one circuit breaker for paralleling the two buses. Two banks of transformers are being installed. One bank, consisting of three transformers rated at 6,667 kva. each and a spare, will transform from 110,000 volts to 11,000 volts. The second bank, consisting of three 10,000-kva. transformers and a spare, will transform from 110,000 volts to 60,000 volts. This transformation from 110,000 volts to 60,000 volts is a temporary expedient to permit the utilizing of the existing 60,000-volt circuits from Oakland to Newark while the permanent 110,000-volt circuits are being completed. It is intended that the four 10,000-kva. transformers will become the permanent bank at Claremont. They will then transform from 110,000 volts to 11,000 volts. These transformers are provided with tertiary windings similar to those at South Tower and used for similar purposes. All 11,000-volt lines from Claremont to the distribution substations and to the steam plant are underground.

The 110,000-volt substation at Fiftieth Avenue and at San Leandro will be required when the lines from Claremont to Newark are changed over to 110,000 volts. Until this change is made the existing 60,000-volt substations will take care of the southern part of Oakland and the adjacent San Leandro territory.

A second bank of three 12,000-kva., 110,000 to 60,000-volt transformers is being installed at Newark, together with a double 110,000-volt bus and two 12,500-kva. synchronous condensers. These condensers will operate on the 12,000-volt tertiary windings of the main transformer banks and will provide the necessary power-factor correction for the two Drum-Newark 110,000-volt lines which terminate at Newark. A bank of three 1,500-kva. transformers, with a spare, is being installed in order to supply 11,000-volt service for the vicinity of Newark.

Three 10,000-kva. transformers and a spare are being installed at the Martin substation to connect the 104,000-volt Sierra circuits with the 60,000-volt system and the 11,000-volt circuits which feed into San Francisco. A double 11,000-volt bus, with switches for the low-voltage side of the transformers and for five feeders, is a part of the Martin substation work. At some future time it is expected that two 110,000-volt circuits will be constructed from Newark to Martin. When this is done a 110,000-volt bus will be built at Martin, and in all probability a second bank of 10,000-kva. transformers will be installed.

High-Voltage Apparatus More Reliable Outdoors

In general the new 110,000-volt substations are of the outdoor type. The 110,000-volt and 60,000-volt apparatus, including the main transformers, is all placed outdoors. The 11,000-volt apparatus, together with the switchboards, is housed in fireproof buildings, and at Newark the synchronous condensers are also housed. It is believed that in the event of a failure high-voltage apparatus is less likely to occasion serious trouble if placed outdoors. The outdoor mounting costs more than indoor mounting. However, the size of the buildings required is reduced and the total cost of the station is much less than that of one that is completely housed.

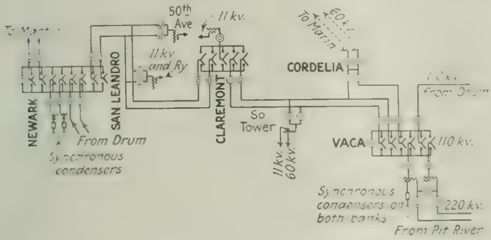
Reference to the accompanying diagram, showing the 110,000-volt switching from Vaca to Newark, indicates the use of a single circuit-breaker for each circuit with air-break selector switches connecting to the two high-voltage busbars. The circuit-breakers are mounted with disconnecting switches which permit the oil switch to be bypassed and disconnected from the circuit. When this is done use is made of the switch connecting the two busbars as a substitute for the oil switch, which has been bypassed. This arrangement of switches and buses gives substantially all the flexibility of a complete double bus with a greatly reduced cost for oil circuit breakers. For example, at Claremont seven circuit breakers are used. With a complete double bus twelve would have been required.

ONLY THE SYNCHRONOUS CONDENSERS AND SWITCHBOARD APPARATUS ARE HOUSED AT NEWARK

The 110,000-volt buses are mounted on pillar-type insulators rather than on suspension-type insulators.

This style of mounting is preferred, because the possible failure of an insulator does not result in as much damage to the buses and their connections as would be the case if the suspension-and-strain arrangement of supports were used. In addition, this method of mounting busbars greatly reduces the amount of steel required in the supporting structures.

At Claremont and at Martin the 11,000-volt bus is a full double bus with two oil switches per circuit. It has been found that the substations in the larger cities, such as Oakland and San Francisco, must be frequently divided into two or more groups, each group being fed from a transmission substation and having one or more steam-driven units operating in parallel with it. In many cases it is necessary to divide the load in a single substation into two groups with the groups operated from the separate systems. For these reasons the full double-bus arrangement of 11,000-volt switches has been adopted for the substation in the larger cities.



SUBSTATIONS AND SWITCHING STATIONS MAKE THE SYSTEM FLEXIBLE AND PERMIT READY ISOLATION OF TROUBLE

Directional Relay Protection Is Used

Automatic relay protection of an extensive high-voltage network is a problem which has engaged the attention of the engineers of the Pacific Gas & Electric Company for several years. The scheme of relay protection for a typical high-voltage switching center is shown on the accompanying diagram. Each circuit is equipped with directional overload relays set to trip for overloads in current when the power is out-going from the station. In the event of trouble on one of the circuits connected to a station, circuits which feed into the station will not trip, even though the amount of energy that is fed in exceeds the setting of the relays.

The entire high-voltage system of the company is operated with a solidly grounded neutral. This applies to the 60,000-volt, the 110,000-volt and the 220,000-volt networks. The neutrals are grounded, not only at all power houses, but at most of the substations. In spite of this widespread grounding of the neutral, it has been found that the current which flows to ground in the event of a flashover of an insulator on the tower lines is generally less than the setting of the overload relays. To obtain automatic operation for circuits one phase of which may have been grounded, a ground-return or residual-current relay is added to the overload relays. As shown in the diagram, this relay is connected in the current transformer circuit in such a manner that it responds only to the unbalanced currents that result from the flow of current to ground. This relay is set to trip at about one-quarter of the setting of the overload relay.

As a ground may occur on any of the three phases, it is not easy to obtain a phase of the voltage corresponding to the phase of the ground current. The directional feature for the ground-return-current relay is secured by connecting it in parallel with the current elements of the overload relays and using the watt element of the overload relays to select the direction of the flow of energy, both for overload currents and for ground-return currents. This system of relay protection has been tried and has proved to be entirely satisfactory.

The plans for all of the work south of Vaca have been prepared by the department of engineering of the Pacific Gas & Electric Company under the supervision of A. H. Markwart, vice-president in charge of engineering. The construction work is under the supervision of P. M. Downing, vice-president in charge of construction and operation. O. W. Peterson, engineer of general construction, has charge of the station construction work and E. H. Steele, engineer of line construction, has charge of the line construction.

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400-Lb. Pressure Adopted

Boilers Have Two Decks of Tubes with Superheater Between—Lower Deck Is Single-Pass and Upper Deck Double-Pass

During the last few years there has been a distinct tendency in central-station engineering toward increasing the operating steam pressures. As a notable example of this tendency may be cited the new power station of the Public Service Company of northern Illinois, now being erected at Waukegan, about 40 miles north of Chicago.

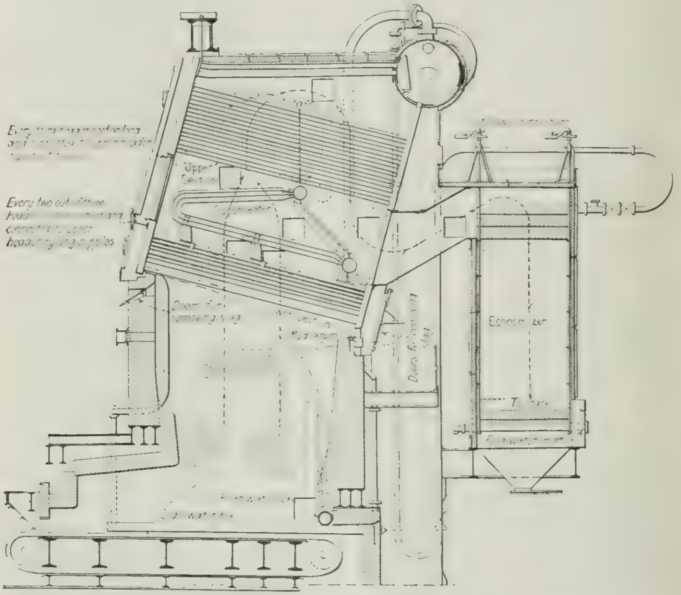
The Waukegan station has been designed by Sargent & Lundy, Inc., engineers, and the steam pressure will be 400 lb. at the boilers—350 lb. to 375 lb. at the turbines. There are a few small experimental or test plants running intermittently at such pressures, but this will be the first central station in this country to employ a boiler pressure in excess of 350 lb., and the boiler that will be used embodies a radical departure in the matter of boiler design. The boilers are being built by the Babcock & Wilcox Company. They are entirely different from any B. & W. boilers thus far used and represent a boiler that has been developed by the engineers of that company working in conjunction with the engineers of Sargent & Lundy over a period of two or three years, with a view to obtaining a boiler that will be suitable for considerably higher pressures.

Small Individual Elements Essential

It has been recognized that in the design and construction of boilers for pressures in excess of 350 lb. the volume of individual elements of the boiler-pressure parts must be smaller than were formerly used in order that the failure of any single element shall not result in serious destruction. Further, small individual elements make possible the use of metal thicknesses for pressure parts of the high-pressure boiler no greater than, if as great as, that of the larger elements ordinarily used in the construction of boilers designed for ordinary pressures, and the difficulties that might arise from excessive thickness of metal exposed to heat and and pressure are thus obviated.

The general features of design of the combined boiler, superheater and economizer unit as finally adopted for Waukegan are indicated by the accompanying illustration. The position of the superheater and the path of the gases are particularly novel.

These new Babcock & Wilcox boilers are of the inclined header design, thirty-four sections wide, the sections being double-deck and connected to 54-in. cross drums. The lower sections are made up of eight 3¼-in. tubes, the tubes being 15 ft. long. Each upper section is composed of seventeen groups, each of two 2-in. tubes of the same length. The 3¼-in. and the groups of 2-in. tubes are so arranged and spaced that there are access lanes between all tubes horizontally and in two directions diagonally. The tubes of the lower sections are exposed for their full length to the direct radiant heat of the furnace, this portion of the boiler being constructed without baffles.



POSITION OF SUPERHEATER AND PATH OF GASES ARE NOVEL

On account of the high superheat required, and also to avoid superheater being of excessive size, it is installed between the 3¼-in. tubes and the 2-in. tubes and is composed of three rows of 2-in. superheater loops.

Provision is made for removal of superheater tubes by connecting two of each three upper and lower section headers by long nipples and the third of each three sections having upper and lower headers by nipples which are shorter.

The gases pass from the furnace over the lower sections, which, as stated, are without baffles; thence over the superheater and into the upper deck, which is equipped with a single baffle, making this portion of the boiler two-pass. The gases are taken from the boiler through the long nipples connecting the upper and lower rear headers and are led to the top of an economizer at the rear of the boiler setting.

With the fuel to be burned and at the capacities that will be developed, there will be some tendency toward the formation of slag on the tubes of the lower section. Provision is made for the removal of such slag from the forward part of the lower tubes through special doors below the uptake headers, and at the rear through special doors opposite the nipples connecting the downtake headers to the mud drum, it being possible to use a "pokerod" between these nipples.

The superheater chamber is such that there is ample room for access above, below and between superheater loops and at the rear, below the second pass, to the superheater headers. This arrangement gives ample opportunity for periodical inspection and for thorough cleaning.

The economizer, placed at the rear of the boiler setting, is of the Babcox & Wilcox transverse-tube "Duratex" design and is built for a working pressure of 450 lb. It is thirty-six sections in height, each containing twenty 2-in. tubes, 20 ft. 10 in. long, connecting 7½-in.-square wrought-steel economizer headers. Feed water enters the lower header at one side of the economizer and passes through a single row of tubes to the corresponding header on the other side. From this header the feed passes through a second row of tubes to a second header on the feed-inlet side of the economizer, and in a similar manner through all sections in series from the bottom to the top. This design with the downward passage of gas and the upward passage of water through the economizer results in strict counterflow of water and gas which is essential for the best heat absorption, and the counterflow principle, together with the gas and water velocities employed, leads to maximum heat-transfer rates and corresponding maximum economizer efficiency.

Each boiler contains 14,086 sq.ft. of surface, the superheater 2,485 sq.ft. and the economizer 8,837 sq.ft. This boiler unit is designed for a normal output of 100,000 lb. to 120,000 lb. of steam per hour and a maximum of 150,000 lb., the steam to be superheated to 700 deg. Fahr.

Forced-Blast Chain Grates

The boilers, which are set with a 21-ft. 7-in. furnace height, are fired under the uptake end and are equipped with Babcock & Wilcox forced-blast chain-grate stokers, each 21 ft. wide by 18 ft. 3 in. long, giving a grate surface of 383 sq.ft. and a ratio of grate to boiler-heating surface of approximately one to thirty-seven. The chain grates are equipped with side-wall and bridge-wall wrought-steel water boxes connected to the circulation of the boiler.

The engineers of the Babcock & Wilcox Company consider this design to be a great stride forward and think that it will be one of the most efficient boiler units yet developed, irrespective of pressure. Three of the complete Babcock & Wilcox units as described have been purchased for the Waukegan station, and three units of the same section, though not so wide, for the Grand Tower station of the Middle West Power Company, for which station Sargent & Lundy are also the engineers.

Status of Electric Furnaces

Electric Melting and Refining Fairly Well Established for High-Grade Steel—Application of Electric Heat to Non-Ferrous Metallurgy and Heat Treating Still Growing Rapidly

By L. H. KNAPP
Industrial Heating Department, General Electric Company

TEN years ago electric heat applications were virtually non-existent. Today the total industrial heating load of the country is estimated at 1,580,000 kw., and it has been prophesied, and with reason, that in the not distant future this load will exceed the total motor load of the country, now estimated at 10,000,000 kw.

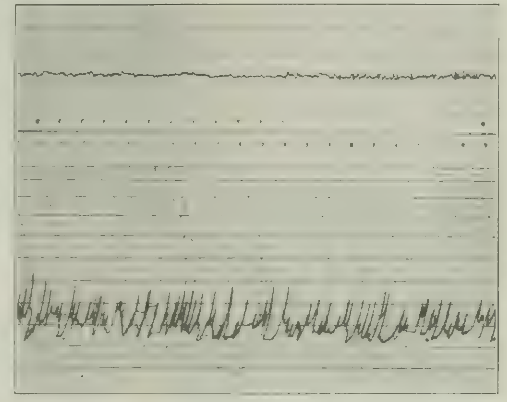
The electric furnace is of comparatively recent origin. The first arc furnace of any practical importance was constructed by Siemens about 1878. The earliest use of the resistance principle for electric furnace heating was about 1815, when W. H. Pepys solved some of the then perplexing questions relative to the nature of steel in a miniature resistance furnace operated from a primary battery. In the furnace he placed some diamond dust containing a wrought-iron wire and heated the wire to redness by passing current through it. The iron wire absorbed the diamond dust (pure carbon) and was converted into carbon steel.

After the discovery of the electric dynamo electric current in larger quantities became more economical and gave renewed impetus to the development of electric heating.

Today industrial types of furnaces may be divided into four general classes—furnaces for forging and melting metals at temperatures of 1,800 deg. F. and above, furnaces for heat treating and low-temperature melting up to 1,800 deg. F., ovens for baking and drying at temperatures up to 700 or 800 deg. F., and localized heating, or the application of individual units. The devices in the last-named category range all the way from arc furnaces holding 40 tons of molten steel at a heat and with a power rating of more than 3,000 kva. to small individual heating units requiring 0.007 kw., or less than the power consumed in the average size of incandescent lamp.

The commercial use of the high-temperature furnace is that of melting and refining ferrous and non-ferrous metals and their alloys. Melting furnaces are of two general types, the arc and the induction, of which the former are by far the most numerous. There are about 400 arc furnaces in operation at the present time, forming about 2 per cent of the total public utility load of the country.

The majority of those installed are the Héroult type. In this furnace the metal is heated by the arcs formed between the carbon or graphite electrodes and the metal of the bath. Essentially the furnace is a steel shell lined with refractory material, the electrodes coming down through holes in the roof. The electrodes are suspended vertically to have the arcs in series, the current passing from one electrode to the bath and out through another electrode. The number of electrodes varies, three being used for three-phase current and two for single-phase, each being manipulated independently by means of a motor-driven winch.



ACCOMPANYING THE DEVELOPMENT OF THE FURNACE HAS BEEN A REMARKABLE DEVELOPMENT IN CONTROL SYSTEMS

The upper curve shows automatic regulation of electrodes in a 125-kw. furnace and the lower shows hand control under the same conditions of operation.

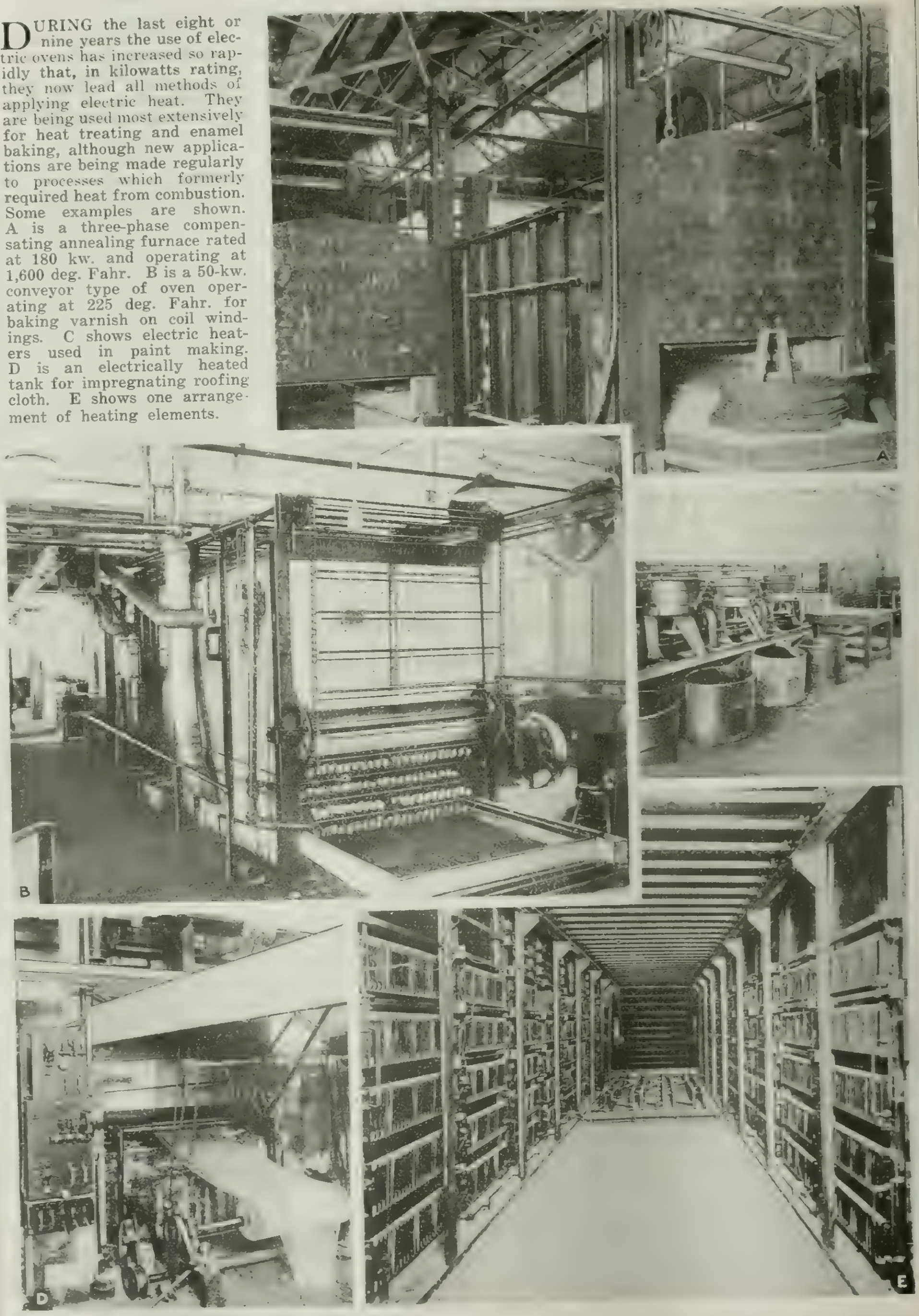
All the furnaces require practically the same electrical equipment. This consists of a transformer, switchboard and protective equipment, electrode motors and tilting motor. Automatic control of the electrode motors is generally used to lessen the fluctuations of the load taken by the furnace. The transformers are designed to deliver low voltage and heavy current to the furnace and to withstand the momentary short circuits that often occur in operation. The switchboard carries the metering equipment, circuit breakers, etc., its size depending upon that of the furnace.

ELECTRIC STEEL IS UNIFORM IN QUALITY

Arc furnaces are being used in steel foundries both for melting and to some extent for refining. They are widely used for producing tool and alloy steels, having supplanted the crucible furnace for this purpose, because of their greater flexibility and lower cost of operation. The furnaces are usually charged cold, and melting and refining are carried on during the heat. Because of the intense heat of the electric arc and the absence of contaminating gases of combustion, sulphur, phophorus or oxides, not only is the rate of melting and refining increased, but the resultant metal is superior to the highest grade of castings made in either the open-hearth or crucible furnace.

Arc furnaces installed in this country range in size from ¼ ton to 40 tons capacity. The average kilowatt-hours per ton vary according to the uses to which the furnace is put. For refined steel and castings, the variation is between 750 kw.-hr. and 1,200 kw.-hr. per ton, depending on the quality of the steel; for straight

Electric Ovens Lead All Heat Applications in Installed Rating

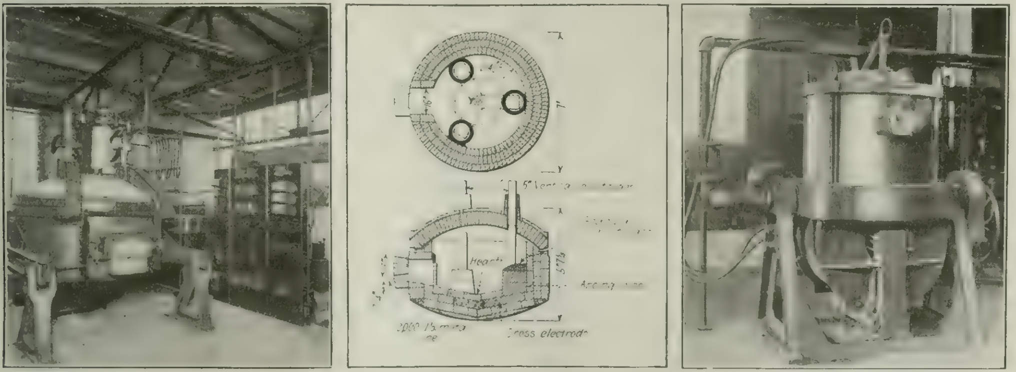


DURING the last eight or nine years the use of electric ovens has increased so rapidly that, in kilowatts rating, they now lead all methods of applying electric heat. They are being used most extensively for heat treating and enamel baking, although new applications are being made regularly to processes which formerly required heat from combustion. Some examples are shown. A is a three-phase compensating annealing furnace rated at 180 kw. and operating at 1,600 deg. Fahr. B is a 50-kw. conveyor type of oven operating at 225 deg. Fahr. for baking varnish on coil windings. C shows electric heaters used in paint making. D is an electrically heated tank for impregnating roofing cloth. E shows one arrangement of heating elements.

refining or "duplexing," between 150 kw.-hr. and 250 kw.-hr., and for melting steel castings from a cold charge, 550 kw.-hr. per ton. The power factor is good. On 60 cycles it is between 85 and 90 per cent and on 25 cycles from 90 to 96 per cent. These values are made possible by the efficient way in which the limitation of current surges is effected.

The development of the induction furnace for ferrous metals has not kept pace with that of the arc furnace. Although its advantages have long been realized, the difficulties have been to find a satisfactory lining material and the necessity of using very low-frequency power. Recently, however, an improved form of furnace has been perfected, equipped with a newly developed lining material. This lining is known as "furnite" and under operating conditions it has given remarkable results, one lining running for ninety-three days, or 604 consecutive heats.

For the continuous melting of copper, bronze and red or yellow brass the induction furnace, however, is superior in certain ways. One repulsion-induction type of furnace is illustrated above.



MUFFLED-ARC AND INDUCTION TYPE FURNACES HAVE BEEN FOUND PARTICULARLY ADAPTED TO NON-FERROUS METALS

The induction furnace is essentially a transformer with a laminated core and primary and secondary coils. The secondary consists of the bath, or a short-circuited ring of the metal to be melted, the energy induced in it being transformed into heat. These furnaces in the United States operate single-phase, but by using a synchronous motor-driven generator set the load on the central station can be polyphase at unity, or even at leading, power factor.

The advantages of the induction furnace from the user's standpoint include an even and easily controlled temperature of the metal in the bath, the circulation in the bath, due to magnetic forces which prevent the settling out of heavy alloys and insure even composition of the metal; elimination of contamination from electrodes and roof dripping, and low percentage of metal loss. From the power company's standpoint, the load is free from rapid fluctuations and the power factor may be high, as has been explained.

Furnaces for heat treating are usually of the resistance type, the heat being transmitted to the charge by radiation from a metallic resistor. Those for low-temperature melting are either of the muffled, or resistance arc, or the induction type. The former class are used in annealing castings, hardening and annealing carbon steel and similar operations. Their size varies greatly. One of the largest, which is used for annealing turbine castings weighing as much as 80,000 lb., forms a connected load of 700 kw. at 550 volts. From this size they range downward to small portable tool-room furnaces taking 5 kw.

DIFFER CHIEFLY IN ARRANGEMENT OF RESISTORS

The general construction consists of an inclosed compartment lined with refractory material. The heating elements are ribbons of nickel-chromium supported away from the walls of the furnace on the inside. The heat from these elements is conducted to the charge principally by radiation. The arrangement of the elements or heating units varies greatly, although they are usually disposed so that heat will strike the charge from all sides and so that the distribution of heat will be uniform throughout the furnace interior.

Why the electric heat-treating furnace has in the five years that have elapsed since its inception outdistanced competing types can be stated in one word—economy. Its effect on over-all production costs is to reduce them radically, sometimes as much as 50 per cent, and to increase both the volume and quality of production.

A large automobile company recently installed furnaces for heat-treating parts. It found that electricity as a fuel cost about twice as much as oil fuel. But on the basis of over-all cost, involving the removal of scale, straightening and cleaning, etc., which was necessitated by the fuel-furnace product, its total costs were more than two to one in favor of the electric heating. Statistics have shown that 40 per cent of fuel-fired ring gears have to be straightened after heating because of distortion. This trouble is totally absent in the electric furnace.

Probably the most important characteristics of the electric furnace are the accuracy with which its temperature may be controlled automatically and the highly uniform heat distribution which is an inherent quality. The direct result of these on the finished product is a striking reduction in, if not the total elimination of, defective products, with a large consequent saving in the over-all production cost. Further savings are effected by the low operation costs, the attendance for an automatic furnace being negligible, and the low maintenance charge. Many furnaces have run continuously for two years with no noticeable deterioration in either the heating element or the refractory lining.

In addition to metal annealing electric furnaces have been put to other uses, notably that of baking vitreous enamel. Comparative costs on an electric and fuel-fired furnace for this purpose have recently been obtained. In six months the cost per hour for operating the electric furnace was found to average 43 cents, while that of the oil furnace was 72 cents, or a saving of 29 cents per hour in favor of the electric. In addition, it was estimated that the production was increased approximately 50 per cent.

TEMPERATURE MUST BE HELD CONSTANT IN GLASS ANNEALING

Another application is that of annealing glasswares of various kinds. It is absolutely essential that the temperature cycle used in annealing glass be maintained absolutely without variation, no matter what the time element. A variation of one or two degrees at any point in the process is enough to ruin the product. The difficulty of maintaining the cycle accurately with fuel-fired furnaces led to experiments with a view to developing an electric furnace, or lehr, that would do the work. Not only was electric heat successfully applied, but the results in elimination of rejects, either from distortion or sulphuring and other contamination, were such in one case as to reduce the over-all cost per unit by 20 per cent. Here again it was the perfect control of temperatures, automatically, and the cleanliness and even distribution of heat in the electric furnace that caused it to be superior in operation to the fuel-fired furnace.

DATA ON ELECTRIC OVENS USED FOR VARIOUS PURPOSES

Duty	Range of Connected Load, Kw.	Number of Types	Temperature Range, Deg. F.	Capacity Range	Power Factor, 60 Cycles
High-temperature melting and refining of iron, steel and ferro-alloys	150 to 4,000	17	2,500 and up	1 to 40 tons	0.8 to 0.9
Melting aluminum, brass, copper and non-ferrous metals and alloys	45 to 400	4	2,000 and 3,000	50 to 2,250 lb.	0.9
Heat-treating and annealing steel and other metals	5 to 1,000	2	1,000 to 2,000	1 to 85,000 lb.	0.9 and up
Baking and drying materials of all sorts	20 to 13,000	1	500 to 1,000	Unlimited	0.9 and up
Localized heating, glue pots, air heaters, metal-melting pots, immersion heaters, soldering irons, etc.	0.007 to 0.5	..	Indeterminate	Indeterminate	0.8 and up

In melting brass or other non-ferrous metals or alloys in electric furnaces the metallurgical characteristics, being different from those of iron and steel, have caused necessary differences in the electrical design, especially with regard to the arc type of furnace. The rapid volatilization of some of the constituents of brass and the importance of maintaining the furnace atmosphere free from oxidizing agents preclude allowing the arc to come into direct contact with the metal, as in the steel furnace. Hence brass arc furnaces are of the "muffled" and indirect type, the heat being transmitted to the metal in the bath by radiation and by conduction. In the "muffled-arc" furnace the electrodes are brought into contact with crushed graphite in the muffles, which rest on arcing blocks on the ends of the cross electrodes in the bottom of the furnace underneath the hearth. The heat generated by the innumerable small arcs formed between the electrodes and the graphite converts the latter into an incandescent mass, or a heat source of large area. The heat from this source is reflected down on the charge from the curved roof and absorbed from the sides of the hearth, giving an even distribution throughout the metal.

An induction brass furnace has recently been developed where the heat is generated in the metal in a cylindrical ring concentric with the primary winding. Above this ring and connected with its opposite ends by two openings is the main bath of metal. By offsetting the primary coil with respect to the center of the cylindrical ring molten metal from the ring is forced up into the bath through one passage and flows down through the other passage into the ring. Thus a positive circulation of the metal in the bath is maintained, which thoroughly mixes the alloys and rapidly transfers heat to the charge.

Most brass furnaces are of comparatively small capacity, ranging from 2,000 lb. to 50 lb., and work at temperatures of about 2,300 deg. F. They consume an average of from 450 kw.-hr. to 175 kw.-hr. per short ton, depending on the size and type of the furnace, method of operation and method of charge. The most remarkable things about brass furnaces, however, are their low percentage of metal loss and high thermal efficiency.

The metal loss for fuel-fired furnaces averages from about 2.5 per cent to 8 per cent, as against 1.5 per cent or 1 per cent with the electric, depending on the kind of metal and type of furnace. The thermal efficiency of the electric furnace averages between 30 and 80 per cent, while that of the fuel-fired furnace is from 1.5 to 16 per cent, the average being 7 per cent. As a rule they operate with power factors of 90 per cent or better and from a continuous non-fluctuating load for the central station.

The development of the electricially heated oven has covered eight or nine years. During this time its use has increased to such an extent that in kilowatt capacity the total exceeds that of any of the other devices employing electric heat. The construction of the ovens is in general very simple, most of them consisting of a ventilated and thoroughly insulated sheet-steel box with resistance-heating units supported away from the walls and sometimes from the floor. The heating units somewhat resemble those used in resistor furnaces, except that, being designed for temperatures about half as great (800 deg. to 500 deg. F.), both the metallic ribbon and the insulating support are lighter in construction.

AUTOMOBILE INDUSTRY IS LARGE USER

One of the largest users of the electric oven is the automobile industry, which has found it invaluable in baking the japan used on automobile bodies, fenders and various small parts. The largest individual oven used is in an automobile plant and forms a connected load of 13,000 kw. It has been found that the cleanliness of the atmosphere in and about the electric oven has had a great influence on the perfection of the finished product, rejections having been reduced from 20 per cent to sometimes a fraction of 1 per cent. Ovens applied to core baking have not only increased the actual production to three times that of the fuel ovens that preceded them, but turn out cores of greater strength and uniformity. One user stated that he did not get enough worthless cores out of his electric oven in a year to make up a carload. The improvement is due to the better circulation of heat and, in some instances, to the increase in temperature obtainable in the electric oven.

Electric ovens are used in many other processes in all sorts of industries—for baking-japan on typewriter and telephone parts, sterilizing hospital equipment, drying effervescent salts and other chemicals, baking steel wire to remove acid, etc. There are many more uses that will be exploited as time goes on and the general knowledge of the paramount advantages of electric ovens increases. Just as the gas oven superseded the coal and coke oven, although more expensive from a fuel standpoint, so the electric has superseded the gas and oil oven for substantially the same reason—long-run economy.

Localized Heat Obtained from Small Units

The localized heating devices are so numerous and their application so varied that it is only possible to consider them in the most general way. In size they range all the way from a small, individual 7-watt heating unit to metal-melting devices with a capacity of 25 lb. of metal at a heat. Their temperature range is as varied as their application.

Some of the more prominent of the individual devices are self-regulating pots for the melting of solder, babbitt and similar metals, pots for melting battery compound, glue pots, soldering irons, oil-tempering baths and other liquid heaters. They all share the same characteristics. They are clean, conserve time and material and when used in the shop or factory greatly reduce fire hazard, which is a more or less outstanding characteristic of gas-heated appliances used for the same purpose.

The electric devices are all built around some form either of the cartridge unit or of the sheath-wire unit. The latter, in a recently perfected form, has greatly widened the field for localized heating. In addition to the devices just mentioned units in the form of air, clamp-on or immersion heaters have been applied successfully to all sorts of industrial processes. They are found in drying rooms, on warming tables, in cigarette machines and in use for heating liquids for various purposes. The economy accruing to the customer of electric power from the use of these devices has been explained. The benefit of such a load to the central station can best be illustrated by a hypothetical case.

Suppose a manufacturer has a bath of some sort which he desires to keep at a certain temperature throughout the working day. By installing a 5-kw. sheath-wire immersion unit he is assured of a continuous supply of hot liquid, with a minimum of inconvenience both in installation and maintenance, since all he has to do is to connect it to the wires and drop it into the bath. Simple as it is, such an installation is the means of a steady and far from inconsiderable income to the central station. Supposing again the heater is run ten hours a day, two hours to heat up and eight in operation. Five kilowatts for ten hours is 50 kw.-hr. per day for a year of 300 days, or 15,000 kw.-hr. per year. Since the load is small, 3 cents per kilowatt-hour is a conservative rate; hence the income of the central station would be $450 a year from a device costing about $25.

Status of the Electrical Industry in New Zealand

The present status of the electric light and power industry in the Dominion of New Zealand is discussed in considerable detail in the 1921 report of the Dominion chief electrical engineer, recently issued. New Zealand has laid out a comprehensive scheme of hydro-electric development based upon an estimated demand of 1 hp. delivered to each five inhabitants. On this basis the whole Dominion requires the generation of 270,000 electrical horsepower, of which 160,000 hp. is required by the North Island and 110,000 hp. by the South Island.

Apart from these two main government supply systems, there are fifty-five generating plants in the Dominion, as detailed in the accompanying table. The total maximum load increased during 1921 from 30,716 kw. to 42,157 kw., and the total installed generator rating at the end of 1921 was 49,630 kw. at main plant and 5,831 kw. of standby or auxiliary plant, showing a margin of 7,473 kw., or 15 per cent of spare plant. Definite plans are under way for the interconnection of several of the more important distribution systems.

The total output of the industry for 1921 was 149,476,379 kw.-hr., of which 124,446,469 kw.-hr. was sold to 73,151 consumers. Although the industry as a whole yielded a net profit during 1921 of £68,106, after paying interest and sinking fund, it is interesting to note that thirty of the seventy-four generating and distributing companies reported a loss for the year. This condition was due mainly to increasing costs and the difficulty in raising the rates charged by the companies, all of which are operating under government licenses containing a schedule of maximum rates.

DETAILED DATA ON THE ELECTRIC LIGHT AND POWER INDUSTRY OF NEW ZEALAND

	Water	Steam	Gas	Oil	Total
No. of stations.....	26	10	19	2	57
No. of consumers....	37,647	23,509	8,752	3,243	73,151
Installed capacity (kw.)	28,883	22,120	3,648	810	55,461
Max. load (kw.)....	21,661	17,587	2,379	530	42,157
Kw.-hr. generated..	91,334,719	50,848,365	5,616,528	1,676,767	149,476,379
Kw.-hr. sold.......	74,686,598	44,478,349	3,869,188	1,412,324	124,446,369
Total capital outlay	£2,379,530	£881,481	£336,145	£72,125	£3,669,518
Capital outlay per kw. installed*....	£82.4	£72.8	£92.1	£90.0	£81.0
Total annual working costs	£181,425	£205,401	£72,403	£20,019	£479,248
Annual working costs per kw.-hr. sold...	0.58d.	2.46d.	4.48d.	3.4d.	1.15d.
Annual working costs per kw.-hr. max...	£8.35	£22.5	£30.4	£37.9	£14.5
Total annual capital charges	£157,801	£50,891	£20,190	£4,196	£233,078
Annual capital charge per kw.-hr. sold .	0.505d.	0.61d.	1.25d.	0.71	0.56d.
Annual capital charge per kw.-hr. max	£7.3	£5.58	£8 48	£7.9	£7.05
Total annual costs...	£339,226	£256,292	£92,593	£24,215	£712,326
Total annual costs per kw.-hr. sold...	1.08d.	3.07d.	5.73d.	4.1d.	1.71d.
Total annual costs per kw.-hr. max...	£15.65	£28.08	£38.88	£45.8	£21.55
Totalannualrevenue	£383,449	£283,899	£87,151	£27,440	£781,939
Totalannualrevenue per kw.-hr. sold...	1.23d.	3.39d.	5.4d.	4.65d.	1.87d.
Totalannualrevenue per kw.-hr. max...	£17.7	£31.0	£36.5	£51.6	£23 65
Net profit... ...	£44,223	£27,607	£6,949†	£3,225	£68,106

* Includes distribution. † Loss

There was virtually no change in the standardization of the system during the year, but several of the older installations are preparing to change over to the standard three-phase, 50-cycle system, which now includes 29,980 kw., or 54.3 per cent of the generating plants installed in the Dominion.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Group Insurance and Labor Turnover

To the Editors of the Electrical World:

In the April 8 issue of the *Electrical World* H. A. Lemmon of the personnel department of Stone & Webster, Inc., of Boston asked two questions. To one he gives his own answer. To the other he suggests an answer but makes no positive statement.[*]

The question which he leaves for some reader of the *Electrical World* to answer is: "When did group insurance ever reduce labor turnover?"

Here are some answers from men, corporations and employers' associations who know group insurance from experience.

Samuel W. Latta, director of the John Wanamaker Foundation of Philadelphia, the employees of which are insured under the group plan with the Travelers' Insurance Company, writes over his own signature:

"We believe group insurance is a strong factor in binding together employer and employees, a powerful weapon in the reduction of labor turnover."

Charles Montgomery, manager of the publicity department of the Fuller Brush Company, says of group insurance:

"It is our impression that the group insurance plan works two ways to our mutual benefit in the Fuller organization. First, it will relieve certain workers of a considerable amount of anxiety regarding the future, which tends to make them more cheerful and, of course, more efficient workers, and secondly, we believe—in fact, we know—that it makes each and every unit of our organization more loyal and much more dependable workers. We might add that among our salesmen in the field especially it tends to decrease labor turnover."

F. J. Spaulding, insurance manager Brooklyn Rapid Transit System, wrote to us as follows: "The attention of our employees has frequently been called to the very liberal conversion clause [of the group insurance policies], and the employees have been informed as to the difference in plan between the group and the ordinary life, limited-payment contract, and I believe it has resulted in our retaining a very large proportion of the insured employees."

The Ajax Rubber Company, in a letter to the company, stated that after the installation of group insurance in its plant in December, 1919, there was a reduction of 26 per cent in labor turnover for the following six months. The director of industrial relations says that he regards group insurance as having earned the largest part of the credit for the improved conditions.

A committee of the National Association of Manufacturers, consisting of Augustine Davis, chairman; Carl M. Hansen, William P. White, C. H. Pond, M. F. Westover, Morris M. Davidson and S. P. Bush, said in a report to the organization:

"All those having in mind improvement of conditions of those in their employ, so far as the same may be justified by modest expenditure, will probably find group insurance a medium which, dollar for dollar on such expenditure, will prove most beneficial to the employer and employees alike, and therefore to the general improvement of industrial conditions."

Special Report No. 6 of the National Association of Corporation Training, issued in October, 1920, was devoted largely to the subject of group insurance. This report stated:

"The speedy winning of favor by insurance over many other schemes of employee relief is readily understandable. To the employer it appeals as a method both of fostering more harmonious relations and reducing turnover, since it offers the strongest kind of deterrent to the employee against severing connection with the company. And even stronger must be its appeal to the employee."

Now for a little evidence from the other side of the fence:

When the employees of the Brooklyn Rapid Transit system went on strike about two years ago the insurance company arranged to have all striking employees notified of the privilege which they had of converting their group certificates into individual policies of insurance when they left the employ of the company. Hundreds of replies were received by both the insurance company and the transit company to the effect that the employees wanted their insurance in force. The wife of one of the employees wrote:

"In regard to the insurance which we have under the B. R. T. system, my husband decided to return to work. Kindly let the insurance go on as before and keep me notified if anything else happens as I certainly want the insurance."

Elsewhere in this article Mr. Lemmon says: "Nor do I know of any instance where the employees indicated that they even wanted group insurance."

Probably the best refutation of the inference from this statement is found in the case of the Public Service Company of Northern Illinois. In November or December, 1920, that institution asked its employees in a circular letter whether they preferred the company's usual Christmas basket or turkey or life-insurance certificates under a group insurance policy. The balloting showed that 73.8 per cent preferred life insurance, and the company immediately took steps to provide it. This corporation has 2,000 employees.

In further refutation of the assertion are the thousands of group insurance certificates in force where the employees themselves are paying a part of the cost. While most of the group insurance is paid for wholly by the employers, some employers consider it necessary to collect a part of the premium from the employees by payroll deduction.

If group insurance were as futile as Mr. Lemmon thinks it will be in promoting good will between the employee and employer, it probably would have faded from the business horizon by now. The first group insurance policy was written something more than ten years ago. It was not the invention of an insurance man, but a proposal from an employer, and a proposal at which insurance men at first looked askance. A few companies tried the experiment and found that this method of insurance underwriting was sound and workable. Until they ascertained this fact they made little, if any, effort to get additional group insurance, but in spite of this the volume grew steadily. There has been an increase in the number of employees insured every year since the first policy was written. Surely ten years is sufficient time to test group insurance. On Jan. 1 of this year there were 6,000 employers in the United States and Canada carrying this form of insurance on more than 2,000,000 employees.

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[*] That the purpose of Mr. Lemmon's article be not misunderstood, we quote from the foreword which accompanied it as follows: "This paper must not be taken as a general indictment of group insurance, but rather of the halting spirit and foreshortened vision which are content with nothing more than an artificial and impersonal relationship between a company and its employees and then wonder why the kind of loyalty and service thus begotten has little heart in it. Group insurance where it is but one feature of an organized family relationship, in which the bonds of interest, mutual service and interdependence are forged of human feelings, is something else."—Editors.

Paying an amount that is called for in group insurance certificates and through an insurance company has many advantages over paying the same amount, or less or more, from the exchequer of the employer. The group insurance payment has no suggestion of charity in it. The beneficiary feels that her husband earned the insurance just as he earned his wages while he lived.

Paying the widow of a deceased worker $979, which is the average amount paid under group policies in the Travelers' Insurance Company in 1921, does not provide her with sufficient to live on for the remainder of her life and educate the children. It does relieve a vast amount of suffering, privation and want. Mr. Lemmon's plan of paying as much as the widow might need would call for larger expenditures than the average business corporation could afford.

Mr. Lemmon wants the employer to be constantly expressing his interest in his employees and in their welfare. What more substantial and sincere expression can there be than the payment of premiums on group insurance monthly, quarterly, semi-annually or annually?

And let us not forget in all this discussion that the manager of a public utility who buys group insurance merely to reduce labor turnover buys it for one of the lesser objects and one of the lesser accomplishments of group insurance. HOWARD E. CRITCHFIELD,

Assistant Secretary Group Department.
The Travelers' Insurance Company,
Hartford, Conn.

[In response to inquiry for data on group insurance, Mr. Critchfield gives the following information as to group insurance in force Dec. 31, 1921, on the books of the seven leading companies:

Company	No. of Policies	Amount
A	1,795	$424,443,627
B	1,179	376,107,369
C	1,246	318,085,180
D	1,195	289,499,073
E	279	73,106,546
F	296	45,382,320
G	93	14,038,783
Total	6.083	$1,540,662,898

–EDITORS.]

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Hearing Through the Hands

To the Editors of the Electrical World:

I recently stumbled on an interesting phenomenon which, if new, may be of great interest to the master minds of both the electrical and the medical profession. While listening to an orchestral concert broadcasted from Station WGY, Schenectady, N. Y., and received at Plainfield, N. J., 150 miles due south, on a type RC short-wave regenerative receiving set, equipped with head telephones, it was definitely established that the human body contains many unrealized factors of capacity and inductance.

It was found that one person listening in and wearing a head set on shaking hands with another person transmitted the sound impulses to the second person, who could hear nothing prior to the hand contact. Further experiment demonstrated that the second person could through his left hand transmit to a third person, and the third to a fourth; also that the individual receiving could transmit to two separate groups of people through his left and right hands. It appeared beyond doubt that the human body can be a supplemental broadcasting station and the eardrum a satisfactory receiving set.

This demonstration that we can hear through our hands by electrical impulse opened up very interesting thought as to whether there might not be some physical application whereby the deaf could hear through radio transmission. The matter appears to be well worth consideration and not beneath the dignity of electrical and medical specialists to study and explain from the scientific standpoint. The throat vibrations of a speaking person when touched by the fingers of a deaf and dumb individual are said to convey to the mind of the deaf a sensation equivalent to hearing. If high-frequency impulses could so accomplish this effect, new channels of research would be opened up.

New York City. HOWARD G. LAPSLEY.

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Points to Remember in Resuscitation

To the Editors of the Electrical World:

I have been much interested in the article in your issue of Aug. 5, 1922, by George M. Ogle of Newark entitled "What Determines the Deadliness of a Shock," and I think the writer has covered the subject in a very thorough manner and that he is especially clear in his outline of the effects produced on the human body by the electric current.

In the last part of the article the writer has a short account of how to proceed in resuscitating a shocked person which is very good as far as it goes, but I wish the method had been given a little more in detail. I think that in cases of electrical shock where respiration is suspended there is the best opportunity of saving life provided those on the ground go ahead at once and do the right thing.

In the printed matter concerning the prone-pressure method of the National Electric Light Association the best way to work is described. There are three things that every electrical worker should remember:

1. Work on the victim in the open air where the accident has happened in order that he may get every particle of oxygen possible in the lungs.

2. Go to work on the man the minute you get him clear from the wires, out of the water or out of the room filled with gas and smoke, and if you are all alone don't even stop to send for a doctor, but go to work and keep at it until help comes.

3. Don't stop your artificial respiration too soon. Remember that just as long as there is one particle of heat in the man's body, just as long as there is one particle of color in the man's face and hands, especially around the lips, the nostrils or fingernails, you have a chance, and don't stop your artificial respiration until every particle of color has left the man's body and rigor mortis has set in. When this has happened you have done all possible.

Three men employed by our company were severely shocked last year, but by using the prone-pressure method all three were saved. A man employed by the Malden Electric Company received 13,000 volts. Prompt work resuscitated him in about twenty minutes.

EDWIN W. BULLOCK, M. D.,
Division Safety Supervisor.
New England Telephone & Telegraph Company,
Manchester, N. H.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Underfeed Stoker Burns Low-Grade Fuel

Operation Featured by Flexibility, High Capacities Up to 350 per Cent and Uniform Thickness of Fuel Bed

HIGH-ASH, clinkering coal has been satisfactorily burned in specially designed underfeed stokers by the Twin City Rapid Transit Company, Minneapolis, at its steam station at Sixth Avenue, S. E., and the Mississippi River.

During the twelve tests made on this equipment no large clinkers were formed at any time, no slice-bar work was required on either side wall or bridge wall and no slag formed on the furnace walls or boiler tubes. The dumping periods were frequent, and there was no appreciable drop in the percentage of CO_2 or in the steam flow. Such furnace conditions provide a unit of great flexibility peculiarly adapted to stand-by and to intermittent demands and to meet the most exacting requirements of railway and power loads. They also reduce the banking losses to the low figure of 250 lb. per boiler per hour.

While the efficiencies on test range from 77 per cent at nominal rating down to 60 per cent at 350 per cent, the average operating economy is placed at about 70 per cent. Considering the wide and sudden variations in load and the character of the fuel, this performance is thought excellent. It may be compared to an average of 60 per cent for the older installation.

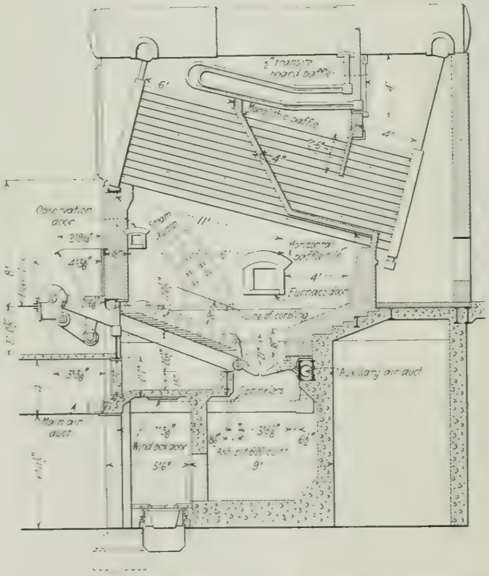


FIG. 1—LARGE COMBUSTION SPACE AND REDESIGNED BAFFLING FACILITATE THE BURNING OF LOW-GRADE FUEL

That considerably better results can be expected with a higher grade of fuel was indicated by four tests made at loads ranging from 200 to 275 per cent of rating with Harrisburg screenings.

Each of the six stoker installations consists of a Westinghouse six-retort stoker, 10 ft. 8¼ in. in width and 10 ft. ⅞ in. from front wall to bridge wall. The front is set flush with the boiler front, thus eliminating all overhanging brickwork. No ignition arches are used. As the bottoms of the front tube headers are only 8 ft. above the floor line, it was necessary to set the stokers 3 ft. below the floor level to secure the desired furnace volume of about 1,300 cu.ft. Each boiler is a thirteen-tube-high, twenty-one-tube-wide, parallel-drum, 5,560-sq.ft. B. & W. unit, having 900 sq.ft. of superheater surface but no economizer. The steam conditions at which the boilers work are 190 lb. per square inch pressure and 100 deg. F. superheat at nominal rating. The general scheme of the stoker setting and the boiler baffling is shown in Fig. 1.

The fuel, as it is introduced from the retorts by the rams, is spread laterally by deflector plates so as to cover the surface of the tuyères. The action of these plates also loosens the fuel, which, when containing large percentages of moisture and dirt, becomes densely packed under the action of the rams. Secondary step-shaped rams, located midway between the deflector plates and the grate tuyères, insure a continuous movement of the fuel bed. Each secondary ram is driven by its individual feed ram, although the length of stroke of all secondary rams is regulated by one adjustment lever.

Another refinement required was the use of extension side-wall tuy-

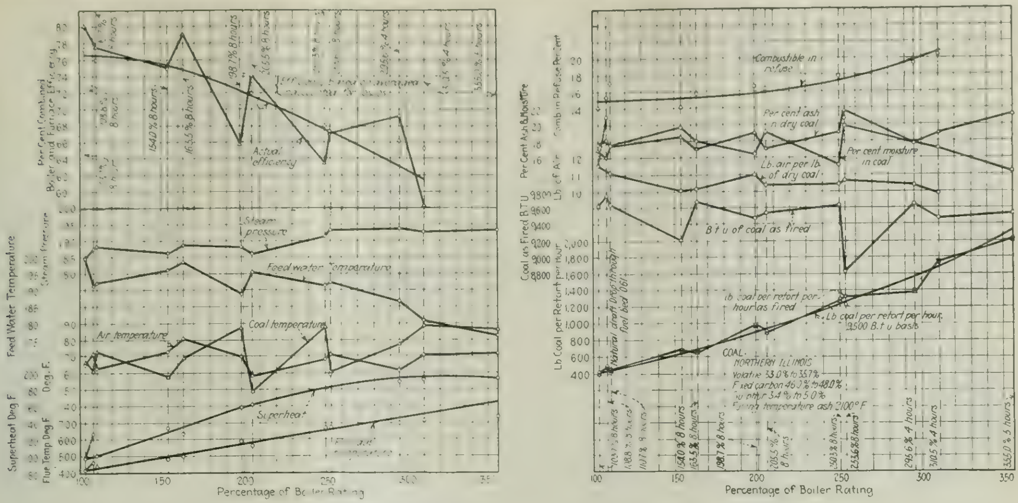


FIG. 2—PERFORMANCE TESTS OF 5,560 SQ.FT. B. & W. BOILER WITH REDESIGNED SETTING AND SPECIAL UNDERFEED STOKER

ères, which extend approximately to the top of the fuel bed. They are so designed that there are no dead pockets for the lodgment of partially burned coal or clinkers, and they protect the walls from the direct heat of the fuel bed and prevent clinkers from forming on the side walls. A battery of high-velocity steam jets, placed in the front wall about 18 in. above the fuel-bed surface and directed parallel to that surface, insures complete combustion by thoroughly mixing the gases before they enter the tubes. These jets also divert the gas flow toward the back wall of the furnace, providing for a sweep of the gases over the full length of the exposed boiler tubes.

Practically a constant gas velocity is established by decreasing the cross-section of the passes in the same ratio that the gases contract because of the abstraction of the heat by the tubes. The bridge wall and baffling are so installed as to expose 90 per cent of the tube length, giving a tube area double that of the grate to absorb heat by the direct radiation from the fire. The high heat absorption directly by radiation accounts largely for the low furnace temperature and the consequent minimum of clinker formation.

The angles of the stoker, the front wall and the bridge wall are so arranged that the radiant heat which does not enter the tube surface directly reaches the boiler with but one reflection. Such a condition means that the maintenance of furnace walls and other brickwork is considerably lowered by the elimination of double and triple reflections.

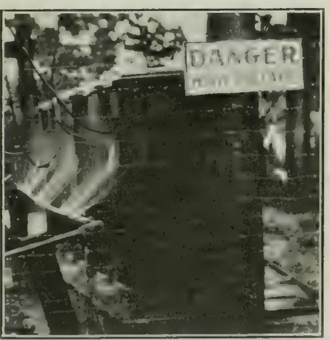
Under the new conditions it was estimated that the temperature of the gases as they entered the second pass would be considerably lower than formerly. The superheater, consequently, was lengthened so that the bends extended over the first pass instead merely of just up to the first baffle. With the boiler operating at about 170 per cent of rating the superheat formerly averaged about 100 deg. F. Fig. 2 shows how it was increased to 140 deg. F. at this rating and also how it continued to increase as the boiler was forced to higher ratings. The performance of the whole equipment is also shown in these curves.

Experience with this equipment has demonstrated the possibility of operating throughout a range from 100 to 350 per cent of rating. At the higher rating low-grade fuel is burned at a rate of 1 ton per retort per hour, and the refuse is disposed of with no excessive loss of carbon or loss of capacity or efficiency while dumping. Whether or not this high rating is the limit of the stoker capacity has not yet been determined, for the rate of evaporation was limited by the capacity of the feed pipes and the feed line to furnish the boiler with water.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Spray Increases Rating 50 per Cent

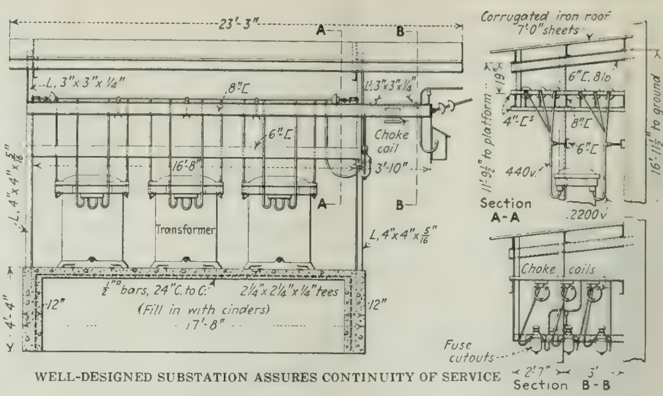
THREE 100-kw. transformers at the Leesville hydro-electric plant of the Central Connecticut Power & Light Company are installed above the forebay of the station and their output increased to about 450 kw. during the summer by the simple spraying arrangement illustrated. A 1-hp., 110-volt motor drives a small reciprocating pump with intake from the forebay, and the water is discharged through a ¾-in. pipe running from the pump to the front of the transformer bank, a continuous spray being in action. The water is returned to the forebay by a drain.



SMALL MOTOR-DRIVEN SPRAY PUMP ALLOWS GREATER LOAD

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Standard Design for Several Sizes of Industrial Substations



WELL-DESIGNED SUBSTATION ASSURES CONTINUITY OF SERVICE

THE question often arises as to what type of transformer substation is most desirable in connection with industrial plants served by public utilities and in large plants having their own generating stations. In designing a distribution system for a large industrial plant involving fifteen transformer banks the writer developed an outdoor substation to accommodate three transformers rated at from 25 kva. to 200 kva. each. For sizes between 200 kva. and 500 kva. the structure is simply increased in length, and two intermediate supports are added. As the load on any distribution system is likely to increase as the production plans or methods change, the standard design for all sizes of transformers was adopted, and the cost was not materially greater than if the substation for the 25-kva. banks had been built smaller.

As will be noted from the drawing, the design permits of location either adjacent to a wall of a building or isolated in the open yard. Where the building served is of a fireproof type, it is sometimes desirable to use the lean-to construction; but where the building adjacent is built of wood the substation should be some distance away so that the transformers shall not become a fire hazard.

A roof is provided in each case and likewise a rear covering when located in the open. This prevents accidental contact with high-tension wires where material is being handled around the plant and serves as a protection against the dust which is present around most industrial plants. The dirty condition of insulators when exposed directly to the elements is the cause of most insulator failures on transformers around industrial plants, and during several years' experience no bushing failures have occurred.

In the design ample protection is provided by means of choke coils and lightning arresters which are mounted on the framework. The concrete base is made of sufficient height so that transformers may be easily installed by running an electric or hand truck up to the base and sliding the transformer over. T-irons are embedded in the concrete base and project 1/8 in. above the base, allowing the transformers to be easily skidded into place. Replacements and removals are likewise facilitated by this arrangement, and large transformers are handled by a very few men. The only lifting necessary is then done by the shop crane in placing or removing the transformers on the truck.

LEAN-TO SUBSTATION CONSTRUCTION

Three 75-kva. 2,200/440-volt transformers are installed here, fed from a three-conductor underground cable.

Where a transformer of unusual height is encountered, it becomes necessary to increase only one dimension, that of the vertical supports. Ordinarily the only change required for large transformers is to increase the length of the structure, adding to the end opposite the choke coils or feed-line end. Where the length is greater than that shown in the drawing, it is desirable to add two vertical supports similar to the end supports at a point between the center and the two end transformers. This design is adapted to either open leads connecting to a pole line or underground leads using lead-covered cable.

The cost of this type of substation without transformers or wiring is between $1,000 and $1,500, depending on whether the adjacent or the isolated structure is used and on the cost of labor. However, the investment is in a permanent structure, and the extra protection is well worth the entire cost.

INDUSTRIAL SUBSTATION ISOLATED FROM WOODEN BUILDING FOR FIRE PROTECTION

This eliminates a fire hazard and allows fire-fighting operation to be carried on without danger from high-tension lines. Three 25-kva. 2,200/440-volt transformers are housed in this substation.

J. E. HOUSLEY,*
Engineer,
Aluminum Company of America,
Kansas City, Mo.

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*Formerly assistant power superintendent of the Aluminum Ore Company, East St. Louis, Ill.

Mechanical Aging of Cables Advocated

IN THE discussion on the process of making high-tension cable joints during the symposium held at the Niagara Falls convention of the A. I. E. E. (see *Electrical World* for Aug. 19, page 373) W. D. A. Peaslee contended that too much emphasis is placed on electrical tests of joints when actual mechanical conditions may be more important. He said that dielectric tests alone may not give such satisfactory results as a combination of mechanical anl electrical tests. He suggested a test similar to that used in determining the effect of alternate heat and cold on porcelain insulators. In this test hot and cold air are alternately blown across the test object every fifteen or thirty minutes. This would be a valuable test, Mr. Peaslee said, if expansion and contraction of joints is accountable for breakdowns, since it would hasten the results of such action. Tests of this nature were conducted by the Commonwealth Edison Company, N. E. Buck asserted, but not with such rapidly repeated temperature variations as Mr. Peaslee suggested. The joints were tested at room temperature and were then raised to 85 deg. C., dropped to —10 deg. C., and then tested at room temperature.

In removing cable joints for changes or repairs it is the practice at Detroit to open the sleeve, knocking out as much of the compound as possible without jeopardizing the insulation and then removing the rest of the compound by pouring hot paraffine over it. In performing this operation A. F. Hovey of the Standard Underground Cable Company warned against knocking out the compound with a hammer, as it may injure the cable.

Mr. Hovey favored using a knife-like tool which can be warmed and then used to slice off the compound. Mr. Buck stated that the Chicago company has discontinued the use of paraffine and substituted petrolatum for melting off the old compound. This method leaves the insulation in better condition.

The discussion also brought out the fact that with increases of voltage the tendency is to increase the length of joints, as experience has generally shown that liberal over-all dimensions give the best operating results. As a consequence it may be found that existing manholes and sytems of hangers will be inadequate for the higher-voltage cables and will have to be rebuilt.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Six Gloves Tested at Once by Hartford Company

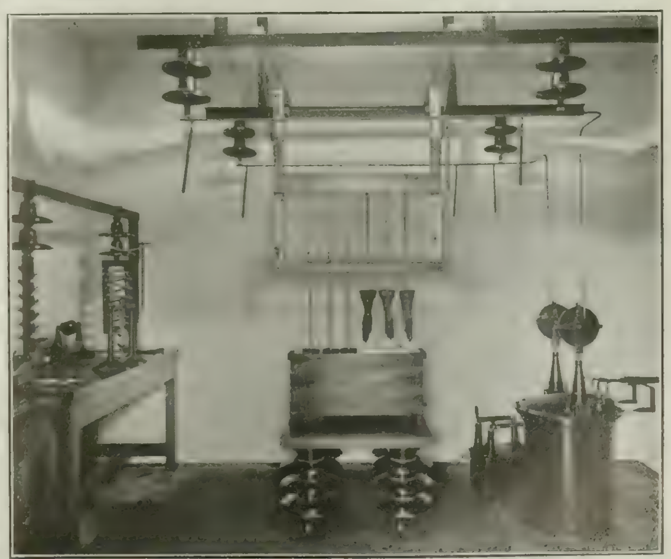
TESTS of rubber gloves are conveniently handled by the Hartford (Conn.) Electric Light Company at the laboratory of the lighting department, the equipment being designed to facilitate try-outs of six gloves at a time. For various high-tension tests in company service the room illustrated in the accompanying photograph has been set apart, the necessary potentials being obtained from a single-phase transformer capable of delivering a maximum of 100,000 volts to ½-in. brass tube buses suspended by high-tension insulators from 3-in. horizontal angle irons attached to the ceiling.

For glove testing a varnished maple frame has been constructed to hang upon the angle irons and thus be easily removable. Through holes in the bottom horizontal piece spindles made of ½-in. rigid conduit equipped with adjustable collars are provided to carry at any desired height fiber disks for glove holding. Below, a metal-lined tank provides the necessary receptacle for glove immersion.

Connections to and from the buses for the 10,000-volt tests required on gloves are made by flexible leads terminating in ⅝-in. copper-strip hooks fastened at the ends of fiber handles 12 in. long, ½ in. thick and ⅝ in. wide. The tank is 32 in. x 14½ in. x 9 in. in dimensions inside and is carried upon a wooden platform resting on four triple-petticoat insulators fitted with casters for ease of handling on the floor.

Single-pole knife switches opened and closed by an insulated switch stick are provided at the top of the travel of the glove-holding rods, plumber's safety chains being used when the glove is partly filled with water for the required flexible connection between the lower terminal of each switch and the rigid conduit spindle which runs into the glove. The test potential exists between the water inside and the water outside the glove, i.e., between the inner and outer glove surfaces. A sphere gap for checking potentials is mounted on the table at the left. In testing, all six gloves are first subjected to a breakdown test, and this is followed by a leakage test in which any glove can be cut out of circuit as desired.

E. Y. RICE,
Chief of Laboratory Staff
Hartford Electric Light Company,
Hartford, Conn.



LABORATORY FOR TESTING RUBBER GLOVES AT ANY POTENTIAL UP TO 100,000 VOLTS

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Maintaining Public Confidence

Favorable Attitude of Public Must Be Retained by Careful Planning of Future Developments—Advisability of Letting Contracts

By F. G. Baum
Consulting Engineer, San Francisco

ELECTRIC securities as a whole are more favorably considered now than at any time in the past. It is possible to sell good electric securities on favorable terms in large amounts. This very condition marks a time of danger for the industry, for certain people will take advantage of the favorable status of the public utility to place speculative securities, which may result in a loss to the investors and thus start a reaction.

Many of the utility companies are also making the mistake of manufacturing, just as the railways made the mistake of too much manufacturing—a mistake which caused part of their present troubles. It is better to support and thus build up outside manufacturing industries which are not liable to be subject to the same conditions. It is the same old problem of "diversity" with which utility men are familiar.

During the development period of any industry there is always this danger of speculative promoters breaking down the confidence which others have built up. During the period of railway construction many roads were built merely for the financing or construction profit. Many were built that should never have been constructed. The result was a loss of confidence by the public in the railways, and the effects of that loss of confidence extend to this day.

The electric power industry, and especially the water-power industry, is now at a similar stage, with the difference that most of the financing and construction must be approved by the regulatory commissions. It is necessary that there be some regulation in the securities issued and sold to the public to protect the public and the industries themselves against the promotion type of developer who cares for nothing except his profit.

But honest and capable financing will not make a good project out of a bad one, nor will good financing and engineering make a good project out of one badly or dishonestly carried out.

The matter of security therefore begins with the fundamental proposition, that is with the engineering, on which depends the success of the project, assuming capable financing and construction. This is especially true of water-power developments, for here success depends first on the location and plans for the project—that is, on the engineering of the project. By engineering is meant the selection and location of the development as well as the design to fit the conditions.

Need for Engineering Study

The power companies should study their possible future requirements and also the possible and logical power developments that should be made to meet the demand of the future. A comprehensive study of the power resources in a given territory is a matter that does not involve very large sums of money; still, there is too general a tendency for the power companies to neglect to study a logical constructive proram. The result is that the companies generally wait until they are forced "to do something" in a hurry, which often results in a merely temporary solution of the power problem and only defers the time when the matter must be attacked fundamentally and a plan worked out to be followed far ahead of existing needs. Without a constructive program the companies are merely drifting on an unknown sea. Such a method may incur serious losses.

In the early railway construction periods much of the work was done by day labor. In later years practically all the railway construction work was done by contract. The reason for the change was the recognition of the well-known human trait that laboring men will not work as industriously and conscientiously for a rich or large company as they will for some contractor of apparently more limited means. Men will not work for the United States or for the Pennsylvania Railroad or for the Niagara Falls Power Company or other large concern as they will for a good contractor.

Should Specialize in Service Rendered

The strike of the railway shop and repair men is more serious than it should be because of the fact that the railway shops have developed large manufacturing establishments in no way necessary for their main business of transportation. A large part of the work of manufacturing now done by these shops should be done by outside regular establishments which make a specialty of that particular kind of work. It required the railway shopworkers' strike, however, to bring the matter home to the railways.

The trouble comes, of course, from the inherent creative instinct of most men. Most men like to build and create things. But this desire is generally not carried out except at the expense of some one else. For example, most men will not design and build a five-thousand-dollar residence for themselves, but will employ an architect and insist on a definite contract to build the residence before they authorize the work. But the same men will start to build a five-million-dollar hydro-electric development without plans or contracts.

Much of the work for hydro-electric and power transmission developments can be very advantageously let by contracts. Company work must necessarily cost more in the long run because of the inherent conditions, which are well known. Of course no percentage contracts should be allowed except for extraordinary conditions.

If the reasons for non-contract work be analyzed, they will often be found to be based on personal ambition. There are cases, of course, where on account of time or unknown conditions contract work is not feasible. But if the companies will carefully consider the future, little day work will be necessary. To let work by contract means that the engineers must have a definite plan formulated. This of itself is of great value, as it forces a study of a complete plan before proceeding with work. That requires that the engineers get busy and put themselves in a position where they will know what they want to do before they start the work. The contract plan is therefore much easier and safer for executives and much safer for the directors and stockholders.

The securities of utilities are now favorably considered by the public. A failure of a few construction programs resulting from the lack of the safeguards afforded by proper engineering study and by the contract system may cause a serious loss. To guard against a setback due to failures the companies should:

First—Carefully study and plan developments. Second—Let all possible work by contract.

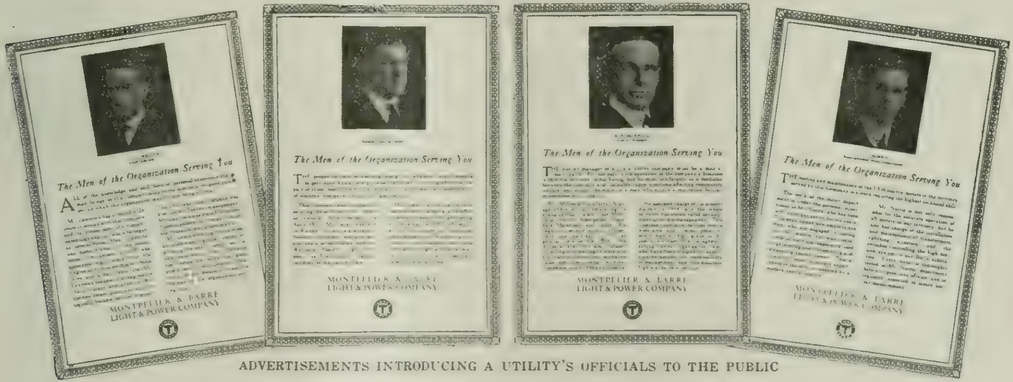
If money is lost, it makes no difference whether the loss was due to lack of foresight or ability, or to personal ambition. To hold the confidence of the public the companies must do their work efficiently. The power companies are becoming a great industry influencing the entire country. It follows that the industry must be conducted by competent men with a high appreciation of their responsibilities.

Introducing the "Men of the Organization" to the Public

LOCAL executive and operating officials of the Montpelier & Barre (Vt.) Light & Power Company will henceforth be better known by the people of its community because of a plan adopted to give these men introductions through the press to the public at large. Last June a series of advertisements was begun in four local newspapers with the object of making the personnel in charge of the company's work in various phases more widely known. Advertisements were printed weekly accompanied by a photograph and short biographical sketch of each local utility official, as illustrated.

Under the keynote "The Men of the Organization Serving You," these advertisements carry an interesting series of messages outlining the importance of trained and qualified men in conducting public utility service, emphasizing the value of long experience, the responsibilities sustained by the staff members, their reputations for fair dealing with the people, their connection with the company in early days, or their more recent appointment to strengthen the power of the organization to render good service. These biographies, tied in as they are with the company's expression of its desire to render the best possible account of its stewardship, have aroused much interest locally, and besides giving the public a better idea of the personalities of department heads and others concerned with its comfort and convenience, have increased the pride of not a few employees in their connection with the utility. They have also established closer and more friendly relations both within and without the company organization.

The Montpelier & Barre company is under the management of Charles H. Tenney & Company of Boston and during the fall it is planned to launch similar publicity programs for others of the Tenney properties.


The Men of the Organization Serving You
MONTPELIER & BARRE LIGHT & POWER COMPANY

ADVERTISEMENTS INTRODUCING A UTILITY'S OFFICIALS TO THE PUBLIC

◆

Buying and Selling at "Cost"

BY "KASSANDRA"

METHODS of cost plus a percentage or cost plus a fixed sum are methods frequently used for buying and selling a contractor's services. Occasionally the method is used for wholesaling electricity or for sales between companies.

The important thing to remember is that the word "cost" alone is indefinite. The only occasion on which the word "cost" is definite is when it refers to the price paid by the present owner at the date of purchase. Even then the question whether freight, insurance and so forth are not part of the cost cause trouble. An agreement to pay cost is therefore in many cases no agreement at all.

An interesting example came up the other day, the facts here stated being slightly changed from their actual form in order to bring out the principle more clearly.

Company A agreed to sell and Company B to buy at cost, including all operating expenses and also interest depreciation, return on investment, etc. After the agreement was made the accountants met and computed the cost by dividing what they called fixed charges in proportion to the maximum loads, and they computed the operating costs as so much per kilowatt-hour. This went along for several years. Then the following situation developed:

Company A foresaw that in a couple of years it could receive some more business from still another company, C, and also foresaw a growth in the demands of Companies B and C. Company A therefore bought land and started the erection of a new station very considerably larger than its old one. The cost of the land, building and equipment naturally made a large increase in Company A's fixed charges, and this it attempted to get Companies B and C to pay. They refused and said that if Company A was going to increase its business, the cost of getting ready to supply B later was not part of the cost of supplying B and C now.

Another complication came up. Company A found that by spending a large sum on more economical turbines it would save enough per kilowatt-hour on its whole output to pay 25 per cent on the new investment, provided things worked out as expected; but there was some question about the water supply working well in that particular case. The question therefore arose as to what would happen in case the plan was a failure and also what would happen if it was a success. Companies B and C wanted the economies made if they were going to be a success, but were not willing to contract forever, or for even ten years, to continue to pay the increased fixed charges if the plan should prove a failure.

On the other hand, Company A was willing to make the investment and run the risk of failure if, on the other hand, it could have all the savings; i.e., if it were not going to be asked to decrease the bills of B and C because of the savings by the new investment.

Then another complication arose. Company B's demand was relatively large, but its use small, compared with Company C's, so that the bills were about the same. After the economizer was put in the fixed charges were going to be increased and the operating expenses decreased. The result was going to be that the economies would actually increase B's bill instead of decreasing it, so long as the fixed charges were divided on a demand basis.

The solution of both these problems finally came to giving up the idea of a cost based on Company A's fixed charges and expenses and making new prices. These prices were not based on the accountant's figures, but the engineers were called in to compute what it would cost B to generate the energy if it put up its own plant, and what it would cost C, and then the executives made prices based on the engineers' estimates.

The final answer appeared to be that the cost which had been in the minds of the makers of the contract was not what Company A was going to spend for operating expenses and fair fixed charges, but the fair cost was what B or C would have to spend to get service elsewhere.

Of course, if the computation of cost had been put in the original contract the case would have been different. If a definition is written into a contract, there is no need of using the word "cost" or even the idea of cost. Let the definition determine the price and that is all that is needed.

Business Revival Brings Lower Rate in Boston

CHARLES L. EDGAR of the Edison Electric Illuminating Company of Boston has announced another reduction in the company's maximum rate from 10 cents to 9½ cents per kilowatt-hour in effect on meter readings after Aug. 31. In calling attention to this cut for the "Schedule A" customers, President Edgar said:

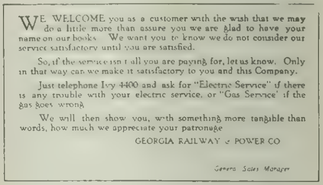
"When we discontinued the coal clause and 5 per cent increase on this class of business on March 1 last I anticipated a continuance of business revival and advertised the hope and expectation of the company to make the reduction now announced.

"Business is increasing everywhere in a healthy way, homes are being built, old houses are being renovated or remodeled and such improvements mean more users of electric service. Costs of wiring for electric service, fixtures, etc., are approaching a pre-war basis, and the Edison company strives to facilitate in every way the use of its service in the home.

"'Schedule A' customers number approximately 136,000, or 88 per cent of the 153,000 users of Edison service. They are the owners or occupants of residences, apartments, small stores and shops. They afford 42 per cent of the company's income for electricity sold. Continued improvement in business conditions with consequent increase in the company's income will, I am sure, bring added developments in Edison service and a steady lowering of rates."

A Bid for the Good Will of the New Customer

HERE is a mark of courtesy and a refinement to its service which has recently been added by the Georgia Railway & Power Company.



WE WELCOME you as a customer with the wish that we may do a little more than assure you we are glad to have your name on our books. We want you to know we do not consider our service satisfactory until you are satisfied.

So, if the service isn't all you are paying for, let us know. Only in that way can we make it satisfactory to you and this Company.

Just telephone Ivy 4400 and ask for "Electric Service" if there is any trouble with your electric service, or "Gas Service" if the gas goes wrong.

We will then show you, with something more tangible than words, how much we appreciate your patronage.

GEORGIA RAILWAY & POWER CO

General Sales Manager

THIS CARD ACKNOWLEDGES NEW CUSTOMER'S PATRONAGE

This card is signed by C. A. Collier, general sales manager, and sent out by first-class mail to all new customers. It thus carries a personal touch in acknowledging the customer's patronage and paves the way for pleasant relations in the future.

What Other Companies Are Doing

Providence, R. I.—An electric home was opened in this city on Sept. 5 under the auspices of the Narragansett Electric Lighting Company and with the co-operation of other interests in the local trade. It is planned to maintain the exhibit until Sept. 30. F. A. Gallagher, Jr., is manager of the company's lighting division.

Dallas, Tex.—An electrical home that will be the last word in electrical conveniences is nearly complete here. It is being erected by two of the local newspapers under the supervision and with co-operation of the Dallas Electrical Club. The home will be opened for exhibition for two weeks or longer as soon as it is completed.

Chicago, Ill.—Merchandise sales by the American Public Service Company during one week in July included forty-one desk fans, four ceiling fans, nine commercial electric irons, two curling irons, one desk lamp and two pump motors. Sales for the week totaled $2,476.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Steam Power Station at Comines.—J. Reyval.—On the River Lys, near the Belgian frontier, the second largest power station in France has just been finished, containing at present three steam turbo-generator units of 25,000 kw. each, two of which will stay in service, with the third unit as a reserve. It is expected to double this output in the near future, the necessary room being already provided. As the site is very sandy, it was necessary to erect the entire station upon piles, with their interstices filled in with cement. Very elaborate coal conveyors are installed, connecting the two approaches with the coal yard and the boiler house. There are at present ten B. & W. tubular boilers installed in two rows, each with a heating surface of 1,000 sq.m., producing from 30,000 kg. to 40,000 kg. of steam at 21 atmospheres pressure. Eight of these boilers are equipped with mechanical stokers while the other two burn pulverized coal. The feed and condensing water are supplied from the river with an electrically driven pumping station, which contains two 450-hp. centrifugal pumps. Three 25,000-kw. turbines, operating at 1,500 r.p.m. under 18 atmospheres steam pressure, drive 10,500-volt, 50-cycle, three-phase generators with a direct-connected 250-volt exciter. For the power supply of the large station itself a 10,500-volt, 3,500-kw., 3,000-r.p.m. steam turbo-generator set is provided. A triple set of busbars is provided, to which are connected for the present three 31,000-kva. transformer banks, each consisting of three single-phase units of 10,500 kva. with a ratio of 10,500 volts to 45,000 volts (delta-star). The entire high-voltage switchgear is housed in. The transmission lines are supported on three-petticoat 14-in. pin-type insulators, carried on steel towers set on an average 200 ft. apart. Near larger cities extensive use was made of 45,000-volt single-conductor, lead-sheathed cables, laid in concrete ducts 4 ft. under ground. Three main substations, two of 10,000 kva. and one of 20,000 kva. transformer capacity, are connected to the trunk lines. The article is twenty-seven pages long and is illustrated with thirty-two photographs and drawings.—*Revue Générale de l'Electricité*, July 15 and 22, 1922.

Control of Boiler Operation.—E. A. Uehling.—The author suggests a method that will bring about the intelligent control of boiler operation as far as combustion and absorption efficiency are concerned. Formulas are presented for calculating heat losses up the chimney and the combustion and absorption losses are analyzed. The application of the formulas to some scientifically conducted tests is shown.—*Mechanical Engineering*, July, 1922.

The Insulation of Furnace Walls.—H. T. Matthew.—The economics obtained in boiler settings, relative conductivity of refractories and methods of application are considered. — *Power*, Aug. 8, 1922.

Generation, Control and Switching

Developments in Power-Station Design.—Various types of protective gear designed for the protection of electrical machinery are described. The Merz-Price circulating-current system for the protection of generators and transformers is explained and this is followed by the balanced-voltage system for feeders. The principle upon which the former is based is that when an alternating-current generator is operating under ordinary conditions the current in one part of a phase is equal to that of any other part of the phase. As soon as a fault develops these conditions no longer prevail, and the unbalance between the entering and leaving currents is made to operate relays.—*Engineer*, July 30, 1922.

Considerations Relating to the Design of Oil Circuit Breakers.—D. R. Davies.—The repulsive effects produced by large currents in oil circuit breakers are considered in the last part of the series covering this subject, and a numerical example is given. In conclusion, the author summarizes the factors which limit the ultimate interrupting capacity.—*Electrician*, Aug. 4, 1922.

Transmission, Substations and Distribution

Zinc Coating of Transmission Towers.—A. Dagory.—Zinc coating, the author claims, affords a permanent protection against rusting. Galvanizing or sherardizing are out of the question on account of the large dimensions of towers. The Schoop metal-spray process, however, is excellently suited for this purpose. The coating may be done in field with an ambulatory equipment, consisting of an air compressor, a sand-blasting outfit and a Schoop pistol, or the towers may be coated in permanent coating shops of the power company. Both methods are being now used on a large scale in France, preference being given the latter method. The amount of zinc deposited with one pistol per hour is about 6 lb., which is sufficient to cover about 60 sq.ft., at a thickness of about 0.002 in. In one of the large coating stations two men can coat eight to ten towers 75 ft. long per day. To insure a perfect coating all towers are left outdoors for five days after their coating, within which time any uncoated spot will show up through local rusting. A very detailed description is given of two of these large coating stations, each equipped with a 200-hp. compressor and all such handling apparatus as is necessary for efficient and quick operation.—*Revue Générale de l'Electricité*, July 29, 1922.

Units, Measurements and Instruments

Efficiency of Steam-Pipe Coverings at High Temperatures.—The apparatus for determining the efficiency of steam-pipe covering which was designed by C. Jakeman of the National Physical Laboratory is described. It is an electrical test in which coverings are placed on a pipe heated by electric coils.—*Engineering*, Aug. 4, 1922.

A Precision High-Speed Oscillograph Camera.—E. A. Eckhardt.—The oscillographic study of closing or opening of circuits, circuit-breaker action, dielectric breakdown and relay and transformer action often requires a time scale for precision work, and the ordinary 60-cycle supply that is generally used on oscillographs is unsuited for this. The Bureau of Standards has developed a complete camera unit for high-speed work which may be used with almost any oscillograph. The drum of the camera is approximately 5 ft. in circumference and 4 in. wide. The film is stretched on the periphery of the drum, and by giving the drum an axial as well as a rotational motion the oscillograph record is traced on the film as a spiral band. A record 40 ft. long is obtained on a 5-ft. film by moving the drum axially ½ in. per revolution and exposing the film through a width-limiting aperture ½ in. wide.—*Journal of Franklin Institute*, July, 1922.

Mechanical Frequency Meter of Telephonic Range.—A. E. Kennelly and C. Manneback.—A frequency meter with a working range of about 250 cycles to 2,500 cycles per second and which is a development of the King sonometer is described. This instrument consists of a brass standard with a weighted steel wire attached to the top. Two movable brass beveled edges allow from 3 cm. to 60 cm. of wire to be used. Half way between these edges the magnets of a telephone receiver are placed. Then, knowing the weight of the mass attached to the wire and the distance between the two edges, the frquency of the voltage impressed upon the receiver can be determined.—*Publication No.* 29 *of the Massachusetts Institute of Technology.*

Illumination

Highway Lighting.—H. E. Butler.—The safety of travel on highways by night will never approach that by day until the character of the road illumination more closely resembles that of good street lighting. The methods of accomplishing this at an investment and maintenance cost sufficiently low to make highway lighting installations possible is described.—*General Electric Review*, August, 1922.

Motors and Control

Electricity in the Tanning Industry.—E. L. JUDKINS.—The article briefly traces the history of this industry and cites federal census figures to show that electric drive is rapidly supplanting steam drive in the modern tannery. In this industry, as in others, electrification possesses distinct advantages with respect to economy, flexibility and reliability of operation.—*General Electric Review*, July, 1922.

Transformers for Motor Starting.—J B. GIBBS.—Methods of supplying reduced voltage for starting alternating-current motors with several line diagrams are given. These include connecting power transformers in various ways and the use of auto-transformers. The starting of rotary converters is also treated.—*Power*, July 25, 1922.

Improved Short-Circuiting Devices for Induction Motors.—A description is given of some recent improvements in short-circuiting devices in so far as they concern the short-circuiting contacts and sleeve. Sketches and photographs are given illustrating some of these developments.—*Brown-Boveri Review*, July, 1922.

Heat Applications and Material Handling

Application of Electricity in the Manufacturing Industry.—A consideration of industrial ovens and furnaces which includes a discussion of the resistor material, heat-insulation materials, various commercial types of heating elements and types of control. The purposes to which the ovens and furnaces are put is also taken up.—*Electrical News*, Aug. 15, 1922.

Baking and Baking Furnaces in the Carbon Electrode Industry.—CHARLES L. MANTELL.—A critical study of the baking process as carried out in electric and gas-fired furnaces is made in this article, the fifth of a series. Other points taken up are a review of the principles underlying furnace construction and design, American operating practice and comparative advantages of different types of furnaces.—*Chemical and Metallurgical Engineering*, Aug. 16, 1922.

Electrophysics, Electrochemistry and Batteries

Adapting Electrical Cleaning to Blast-Furnace Gases.—N. H. GELLERT.—The difficulties encountered in the problem of cleaning blast-furnace gas are discussed, and the method of making the gas measurements necessary to determine the required capacity of the cleaning equipment is briefly explained. A description is given of the various features of an electrical precipitation plant for the cleaning of this combustible gas. In this method the gas is passed through a vertical pipe in the exact center of which is suspended an electrode chain or wire. This electrode is suspended from insulators and is charged with high-tension direct current. The pipe itself is grounded. The dirty gas in passing through becomes ionized, and the gas molecules carry the charge to the dust and fume particles, which are repelled by the negative chain electrode and are deposited on the sides of the pipe. At Sheridan, Pa., the precipitator based on this principle has been operating continuously and collecting approximately 5,000 barrels of dust per day.—*General Electric Review*, July, 1922.

Traction

Electric Locomotives.—V. L. RAVEN.—Avoiding detail points of mechanical and electrical design, the author deals with more general questions concerning (1) the requirements for which any locomotive must be designed, (2) the various designs which have been worked out to meet the requirements, and (3) the advantages and disadvantages of various designs which have been completed.—*Electrician*, July 14, 1922.

Swedish State Railways Extend Electrification.—The high cost of coal and the abundance of water power combine to make electric operation in this country an economic necessity. The electrification of the section between Kiruna and Riksgransen was completed in 1914. The first addition to this extended from Kiruna southward to Nattavara, a distance of about 90 miles, and was completed in October, 1921. Two months later this had been extended 74 miles to Boden, and the remaining distance to Lulea was placed in operation in July of this year. Hydro-electric power is generated at 4,000 volts, 15-cycle, single-phase, stepped up to 80,000 volts, and transmitted over steel towers to substations, where it is stepped down to 16,000 volts for the overhead contact wire.—*Railway Electrical Engineer*, August, 1922.

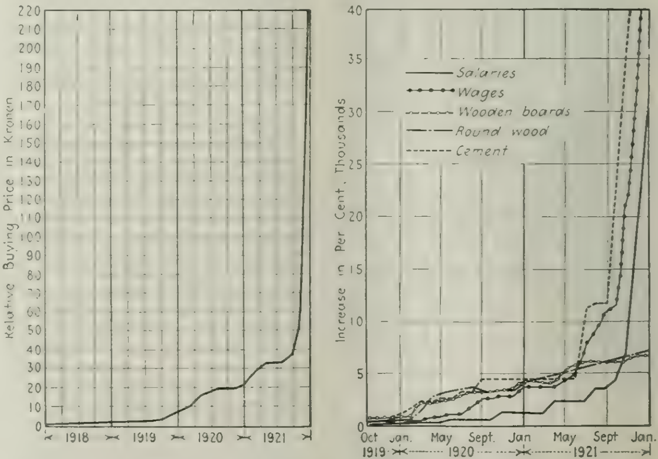
Telegraphy, Telephony, Radio and Signals

Sources of Elementary Radio Information.—Information concerning radio periodicals, government radio publications issued by various bureaus, radio books from numerous publishers, radio laws and regulations, call letters and safety precautions to be observed at radio stations are given in this circular. A few of the more elementary questions concerning radio communication are answered.—*Circular No. 122 of the Bureau of Standards.*

The Use of Telephones in Mines.—D. E. A. CHARLTON.—Safety regulations in several states provide for the compulsory installation of telephones in mines. Operating under severe conditions requires special construction of devices. Reliable transmission and signaling, prevention of burn-outs and safety to users are the essential requirements. Several typical installations are illustrated, and two diagrams showing the arrangement of telephone switches with wiring layout are also given.—*Engineering and Mining Journal-Press*, Aug. 26, 1922.

Miscellaneous

Money Inflation in Austria.—P. DITTES.—The financial difficulties which are being experienced in the erection of the great hydro-electric power plant at the Spullersee in Austria, with an initial output of 24,000 hp., can be realized from the two accompanying diagrams, giving the percentage of prices, wages and salaries since the beginning of the installation in 1919. Owing to the constantly increasing depreciation of currency the average cost of electrical machinery was at the beginning of 1922 more than 220 times that of 1917. Since then prices have climbed still higher.—*Elektrotechnik und Maschinenbau* (special issue), June, 1922.



EXCESSIVE INCREASE OF PRICES HAMPERS CONSTRUCTION WORK IN AUSTRIA

Left.—Increase of prices of electric machines. Right.—Excessive increase in cost of materials and wages since the beginning of erection in per cent of the prices of 1914.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Alternator, Short-Circuit Current in.

An attachment to the Tirrill regulator has been developed for considerably reducing the short-circuit current. As soon as a short circuit on the line occurs a special quick-acting current or voltage relay energizes a solenoid whose plunger mechanically modifies the position of the contacts of the Tirrill regulator. The new position of the contacts is such that the exciter voltage is reduced to about one-third of its no-load value. As soon as the short circuit has been cleared the regulator contacts automatically assume their normal position. —*M. Jackwirth, Berlin, Germany.*

Insulators, Heat

Investigations have been carried out on the heat-insulating properties of materials such as cork, slag, wool, charcoal, diatomaceous earth, wood, eucalyptus fiber, bitumen flooring composition, concrete blocks and a special material consisting of rubber expanded by gas into a highly cellular form. The material was heated electrically. The best insulator was found to be the cellular rubber, which had a conductivity of only 0.000085 C.G.S. units, that of still air being 0.00005.—*National Physical Laboratory, London, England.*

[The data obtained will be of value in the design of electric water heaters for domestic use and of large boilers for the storage of electrical energy in the form of heat. Copies of the report may be had from H. M. Stationery Office, at 3s. net.—EDITOR.]

Lamp, Tungsten, Color Temperature of

By using rotatory dispersion through nicol prisms data have been obtained upon the color temperature of the gas-filled tungsten lamp as a function of efficiency, up to nearly the melting point of tungsten. The filament failed at a temperature of about 3,644 deg. K., the efficiency being about 39 lumens per watt.—*Irwin G. Priest, Bureau of Standards, Washington, D. C.*

Oil, Transformer, Test of

Samples of oil under test were heated in copper vessels at 112 deg. C. for 300 hours in the presence of air, under conditions approaching as nearly as possible those in a transformer. Copper needles wound with cotton thread were inserted in the vessels, and samples were taken at regular intervals. The following factors were determined: Change in the color of oil, solid sediment, and the tensile strength of the cotton. It is believed that this method gives a much more thoroughgoing picture of the properties of an oil than other methods in use. For details see *Brown & Boveri Mitteilungen,* Vol. 9, page 164.—*H. Staeger, Baden, Switzerland.*

Plating of Copper Map Plates.

The old method of correcting copper map plates was quite expensive. The new process consists in directing a stream of copper-oxide solution against the metal surface in such a way that a current passes from the anode contained in the projecting apparatus to the metal plate which forms the cathode. The metal then deposits only upon those points at which the stream of liquid is directed and not over the rest of the plate, even though the solution may subsequently flow over it. The copper is deposited in a dense adherent form and can be readily polished and engraved.—*Bureau of Standards, Washington, D. C.*

Relays for Indicating a Grounded Conductor.

This relay is built on the wattmeter principle. Its series coil carries the unbalanced current of the three power-line conductors (three-phase system), and its potential circuit is excited from a Peterson coil between the neutral and the ground. Should a ground occur on the line the relay is actuated by the energy component of the earth current and can be made to operate a switch or to close a signal circuit. The arrangement is quite sensitive.—*K. M. Zukermann, Berlin, Germany.*

Rubber, Accelerated Aging Tests on.

Fresh air heated to 71 deg. C. was continuously circulated around the rubber pieces which were tested over a period of fourteen days. The results of several thousands of such tests show that this is a valuable procedure for predicting the relative rate of deterioration of various rubber compounds. After four days in the oven, an approximate correspondence between accelerated life and natural life seems to be one day for every six months. — *W. W. Evans, B. F. Goodrich Company, Akron, Ohio.*

Transformers, Temperature Indicator for.

A semaphore has been developed which shows directly by the three positions of a shutter when the oil temperature is below 80 deg. C., when it is between 80 deg. C. and 89 deg. C. and when it is above the latter limit. Immersed in the oil is an actuating element which changes its form with the temperature and revolves a rod carrying a cam which controls the shutter. The shutter can be easily reset from outside.—*Condit Electric Manufacturing Company, Bonston, Mass.*

Turbines, Steam, Vibration Test, Stationary.

A system of tests has been developed by which turbine wheels, while stationary, are vibrated by means of a solenoid or some other external force until the wheel disk starts a series of vibrations, persisting so long as the force is applied. This vibration may be of any number of nodes, the waves traveling circumferentially around the wheel.—*General Electric Company, Schenectady, N. Y.*

Research in Progress

Furnace, Arc, Wave-Form of Current in.

Experiments are being made on a 6-ton, three-phase Héroult steel furnace to determine the wave-form of the primary and secondary currents and voltages during the melting and refining processes. A three-element oscillograph is used, which may be connected at will into either circuit through suitable instrument transformers. It is also proposed to take photographs of the arc itself by means of a rapid multiple-image camera.—*E. T. Moore, Halcomb Steel Company, Syracuse, N. Y.*

Manganese in Magnetic Steel.

Manganese has an effect on the magnetic properties of steel somewhat similar to that of carbon. A series of iron-carbon-manganese alloys of exceptional purity have become available for a study. They will be subjected to a standard heat treatment and their magnetic properties determined. New apparatus recently developed at the bureau for the testing of small specimens is being used in this investigation.—*Bureau of Standards, Washington, D. C.*

Radio Telephone, Range of.

Comprehensive tests are planned to determine the effective working ranges of radiotelephone communication when using various kinds of transmitting and receiving sets. Preliminary plans have been outlined and some correspondence conducted.—*Bureau of Standards, Washington, D. C.*

Resistance Material, Invar.

Invar wire 0.001 in. in diameter was obtained and finer wire could have been drawn had dies been available. Invar tape was made by first drawing the metal into wire a little less than 0.25 in. in diameter and then rolling the wire flat in a hand mill. Tape 0.015 in. thick and 0.26 in. in width was obtained. It is very difficult, as was anticipated, to get the tape in straight lengths.—*Bureau of Standards, Washington, D. C.*

Welded Tanks

Each co-operating manufacturer will weld three tanks according to his standard practice, of a size that will be determined by an appropriate committee. These tanks will be shipped to some central testing laboratory and tested to destruction, to determine the best method of welding. — *C. A. Adams Harvard University, Cambridge, Mass.*

Welding Wire, Tests on

The following tests are under consideration to determine the qualities of good welding wire other than chemical composition: (a) Melting by the oxy-acetylene flame to determine flowing qualities and condition of the metal; (b) melting by electric current; (c) baking on a vitreous enamel by heating electrically; (d) testing welds produced by extremely good, intermediate, and poor wires.—*American Welding Society, 33 West Thirty-ninth Street, New York City.*

Suggestions for Research

Conduit Lines, Temperature Rise in.

Some scheme of testing should be devised so that by means of some simple measurements it may be possible to determine the radiation constants of different portions of conduit lines in service and establish current ratings of transmission cables so as to eliminate the burn-outs due to overloads.—*D. W. Roper, in A. I. E. E. Journal, June, 1922.*

Heating, Electric, of Water for Residences.

With the present tanks insulated with hairfelt, it seems that the losses cannot be reduced below 300 watts, which represents a considerable amount compared with the useful power. Either a better heat insulation must be found or some radical method of arresting this loss must be devised. Perhaps a tank constructed on the thermos bottle principle, or at least one provided with dead-air spaces might be a success.—*Hydro-Electric Power Commission, Toronto, Ontario*

Insulating Materials, Fibrous, Micro-Study of.

With a more detailed study of paper and cambric used in high-tension coils and machinery, it becomes desirable to photograph individual fibers under the microscope. The necessary technique and instructions will be found in *Technological Paper No. 217* of the Bureau of Standards by R. E. Lofton.

Transformers, Water Indicators for.

The attention of manufacturers is directed to the desirability of developing two types of indicators for water-cooled transformers, first, an adequate type of sight-flow indicator for open systems and, second, an indicator for closed systems which will indicate or sound an alarm either on failure of water or on increase of pressure due to clogging coils.—*Electrical Apparatus Committee of the N. E. L. A.*

Apparatus Available

Magnetic Testing, Effect of Temperature.

At a certain temperature ferromagnetic materials lose their ferromagnetic properties and become very feebly magnetic. It is not so well known, however, that more or less abrupt changes in magnetic properties take place at lower temperatures during heating and cooling, and that these changes are often indicative of structural transformations in the material. An apparatus has been designed for a study of such magnetic transformations.—*Bureau of Standards, Washington, D. C.*

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

Low Duty on Bulbs Voted

Conference Committee Sustains the Senate Tax of 20 per Cent—Rates on Other Electrical Materials

THE conference report on the new tariff bill, which was submitted to the House on Tuesday last, carries the Senate rate of 20 per cent ad valorem on incandescent light bulbs.

This rate caused one of the liveliest controversies over the bill while it was pending in the Senate, the finance committee having proposed a rate of 70 per cent, subsequently receding to the House figure of 35 per cent, and the Senate voting a reduction under this. It had been considered probable that the conferees would restore the House rate.

Mica bears a rate of 4 cents per pound if valued at less than 15 cents per pound and 25 cents above that value, while trimmed mica has a duty of 30 per cent and manufactures of mica a duty of 40 per cent. The existing law provides the same rates for unmanufactured mica, with 30 per cent on trimmed and 30 per cent on manufactures.

OTHER PROVISIONS OF THE MEASURE

The new bill provides a duty of 60 per cent on plain white porcelain.

Amorphous graphite bears a duty of 10 per cent and crystalline lump, chip or dust graphite has a rate of 1½ cents per pound. Graphite is free under existing law.

Under the new law carbons and electrodes and brushes and parts of brushes for motors and generators will bear 45 per cent duty. This represents an increase of from 50 to 200 per cent over the existing rates.

Electric storage batteries bear a duty of 40 per cent in the new bill.

An additional duty of 10 per cent is imposed upon any utensil having an electric heating element.

Asbestos paper will bear a duty of 25 per cent in the new law. The present duty is 10 per cent.

Electrical measuring instruments will be charged 45 per cent duty.

Copper wire will bear a duty of 25 per cent. Copper in rolls or sheets has a duty of 2½ cents per pound.

Zinc in pigs will be charged 1¾ cents per pound import duty, zinc in sheets 2 cents per pound, and in sheets covered with nickel 2¼ cents per pound.

Aluminum in crude form bears a rate of 5 cents per pound and in plates, sheets or bars 9 cents per pound. The rates in the Underwood bill were 2 cents and 3½ cents per pound.

When the conference bill was submitted to the House it was thought that it would quickly pass both chambers and become a law within ten days, but the unexpected action of the Representatives in recommitting it with instructions that the dye embargo be abandoned and that fertilizer potash be put on the free list has upset all calculations and it is even predicted by some that the bill cannot be passed before the November elections.

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Coal Bills Soon to Reach the President

The United States Senate has passed the administration coal bills, and the indications are that the House and Senate conferees will not have great difficulty in adjusting their differences, as there are no essential points at issue, and that the perfected measures will be sent to President Harding before Sept. 20.

Varying dates for the expiration of the measure form the greatest difference between the House and Senate bills to control the distribution and the price of coal, the House bill providing a life until Jan. 1, 1924, and the Senate bill providing that it shall expire six months after enactment.

The Senate bill to create a fact-finding commission provides for a commission of five members and includes instructions to report recommendations on the standardization of mines on the basis of production and efficiency, standardization of wages and working conditions and the advisability and wisdom of nationalization of mines and of government control of the industry, while the House bill lacks the latter features and provides for a commission not to exceed nine members. The standardization and nationalization features of the Senate bill are expected to cause the greatest difficulty in conference.

The arrangement arrived at on Wednesday by the shop crafts unions by which strikers have been authorized to negotiate agreements with individual railroads on terms likely to be accepted by many of the carriers will, it is thought, gradually bring the rail strike to an end and thus greatly accelerate the movement of coal.

The attention of the President and of his advisers is being called to the advisability of naming as a member of the fact-finding commission some one thoroughly familiar with the peculiar coal problems of the public utilities. Steps also are being taken looking to the appointment of a public utilities man on the staff of the Fuel Distributor.

Public Relations Gratify

New England Men Discuss Also Conservation, Automatic Substations and Other Topics

GRATIFYING evidence of improving public relations and of the increasing efficiency of utility operation was reflected in the fourteenth annual convention of the New England Geographic Division of the National Electric Light Association, held at the Hotel Griswold, New London, Conn., Sept. 6-8. Four hundred members and guests attended, and addresses by President Frank W. Smith of the national organization, William C. Bliss, chairman Rhode Island Public Utilities Commission, and H. T. Sands, chairman of the Public Relations National Section, N.E.L.A., were features of the public relations session, at which Edwin A. Barrows, president Narragansett Electric Lighting Company, Providence, R. I., was inducted into office as president of the New England Division for the coming year.

In opening the convention President C. L. Edgar voiced the desirability of minimizing the lost motion in committee work resulting from the overlap between the association and divisional working years and gave an interesting résumé of the growth of the division.

WORK OF PUBLIC SERVICE BUREAU

J. B. Groce, director New England Bureau of Public Service Information, Boston, reported that the first year's work of the bureau will have yielded about 660 solid columns of material clipped from newspapers copying from the *Bulletin* of the bureau. None of this material has been direct propaganda, all of it has been educational, and every line has been published voluntarily by the editors. Gradually the public is coming to know more about its utilities and, to quote the speaker: "The destructive force of silence is no longer at work in the public utility industry." Mr. Groce urged that every well-managed public utility appoint one official, preferably a higher executive, to maintain contact with press representatives. Courtesy on the part of officials and employees, the speaker said, is of supreme importance.

An exhaustive report on accident prevention and its benefits was presented at this session by H. W. Moses, committee chairman, Boston; William Gould, Massachusetts Lighting Companies, Boston, discussed the nation-wide growth of customer ownership; H. L. Ogden, Boston, discussed the savings attained through centralized purchasing information, and an extended report was presented by the committee on taxation, Bowen Tufts chairman, calling attention to the magnitude of governmental expenses at present and their threatening effect on utilities.

Closer co-operation between the accounting and the construction departments was the keynote of the accounting session, of which F. J. Stanwood, Boston, was chairman.

Progress in convincing rural-line customers of the equity of their bearing a proper share of line-extension costs and charges was testified to by a number of speakers in the technical session, under Chairman R. F. Whitney, Fall River, Mass. H. M. Parsons, Palmer, Mass., presented a comprehensive résumé of the rural-lines problem and its status, including an outline form for analytical studies of line extension economics. It was urged that at least 33⅓ per cent of a line-extension cost be guaranteed annually by prospective customers, and the danger of low guarantee percentages, as ordered in some cases by commissions, was touched upon.

R. S. Hale, chairman wiring committee, presented a report urging the elimination of the so-called "danger fuse" on the grounded wire of two-wire branches. L. L. Elden, Boston, urged the installing of wiring systems on the basis of actual rather than connected loads in buildings as a means of securing large economies in investment.

Automatic stations were informally discussed in the technical sessions and the point was made that whereas a 10,000-kw. plant may cost $30 per kilowatt for either automatic or manual operation, the running costs may be ten times as high in the latter case. Maintenance costs and continuous-performance data are yet too scarce to justify final conclusions as to the field of automatic installations. Improvements in power-factor measurement and the importance of loading generators more heavily in many industrial installations interconnected with utility lines were also considered. During these sessions addresses were given by T. Johnson, Jr., General Electric Company, on "Radio and the Central Station"; by R. F. Cavanaugh, Employers' Liability Assurance Corporation, Ltd., Boston, on "Co-operation Between Insurance Companies and Power Sales Organizations," and by E. L. Clark, Minneapolis, on "Red-Cedar Poles and Their Treatment."

In sessions of the Commercial Section there were animated discussions on the importance of higher intensities of illumination in micrometer work, the need of intensive effort by central-station companies in establishing and maintaining lighting specialist service, personal selling by employees of all ranks, the national billboard campaign advertising the movement to electrify, and merchandising problems. P. L. Miles, Edison Electric Appliance Company, Chicago, addressed the convention on "How to Merchandise Electric Ranges" at the closing session. In later issues abstracts and summaries of some of the topical reports and discussions will be presented.

These officers for 1922-3, in addition to President Barrows, were elected: Vice-President, Samuel Ferguson, Hartford, Conn.; treasurer, G. M. Guilford, Boston; secretary, Miss O. A. Bursiel, Boston. The executive committee will comprise E. M. Graham, Bangor, Me.; F. A. Belden, Portsmouth, N. H.; W. H. Richardson, Brattleboro, Vt.; T. C. Fales, Boston; W. P. Schwabe, Thompsonville, Conn.; E. L. Milliken, Woonsocket, R. I.; F. S. Price, C. B. Burleigh and A. J. Hixon, Boston, and A. B. Reynders, Springfield, Mass.

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New Officers of Pennsylvania Electric Association

At the concluding session of the Pennsylvania Electric Association held last Saturday at Bedford Springs, Pa., the following officers were nominated and elected: President, H. H. Ganser, manager Counties Gas & Electric Company, Norristown; first vice-president, J. H. Shearer, general superintendent Penn Central Light & Power Company, Altoona; second vice-president, E. H. Davis, president and general manager Lycoming Edison Company, Williamsport; treasurer, G. M. Gadsby, vice-president West Penn Power Company, Pittsburgh.

Iron and Steel Men Meet

Cleveland Convention Proves Most Successful Yet Held—R. B. Gerhardt Made President

WITH a registration of more than 850 and over ninety booth exhibits, the Association of Iron and Steel Electrical Engineers held its most successful convention in Cleveland on Monday to Friday of this week, Sept. 11-15. The large Cleveland Public Hall was used for technical sessions, exhibits, entertainments and refreshments, and this resulted in a compact and well-attended gathering.

On Monday morning at the business sessions the officers were elected for the ensuing year as follows: President, R. B. Gerhardt, electrical engineer with the Bethlehem Steel Company at Sparrows Point, Md.; first vice-president, L. F. Galbraith, electrical engineer with the West Penn Steel Company at Brackenridge, Pa.; second vice-president, R. S. Shoemaker, superintendent of maintenance American Rolling Mill Company, Middletown, Ohio; treasurer, James Farrington, electrical superintendent La Belle Iron Works, Steubenville, Ohio; secretary, John F. Kelly, Pittsburgh, Pa. The directors elected were George Schaeffer of Reading, Pa.; A. L. Feret of Birmingham, Ala.; B. G. Beck of Gary, Ind., and E. H. Wentz of Lorain, Ohio.

On Monday afternoon the committee reports were presented and caused much discussion. Abstracts of reports and papers and of the discussions on them will be printed in the next issue of the *Electrical World.*

TITLES OF THE PAPERS

The paper on "Generating-Station Development," by D. B. Rushmore and E. Pragst, presented on Tuesday morning was very favorably received and elicited comments of value. In the afternoon another good paper, by F. C. Watson, on the electrification of a monel-metal plant, was given. The papers scheduled for the remaining days of the convention included "A Review of Steel-Mill Electrification," by B. G. Lamme and W. Sykes; "Improvement in Efficiency of Electric Power Supply," by Dr. C. P. Steinmetz; "Steam-Turbine

Photograph by Gables' Studio, Altoona, Pa.

DELEGATES AND GUESTS AT CONVENTION OF PENNSYLVANIA ELECTRIC ASSOCIATION

Operation," by L. W. Heller; "Internal-Combustion Engines for Power Generation in Steel Mills," by D. M. Petty; "Judging the Combustion of Gaseous Fuels from Gas Analysis," by A. G. Witting, and "Some Considerations in the Electrification of the Steel-Plant Railroad Yard," by R. B. Gerhardt. There was also a topical discussion on the boiler practices of 1922 participated in by J. B. Crane, E. R. Fish, Alfred Cotton, R. E. Butler, R. M. Rush and P. H. Falter.

On Tuesday evening the delegates and their friends were entertained in the large auditorium by an organ recital and a lecture on the "Science of Numbers" by E. Kieft.

The convention arrangements were splendidly handled by John F. Kelly, the secretary, and a pleasing feature was the dismissal of the sessions in plenty of time for the members to see the exhibits. Commendatory remarks were heard on every side concerning the exhibits made by the manufacturers interested in the steel industry. Large and small electrical concerns had their latest equipment displayed in such a way as to demonstrate actual operations.

On Thursday the annual banquet was held at the Hotel Statler, with prominent speakers. On Friday inspection trips were made to Cleveland industrial plants.

The association is growing rapidly and the Cleveland convention marks a distinct step forward in its activities. It is probable that Buffalo will be the scene of the next convention because of the invitation received from the Chamber of Commerce and the Lackawanna Steel Company.

League Activity Defined at Association Island

In the final session of the conference of local electrical leagues held last week at Association Island, Henderson Harbor, N. Y., at the invitation of the Society for Electrical Development, definite steps were taken toward laying down a practical program for league activities and establishing national co-ordination. The last day's meeting was designated as the "press session" and presided over by F. M. Feiker.

As a result of a rapid canvass of the delegates from the thirty-five cities represented, the following purposes were designated as the fundamental elements in local co-operative work—social activities, such as luncheons and addresses, co-ordinated publicity, electric homes and electric shows, advisory service for wiring plans, residence, commercial and industrial lighting.

Representatives of leagues were urged to study and report the best methods and experience in organizing local leagues, financing league activities and developing co-operative organization for groups of communities too small to support independent leagues of their own. Consideration was also given to various perplexing problems of league work which should be expected and provided for in advance where possible, among them being the question of permanent headquarters, a paid secretary, non-electric store competition, central-station commercial policy, and the paralyzing effect of having two antagonistic factions, a situation reported from several of the larger cities.

A resolution was offered by W. E. Robertson, Buffalo, and unanimously adopted congratulating the Society for Electrical Development on initiating this first organized contact between local leagues and recommending that the society direct its effort energetically to the establishment of electrical co-operative organizations in other cities as the essential agency for applying and extending the national movement for business development now being directed by the joint committee of the industry, and that the society be recognized as the headquarters of league activity and function as the clearing house for league co-operation.

Rocky Mountain Men Meet

Members of the Rocky Mountain Geographic Division of the National Electric Light Association and of the Colorado Electric Light, Power and Railway Association met in joint convention at Glenwood Springs, Col., on Monday, Tuesday and Wednesday of this week. A report of the sessions will be given in next week's *Electrical World.*

New Departure in Impulse Wheel Design

Experiments made recently at the Philadelphia plant of the William Cramp & Sons Ship & Engine Building Company by the I. P. Morris department and its associate, the Pelton Water Wheel Company, are said to have demonstrated the success of waterwheels built according to a design radically different from anything heretofore on the market. Small wheels of the new type built for test purposes have shown higher efficiencies than can be expected from impulse wheels of ordinary design and are said to be efficient over a wide range of heads, including those in the neighborhood of 800 ft. to 1,000 ft., where the relative merits of reaction and impulse types are frequently in dispute.

The new design follows the principle of the impulse wheel, but instead of a jet or jets tangentially disposed to the periphery of the runner, the flow in the new design is normal to the runner plane. Further, instead of one or more separate jets to which the buckets are subjected during only part of a revolution, the new design applies the spouting water to all the buckets simultaneously and continuously around the entire periphery of the wheel; that is, the water reaches the runner in the form of an annular ring whose diameter is equal to the diameter of the runner. The flow in this ring contains both tangential and axial components.

Regulation is effected by an annular plunger moving axially to close the orifice of the nozzle. A section through the annular nozzle as taken in a plane containing the turbine axis shows a contracting water passage somewhat similar in form to a section through the ordinary needle nozzle.

Runners for wheels of this design can be built of extremely small diameters, it is claimed, as compared with impulse wheels of ordinary design, and units of this type are to be put on the market in commercial sizes as soon as the present experiments are completed and details of construction in larger sizes have been worked out. Two types of the new design are being studied. One of these was developed by H. Birchard Taylor and the other by Lewis F. Moody.

Applications Before Federal Power Commission

W. H. Samson of Corning, Cal., has amended his previous application to the Federal Power Commission for a preliminary permit covering the power project on Trinity River and on Clear Creek, a tributary of the Sacramento River. The primary power to be made available is estimated at 40,000 hp.

The Snow Mountain Water & Power Company of San Francisco has applied for a preliminary permit to cover the construction of a reservoir on the middle fork of Eel River, with a tunnel and conduit to a reservoir on Elk Creek. This is in addition to a tunnel and conduit to the applicant's existing Van Arsdale dam. About 7,500 hp. of primary power is involved.

A widely known firm of consulting engineers having reported favorably on the Ouachita River project of the Caddo River & Irrigation Company, that company has submitted plans for a license. The power will be used at the bauxite mines in southern Arkansas and will be fed into the interconnected system of the Little Rock Power & Light Company. The project involves the ultimate expenditure of $8,000,000.

At least 10 per cent of the applications before the commission are affected by the new policy of that body not to accept a second application from individuals or corporations that did not show financial ability to carry out the project on the previous application, unless an added showing as to financial backing can be made.

Southern Power Company in Straits for Fuel

Word comes from Charlotte, N. C., that the Southern Power Company, furnishing 300,000 hp. of electrical energy every day to industries in the two Carolinas, among them 300 textile mills, will be forced to suspend operations for one day each week unless it receives more coal. Five million cotton spindles are included in the mills served by the company.

Officials of the company said that they regarded the outlook for coal supplies during the next few weeks as exceedingly unfavorable so long as the rail strike continued to hamper the movement of trains.

Brilliant Gathering Honors Edison

The Foundation of Electric Central-Station Service Fittingly Celebrated in New York by Edison Pioneers and Others—Condition of the Art Forty Years Ago and Early Struggles to Establish Edison Systems Vividly Recalled

THE starting of electric central-station service in New York City forty years ago was celebrated at a banquet in the Hotel Commodore, New York, on Monday evening last, Sept. 11. Included among the guests of the New York Edison Company on that occasion were the largest array of Edison pioneers ever assembled and many captains of industry. The early days of the art were recalled by several of the speakers and the debt which humanity owes to Edison was repeatedly accentuated.

At the speakers' table were such men as James A. Farrell, Charles M. Schwab, Clarence H. Mackay, Otto Kahn, Samuel M. Vauclain, Melville E. Stone, Gerard Swope, Guy E. Tripp, A. W. Burchard, H. H. Westinghouse, Schuyler S. Wheeler, C. O. Mailloux, Frank B. Jewett, Henry L. Doherty, Frank W. Smith, S. Z. Mitchell, J. J. Carty, Charles L. Edgar, W. W. Freeman, Alex Dow and others. Nicholas F. Brady, president of the New York Edison Company, acted as toastmaster, and the speakers were Murray Hulbert, Acting Mayor, who presented Mr. Edison with a casket containing a key symbolizing the freedom of the city; Charles Edison, son of the noted inventor; Samuel Insull, Frederick P. Fish, noted patent attorney, and John W. Lieb.

During the evening the original chandeliers wired by Edison were lighted and contrast was made between the illumination of one of the original incandescent lamps and the latest and largest incandescent lamp yielding 100,000 cp. The last-mentioned lamp is intended for motion-picture studio work, but is not yet commercially available. Souvenirs commemorative of the occasion were distributed by the host, the New York Edison Company.

The toastmaster first called upon acting Mayor Hulbert, who spoke for New York City.

MR. HULBERT TELLS WHAT EDISON DID FOR NEW YORK

Mr. Hulbert said that in contemplating the record of their guest there was borne in upon him the truth that every man of history who has contributed anything to the march of progress and civilization in the way of discovery or invention had been compelled to force his work upon a protesting humanity. The speaker told of the trials of many famous pioneers along these lines. Of Edison he said:

"Born in circumstances as humble as any of the great inventors who preceded him, his youth as beset with trials and obstacles, and his early manhood as strenuous in effort and enterprise, he yet succeeded in surmounting his difficulties and rising to the pinnacle in his chosen field of endeavor.

"The electric light and the electric train made New York's subway possible. The discovery of the electric dynamo made possible those huge office buildings of which New York is so proud, for without the electric elevator none of these structures could have risen. Can any one picture a Coney Island Mardi Gras by gaslight? And what would Broadway be without its white light district?

"So the people of New York, both in their hours of work and in their hours of play, realize that Mr. Edison has in very truth made easier and more agreeable their path of life. And therefore, as Acting Mayor of this great municipality, I know that in extending congratulations to Mr. Edison I am giving voice to the sentiments of our six millions of people, and their feelings of appreciation and gratitude for his great work for the humanity of which they are a part take the material form of this key, which carries with it the freedom of the greatest city on earth."

MR. EDISON'S RESPONSE

After the presentation to Mr. Edison by acting Mayor Hulbert of the key, Charles Edison was called upon and responded for his father as follows:

"Mr. President Hulbert, I thank you sincerely for your courteous presentation of the freedom of the city, and will you kindly convey to His Honor Mayor Hylan and to the honorable Board of Aldermen of the City of New York my deep-felt appreciation of the distinguished honor conferred on me, and of which I am very proud?

"This commemorative celebration has a deep personal significance to us, for the Pearl Street station was the greatest adventure of my life. It was akin to venturing on an uncharted sea. No precedents were available. I felt the sense of a great responsibility, for unknown things might happen on turning a mighty power loose under the streets and in the buildings of lower New York. However, I kept my own counsel. Thanks to the faithful co-operation of my unfailing companions, the Pearl Street station was carried promptly to the point of successful operation. The later development of the industry is a matter of history.

"As I look around this assemblage my thoughts run backward to those days. Although Father Time has laid his silvery fingers upon us, the memory of our early struggles at Pearl Street affords a pleasant retrospect. It is natural as I sit here tonight, surrounded by so many of my old friends and fellow-workers, that there should be mingled with my joy something of sadness as I think of the men whose companionship we can no longer share. If there be some addition through my work to the resources of human welfare, that benefit has accrued largely through my good fortune in being favored with the devotion of my associates, willing to throw their all into my melting pot. I have never ceased being grateful to the Edison men whose friendship I have enjoyed ever since the morning fifty-three years ago when I landed here from the Boston boat.

"To the wider circle of friends I must express the fullest appreciation of the encouragement that has enabled me to perfect various inventions. It is notably embodied in the splendid public utilities bearing my name, of which the New York Edison Company is typical. I would think more highly, perhaps, of the little I have done if I did not feel it to be only a promise of what lies before. There is still much to be done in the promotion of human happiness and comfort."

SAMUEL INSULL RECALLS OLD DAYS

Samuel Insull, president of the Commonwealth Edison Company of Chicago, was then called upon. After telling in reminiscent vein of how, as a "raw English boy," he came to be associated with Edison and of some of the early financial struggles of the first Edison lighting company, Mr. Insull said:

"It is not my purpose this evening to go into the scientific and technical details of the brilliant accomplishments of the distinguished inventor. Controversies as to the value of his achievements have long ceased. The basic, fundamental work accomplished by him in inventing a system for the generation and distribution of electrical energy which has never been supplanted, but has been supplemented by other systems of production and transmission, is so universally acknowledged that it would not seem fitting on an occasion of this kind to occupy your time with detailed technical explanations.

"It must be remembered, however, that Mr. Edison's work in connection with the establishment of his electric light and power system was not limited alone to his accomplishments as an inventor. Besides the experimental work of the laboratory, this great inventor was the controlling and engineering mind that carried out the designing, installation and first operation of his central-station electric lighting system.

"In 1881 plans for the central station were completed and the details of construction of the conductors in the street were all on paper. But the dynamos and electrical instruments had no existence except on the drafting board; practically nothing was known of modern methods of insulation or of house wiring; the socket and switch in use today had not been thought of; the miscellaneous devices now considered necessary in connection with house wiring had not been considered. In addition to the development of the system and its installation, manufacturing establishments had to be created in which to manufacture the first material needed. Mr. Edison and his corps of assistants had to abandon the experiments of the laboratory and the designing of the drafting room to equip and manage shops in which to manufacture the apparatus necessary, from the generator to the lamp. The conception of the system, the perfecting of the original apparatus, its manufacture, its installation and its early operation were all borne by this man whom we honor tonight, assisted by an enthusiastic but small band of workers having an almost idolatrous belief in their chief as the pioneer of this great industry."

WHERE EDISON'S GREATNESS LIES

Mr. Insull then recited some further particulars of the original central-station company in New York and drew a contrast between it and the vast metropolitan system of today. He continued:

"I would be violating my personal feelings and be neglectful of my duty if I did not say something of the influence of this one man upon this great industry. Mr. Edison's work on telegraphic and telephonic apparatus and his discovery of the means of recording and reproducing the human voice firmly established him as a great inventor. He was by no means the first experimenter or the first person to endeavor to adapt electricity to the use of man as an illuminant or for power purposes. While the Patent Office records of this and other countries bear tribute to his contribution to the development of the art, we have to go a little deeper to discover the paramount influence of his mind in connection with the development of this industry. If you will study the technical literature of the period contemporaneous with his early electric light experiments, you will find how little the writers of that period understood the theory of the production and distribution of electrical energy, not alone as the technical man understands it, but as the ordinary layman, the man in the street, understands it today. Few writers for the technical press of that time had any conception of what Mr. Edison was trying to produce.

"It was understood in the popular mind that he was endeavoring to subdivide the electric current for ordinary everyday use, but the principles underlying this popular conception were little understood either by the technician or the layman. It was Mr. Edison's conception that what was needed was a translating device—that is, an electric lamp of high resistance taking a small quantity of current of relatively high pressure.

"That was the first stepping stone to success. You can call this, if you like, discovery; you can call it the intuition of a natural mathematician; you can call it the establishment of an engineering principle, but, the translating device once settled on as the cardinal principle, the production of the device itself, the working out of the details of the apparatus, the generation of the energy, the conducting (or transmission) of it, the measuring of it and the controlling of it were all matters of invention or engineering detail. Each one was a step by itself, demanding foresight, vision, brilliant conception of methods to be used and indomitable pluck and perseverance in working them out; but yet, as compared with the original conception, all were matters of detail.

"It took the transcendent genius of an Edison to discover that a high-resistance translating device or its equivalent was the first essential to success, and that discovery was the primary step toward placing him on a level with the few whom the people of all time will put in the first rank of the world's inventors."

Frederick B. Fish, patent attorney for the General Electric Company and president of the National Industrial Conference Board, was introduced and said among other things:

EDISON GREAT IN MANY WAYS

"It is a rash thing ever to say that one man is the greatest, that the world has no one in the line of work to which he has devoted himself who is greater; it is futile and absurd to ask who was the greatest poet or the greatest soldier or the greatest statesman, but I believe that if we approach the matter coolly and sanely, we shall all be obliged to admit and to assert that Mr. Edison is the greatest of all the inventors that history has recorded.

"There are many forms of inventions and many types of inventors. Some inventions are an accident. Sometimes an invention comes as an inspiration. And Mr. Edison, I think, has said that genius is not inspiration but perspiration. That is only partly true, for sometimes it is inspiration. For instance, I personally am unable to conceive how he ever gave birth to the simple thought of the carbon filament —so insignificantly small and of such a material that if touched with a match it would go to pieces at once—as a filament for an incandescent lamp. I believe that that was an inspiration.

"Another form of invention is appreciating a problem and working with full knowledge, by logical processes, until that problem is solved. Another is research, going almost blindly into the materials and the forces of nature and trying one form after another until you finally come to something that is useful. Though some inventors are great in one direction and some in others, Mr. Edison has been great in every form.

"When this incandescent lamp was invented it introduced into the world the foundation for the greatest industrial development that the world has ever seen. Even the introduction of steam, which was a comparatively slow process, did no more and that slowly. It took a hundred years before steam had found its own. The lamp has only been in existence forty years and has attained its present distribution."

After alluding to other electrical developments which, he said, sprang from the perfection of the incandescent lamp, Mr. Fish concluded:

"And so it goes in every direction. We cannot conceive what our situation would be if the incandescent lamp had not been invented. I can see that the invention of the incandescent lamp and its development directly into extensive light and power systems, through Mr. Edison largely—at any rate he was at the foundation of it—led to the employment of millions of people and to production and to comfort and happiness for the whole human race. I feel that there has never been anything more fruitful or productive, and out of which so much else has grown, as that wonderful invention made in the year 1878. Consequently, as we have the eagle for the insignia of our country and England has the lion, I think myself there would not be any better insignia for industry as a whole than the incandescent lamp, which typifies one of the greatest things ever done for industry in and of itself by the greatest inventor that ever lived, and typifies also the way in which industries can be developed from a small foundation. If that small foundation is of an essential character, it can lead to logical, tremendous and far-spread development in the interest of the human race."

Mr. Lieb's Tribute

The last speaker was John W. Lieb, vice-president of the New York Edison Company. Mr. Lieb spoke, in part, as follows:

"Many of the old friends and early associates of Mr. Edison, who are honoring us with their presence here this evening in celebration of this notable event, and some of whom were on the spot forty years ago when the service of the old Pearl Street central station was inaugurated, could not in their wildest dreams have imagined the epoch-making importance to the world of the great demonstration in which they were then taking part.

"After years of patient, untiring, persistent effort, under the inspiration and direction of the great master mind and sustained by his buoyant faith, the day had come when the supreme test was to be made of a stupendous idea, the working out in practice of a bold conception, the launching of a great new enterprise—the generation of electric current on a commercial scale in a central station, and its distribution through an extensive system of underground conductors to furnish a house-to-house supply of light and power over a considerable area of a great city.

"It is not the mere dream of an optimistic inventor that we are considering, involving the practical application of a new device, apparatus or piece of machinery, or the exploitation of a newly patented process or method of manufacture. It was to be from its very inception a complex aggregation of many parts, before any one single element of the many that were necessary to solve the problem had been perfected—many perhaps not even conceived. It was a broad and comprehensive conception or plan requiring the intimate correlation and co-operation of many units, some mechanical, some electrical, some chemical—all to be joined in a hitherto unknown and untried operating relation to produce a result not clearly defined except as it involved the rendering of a substitute or alternative service for one that was already being supplied to the public.

"The bold concept of Edison was no less an idea than to parallel or duplicate along entirely novel lines a flourishing and fully developed industry—the gas industry—that had been in existence as a successful and lucrative business for fully seventy years."

Service to the Public

Mr. Lieb here entered into a brief description of the development by Edison of the carbon-filament lamp, the "Jumbo" dynamo, the distribution system and the chemical meter used in the Pearl Street installation, making reference to the isolated lighting plants that preceded the first central station. He followed this with statistical data covering the growth of the New York Edison Company from 1882 to 1922, dwelling not only on its engineering progress but on its commercial development and its successful work in the promotion of good relations with its employees, and with the public. Its motto "At your service," he said, is not merely an advertising slogan but expresses a dedication of the company to the service of the community. This characteristic, Mr. Lieb added, is not singular to the New York company but is conspicuously present in the sister Edison companies established in other cities. He said:

"Each of these companies has made of itself a veritable public institution, a local instrumentality, ministering to the needs and conveniences of its community, growing with it in territory and prosperity and bringing to it the advantages of a progressive and public-spirited enterprise.

"It has been a recognized canon of the central-station industry, for which the pioneer Edison companies may claim credit, that no effort or reasonable expense may be spared that the service shall not fail, and every man in the organization feels a personal pride and interest in maintaining the record in this respect; and the success of our enterprise in every phase of it is due in no small measure to a full recognition of our obligation to maintain continuity in the service to our customers. Without such a successful determination, helped enormously it is true by the perfection of the system, it would have been impossible to lift our business from a kind of show business, in many respects, to a vital necessity filling every possible requirement for electric service throughout the community, however critically important to the maintenance of civic life and health, and in magnitude however great, from service to trunk-line railroads to the single lamp of a news stand.

"One of the conspicuous company policies, a heritage from the pioneer days, to which we would direct particular attention at this time is that of unfailing courtesy and polite consideration given to the public and to subordinates in the service.

Growth of Publicity

"In order to bring the rapidly appearing progressive improvements in lighting equipment and electric appliances of every kind to the attention of the public as promptly as possible after they were developed and could receive the company's indorsement as safe and practicable apparatus for commercial use by the customer, it was necessary, soon after the early years of solidifying the service had passed, to provide for proper publicity. It affords an interesting study to note the outstanding importance which all of these commercial activities, most of which were unknown to the earlier days of intensive engineering development, have now assumed, and the very large part they play in securing an effective utilization of the service once it has been brought to the door of the consumer.

"The Edison companies have uniformly been progressive, have kept their plants and equipment up to date and have, as soon as developed, installed the latest, most improved and most efficient types of apparatus, placing them ever in the forefront of mechanical and electrical progress in engineering construction and operation.

"That the sister Edison companies too, like our own, have flourished like the proverbial green bay tree was to be expected, as they all had for a common heritage a thoroughly practical and sound system to exploit, had the same initiation into broad and liberal policies toward the public, and they have one and all spared no effort to create a favorable public opinion founded on rendering the highest standards of service at reasonable rates.

"The New York Edison Company is proud to bear Edison's name, and we appreciate the honor which his presence here this evening and that of his gracious and charming wife lend to this great occasion, marking another milestone in the progress of our beloved old New York.

"As Richard Rogers Bowker, a former distinguished vice-president of the company, has beautifully expressed it in his sonnet entitled 'Fama Eterna':

"Blest is the man who for his country dies,
Twice blessed he who lives to serve mankind,
Thrice blessed he who in life's little hour,
Searching God's treasure house with lucent eyes,
A lamp for all men and all times may find,
And thrill the world with light and heat and power."

Facts Bearing on Original Appleton Plant

It has been asserted on various occasions that the Appleton (Wis.) plant was the first central lighting plant to be operated in the United States. Some of the claimants have even declared that the plant began operations as early as Aug. 5, 1882. In view of the conflict thus caused with the claims made for the Pearl Street station in New York City, the following facts have been unearthed:

A group of Appleton investors, headed by H. J. Rogers, president of the Appleton Paper & Pulp Company, signed a contract on Aug. 18, 1882, with the Western Edison Electric Light Company for two Edison "K" dynamos, which were driven by water power. Edward T. Ames, an engineer employed by the company, was sent to install the plant on the property of the Appleton Paper & Pulp Company. This work required nearly six weeks. According to the Appleton *Crescent*, the generators arrived on Saturday, Sept. 23, and a test of the lighting system was made on Wednesday, Sept. 27, but owing to misconnections the lamps failed to light. A second test on Saturday, Sept. 30, was more successful. The issue of the Appleton *Crescent* of Oct. 2, 1882, stated that the buildings illuminated were "as bright as day." It is therefore evident that the statement made in government census reports and in other places giving to Appleton the credit of possessing the first central electric light plant in this country is an error. Appleton has the distinction of having had the first hydro-electric incandescent lighting plant; but the first central station in this country was the original Pearl Street station in New York City, which began operation Sept. 4, 1882.

Rocky Mountain Exposition Taking Shape

Inspired by a determination to make the Rocky Mountain Electrical Exposition, to be held at Salt Lake City from Oct. 2 to Oct. 14, the greatest event of its kind ever held in the West, an elaborate publicity program is being carried out by its promoters. This includes newspaper advertising and the circulation of literature, posters, dodgers and cards not only in the territory around Salt Lake City but all through the Intermountain section. An unprecedented attendance is looked for

Exhibitors are arranging for booths at a rapid rate, more than forty prominent manufacturers and dealers having already taken space. A complete organization of committees has been effected, and they are working in a manner which assures the success of the enterprise. Chairmen of these committees are: General exposition committee, A. M. Jackson; exhibits, H. M. Ferguson; features, P. P. Ashworth; finance, W. S. Hodgson; advertising and publicity, M. L. Cummings, Jr.; arc and searchlight, C. R. Higson; music, E. L. Dee; Commercial Club and Chamber of Commerce, Harry L. Bracken; co-operating with engineer organizations, H. T. Plumb; co-operating with commercial organizations, H. F. Dicks. A. M. Jackson is manager, P. L. Goddard secretary and R. C. Nash treasurer of the exposition.

New York Electrical Show to Be Held Oct. 7-14

This year the New York Electrical and Industrial Exposition, which last year was held in the Seventy-first Regiment Armory, goes back to its old quarters, the Grand Central Palace, which is the exposition center of the city. Here it will occupy three entire floors, opening on Saturday, Oct. 7, and closing on the following Saturday, Oct. 14. Radio, industrial and other appliances will be featured, and one floor will be devoted to electrical equipment of special interest to various industries, including banks, butcher shops, bakeries, laundries, groceries and other stores, shoemaking factories, print shops and the building industry.

Electrical Conference for Western New York

As the outcome of a recent luncheon meeting of executive officers of all the chief electrical interests of the Niagara frontier it was agreed to further the growth and prosperity of electrical business in western New York State by the formulation and financing of a continuing movement for the general upbuilding of the industry in that region. To that end it was determined to hold a two-day conference of the electrical men of western New York in Buffalo on Thursday and Friday, Sept. 28 and 29. An excellent program, with entertainment features interspersed, is promised. William R. Huntley, vice-president Buffalo General Electric Company, is general chairman of the committee on arrangements, of which the other members are William E. Robertson, general manager Robertson-Cataract Electric Company; Alfred H. Schoellkopf, vice-president Niagara Falls Power Company; Edmond D. McCarthy, president McCarthy Brothers & Ford; Stefaan Piok, general manager Niagara, Lockport & Ontario Power Company; Frank A. Coupal, sales manager Buffalo General Electric Company, and George S. Anderson, president Electric Club of Buffalo.

Radio Installation Rules

The technical sub-committee having the revision of Rule 86 of the National Electrical Code, covering the installation of radio apparatus, in charge will hold a meeting in the near future to consider any changes which may be proposed in the tentative rules submitted under date of April 29, 1922. Any suggestions for changes before the rules are adopted should be submitted to William S. Boyd, chairman of the committee, 175 West Jackson Boulevard, Chicago, at once.

American Engineering Council Takes Up Muscle Shoals

A resolution authorizing the appointment of a committee of leading engineers to study every phase of the Muscle Shoals development problem was passed at the meeting in Boston on Friday last week of the executive board of the Engineering Council of the Federated American Engineering Societies. The president of the body, Mortimer E. Cooley, will appoint this committee, which, however, is to be selected by a special committee of the executive board and its personnel approved by the committee on procedure, of which Calvert Townley is chairman. The resolution, which was supported by Philip N. Moore in a spirited speech in which he denounced the proposal of Henry Ford, declares that the results of the proposed study will constitute "a service of great and possibly determinative value to the nation" in the settlement of the controversy over Muscle Shoals.

The report of the committee on work periods, which, as the result of an investigation covering nearly two years and aided by the fund established by Philip Cabot of Boston, declared for the eight-hour and against the twelve-hour shift in continuous industries, was adopted by a large majority and will be printed in full.

Gardner S. Williams of Ann Arbor, Mich., and W. B. Powell of Buffalo were appointed to draft a bill calling for the registration of engineers. Dr. William McClellan of Philadelphia, past-president of the American Institute of Electrical Engineers, was added to the committee on foreign relations.

Lighting Fixture Market to Be Held in Cleveland

At a meeting of the fixture market committee of the Lighting Fixture Dealers' Society of America held in Philadelphia on Sept. 6 it was decided that the 1923 convention and fixture market will be held in Cleveland in the week of Jan. 15, 1923. Instead of holding the convention and market in a public auditorium, as has been customary in the past, this convention and market will be held in a hotel. There will be no special effort put forth to have the public attend, it being the consensus of opinion that a great deal more can be accomplished by confining the entire week to the interests of the manufacturers and dealers. Ample space will be acquired for sample rooms.

A meeting of the executive board of the society will be held at the Hotel Cleveland, in Cleveland, at 10 a.m. Oct. 10. Subjects to be taken up will relate to the convention and fixture market and to the co-ordination of the activities of the Lighting Fixture Dealers' Society of America and the National Council Lighting Fixture Manufacturers.

A meeting of the National Council Lighting Fixture Manufacturers' executive committee will be held at the same place and for the same objects on Oct. 11 at 9.30 a.m.

Many Accidents Prevented

Insurance Man Reviews Progress in Utility Field at Safety Congress

Disagreement with what he characterized as a tone of pessimism in the last report of the accident prevention committee of the National Electric Light Association was expressed by C. E. Morrison, vice-president and general manager of the Utilities Mutual Insurance Company, in a review of the progress of accident-prevention work before the joint session of the Public Utilities and Electric Railway Sections of the National Safety Congress at Detroit recently. He pointed out that the first committee report and exhibit was presented only eight years ago, at the 1914 convention of the association, and thought that the tone of pessimism in the last report was due to the close application of the members of the committee to the work, which led them to fail in seeing the real progress that had been made.

The extent of this progress, he said, was evident from the growth of the utility sections of the National Safety Council from a small beginning in 1916 to a present membership of 250, including many large holding companies that gave more weight, because of the territory they cover, than a mere recital of the number of members would indicate.

In the discussion, Harry J. Bell of Chicago said that there was room for dispute as to whether the motive for safety work was originally economic or humanitarian, but that there was now a combination of the two motives. It is not sufficient, he held, that the executive give his approval to the work of a safety department, but he must put it on the same basis as any other department in the organization and support its work unreservedly. He advocated intensive work in the schools for the training of the children in safety matters.

Commonwealth Edison Safety Work

W. C. Berry of the Commonwealth Edison Company, Chicago, in discussing the benefits of safety work, told of the results obtained by that company, when a condition involving yearly insurance premiums of $225,000 and losses of $95,000, of which the company contributed $25,000, had existed. The organization of safety work resulted in a saving of $40,000 in the first year. The total costs of administration of the work last year were $67,000 and covered the handling of cases in which the insurance premiums would have totaled more than $200,000. During that year the total cost of injuries to the public was only $4,000, and there are no court or other cases pending. In the handling of injuries to employees it is the policy to pay a man his wages during the entire time of disability.

Wills Maclachlan of Toronto advocated a holiday without pay for the foreman whose gang constantly had accidents. C. B. Scott complained that many who are called on to take up accidents and safety work fail to make use of the work that has already done by the committees devoting time to safety studies.

In the discussion of the co-ordination of design and safety matters, J. H. Warnick of Fort Wayne said that it was of the utmost importance that the men responsible for both classes of work be in intimate contact with each other and that in design work the safety engineer should watch the safety features. In the general discussion it was suggested that the safety engineer should be called on to check and approve all drawings from the standpoint of safety. Wills Maclachlan of Toronto took issue with this and said that designers must be so impressed with safety measures that they would be included as a matter of course, but that dictation by one department to another is undesirable and should be avoided.

Accidents in Electrical Plants

In the discussion on the breakdown of electrical machinery B. K. Spencer, electrical engineer of the Travelers' Insurance Company, said that most breakdowns are caused by some form of improper maintenance. A rather warm discussion of the respective merits of water, steam, carbon tetrachloride and some form of inert gas as fire extinguishers in big generators sprang up. Mr. Spencer's general preference was for water. It was asserted that the use of steam at the Colfax plant in Pennsylvania had proved very satisfactory and that the difficulties of drying out afterward had not been serious. In discussing the use of water Mr. Spencer called attention to the employment of a split ring in the interior of the generator to spray the water on the rotor and the stator coils and suggested that two valves in series should be used to control the supply. A bleeder between the two to detect leakage through the first valve was suggested to prevent accidental entrance of water to the machine. The question of automatic control of any of the agents used for extinguishing fires was discussed but seemed to meet with little favor.

Wills Maclachlan brought up the question of the handling of oil switches on small systems that are being connected to large transmission systems. Generally, he said, the oil switches were adequate as long as the small system was isolated. When connected to a large transmission system the amount of energy back of the entire system and the amount that could be concentrated at a trouble point made such switches a hazard. A question was asked as to the use of reactors at the point of connection to limit the energy fed into the small system, and the opinion was expressed by several that such measures were not desirable. The general opinion favored oil switches of proper capacity at the strategic point as the most effective method. It was pointed out that the use of transformers between the main system and the smaller one was an aid in holding down the amount of energy fed into the smaller system in case of trouble.

The officers of the Public Utility Section for the next year are: Chairman, A. O. Mitchell, Northern Indiana Gas & Electric Company, Hammond, Ind.; vice-chairman, H. A. Mott, Illinois Bell Telephone Company, Chicago; secretary, B. B. McCollouch, Bureau of Safety and editor *Safety Bulletin*, Chicago. Among the officers of the National Safety Council are Homer Niesz of the Commonwealth Edison Company, Chicago, who is the treasurer and chairman of the finance committee for the coming year, and Charles B. Auel, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., who was elected vice-president in charge of industrial safety.

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Association Safety Activities to Be Co-ordinated

A meeting of a joint committee representing the National Electric Light Association, American Electric Railway Association, American Gas Association, Pennsylvania Electric Association and the Bell Telephone interests was held during the recent National Safety Congress at Detroit and means of co-ordination and prevention of duplication of the work of the safety and accident prevention committees of the several groups were discussed. The discussion developed the fact that many of the studies carried on are of common interest, and while the work of the individual committees cannot be interfered with, some means of keeping intimate touch between the several committees is a necessity. After discussion of various methods a committee was appointed to prepare and submit for approval a plan that would meet the ideas expressed in the discussion.

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N. E. L. A. National Section Group Meetings

Meetings of the Technical National Section committees of the National Electric Light Association are announced to be held as follows at the Hotel Pfister, Milwaukee, Wis.: Sept. 18-19, committees on inductive co-ordination, safety rules and underground systems; Sept. 19-20, committees on meters and prime movers; Sept. 20-21, committees on electrical apparatus, overhead systems and hydraulic power. There will be a general section meeting on the evening of Sept. 19 and an executive committee meeting on the evening of Sept. 20.

Commercial National Section meetings will be held at French Lick Springs, Ind., as follows: Sept. 28, Power Sales Bureau, committee on electrically equipped furniture and "Electrical Salesman's Handbook" committee; Sept. 29, Electric Vehicle Bureau, Merchandise Sales Bureau, education committee and committee on commercial service and relations with customers. An executive committee meeting is scheduled for Sept. 30.

The Accounting National Section group meetings are arranged for October as follows: Oct. 25, committees on accounting education, accounts payable records, budget, classification of accounts and annual reports, customers' records and billing methods, and purchasing and storeroom accounting; Oct. 26, committees on fixed capital records, mortgage and trust agreements, payroll standardization, security holders, and preservation and destruction of records. The executive committee will meet on Oct. 27.

Brief News Notes

San Diego Company Buys Coronado Plant.—The San Diego Consolidated Gas & Electric Company has purchased the plant and distributing system of the United Light, Fuel & Power Company in Coronado at an announced price of $100,000. The Coronado plant, which is across the bay from San Diego, is serving about 1,300 customers.

Interpretation of Washington State License Law.—According to an opinion rendered by the Assistant Attorney-General of the State of Washington, the bonding provision of the electrician's license law recently enacted in that state applies to independent contractors and not to salaried electricians or workers by the day. This provision had led to confusion.

Big Power Station on Pemigewasset River Planned.—Herbert B. Rust has petitioned the New Hampshire Public Service Commission for permission to build a power station at Ayer's Island in the Pemigewasset River between Bristol and New Hampton. The project involves the expenditure of approximately $1,000,000. The dam will be 55 ft. high and 1,200 ft. long and will be of reinforced concrete. A large territory between the two towns will be overflowed, making a lake of from six to eight square miles or more in area.

Louisville's "White Way" Halted.—The "White Way on Broadway," to be constructed in Louisville by the installation of electric lighting standards from First to Eleventh Street, is delayed pending termination of a dispute between the Louisville Gas & Electric Company and city officials. The company asserts that it has the right to refuse to furnish energy for a system such as that planned, while the city maintains that the company must light any system the city may care to set up. The standards are the gift of a citizen, and the merchants had agreed to bear the expense of installing them.

Atlanta Passes Ordinance Governing Radio.—A new code governing radio installations has been adopted by the city of Atlanta. This code provides that all installations and equipment must be approved by the city superintendent of electrical affairs. A two-hundred-dollar fine or thirty days on public work, or both, is the penalty provided for violating the ordinance. The code details the approved form of installation of all equipment for receiving and sending stations. It details also the protective devices that must be used to protect the supply system from surges and other contingencies. These may be condensers, vacuum-tube protectors, resistors or electrolytic arresters.

Georgia Commission Changes Name.—The name of the Georgia Railroad Commission was changed by act of the recent Georgia General Assembly to Georgia Public Service Commission. The change in name and the provision of a fund of $70,000 a year with which the commission may make investigations were the only changes made, although a strong fight to reduce the commission from five to three members was waged. An engineer and special staff of experts will be employed with the additional funds to gather evidence on behalf of the state. In many past hearings the utilities have met no opposition, members of the commission said, and it is desired to bring out whatever reasons may exist against granting applications for increased rates or other concessions.

Columbus, Ohio, to Test Proposed Lighting Systems Scientifically.—Before adopting a new street-lighting system in Columbus, Ohio, the city authorities have resolved to make a scientific test of both the amount of energy that will be consumed by proposed installations and the visibility that they will insure. Four manufacturers have accepted the invitation to make an actual display and sample lamps have been received. As soon as the exhibits are in place Prof. F. C. Caldwell of the university will make the actual measurements of the light, using the best instruments known to the science. A committee of the Chamber of Commerce and city officials will act as judges of the actual visibility, and it is quite probable that the City Council and representatives of other civic bodies will aid them in passing upon this feature.

Power Stations in Switzerland.—The *Electrical World's* correspondent in Switzerland sends the following list of power stations now under construction in that country or of which the future construction is assured: By the Swiss Federal Railways, Amsteg, on the St. Gotthard (minimum net capacity 6,100 hp., maximum net capacity when completed 85,800 hp.), first installation of four groups, each of 14,300 hp., for railway traffic, one group of 14,300 hp. for industrial energy, and final installation of five groups, each of 14,300 hp., for railway traffic and one group of 14,300 hp. for industrial energy; Barberine, first installation of three groups, each of 13,600 hp.; by the Société des Forces Motrices de Chancy-Pougny, Geneva, 43,000 hp.; by the Grisons Power Works of Chur, 45,000 hp.; by the Wynau Electrical Works at Langenthal, 8,400 hp.; by the city of Zurich in combination with the Northeastern Swiss Power Works at Wäggital (only for winter power), 140,000 hp.

Associations and Societies

Telephone Pioneers of America.—The annual meeting of this society and the first meeting of its newly organized "general assembly" will take place at Cleveland on Sept. 29 and 30. There will be a demonstration of the "Bell loud speaker" under the direction of Gen. J. J. Carty, president of the Telephone Pioneers.

Public Utility Advertisers Will Form Association.—A new association of advertising interests will be permanently organized under the name of the Public Utility Advertising Association during the convention of the American Electric Railway Association, which will be held during the first week of October in Chicago. A code of ethical standards of advertising practice will be proposed for adoption.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Sept. 19-22. Herbert Smith, 211 Hobson-Pritchard Bldg., Huntington.

American Electrochemical Society—Montreal, Sept. 21-23. A. D. Spillman, Columbia University, New York City.

Illuminating Engineering Society—Swampscott, Mass., Sept. 25-28. Samuel G. Hibben, 29 West 39th Street, New York. (For program see issue of Aug. 5, page 292.)

American Institute of Mining and Metallurgical Engineers—San Francisco, Sept. 25-28. F. F. Sharpless, 29 West 39th Street, New York.

N. E. L. A. Geographic Divisions—Great Lakes, French Lick Springs, Ind., Sept. 27-30. (For program see issue of Aug. 19, page 393.)

Indiana Electric Light Association—French Lick Springs, Ind., Sept. 28-30. Thomas Donohue, Lafayette, Ind.

Telephone Pioneers of America—Cleveland. Sept. 29-30.

American Electric Railway Association—Chicago, Oct. 2-6. J. W. Welsh, 8 West 40th Street, New York.

Empire State Gas and Electric Association—Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.

Electrical Supply Jobbers' Association, Atlantic Division—Philadelphia, Oct. 6. E. Donald Tolles, 165 Broadway, New York.

Arkansas Utilities Association—Hot Springs, Ark., Oct. 9 and 10. R. I. Brown, Little Rock Ry. & Electric Co., Little Rock.

Society of Motion Picture Engineers—Rochester, N. Y., Oct. 9-12.

Association of Edison Illuminating Companies—White Sulphur Springs, W. Va., Oct. 11-14. Preston S. Millar, 80th St. and East End Ave., New York.

National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St., New York.

Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 13-14. A. Bliss McCrum, Charleston, W. Va.

Electric Power Club—Asheville, N. C., Oct. 30. S. N. Clarkson, 506 Laclede Gas Bldg., St. Louis.

Ontario Association of Electrical Contractors and Dealers—Toronto, Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.

National Association of Railway and Utilities Commissioners—Detroit, Nov. 14. J. B. Walker, New York Transit Commission, New York.

Recent Court Decisions

Electric Service Company Not Liable to Individual for Its Breach of Contract with City.—A truck driver injured by an unlighted "safety isle" in the street which an electric service company had contracted with the city to keep lighted sued the company for damages (Cochran vs. Public Service Electric Company). The Court of Errors and Appeals of New Jersey has found that the company owed no duty to the plaintiff, who must look to the city for redress, it being primarily the duty of the city to illuminate the obstruction which it had erected. (117 At. 620.)*

Grants of Power to Cities to Be Construed Strictly.—The city of Shreveport, La., having brought suit against the Southwestern Gas & Electric Company to prevent it from charging increased gas rates allowed by the Public Service Commission of the state, the Supreme Court of Louisiana affirmed the judgment of the lower court denying an injunction. Grants of power to a city beyond those necessary for it to function properly as a municipality are, the Supreme Court held, to be construed strictly, and the power compulsorily to fix rates is a high attribute of sovereignty not thus necessary and had not been conferred on the city by its charter but had been vested by the state in the Public Service Commission. (92 So. 365.)

Degree of Proof of Negligence on Company's Part That Is Necessary to Sustain Damages.—In Book vs. Missouri Public Utilities Company a jury awarded damages for the death of a farmhand who was found lifeless a few feet from fenced-in transformers which stepped down 23,000-volt energy supplied by the company to 2,300 volts for use in pumping. Testimony was given that a guy wire installed by the company about 9 ft. from where the body was found was so loose that it could easily make contact with the high-tension wires, and the plaintiff held that the man was killed by contact with this guy wire. The defendant advanced the theory that the man, near whose hand two strips of wire were said to have been found, had committed suicide by reaching through the fence with one of these wires and making contact with the high-tension wires. The Missouri Court of Appeals at Springfield sustained the trial court, declaring that all that is required to make a finding that a defendant has been negligent is proof, either direct or circumstantial, that there was some want of due care to which the injuries might reasonably and fairly be attributed. (242 S. W. 433.)

Rates Representing Maximum Value of Service to Consumer Are Not Confiscatory.—Overruling exceptions taken to rulings of the Public Utilities Commission of Maine in Hamilton vs. Caribou Water, Light & Power Company, the Supreme Judicial Court of that state declared that the findings of the commission are not open to judicial review unless it is alleged that the commission puts forward as facts allegations without substantial evidence to support them. Findings unsupported by such evidence will be held erroneous as a matter of law and subject to exceptions. It will not be assumed that the commission disregarded the law because its findings did not cite the facts on which they were based, but it is the duty of the commission, when requested by any interested party, to set forth these facts. The Supreme Court further held that the rate charged by a utility under a decision of the commission must be reasonable both to the utility and to the consumer, and if the rates established represent the maximum reasonable value of service to the consumer, they are not confiscatory as to the utility, whatever may be the result upon its returns. (117 At. 582.)

Partition of Rights to Water Power.—In a suit instituted in 1913 (now known as Ficklen vs. Fredericksburg Power Company) a partition of mill-site and water-right property was asked, the complainant owning nine-tenths and the power company one-tenth. A later suit brought against the Spotsylvania Power Company, successor in interest to the Fredericksburg Power Company, was consolidated with it and has recently been decided by the Supreme Court of Appeals of Virginia, which makes these findings among others: Water rights appurtenant to a mill and acquired by contracts with a riparian owner who had built a dam are limited to the rights granted in the contracts regardless of the flow of water or the necessities of the mill; there is nothing inherent in a water-power right which prevents a partition thereof in kind; in the absence of specific restrictions in the grant of a water-power right the grantee may make such use of the water as he chooses, provided only that he does not thereby interfere with the rights of others; wherever the wording of the deed makes it doubtful whether a limitation of the quantity of water for power or a restriction of the use of the water power is contemplated the courts will adopt the former construction; a contract between the owners of two mills using water power from the same dam that none of the water should be used on designated premises cannot be enforced by a stranger to the contract who subsequently constructed a dam higher up the stream and agreed to furnish both mills with their water. The Supreme Court found that the appellee should furnish a larger flow of water to the appellant than the decision of the trial court had specified. (112 S. E. 775.)

Law Governing Appeals from Decisions of Wisconsin Railroad Commission.—In an action taken by the Chicago, St. Paul, Minneapolis & Omaha Railway Company against the Wisconsin Railroad Commission, the Supreme Court of Wisconsin has found that, under the statutes governing commission procedure, no action will lie to test the lawfulness or reasonableness of an order denying a motion to rescind an order formerly made which was based upon the same facts. If such an action did lie, the limitation of ninety days for bringing an action to test the lawfulness of an order made by the commission would be abrogated, for such a motion to rescind could be made at any time. (189 N. W. 150.)

Commission Rulings

Ability to Pay Is Not a Proper Criterion of Rates.—Adverting to the contention of the American Foundry & Machine Company that it was unable to pay the rates of the Utah Power & Light Company, the Utah Public Utilities Commission said: "Complainant states that since the war profits realized from electric furnace operation have been meager and it cannot afford to pay the general power rates. If the commission were to take into consideration the ability to pay of a single consumer, it would end in every customer having a different rate, and all uniformity of rate structure would be destroyed, with illegal discrimination the result."

Federal Income Tax and Operating Expenses.—Departures from the former trend of commission decisions in regard to inclusion of federal income taxes in operating costs are being made and some companies have been allowed so to include the tax. The Idaho Public Utilities Commission, for instance, permitted the Grangeville Electric Light & Power Company to do this in its recent denial of that company's application to put an increased rate schedule into effect (see issue of Aug. 12, page 345). The Idaho commission based this reversal of its former attitude on the decision last spring of the United States Supreme Court in the case of the Galveston Electric Company, when, speaking through Justice Brandeis, the court said: "In calculating whether the 5-cent fare will yield a proper return it is necessary to deduct from gross revenues the expenses and charges, and all taxes which would be payable if a fair return were earned are appropriate deductions. There is no difference in this respect between state and federal taxes or between income taxes and others. But the fact that it is the federal corporate income tax for which deduction is made must be taken into consideration in determining what rate of return shall be deemed fair."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Dr. Waterhouse Accepts Chair of Metallurgy at M. I. T.

Dr. George B. Waterhouse, for the past sixteen years connected with the Lackawanna Steel Company, Buffalo, has accepted an appointment as head of the department of metallurgy at the Massachusetts Institute of Technology, Cambridge, Mass., and will assume his new duties at the beginning of the college year this fall. Dr. Waterhouse will take to his new work a broad practical experience in metallurgy fortified by a liberal education. He succeeds Prof. H. O. Hofman, who resigned last June as head of the department after many years of service.

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W. F. Davison has left his position with the University of Michigan to accept a position as director of engineering investigation with the Brooklyn Edison Company.

Major James J. Loving, army engineer at Montgomery, Ala., was ordered recently by Major-Gen. Lansing H. Beach, chief of engineers, to make a detailed report on the power project which the Alabama Power Company proposes to construct on the Tallapoosa River in Alabama.

Alfred D. Flinn, secretary of the Engineering Foundation and chairman of the division of engineering of the National Research Council, has returned from a six weeks' tour to the Pacific coast, during which he addressed groups of engineers to enlist their aid in a nation-wide plan for engineering and industrial research. Mr. Flinn addressed meetings at Salt Lake City, Los Angeles, San Francisco, Sacramento, Portland, Oregon, Seattle, Duluth and Minneapolis.

Frank Howard has recently been appointed general superintendent of the Ohio Power Company with headquarters at Canton, Ohio. Mr. Howard comes to his new position after about twenty-eight years' association with the construction and operating departments of the Western Engine Company and public utility organizations absorbed by the American Gas & Electric Company. Before receiving the present appointment, he was the general superintendent of the Wheeling Electric Company and the Eastern divisions of the Ohio Power Company.

Dr. F. C. Caldwell, professor of electrical engineering in Ohio State University and chairman of the committee on education of the Illuminating Engineering Society, has recently been elected to the board of councilors of the Eyesight Conservation Council of America. Surveys in industrial centers and in city and rural schools show that enormous losses are being sustained by the nation through defective eyesight. The Eyesight Conservation Council plans to enlist the co-operation of the engineering profession to a wider extent in lessening this evil.

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A. D. Lunt Is Manager General Electric Patent Department

Alexander D. Lunt has recently been appointed manager of the patent department of the General Electric Company by Vice-president A. G. Davis, who has heretofore held the position to which Mr. Lunt is named. Mr. Lunt joined the General Electric patent department as an assistant attorney April 1, 1898. In addition to the general duties of patent attorney he has been active in patent litigation relating to incandescent lamps and, more recently, in radio litigation. He was born in Biddeford, Me., and during his early life resided at Portland, Me. In 1891 he was graduated from the Worcester (Mass.) Polytechnic Institute with the degree of B. S., and two years later he gained his post-graduate degree of M. M. E. in electrical engineering at Cornell University. He then became a member of the examining corps of the United States Patent Office and remained in that position until engaged by the General Electric Company. He studied law at Columbian University, now George Washington University, and was admitted to the bar in 1897.

A. D. LUNT

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H. R. Woodrow, formerly connected with the Westinghouse Electric & Manufacturing Company at New York, is now associated with the Brooklyn Edison Company as assistant electrical engineer.

H. C. Couch, head of the Arkansas Light & Power Company, Pine Bluff, Ark., is on a trip through Georgia and the Carolinas, during which he will make a close study of the cotton-mill industry in that section.

E. Burwell Ilyus has resigned his position with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., to accept the position of assistant engineer in the substation division of the engineering department of the Duquesne Light Company, Pittsburgh.

Allen Ashley, associated with the domestic sales department of the Westinghouse Electric & Manufacturing Company for ten years and with the foreign sales department of the Allied Machinery Company of America for four years, has established a clearing house to handle surplus machinery and supplies at 152 West Forty-second Street, New York City.

Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, was the recipient of a diamond service pin at the executive offices of the company on Sept. 1, in commemoration of the thirty-fifth anniversary of his connection with the organization. A delegation of bureau and department heads and associates, with E. S. Mansfield as spokesman, made the presentation.

Arthur A. Buck, who has recently become assistant manager of the patent department of the General Electric Company, was born in Bucksport, Me. After being graduated from the Massachusetts Institute of Technology with the degree of E. E. he became associated with the Lynn works of the General Electric Company, where he remained for one year. He left the Lynn works to accept a position in the examining corps of the United States Patent Office at Washington, and while in the capital he studied law at Columbian University and was admitted to the bar. Mr. Buck has been an assistant attorney in the patent department of the General Electric Company since August, 1899.

Obituary

Thomas S. Martin, a mechanical and electrical engineer with the Lidgerwood Manufacturing Company, died recently at his home in Brooklyn, N. Y. Mr. Martin was forty-five years of age.

Claude P. Gordon, electrical engineer and construction superintendent for Thompson & Castleton, Inc., Seattle, died in Wichita Falls, Tex., recently. Mr. Gordon was twenty-nine years of age and a member of the American Institute of Electrical Engineers.

Charles W. Oakley, formerly state president of the National Stationary Engineers and long prominent in improving power-plant operating and working conditions, died recently at his home in Clifton, N. J., aged fifty-one.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Wanted: Better Salesmanship Abroad

The Importance of True Representation of American Business by Men Chosen for Fitness and Capacity

By Julius Klein
Director Bureau of Foreign and Domestic Commerce

ONE of the most vital essentials to our success in foreign business today is the selection of efficient traveling representatives of American firms for service abroad. A comprehensive world survey of this phase of American trade development by experts of the department has revealed striking facts and conclusions. Several instances have recently been brought to light where unwise appointments have proved extremely costly, or even disastrous, to American manufacturers whose judgment was at fault.

This is a most serious problem, involving, as it does, not only the welfare of the offending firms but the good will and standing of American export business in general. In foreign countries the traveling representative of an American house is regarded as the spokesman of his country as well as of his company—he has the power to build up or damage the prestige of both. The banner bearers of American industry in the world markets should be the best men obtainable, and every effort should be made to secure capable Americans to perform the task, even at some temporary sacrifice in domestic trade.

A partially successful pill salesman, whose sole qualification for the position is knowledge of Spanish and of "the customs of the people," may not be so successful in the automobile business. This was the recent sad experience of the manufacturers of one of the highest-priced makes of American automobiles in South America. The vendor of "cure-alls" made the American automobile company ridiculous in the eyes of scores of shrewd Latin-American business executives who put the incident down as "just one more example of Yankee stupidity."

Precisely the same mistake was made by a leading revolver concern which sent out as its South American salesman an accomplished linguist, the son of a missionary, born and brought up abroad, who had spent two weeks in the factory in New England. On his first business call he took his samples apart and couldn't put them together again. It is nothing less than absurd for a steel company to send to Europe a man who does not possess a fundamental knowledge of the steel business, whose only asset, probably, is a long tour in Europe in a non-commercial capacity or as a pleasure seeker. In this country a salesman or field office manager can get in touch with the home office by telephone if in trouble. Abroad this is usually impossible unless he has long-distance radio receiving and sending sets in his pocket.

On the subject of nationality many firms favor the selection of a real American bearing the indubitable appearance of one in preference to a naturalized citizen who is selected solely because of his knowledge of the language and customs of his native land. Many foreign firms have a keen respect for American business methods, and they will frequently do business with a bona fide "Yankee" who evidently lacks polish, as against a man of their own nationality who approaches them as the representative of an American

One Thing Science Has Been Unable to Accomplish

CAN YOU SEE ?
PERFECTLY
THE X-RAY HAS ENABLED US TO SEE THRU THE THICK-HIDED RHINOCEROS
YOUR WIFE WANTS YOU ON THE WIRELESS
AND SPACE HAS BEEN PRACTICALLY ANNIHILATED SO FAR AS HUMAN COMMUNICATION IS CONCERNED
ACROSS 8000 000 YEARS
AND KING AGADAD WAS A GOODLY KING AND KEPT PEACE WITH ALL THE TOWNSMEN
AND BY PATIENT EFFORT MAN HAS REVEALED THE SECRETS AND LIFE OF OUR ANCIENT ANCESTORS
CAPITAL CAN DO NO WRONG ALL LABOR IS BOLSHEVIST
DON'T TALK TO ME ABOUT LABOR I KNOW ALL ABOUT IT
ONLY MY OWN SIDE OF THE QUESTION
SOLID WALL OF PREJUDICE
! FOR PETE SAKE ! LISTEN TO REASON
SOLID WALL OF PREJUDICE
LABOR CAN DO NO WRONG EVERYBODY ELSE IS A WALL STREET TOOL
DON'T TALK TO ME ABOUT CAPITAL I KNOW ALL ABOUT IT
ONLY MY OWN SIDE OF THE QUESTION
LABOR
BUT BLIND PREJUDICE REMAINS IMPENETRABLE

From the Philadelphia North American

house. His record, his character, his family connections in the country and many other factors may mitigate against his success in his home country in the robes of a "Yankee salesman."

In considering a prospective traveling agent it is undesirable to give exclusive attention to any single element or phase of his equipment. He must be suited (a) to the territory and the trade to be visited, (b) to the line of goods to be handled and (c) to the commercial policies of his employer. He must be a trade builder in the wider sense and not a mere order-book filler. The agent should be a man of good education, thoroughly versed in the fundamental technical aspects of his field. He should possess a broad fund of information so that he can converse with foreign buyers about something besides his own line of goods. Superficial knowledge of the topics of the day frequently paves the way for profitable business, especially in Latin America. He should be able to sell American manufacturing methods as effectively as a bill of merchandise or an individual unit of machinery, persuading a prospective foreign buyer that the American way of producing a given article is eminently efficient or, possibly, superior to others.

Personality and stability of moral character are factors whose importance can scarcely be overestimated. The habitual gambler, the drunkard or the fast liver is a distinct liability, no matter how brilliant he may be as a salesman between the "twilight zones." The nonchalant readiness of more than one American firm to "take a chance" in these respects has cost this country large prospective business and, worse still, has distinctly damaged American reputation abroad. It should be made clear, however, that the warning against the unreliable traveler possessing the faults just mentioned does not imply any prejudice against the salesman who is a "good mixer"—a mixer who blends his social activities with restraint and proper standards of living.

Tact and good manners are also essentials. The "hustler" with his American line of "bluff good-fellowship" frequently meets with disaster in South America. The Latin American is accustomed to well-phrased compliments and a strict observance of certain conventions. He dislikes the appearance of doing business in a hurry, yet understanding of proper approach often results in actual orders almost as quickly as in the United States. The "plugger" type is preferred to the temperamental "star" salesman, for it has been found that the latter often suffers severe failure abroad when his customary spectacular methods cannot be adjusted to foreign conditions.

The salesman pioneering for his house and expected to select permanent agents must possess sound judgment. It is a common fault in this regard to assign agencies to dealers placing the largest orders, irrespective of the dealers' organization, stability and capacity to render service. Equally dangerous is the selection of a house which is already handling so many more profitable classes of goods that the new line is certain to be slighted or ignored. When the agent selected happens to be a European, handling competing European goods, the error is all the more serious. The ability, therefore, to form a shrewd, just estimate of persons and situations is invaluable.

Sales instinct, the desirability of preliminary training in the home office, preliminary knowledge of foreign conditions, ability to speak the language of the country, accuracy and exactness, supervision over traveling representatives, the salary question, continuity in service and the legal aspects presented are some of the other factors involved.

Shall Our Dealers Save Their Markets?

The Big Problem of Local Retail Distribution—What the Electrical Dealer Must Do to Hold His Place

By J. E. Livor

Secretary and Sales Manager Pettingell-Andrews Company, Boston

Back in April this company sent out to all dealer-customers a special appeal signed by our president warning the dealer, not against the merchandising of radio material, but against the neglect of the regular electrical business on account of radio enthusiasm. Many dealers have since discovered the truth in this warning and have governed their actions accordingly. For it has been demonstrated that the radio business, under existing conditions, is distinctly a seasonal business. Unquestionably it will come back in good shape in the fall, but in the meantime a great many dealers, blind to the handwriting on the wall, have neglected their electrical business in such a manner as practically to hand it to their competitors.

Non-Electric Competition

The big question today that is puzzling the electrical industry is whether or not the electrical dealer is going to function properly and continue to be the retail distributing point for electrical merchandise. Inactivity on the part of many dealers has enabled enterprising and aggressive hardware stores, department stores, individual solicitors, agents, and even grocery stores, to merchandise electrical material, and they are fast taking away from the electrical dealer much opportunity that really belongs to him.

It therefore behooves the electrical dealer to arouse himself to a proper realization of the situation before it is too late. If he expects to hold his own and actually sell goods, he must immediately make a careful analysis of his condition, clean house and get to work in earnest on his own business, which is the merchandising of electrical material, whether it be housewiring or washing machines, ironers or vacuum cleaners, or any of the smaller appliances.

Merely to have a store and wait for the customers to come in and *buy* is not sufficient. The dealer must *sell*. Where conditions warrant it—and the cases are mighty few where they do not warrant it—he must go out and sell. He must have a sales organization trained to deliver the message of the electrical idea. If his business at present does not permit two or three outside representatives, he must have at least one. He must keep his name before the people of his community constantly, so that they will associate his name first of all with the thought of electrical merchandise.

Methods that Win

The success of the department stores is due mainly to the fact that they keep themselves continually in front of the consumer, advertising consistently and persistently. They are also putting out solicitors to work on the larger electrical appliances, and they are thus in marked contrast to most electrical dealers, who are lying dormant, making no attempt to create business but just accepting the business which comes their way.

The electrical dealer is accustomed to go out personally and solicit a wiring job. He has built up his business on that basis. Why can he not make the same application to the merchandising of electrical material?

The world is coming into the greatest electrical era in its history. Is the dealer going to take hold and become an active, vital part of the progress which we are facing, or is he going to continue to stand idly by and see the business which is legitimately his taken away from him by those who are more keenly appreciative of its possibilities?

Our record furnishes sufficient proof of our optimism and our faith in the future of the electrical business, and if this note of warning seems to be pessimistic, we want to give assurance that we are sending it out only after a most thoughtful analysis of commercial conditions in the New England territory, and we have been led to believe that they obtain in other sections of the country to no less degree. It presents a problem that demands and merits the attention not alone of every dealer but of the jobbers and manufacturers. For if the dealer is to save this situation for himself and maintain the present set-up in the distribution of electrical goods, this message must be carried to him forcefully by every supplier that he has, supported by a practical co-operation that will not only show him the opportunity and point the way but at the same time actively help him to achieve it.

Survey of Business Conditions

Bright Outlook for Pulverized Fuel Equipment

The International Combustion Engineering Corporation, which now controls the "Lopulco" system for burning coal in pulverized form, has within the past sixty days booked orders for over a half-million dollars' worth of equipment of this type. The total booking for combustion equipment in August was more than $900,000, exceeding by more than 200,000 any previous month.

Among recent orders for the "Lopulco" system are those from the United Electric Railways Company, Providence, R. I.; the West Penn Traction Company, Pittsburgh, Pa.; the Rochester Railway & Light Company, Rochester, N. Y.; the Duquesne Light Company, Pittsburgh, Pa., and the Union Electric Company, St. Louis, Mo. As the Union company is a subsidiary of the North American Company, whose Lakeside plant at Milwaukee is equipped with this system, the decision to depend entirely upon pulverized fuel for the new power plant in St. Louis is significant. The installation at Providence will comprise equipment for three new boilers of more than 1,000 hp. rating.

New Type Electric Cycle Car on Japanese Market

A new type of electric cycle car has been placed on the Japanese market, according to a report received at the Department of Commerce from Consul Dickover, Kobe. This car, which is assembled in Osaka from parts mostly manufactured in Germany, although some parts of the bodies are made in Japan, is covered by German and Japanese patents and is produced at present in one-seater models. The motor is a ½-hp. electric engine of a reversible type and may be charged by the ordinary electric current through a transformer. It would appear that the advantages of small size and economical operation would render a car of this kind very popular, but as yet none of them have been seen on the streets.

Petroleum Products Exports for July Show Increases

For the month of July the volume of exports of each of the chief petroleum products showed large increases over those for July, 1921, except for gas and fuel oil. The foreign movement for July showed substantial increases over June in crude oil, gasoline, lubricants and paraffin wax, but declines in illuminating oil and gas and fuel oil.

Exports of crude oil were 64 per cent above those for the month a year previous. The average declared export price of crude was $1.74 per barrel in the month of July, 1921, and $2.03 in July, 1922.

The volume of foreign business in gasoline, naphthas and other light products in July was 102 per cent above July, 1921, shipments. The average export price for the two periods was practically the same, 23.5 cents per gallon.

Exports of illuminating oil showed a 39 per cent increase as compared with July, 1921, the average export price for July, 1921 and 1922, being 10.4 cents and 11.4 cents per gallon respectively. Foreign shipments of gas and fuel oil declined 40.2 per cent as compared with July, 1921. The average export prices for the month in 1921 and 1922 were $1.93 and $1.64 per barrel respectively.

Shipments of lubricating oils were 50 per cent greater than for July a year ago. The declared export prices for July, 1921, averaged 30 cents per gallon and for July, 1922, 23.4 cents. Exports of paraffin increased 42 per cent as compared with July, 1921.

Prevailing Conditions Affecting Cost and Volume

Construction.—Contracts awarded in the twenty-seven Northeastern states during August amounted to $322,007,000, according to the F. W. Dodge Company. This figure was 46 per cent over that of August, 1921, and only 8 per cent under that of July, 1922. That a seasonal decline has set in after four months of unprecedented activity and that the decline is so slight would seem to be a most wholesome indication for the remainder of the year.

Loading of Freight.—Loading of revenue freight on American railroads totaled 890,838 cars during the week which ended on Aug. 26, according to reports just received by the American Railway Association from the rail carriers. This exceeded the previous week by 34,619 cars. It also was the largest number of cars loaded during any one week since Oct. 1, 1921.

Bank Clearings.—Returns of bank clearings last week were for five business days only, owing to the holiday, and the aggregate at twenty cities in the United States, as reported to *Dun's Review*, is $5,505,175,000. This total is 21.4 per cent in excess of the $4,533,503,074 for the five-day period of 1921, but is 3.2 per cent less than the $5,689,629,108 of two years ago, when the figures were also for five days.

Volume of Business.—Volume of business for the week ended Sept. 6, as measured by debits to individual accounts reported to the Federal Reserve Board for banks in leading centers, totaled $7,406,000,000, or $162,000,000 in excess of the total for the preceding week. This increase is quite notable, in view of the fact that the week contained only five business days, and is due in large part to end-of-month transactions that were effected during the week.

Failures.—For the five-day business week caused by the observance of Labor Day in the United States, a smaller number of failures was reported to R. G. Dun & Company by each of the four sections, and the total for this week was 329, as against 376 last week. The five-day week a year ago had 285 defaults.

Iron and Steel Exports.—July exports of iron and steel were only 159,338 long tons, as compared with 220 112 tons for June, according to figures of the Iron and Steel Division of the Department of Commerce. This shows a decrease of 60,774 tons over June and 71,922 over May.

Coal Shortage to Help Heater Sales

Prominent Manufacturer Has Been Producing Intensively for Two Months—Jobbers Preparing to Meet Situation Effectively

Sections of the United States that use anthracite coal in large quantities for domestic heating are likely to temper the cold drafts of autumn with electric heating equipment to a greater extent this year than ever before, if the distributors in these localities size up the situation promptly and order the necessary units in time to secure satisfactory deliveries.

A prominent manufacturer of heaters informed a representative of the *Electrical World* this week that for two months past his factory has been producing heaters for this fall's demand on a scale of intensive working; that stocks are being built up to meet the initial requirements of the cold season, and that already orders are beginning to reflect a greater interest in this type of apparatus.

Retailers have not awakened to the opportunities expected in this line, but the more far-seeing jobbers are beginning to look ahead with the idea of preparing to meet the situation effectively.

Cost of Operating Heaters Need Not Be Burdensome

In some quarters the cost of operating heaters from lamp sockets at regular lighting rates has militated against the sale of these outfits on a large scale, but experience has shown that for the earlier weeks of cold weather, the cost of operation need not be burdensome as compared with the expense of starting and controlling furnace and stove fires. Fuel administrators in different localities are urging householders to refrain from using anthracite coal before Nov. 1, and the long strike of anthracite miners has assured the public a trying season of inconvenience if not worse.

Within its proper field of usefulness, therefore, the air heater, operated on central-station energy, bids fair to make a new place for itself in the consumer's household affairs this fall. The manufacturers will be able to handle the situation more effectively if the distributors take time to analyze the prospective market and place orders accordingly. Delivery requirements can then be met more satisfactorily, and there will be less chance of a shortage of this class of equipment if the demand is cultivated to its logical size.

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Switzerland Is Reported Good Market for Appliances

Switzerland is rapidly becoming an electrical country par excellence and offers an opportunity for development as a field for the sale of American electrical appliances, particularly labor-saving devices such as washing machines, says *Commerce Reports*. The cost of labor is extremely high in Switzerland, and the Swiss and German appliances now being used seem inferior to the American article in both ingenuity and convenience.

◆

Fall Lamp Sales Outlook Brighter than Ever

In an analysis of the fall outlook for lighting sales, W. G. McKitterick, manager of the large lamp sales department of the National Lamp Works of the General Electric Company, Cleveland, says that the lamp business has proved a constantly increasing source of revenue for the agent who has taken the time to analyze its possibilities and, having done this, has apportioned to it the time and effort that any soundly organized business needs for healthy growth.

"This year is no exception to the rule," he says. "If anything, the outlook for this fall is brighter than ever. In years past some one or two lighting fields have usually been quiet, the past two years, for example, showing the industrial field to be below normal. In its stead has come an unusual demand, created by forceful advertising and equally strong and effective work on the part of our field missionaries for better street, sign, commercial and home lighting. These fields are going to show undiminishing fertility for several years to come.

"With improved business conditions, industrial lighting is coming back into its own—with a vigor that reminds one of the period from 1916 to 1920. This means that for the first time in the history of the incandescent lamp every conceivable large field that lighting can touch is active and susceptible to the dealer's or salesman's activity, especially if it is conscientiously and intelligently applied.

"Lighting salesmen, in summer conference for the purpose of reviewing the work of the past year and outlining their extension program for the fall and winter months, are enthusiastic to the core. They say their experiences of recent months forecast to their satisfaction a period of lighting activity hardly, if ever, equaled in any past year or period of years."

Comparative Prices of Station Supplies

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb	$0 0285	$0 0261	$0 0270
Cold finished shafting	per lb	0 0365	0 0340	0 0415
Brass rods	per lb	0 170	0 1750	0 1433
Solder (½ and ½)	per lb	0 225	0 217	0 18
Cotton waste	per lb	0 115	0 11	0 102
Washers, cast iron (½-in.)	per 100 lb	4.00	3.83	4.06
Emery, disks, cloth, No. 1, 6-in. diameter	per 100	3 11	3 11	.
Machine oil	per gal	0.36	0.36	.
Belting, leather, medium	off list	40–5%@ 50%	40–5%@ 50%	.
Machine bolts, up to 1-in.x 30-in.	off list	55% @ 60%	50% @ 65–10%	50% @ 60–10%

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Refrigerator Sales Active in Massachusetts

Interest in electrical refrigeration has increased rapidly of late in Massachusetts, and the Economy Electric Company of Worcester states that within a year forty-seven installations have been made in Worcester County alone.

This organization is distributor for the section just named and Peter A. Coghlin, treasurer, informed the *Electrical World* last week that a particularly satisfactory phase of this business has been the purchase of such equipment by many executives and business leaders familiar with manufacturing and mechanical activities.

Boston sales of this product have also been exceedingly active during the past few months.

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Metal Market Situation

Domestic buying of copper is fair and the foreign sales continue good. The price is firm with only a small amount of copper available under 14 cents, delivered.

Domestic inquiry is large, but most of it as yet is in order to keep in touch with price. Brass and wire mills are operating at good rate. Current orders, however, are not especially large, as ultimate buyers are waiting to see more marked improvement in rail and fuel conditions before placing further orders.

The domestic demand for copper is mainly for September and October shipment.

NEW YORK METAL MARKET PRICES

	Sept. 6, 1922 Cents per Pound	Sept. 14, 1922 Cents per Pound
Copper		
Prime Lake	14 00	14.00
Electrolytic	14 00	4 00
Casting	13.45	3.45
Lead, Am. S. & R. price	5 75	5.75
Antimony	5 25	5.25
Nickel, ingot	36 00	6.00
Zinc, spot	6 50	6.50
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00–11.25	11.00–11.25
Brass, heavy	5.75– 6.25	5.75– 6.25
Brass, light	5.25– 5.50	5.25– 5.50
Lead, heavy	4.62½–4.75	4.62½–4.75
Zinc, old scrap	3.00– 3.37½	3.00– 3 37½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

BUSINESS in the electrical industry continues to increase. Central stations are buying more material in preparation for the winter months. Fan sales were good last week in Chicago because of the unusually hot weather. Fixtures of the better grade are selling in better volume. Profits in motor sales are reported as unsatisfactory to the manufacturers and some price increases are expected. A light but sustained demand is reported for ranges, and the anthracite-coal shortage is arousing prospective customers. Storage-battery sales for August were far ahead of the corresponding period of last year.

New York

Conduit Stocks Low—Fixture Sales Increasing—Larger Size Motors in Better Demand

A slight improvement in the jobbers' business is reported, demand picking up since announcement of a clearing up in the strike situation. The outlook for fall business is promising, appliance dealers being most optimistic. Central-station companies are buying in better volume and are preparing for the coming cold months.

Conduit.—Larger sizes of conduit are running low and prices are stronger. Another price increase in this line is expected.

Flexible Armored Conductor.—Sales are greater than for the corresponding period of August. Some dealers report their stocks as very low.

Fixtures.—A slight spurt in sales of the better grades is reported. Supplies are ample.

Motors.—Demand for smaller sizes continues fair with a slight increase in business for the larger sizes.

Chicago

Fan Demand Stimulated by Hot Weather—Lamps Moving Well—Curling Irons Active

The electrical trade felt an active call for fans this week due to a week of torrid weather. Although late in the season for an opening in this market, jobbers were unanimous in welcoming this chance of lowering their fan stocks. Wiring materials are firm both in price and movement. The call for lamps has been started by industrials and railroads. All dealers report a steady demand for curling irons. High-tension equipment is still keeping up its active sales rate.

Conduit.—Action on this material is steady and prices are firm. The ½-in. black pipe is quoted at $50 and $52 per 1,000 ft. in 5,000-ft. lots. Stocks are still low, especially in the smaller sizes.

Flexible Armored Conductor.—A fair business is reported on the two-wire, single-strip No. 14 conductor. Stocks are ample and it sells for $48 per 1,000 ft. in 5,000-ft. lots.

Wire.—The movement still continues, but prices are firm. No. 14 is available in 5,000-ft. lots for $6.35 per 1,000 ft. Stocks are normal. The call for bare and weatherproof is steady, but without any pronounced sales.

High-Tension Equipment.—Sales are still progressing. One manufacturer announces the sale of two out-door substations rated at 25,000 volts, 1,000 kva., for a utility in Minnesota and one 37,000-volt, 1,500-kva. substation for Massachusetts.

Lamps.—Fall buying of lamps by the railroads and industrials has commenced, and jobbers predict an autumn of active business. All types are moving well and stocks are in good condition.

Appliances.—All dealers state that the demand for curling irons is increasing. They attribute this to the popularity of bobbed hair. However, the sale of hair driers has slumped. Flatirons are continuing in demand owing to several sales campaigns by leading houses.

Fans.—A week of hot weather has resulted in an intensive sale of fans. One jobber states that he had reduced his stocks one-half during the past week. Most other dealers report similar business.

Boston

Excellent Outlook for Fall Business—Larger Sizes of Conduit Are Running Low

Trade continues better, with an excellent fall outlook. Prices are firm, stocks meeting demand readily on the whole, and business is admirably diversified. Building contracts in New England during August totaled $28,074,000, a gain of 8 per cent over the preceding month and 37 per cent above August, 1921. More industrial building is starting up. Traction and telephone earnings are improving; central-station business expansion gains headway, and more line construction is being authorized, cheaper money helping here. Labor troubles in this district are subsiding. Deliveries are still uncertain in steel products, and large apparatus tends toward longer quotations.

Rigid Conduit.—Larger sizes are running low in stock and deliveries are as yet uneven from the mills. Prices are firm, with upward trend.

Storage Batteries.—Sales are far ahead of last year, although nothing like full manufacturing capacity is being taxed as yet. Road truck sales are dull, but industrials are picking up a little. Local stocks are good.

Flexible Armored Conductor.—No. 14 single-strip sold at Boston Monday for $44.20 per 1,000 ft. in 1,000-ft. lots. Prices tended to stiffen as the week advanced. Demand is healthy and the supply ample at present.

Appliances.—Toasters, cleaners, irons and refrigerating apparatus are moving well. Washers are very dull, and fans are stirring spasmodically in response to humid weather conditions. Radiant heaters are moving better, with excellent prospects for a heavy fall trade.

Electric Ranges.—A light but sustained demand is evident. Interest in newly developed products is broadening, and the anthracite coal shortage is arousing prospective purchasers somewhat.

Motors.—A very diversified market is apparent, with a more encouraging sales volume. The margin of profit in motor manufacture is regarded as unsatisfactory in some quarters.

Atlanta

Poles Moving Satisfactorily—Panelboard Orders Reported in Number—Lamp Stocks Are Good

The rail strike is causing increased difficulty in the receipt of materials, particularly in the receipt of fuel by industrial plants. Unless fuel is received in the very near future, quite a number of plants are going to be forced to curtail operations. It is of interest to know that the oil mills and gins in Georgia have been put on the preferential fuel list and it is reasonable to suppose that these will be able to operate satisfactorily. Transportation difficulties are responsible for a decline in the volume of sales in July in five wholesale lines, though four others show increases. Building activities in the Southeast have held up fairly well, fifteen important cities showing increases, while nine show decreases. Building permits in Atlanta for the month of August numbered 502, with a valuation of $1,905,000. Electrical jobbers report the general outlook as very bright, dependent, of course, upon the effect the coal and rail situations may have on business.

Oil-Engine Generating Sets.—Activities in this line are reported quite satisfactory by manufacturers' agents, especially in the moderate and large size sets up to 150 kw. Three large orders for this material were received last week from a section of North Carolina. Shipments are satisfactory but deliveries are slow.

Poles.—Very satisfactory movement

in chestnut and juniper poles are reported, but high prices are holding down the volume of sales of Western red cedar. Taken in the aggregate, the movement of this line is satisfactory for this season of the year. Pole yard stocks are ample.

Pole-Line Hardware.—All jobbers report brisk sales throughout the entire line, with excellent stocks on hand, though factory shipments are slow. No recent price changes.

Panelboards.—A reasonable number of orders for power panels is reported, with lighting panels in considerable demand, commercial buildings nearing completion accounting for this activity.

Radio Equipment.—Jobbers report this line as moving very satisfactorily with stocks in excellent condition. A great many retail stores other than electric have put in stocks of this equipment, tends to swell volume of business.

Lamps.—Jobbers have good stocks on hand to supply the fall trade, which has now started. "Type C" lamps in 100-watt and 150-watt sizes are maintaining their popularity, with the 40-watt and 60-watt most popular in the vacuum types.

Cleveland

Marked Improvement Is Reported—Conduit Stocks Are Low—Radio Business Shows Activity

A marked improvement in demand in all lines is reported, and with the exception of conduit the supply has been steady. Prices have advanced but slightly, and it is the general opinion that a complete readjustment has occurred and that firm prices will prevail on future orders.

Conduit.—Stocks are very low and jobbers are buying up every available carload, but because of the difficult deliveries prices are steadily climbing. Demand is firm, however.

Lamps.—Greater activity in the sale of the ordinary grades is reported, the demand being in good volume all over the state and being attributed to the increase in the construction of homes. There have been no price changes.

Fuses.—A steady demand with supply in proportion is noted, but prices remain unchanged. Jobbers are fairly well sold and a slight lessening in activity is expected.

Wire.—An abundant supply exists and demand is only fair. No. 14 rubber-covered has suffered especially in the gradual price decline.

Washing Machines.—Nothing unusual has developed since last week. The demand continues to meet expectations and supply is sufficient. A slight increase in ironer sales is noted, but production has been increased to meet it.

Vacuum Cleaners. — Manufacturers are experiencing no difficulty in disposing of their entire production and jobbers are by no means overstocked. In spite of the demand, however, prices remain steady.

Motors.—Demand is increasing, but ample stocks are reported. Prices have fluctuated, but the tendency is upward. A fair fall season is anticipated.

Radio.—All indications are that the long-expected activity has commenced. Dealers express the opinion that, if the present demand continues to increase, the sales will exceed last year's by a generous margin.

Ranges.—While stocks have not been noticeably depleted the receipts show a satisfactory week. Preparations are under way for an active October.

St. Louis

Jobbers Experiencing Active Business—Motors Selling Better—Tape Demand Is Improving

Notwithstanding the generally unsettled business conditions prevalent in August, building permits were substantially better than in the preceding month and in the corresponding month last year, the respective values being $2,206,670, $1,985,947 and $1,307,206.

During the past week jobbers experienced active business. Railroad shipments were far from satisfactory, however, and short stocks were occasionally found. Business from the coal mines was getting back to its stride and general wiring supply trade was good. With indications of more ready money in the agricultural districts this fall, the smaller municipalities are preparing for improvements and inquiries for small power plants are good. A number of the municipalities distant from larger central stations are replacing their steam plants with oil-driven engine-generator units.

Motors.—Demand is active in all sizes, especially up to 50 hp., and the increased demand for fractional-horsepower motors is of particular note. Stocks are in good condition and prompt deliveries are the rule.

Rubber-Covered Wire.—There is increased demand for industrial power uses, and sales of No. 14 remain steadily active. Stocks are spotty. Representative prices, per 1.000 ft., in 5,000-ft. lots, are: No. 14, $6.50; No. 12, $9.50; No. 10, $12.50; No. 8, $15.75.

Lamp Cord.—Sales are comparatively quite and stocks are ample. No. 18 twisted cotton sells for $11.50 per 1,000 ft. in 1,000-ft. lots. Similarly, parallel cotton sells for $15.24, twisted silk for $27 and parallel silk for $28.80.

Fixture Wire.—Demand has become quite active, with stocks good and prices firm. In 1,000-ft. lots, No. 18 rubber-covered black sells for $3.47 per 1,000 ft. and likewise No. 16 sells for $4.51 per 1,000 ft.

Tape.—Demand is steady and improving, with stocks good and prices stable. A popular brand of friction tape is quoted at 32 cents per pound, with others ranging from 28 cents to 56 cents, depending upon weight and quality. Rubber-tape prices range from 30 cents to 84 cents.

Salt Lake City-Denver

Railway Strikers Going Back to Work Expected to Help Business—Building Active

Railway strikers are going back to work and there is little discussion about the transportation crisis. Business has shown a decided slump as a result of thousands being temporarily off the payroll. It is believed that buying will resume on a better scale when the next pay day is here. Building permit figures show that August of this year has a substantial lead over August, 1921. More permits were issued a year ago, but a good gain is shown in total of expenditure, indicating that larger construction jobs are getting under way.

Electric Vacuum Cleaners.—Easy payments are the feature of vacuum-cleaner advertising, $1 down and $5 a month being the usual offer.

Pole-Line Hardware.—A 5 per cent price increase due to the stiffening tendency in steel market is reported. Demand is steady and fair. Stocks at present are somewhat low.

Switchboards and Panels.—A very substantial pickup in demand is noted. Factories are back on fuel schedule.

San Francisco

September Promises to Be Good for Washers—Appliances Are Slow—Little Non-Employment

September promises to be a good month for washers, although the showing of the larger cities is low, which probably foretells a temporary saturation of present selling methods. Collections are slow despite increasing pressure, and overbuying is sternly curtailed. Companies report considerably decreased business for appliances. Very little non-employment is noted, although the approaching close of the fruit-canning season may alter present conditions. On the other hand, new mines are being opened and certain old ones deepened.

Portland-Seattle

General Business Conditions Good—Building Continues Active—Prospects for Fall Trade Excellent

Electrical jobbers report business to be very good and prospects for fall trade are excellent. There is a heavy demand for conduit and pole-line material. Stocks of both items are somewhat short and conduit prices have advanced about 5 per cent. In general, the credit situation is easing up and collections are reasonably good.

Wire. — Single-braid, rubber-covered wire, No. 14, is quoted at $6.75 per 1,000 ft. in 5,000-ft. quantities and No. 12 at $9.10 per 1,000 ft. Triple-braid weatherproof wire is quoted at $24.50 per 100 lb. in sizes from No. 4/0 to No. 8. No. 18 cotton-covered lamp cord is quoted at $15.45 per 1,000 ft. in coil lots.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Westinghouse Gets Order for Turbine-Generator Unit

The Union Electric Light & Power Company of Illinois has recently ordered from the Westinghouse Electric & Manufacturing Company a 35,300-kva. turbine-generator unit for its new plant in St. Clair County, Ill., just across the Mississippi River from St. Louis.

The turbine part of this unit is designed for 30,000 kw., 300 lb. steam pressure, 250 deg. superheat and 28½ in. vacuum. The generator is designed for electrical characteristics of 13,800 volts, three-phase, 60-cycle, and 85 per cent power factor.

The plant, known as the Cahokia power plant, is being designed by McClellan & Junkersfeld, Inc., of New York City. It will tie in with the other plants of the Union Electric Light & Power Company, which furnish power for St. Louis and the surrounding territory.

Western Union Shows Fair Gain in Business

The Western Union Telegraph Company in its July, 1922, report shows operating revenues amounting to $8,647,676, an increase of $298,591 over July a year ago. After allowing for expenses, operating income stood at $1,812,128, an increase of $526,289, as compared with the previous July.

For the first seven months of the year total operating revenues amounted to $58,487,072, a decrease of $1,743,763 compared with the corresponding period a year ago. Balance after expenses for the seven months was $12,240,590, an increase of $3,184,585 over last year, while operating income stood at $9,260,891, an increase of $2,243,809 over the seven months of 1921.

G. E. Sold $62,000,000 Worth of Mazda Type Lamps in Year

Of the Mazda type of electric lamp alone the General Electric Company's sales last year were about $62,000,000. Sales to the American public of electric lamps by all manufacturers (excluding miniature sizes) aggregated $93,000,000, of which $92,000,000 was for tungsten filament lamps.

A tremendous saving in cost of light was made possible by development of the tungsten lamp. Electrical statisticians have estimated that last year energy used to produce electric light cost the public about $500,000,000, whereas an equivalent amount of light with old type carbon lamps would have cost $2,000,000,000.

In 1907 the 40-watt tungsten lamp cost $1.50. Today the price is 35 cents, and it is estimated that eleven times as much light is obtained for the same expense. The Edison Electric Illuminating Company of Boston uses more than $500,000 worth of tungsten lamps a year.

It has been established that 8,000,000 of the 20,000,000 homes in the United States are wired for electricity. There are 20,000,000 electrical appliances in use in this country, including 2,000,000 cleaners, 125,000 ranges, 6,000,000 irons and 2,000,000 washing machines.

Jewell Company Increases Sales Representation

The Jewell Electrical Instrument Company, 1650 Walnut Street, Chicago, has increased its sales organization by the addition of representatives in six cities. This change was required by the growth of its instrument business and a more intensive selling program. It will also allow these representatives more time to devote to the sale of instruments. The following men were appointed: John Forshay, New York; L. B. Underwood, Philadelphia; J. H. Burroughs, Buffalo; P. J. Burrill, Cleveland; F. T. Morrissey, Dallas; Eicher & Bratt, Seattle.

The Ohio Brass Company, Mansfield, Ohio, manufacturer of electrical transmission equipment and supplies, has purchased a tract of property at Niagara Falls, Ont., comprising about 16 acres of land, as a site for the erection of a large plant for Canadian trade.

The Continental Engineering & Sales Company, New York City, has announced through its vice-president, H. F. Rohnfeld, that it has recently incorporated under the new name of the Continental Electric Engineering Corporation.

The Central American Plumbing & Supply Company of Panama and Colon, R. P., has entered the field of electrical jobbing and contracting.

Allen Ashley, who has been associated with the domestic sales department of the Westinghouse Electric & Manufacturing Company for four years, has established a clearing house to handle surplus machinery and supplies at 152 West Forty-second Street, New York City.

Connors Electric Shop, Orlando, Fla., has been organized by M. B. Connor as an electrical repair shop to deal in electrical power equipment and as a battery service station.

The Otis Elevator Company, has been awarded the contract for installing six electric freight and two electric passenger elevators in the new building of the Belknap Hardware Company, Louisville, Ky.

G. P. Atkinson, who has been associated with the Weston Electrical Instrument Company for the past six years, will also represent the Ward Leonard Electric Company in the Atlanta (Ga.) district. Mr. Atkinson has established an office in the Atlanta Trust Building.

The Western Electric Company, Hawthorne, Ill., has awarded a contract to the McClintic-Marshall Company, Pittsburgh, for the erection of the steel frame for a new plant unit, 175 ft. x 556 ft., estimated to cost about $1,000,000, including equipment. With the completion of this structure the plant will comprise ninety-two buildings.

The Westinghouse Lamp Company, Bloomfield, N. J., is completing plans for the erection of a new building at its local plant, on the opposite site of Arlington Avenue, Watsessing district, and has made application for permission to construct a tunnel under the thoroughfare to connect the old and new plant structure, for service lines, etc.

The Independent Lamp Works plant at 80 Bergenline Avenue, Union, N. J., has been acquired from Isadore Haber, receiver, by Fernando C. Mesa, Newark, N. J., operating an ammunition plant in the Irvington district, and associates. The new owners propose to continue the operation of the plant for the manufacture of incandescent electric lamps.

The Salmon Falls (N. H.) Manufacturing Company, has awarded a contract for the construction of a new one-story 30-ft. x 80-ft. brick and concrete hydroelectric power plant at Salmon Falls. The cost of the project will be in the neighborhood of $250,000. Charles T. Main, 200 Devonshire Street, Boston, is the engineer.

The Hayward Woolen Company, East Douglas, Mass., has awarded a contract for the erection of a one-story, 25-ft. x 40-ft. brick and concrete addition to the boiler and power house at its plant in East Douglas. C. T. Main, 200 Devonshire Street, Boston, is the engineer.

The McClave-Brooks Company, Scranton, Pa., manufacturer of McClave combustion system, including grates and stokers, has appointed B. S. Briggs, 1736 South Eighteenth Street, Omaha, as its representative in Nebraska and western Iowa. On Oct. 1, C. H. Thomas, now attached to the Chicago office, will assume his duties as manager of the Detroit branch office, which is being opened to take over the sales work formerly handled by A. H. Sloan & Company, Inc., of that city. The McClave-Brooks Company of Scranton has appointed Joseph B. Noros, 834 Connell Building, Scranton, as its special representative in the anthracite field and in eastern Pennsylvania.

Foreign Trade Notes

ADDITIONAL FUNDS RECOMMENDED FOR THE NORE POWER SCHEME AND NUMEDAL RAILWAY, NORWAY.—The Norwegian Ministry of Labor, according to the *Electrical Times*, has recommended the grant of 8,000,000 kronen during the next budget period toward the Nore power station and the Numedal Railway. Of this amount it is proposed to apportion 3,000,000 kronen to the Nore power station and the remainder to construction work on the Numedal Railway. Previous to this 7,000,000 kronen had been appropriated for the Numedal railway and 27,000,000 kronen had been expended on the Nore project.

ELECTRIFICATION OF CABLE TRAMWAYS IN MELBOURNE, AUSTRALIA.—An interim report has been submitted by the Melbourne and Metropolitan Tramways Board to the Minister of Public Works, according to the *Electrician*, on the electrification of the cable tramways and the construction of the more urgently required electric lines. The report precedes the general scheme to be submitted within three or four months. The cost of electrifying the cable tramways is estimated at £4,200,000. The cost of about 30 miles of new electric tramways, with additional rolling stock, is placed at £2,000,000. It is proposed to spread the expenditure over fifteen years. None of the proposed lines can be built without authority from Parliament, and various proposals must be submitted to the railways standing committee for investigation and report.

EXTENSION OF TELEPHONE SERVICE IN SOUTH AFRICA.—Of the £500,000 recently appropriated by the South African government for telephone extensions, the *Electrician* states, £230,000 will be expended on the development of communication in the country districts of all four provinces. The remainder will probably be devoted mainly to the enlargement of inadequate exchanges in the urban areas, with special attention to Cape Town and its environs. Last year telegraph and telephone material amounting to £59,572 was imported, compared with £31,564 in 1920, while the amount recorded as government stores was £195,563. Between November, 1918, and March, 1921, the Union government spent £726,489 on new telephone and telegraph works, including the opening of eighty-nine exchanges and the addition of 13,711 miles of wire and of 6,080 telephones.

TRANSMISSION OF ELECTRICITY TO DENMARK.—A question of importance in connection with the Swedish electrical development, *Commerce Reports*, states is that of power transmission to Denmark by sea cable, principally from the Trollhättan station, near Gothenburg, to Copenhagen. At present only a small amount of energy is being transmitted in this way, the slow progress being primarily due to early opposition encountered in Sweden. As it has become evident, however, that the available supply is sufficient to allow such export without endangering the supply for domestic use, this opposition has practically ceased, and commissions in Denmark and Sweden are now at work on the technical details. Legislation covering the project in both countries is also before the respective national bodies.

PROPOSED HYDRO-ELECTRIC DISTRIBUTION SCHEME FOR NEW ZEALAND.—A report outlining a scheme for distribution of hydro-electric power involving an expenditure of £434,439, according to the *Electrician*, has been submitted to the Marawatu-Orona Electric Power Board. The board has decided to borrow £500,000 to carry out the project.

ELECTRIFICATION OF RAILWAYS IN SOUTHWESTERN PART OF SWITZERLAND.—The next lines of the government railroad to be electrified, says William E. de Courcy, Geneva, in a report, will benefit the southwestern cantons of Switzerland—Geneva and Vaud. A new program has been prepared of the sections in these cantons on which electrification work will soon be undertaken. These are as follows: Geneva-Lausanne, 40 miles, the sole connecting link of railway between Geneva and the rest of Switzerland; Lausanne-Vallorbe, 30 miles; Dailles-Yverdon, 14 miles; Lausanne-Palezieux, 16 miles. In addition to this network, of which Lausanne is the center, the program includes the lines from Zurich to Olten, 45 miles, and from Berne to Palevieux via Fribourg, 60 miles. The work, it is expected, will be completed by the end of 1927. The cost with necessary locomotives is estimated at 250,000,000 francs.

ITALIAN GOVERNMENT TO GRANT CONCESSIONS FOR ELECTRIFICATION OF RAILWAYS.—A report to the Department of Commerce states that further electrification of the Italian Railways would be conceded to private enterprise, according to press comments in Italy, and a bill has been presented to the Chamber of Deputies to bring about such a result. The reason behind the project is, doubtless, that, with the state railways showing a huge deficit for the past fiscal year and with propositions being considered for a return of the whole state system to private industrial management, there is little chance that the government can or will take up seriously such a plan, even though the need is manifest.

Foreign Trade Opportunities

COAL-HANDLING PLANT FOR MORWELL POWER STATION, AUSTRALIA.—Tenders will be received by the State Electricity Commission of Victoria, Melbourne, Victoria, Australia, until Dec. 18, according to the *Electrical Times*, for a coal-handling plant for Morwell power station and briquetting works (Specification No. 282). Copies of tender form and specification may be obtained on application to Agent-General for Victoria, Melbourne Place, Strand, London, W. C. 2.

New Apparatus and Publications

RADIO RECEIVING SET.—The Missouri Radio Corporation, 2,625 Washington Avenue, St. Louis, is distributing a four-page leaflet describing the "Missouri" radio receiving set.

SIGNAL AND CONTROL EQUIPMENT.—The Signal Engineering & Manufacturing Company, 533 Canal Street, New York City, is distributing an eight-page leaflet describing its high and low voltage signal and gong equipment.

WELDING METALS.—Bulletin No. 100 issued by the Wilson Welder & Metals Company, Inc., 132 King Street, New York City, describes and illustrates the Wilson "Color-tipt" welding metals in rod form, and also a small portable welding unit to operate on the Wilson "Plastic-Arc" system.

PULVERIZED-FUEL EQUIPMENT.—Bulletin A issued by the Quigley Fuel Systems, Inc., 26 Cortlandt Street, New York City, describes the "Quigley" powdered-coal system and appliances.

GEARS.—"Quiet Running Gears" is the title of publication No. 4,453, issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., covering the "Micarta" gears.

SAFETY CAR EQUIPMENT.—Bulletin No. 44,015, issued by the General Electric Company, Schenectady, N. Y., describes its safety devices for street-railway cars, including motors, controllers, air brakes, etc.

ELECTRIC EQUIPMENT FOR PRINTING PRESSES.—The Monitor Controller Company, Baltimore, has issued bulletin No. 103, in which it describes and illustrates the "Monitor" automatic equipment for printing presses, binding and other printing-shop auxiliary machinery.

WAVE TRANSMISSION.—"Wave Transmission" is the title of a fifty-six page booklet issued by Walter Haddon, 132 Salisbury Square, Fleet Street, London, E.C.4, entitled "Wave Transmission," which gives a description of power transmission by wave vibrations and the storage of energy in liquids and also of industrial applications of wave transmission.

RELAYS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 47,606, describing relays and their operation and general application.

ELECTRICALLY OPERATED PUMPS.—The General Electric Company, Schenectady, N. Y., is distributing bulletin No. 48,028, showing the feasibility of using electric motors for driving pumps of all kinds.

TURBO-BLOWERS.—The English Electric Company, Ltd., Queen's House, Kingsway, London, W.C.2, is distributing two publications, Nos. 367 and 370, entitled "English Electric Turbo-Blowers" and "Electric Driving in Scottish Woolen Mills" respectively.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MEREDITH, N. H.—Work, it is understood, will soon be begun by the Utilities Power Company of Meredith on the construction of a large hydro-electric plant on Ayers Island in the Pemigewasset River. The proposed plant will supply electricity to communities in the northern section of the state. Herbert B. Rust, Providence, R. I., is president.

PORTSMOUTH, N. H.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 19 for 19,500 ft. of electric cable for use at the local navy yard.

SALMON FALLS, N. H.—The Salmon Falls Manufacturing Company plans for extensions in its hydro-electric power plant to increase the capacity from 1,200 hp. to 3,000 hp. for use at its local cotton mill. A fund of $200,000 is being arranged for the work. R. T. Lyman is president.

PAWTUCKET, R. I.—Electric power equipment will be installed in connection with the three-story mill addition to be erected by the Hope Webbing Company, Main Street, estimated to cost about $300,000. Perry & Whipple, 15 Westminster Street, are architects and engineers.

PROVIDENCE, R. I.—The Paragon Worsted Mills, Westminster Street, will build a one-story power house at their plant.

MERIDEN, CONN.—The Aeolian Company will build a one-story addition to the power plant at its local piano factory, 30 ft. x 50 ft.

NORWICH, CONN.—The Public Utilities Commission has granted the Eastern Connecticut Power Company permission to extend its transmission lines to Sprague to furnish electricity in the village and to the Airlee Mills.

North Atlantic States

PARISHVILLE, N. Y.—The St. Lawrence Transmission Company is extending its transmission line from the Hanawa power house to Parishville to furnish electricity here. The local plant has been acquired by the St. Lawrence company.

ROCHESTER, N. Y.—The Rochester Gas & Electric Company has applied for a permit to remodel its No. 26 station at Graves and Aqueduct Streets. A new turbine will be installed. The cost is estimated at about $49,000.

JERSEY CITY, N. J.—The City Commission has authorized an issue of $1,500,000 in bonds for the construction of a sewage-disposal plant near Boonton. The equipment will include electrical apparatus, mechanical gates, etc. Clyde Potts, 30 Church Street, New York City, is consulting engineer.

MADISON, N. J.—The Council plans for extensions and improvements in the municipal electric plant, to include the installation of new equipment. The plan to purchase central-station power from the Morris & Somerset and Commonwealth Electric companies has been abandoned.

TRENTON, N. J.—The equipment of the proposed power plant to be erected at the State Normal School, for which bids on a general contract are now being taken, will include a high-pressure steam plant, electric generators and accessories, ice-making and refrigerating machinery, etc. The commissioner of education, State House, is in charge. Gilbert & Betelle, Broad Street, Newark, are architects.

VERGA, N. J.—The Public Service Electric Company will extend its transmission line and install a distributing system here.

CHARLEROI, PA.—Preliminary arrangements have been completed for the construction of a central distributing station and steel switch yard at Charleroi for the West Penn Traction & Power Company, to cost about $1,000,000. The proposed station will be equipped with two high-tension transmission lines stepped down to 25,000 volts and distributed to all parts of the extensive system.

PHILADELPHIA, PA.—The Philadelphia Electric Company will commence the immediate construction of a two-story substation, 59 ft. x 122 ft., at American and Susquehanna Streets, to cost $110,000.

PITTSBURGH, PA.—The West Virginia Power & Transmission Company has applied to the Federal Water Power Commission for authority to construct ten separate hydro-electric developments on the Cheat River in West Virginia and Pennsylvania. The lower dam and power house will be erected near Monongahela. It is proposed to develop about 400,000 hp.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Sept. 28 for electrical supplies as called for in Circular PR-1033-A-1CP; also, until Sept. 30 for electrical supplies as called for in Circular PR-12034-A-1CP; until Sept. 25 for 5,000 batteries (Circular PR-12268-1CP); until Sept. 29 for 300 condensers, S. C. type, and plug for radio telephone; until Sept. 27 for one collimator (Circular PR-12675-1CP).

ALLENTOWN, PA.—P. B. Sawyer and C. M. Walter, both of Allentown, have organized the Lowhill Power & Light Company and the Heidelberg Power & Light Company, to install and operate plants and systems in Lowhill and Heidelberg Townships respectively. Thomas J. Perkins, Allentown, represents the companies.

YEAGERTOWN, PA. — The Board of Township Supervisors plans for the installation of a lighting system on Mann Avenue.

YORK, PA. — The Gilbert Wall Paper Company, 728 Linden Avenue, will build a power house in connection with its new mill at State Street. J. A. Dempwolf, Casset Building is architect.

BALTIMORE, MD.—Bids will be received by Board of Awards, City Register's office, until Sept. 20 for 100,000 ft., more or less, of 3-in. fiber conduit, for use of the Electrical Commission. Charles F. Gocb, chief engineer.

EASTON, MD.—The Utilities Commission will commence the immediate erection of additions to the municipal power plant.

ST. MICHAELS, MD. — The Board of Commissioners is disposing of a bond issue of $20,000 for extensions and improvements in the municipal electric system.

WILLIAMSPORT, MD. — The Potomac Public Service Company plans for the construction of a steam-operated electric power plant here to cost about $1,500,000. A site has been purchased. Headquarters are at Hagerstown. The company is operated by the American Water Works & Electric Company, 50 Broad Street, New York.

HUNTINGTON, W. VA.—Bids will soon be asked for extensions to the lighting system on Eighth Street and Fifth Avenue. L. D. Newman is commissioner of public utilities.

WARWOOD, W. VA.—The Beach Bottom Power Company plans for the rebuilding of the portion of its power plant, destroyed by fire Sept. 1 with loss estimated at about $40,000.

DALE ENTERPRISE, VA.—The Home Mutual Light Company, recently organized, plans for the installation of a system in different parts of Rockingham County for light and power service. R. S. Showalter, Dale Enterprise, is secretary.

NORFOLK, VA.—The Norfolk & Western Railway will electrify its coaling pier No. 3. Motors, hoisting machinery and other electric equipment will be installed. J. E. Crawford is chief engineer.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 26 for 200 storage batteries for use at the Philadelphia Navy Yard. (Schedule 137.)

North Central States

BRECKENRIDGE, MICH.—At a special election held recently the proposal to establish a municipal electric light plant was carried.

FLINT, MICH.—The Flint Motor Car Company will build a power plant at its new local automobile works, estimated to cost in excess of $500,000. The company is a subsidiary of the Durant Motors, Inc., 1819 Broadway, New York, N. Y.

FLINT, MICH.—The Durant Motor Car Company has awarded a contract to the Christman Construction Company, Lansing, for the erection of the following buildings at its local plant: Main building, 80 ft. x 900 ft., three stories; plant No. 4, 400 ft. x 80 ft., three stories; plant No. 5, 257 ft. x 400 ft., one story; plant No. 6, 100 ft. x 500 ft., one story; also a power house to be known as plant No. 7.

BARBERTON, OHIO.—The extension of the ornamental lighting system on Tuscarawas Avenue from Fifth to Eighth Street is under consideration.

FREMONT, OHIO.—The Board of Control has awarded the Ohio Power Company a new street-lighting contract under which the company is to install a new street-lighting system consisting of 580 lamps. The contract also calls for sixty-seven ornamental lamps to be erected on State Street.

GALION, OHIO.—The County Commissioners have appropriated $15,000 for a new power house and laundry at the County Children's Home at Galion.

LIMA, OHIO.—Extensions to the ornamental lighting system to State and Cole Streets and Woodlawn Avenue in the west end is under consideration.

MANSFIELD, OHIO.—Plans are being prepared by R. S. Harsh, state architect, Ohio Building, Columbus, for an additional building at the Mansfield Reformatory. The Ohio State Board of Control is in charge.

MARTINS FERRY, OHIO.—The proposal to issue $400,000 in bonds for reconstruction of the municipal electric light plant and waterworks system will be submitted to the voters on Nov. 7. J. N. Chester, Union Bank Building, Pittsburgh, Pa., is engineer.

PORTSMOUTH, OHIO.—The Portsmouth Street Railway & Light Company contemplates extensions and improvements to its system involving an expenditure of about $300,000.

LOUISVILLE, KY.—A building for cables to distribute energy will be erected by the Louisville Gas & Electric Company in connection with the addition now being built at the Riverside plant. The total cost of the improvements is estimated at $2,000,000.

LOUISVILLE, KY. — The Consolidated Realty Company will install a street-lighting system on a 30-acre tract of land, now being developed for residences. Leslie W. Moorehouse is head.

RICHMOND, IND.—The Liberty Light & Power Company has been granted permission by the Public Service Commission to issue stock for $50,000, the proceeds to be used for the construction of a transmission line from Richmond to Hagerstown, Ind.

DIXON, ILL.—The Illinois Northern Utilities Company will commence the immediate erection of an addition to its local power house, to cost about $45,000. Sargent & Lundy, 72 West Adams Street, Chicago, are engineers.

WAUKEGAN, ILL.—The Waukegan Generating Company is completing plans for the first unit of a steam-operated power plant on Dewey Street, with capacity of 25,000 kw., estimated to cost in excess of $750,000. Sargent & Lundy, 72 West Adams Street, Chicago, are engineers.

BARABOO, WIS.—The Baraboo Towel Mills, operated by George McArthur & Sons, plan for the construction of a hydro-electric power plant on the Baraboo River for mill service, estimated to cost approximately $30,000.

RACINE, WIS.—Steps have been taken by the merchants on Wisconsin Street for the installation of a new lighting system on that thoroughfare from the State Street bridge to Sixth Street.

GENTRY, MO.—The town has voted to grant the Maryville Electric Light & Power Company a twenty-year franchise and a ten-year contract for street lighting. The company will extend its transmission line from Grant City.

KLONDYKE, MO.—The power plant of the Tavern Rock Sand Company was recently destroyed by fire, causing a loss of about $10,000. The plant, it is understood, will be rebuilt immediately.

RICH HILL, MO.—The construction of a new power station to cost about $15,000 for the municipal water and light plant is under consideration. The purchase of equipment, to cost about $20,000, has been authorized.

ST. LOUIS, MO.—The Missouri Electric Light & Power Company, recently organized with a capital of $25,000,000, to take over the Union Electric Light & Power Company, contemplates the construction of a new electric power plant near the municipal bridge. Other plant and line extensions will be made.

LEAD, S. D.—The electric lighting and water pumping plant at Sylvan Lake was recently destroyed by fire.

RAPID CITY, S. D.—A power plant will be constructed in connection with the proposed state-owned cement plant to be located here, estimated to cost close to $2,000,000. J. C. Buckbee & Company, 38 South Dearborn Street, Chicago, is engineer.

SIOUX FALLS, S. D.—The County Commissioners have granted the Northern States Power Company permission to erect a high-tension transmission line from Sioux Falls to Canton. The company has begun work on a 66,000-volt line.

McCRACKEN, KAN.—The city is having plans completed for the construction of a municipal power plant to cost about $45,000. The Ruckle Engineering Company, Hutchinson, Kan., is engineer. Bids will soon be called.

WICHITA, KAN. — A one-story power house, 60 ft. x 80 ft., will be erected at the proposed high and manual training school by the Board of Education, estimated to cost close to $1,000,000, upon which work will soon be commenced. Lorentz, Schmidt & Company, 121 North Market Street, are engineers.

Southern States

FAYETTEVILLE, N. C. — The Carolina Power Company will build its proposed transmission line from Laurinsburg to Fayetteville, 45 miles, by day labor. It will be on steel towers and operate at 100,000 volts.

MAYSVILLE, S. C.—The City Commission is disposing of a bond issue of $12,000 for the installation of a municipal transmission and distributing system.

ATLANTA, GA.—The stockholders of the Georgia Railway & Power Company have authorized an increase in capital stock of $500,000, subject to the approval of the Public Service Commission. The proceeds are to be used for extensions and improvements.

DALTON, GA.—The Georgia Railway & Electric Company is planning to build a new substation in Dalton and also contemplates erecting a 110,000-volt transmission line from Lindale up through the Lafayette Valley. Arrangements are being made by the company to connect up with the transmission lines of the Tennessee Power Company.

JACKSONVILLE, FLA.—The Jacksonville Traction Company will make extensions and improvements in its Riverside Avenue power plant to cost about $30,000.

PAHOKEE, FLA. — The Council has granted the Howard Company a franchise for an electric light plant, waterworks, telephone system and ice plant.

CHATTANOOGA, TENN. — The Dixie Spinning Mills, affiliated with the Dixie Mercerizing Company, Warkins Street, will build a one-story power plant in connection with their proposed local spinning mills, estimated to cost about $250,000. Roberts & Company, Atlanta, Ga., are engineers.

HARRIMAN, TENN.—The Blanchard & Campbell Coal Company, recently organized, is planning to install electrically operated machinery at its mining properties.

MEMPHIS, TENN. — The Clover Farm Dairy Company, 789 Union Avenue, will build a power plant at its new dairy buildings at Union Avenue and Walnut Street. An ice-manufacturing plant will also be constructed. The entire plant will cost $250,000. L. N. Leonard is general manager.

NASHVILLE, TENN.—The city has sold a bond issue of $50,000 for extensions and improvements to the municipal electric system.

NASHVILLE, TENN.—Plans for the proposed new building of the National Life & Accident Insurance Company provide for the installation of an electric plant to supply electricity for lighting the building and operating the elevators.

BIRMINGHAM, ALA. — The Alabama Power Company has applied to the Federal Water Power Commission for authority to build a new hydro-electric project on the Tallapoosa River to develop 140,000 hp. for distribution among the cotton factories in the eastern section of Alabama. The project includes the construction of four dams, to cost about $12,000,000, and the erection of a 90-mile high-tension transmission line to connect the Mitchell dam and Opelika and Janett, to cost about $1,000,000. Surveys have already been made for the transmission line.

BIRMINGHAM, ALA.—The Phœnix Portland Cement Company will build a power plant in connection with its proposed mill at North Birmingham, estimated to cost about $2,000,000. Headquarters are in the Real Estate Trust Building, Philadelphia, Pa.

IMBODEN, ARK.—The Imboden Hydro-Electric Power & Manufacturing Company, recently organized, has options on Yosemite lands along Spring River. It proposes to develop about 2,000 hp.

PINE BLUFF, ARK.—The Tillar Light & Power Company plans for the immediate rebuilding of the portion of its local power plant recently destroyed by fire.

MONROE, LA.—The Council has authorized the preparation of plans for improvements in the municipal power plant to cost about $12,000. Bids will soon be asked.

RAYVILLE, LA.—The Council is arranging for a bond issue of $150,000, the proceeds to be used for a municipal electric power plant and system.

BASTROP, LA.—The city has voted bonds for $45,000 for extensions and improvements in the municipal electric system and waterworks.

DRUMRIGHT, OKLA. — The Oklahoma Gas & Electric Company has surveys under way for the construction of transmission lines to Cleveland and Pawnee, Okla., consisting of two individual lines to these respective districts. A new power plant is contemplated at Drumright, which will be equipped as a central distributing point.

TEMPLE, TEX.—The city has awarded a contract to the Temple Electric Company for the installation of an ornamental lighting system in a portion of the business district.

CORSICANA, TEX. — Preliminary plans are under way for the installation of an ornamental lighting system in the business district. Service will be furnished by the Corsicana Electric Light Company.

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Pacific and Mountain States

MILAN, WASH. — The Mount Spokane Power Company has applied for a franchise in Clayton and West Clayton and to build 8 miles of pipe line. The cost of the work is estimated at $35,000.

OKANOGAN, WASH. — The Okanogan Valley Power Company will extend its transmission system in the Pogue Flat district.

TACOMA, WASH.—The Council has approved the installation of an ornamental lighting system on Sixth Avenue from South G Street to South Pine Street.

BANDON, ORE.—The Council has decided to complete the hydro-electric dam on Willow Creek this summer. The cost is estimated at $7,000.

SALEM, ORE.—The Oregon Pulp & Paper Company contemplates the installation of a power house in connection with its proposed four-story mill, estimated to cost about $300,000.

ANTIOCH, CAL. — Arrangements are being made for the installation of a series of electrically operated pumping plants at the Birtschmann ranch, near Antioch, to cost about $100,000. Easley & Anderson, Antioch, are engineers.

LOMPOC, CAL.—The Midland Counties Public Service Corporation is planning to erect a large substation in Lompoc.

LOS ANGELES, CAL.—The city power bureau has broken ground for the construction of a two-story substation, 55 ft. x 107 ft., on the Harbor Boulevard, San Pedro, for power and light service, to cost about $300,000. Transformers, condensers, switchboards and other equipment will be installed.

PAYSON CITY, UTAH.—Plans are under consideration for the installation of a better street-lighting system.

DILLON, MONT.—The Montana Power Company will build a transmission line from the Madison River to Dillon, to cost about $50,000.

GILA BEND, ARIZ.—The State Corporation Commission has granted F. F. Weidner authority to operate an electric plant here.

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Canada

VANCOUVER, B. C. — Tenders will be received by the Vancouver Harbor Commission, until Oct. 2 for electrical equipment for the new Ballantyne pier. The cost of the work is estimated at about $200,000. A. D. Swan is consulting engineer.

HULL, QUE.—The Hull Electric Company has acquired property holdings along the shores of the Gatineau River, including the riparian rights to the Paugan Falls, where it proposes to establish a hydro-electric plant with an ultimate capacity of 150,000 hp. The cost is estimated at $10,000,000.

QUEBEC, QUE.—The Grand Metis Falls on the Metis River will be developed by the Lower St. Lawrence Power Company. The initial installation will have a capacity of 3,000 hp. and will serve sixteen municipalities. The proposed development, it is stated, is being financed by Newman, Sweezy & Company, Montreal, and McLeod, Young, Weir & Company, Toronto, Ont.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 22, 1922)

1,426,947. Electrical System; S. R. Bergman, Nahant, Mass. App. filed Oct. 26, 1920. Farm-lighting apparatus.

1,426,966. Secondary Electric Battery or Accumulator; H. Dean, Clifton Junction, England. App. filed Sept. 30, 1921. Construction prevents spilling of electrolyte.

1,426,971. Electrical Apparatus; G. Faccioli, Pittsfield, Mass. App. filed March 11, 1919. Windings to withstand high-frequency phenomena.

1,426,981. Insulator; W. T. Goddard, Rochester, N. Y. App. filed July 5, 1919. With rocking bearing on connecting element.

1,426,993. Closed-Circuit Relay; P. Kardaetz, Berlin-Reinickendorf, Germany. App. filed Dec. 13, 1921. Construction insures operation in case of interruptions of short duration.

1,427,011. Electric Battery Electrolyte; L. G. Orsolino, Manila, P. I. App. filed Feb. 7, 1922. Electrolyte for primary battery consisting of vinegar obtained from sap extracted from palm trees.

1,427,017. Fingerpiece; J. S. Popper, New York, N. Y. App. filed Jan. 19, 1921. Dials of machine-switching telephones.

1,427,054. Electrical Starting and Igniting Apparatus; J. Bohli, Obach, Solothurn, Switzerland. App. filed July 6, 1921. Current taken from battery on starting to produce large sparks.

1,427,067. Engine-Starting System; W. A. Chryst, Dayton, Ohio. App. filed Sept. 19, 1917. Motor for starting gas engine acts as generator.

(Issued Aug. 29, 1922)

1,427,094. Electric Heater; P. Daniel, Bound Brook, N. J. App. filed Aug. 27, 1920. Vaporizes gasoline at spray nozzle of carburetor.

1,427,138. Umbrella-Handle Lighting Device; L. Wakicki and C. Bober, New Britain, Conn. App. filed Nov. 16, 1921. Light and battery inserted in handle.

1,427,160. Hook-Switch Mechanism; R. H. Manson, Rochester, N. Y. App. filed Nov. 19, 1917. Automatic telephone hook-switoh.

1,427,170. Telephone-Exchange System; F. M. Slough, Rochester, N. Y. App. filed Dec. 5, 1917. Cross-connecting on central board to prevent overloading of single section.

1,427,171. Electrolytic Apparatus; A. W. Smith, Cleveland, Ohio. App. filed Nov. 8, 1920. For decomposing water.

1,427,203. Current-Lighting Device; B. E. Getchell, Greensburg, Pa. App. filed Aug. 25, 1917. Limits current supplied to consumers where meters are not employed.

1,427,231. Electric Seam-Welding Machine; E. Schroder, Berlin, Germany. App. filed March 15, 1920. Machine moves forward a certain distance and welds, then returns a shorter distance and welds, etc.

1,427,236. Electrolytic Method and Apparatus; J. J. Sherwood, St. Louis, Mo. App. filed March 20, 1920. Gas generated is withdrawn to prevent decrease of plate surface.

1,427,255. Electric Circuit Protecting Device; S. N. Baruch, San Francisco, Cal. App. filed Nov. 11, 1919. Thermal and electromagnetic relay.

1,427,301. Gearing for Engine Starting and Lighting Generator; A. J. Kloneck, New York, N. Y. App. filed May 16, 1917.

1,427,324. Process for Manufacturing Electric Transformers of Small Power; C. M. E. Priestley, Paris, France. App. filed Feb. 11, 1913. Coil, terminals and core placed in mold and subjected to molten insulating material.

1,427,342. System of Control; B. O. Austin, Wilkinsburg, Pa. App. filed Oct. 6, 1919. Automatic acceleration of either alternating-current or direct-current railway motors.

1,427,350. Radiotelegraphic Coupling; J. Bethenod, Paris, France. App. filed Sept. 2, 1919. Between antenna and high-frequency generator that directly feeds the frequency employed.

1,427,352. System of Control; W. G. Brooks, Chicago, Ill., and L. G. Riley, Wilkinsburg, Pa. App. filed Nov. 28, 1919. Operating two railway cars with type "K" controllers from one car using three train-line conductors.

1,427,356. System of Control; A. H. Candee, Pittsburgh, Pa. App. filed Oct. 6, 1919. Accelerating resistor for multi-control railway operation.

1,427,360. Single-Phase Dynamo-Electric Machine of the Induction Type; L. W. Chubb, Edgewood Park, Pa. App. filed Jan. 16, 1919. Auxiliary closed primary winding to damp out harmonics.

1,427,367. Circuit Interrupter; C. Le G. Fortescue, Pittsburgh, and F. C. Hanker, Wilkinsburg, Pa. App. filed Oct. 17, 1918. Electromagnetic relay.

1,427,368. Circuit Interrupter; C. Le G. Fortescue and J. B. MacNeil, Pittsburgh, Pa. App. filed Oct. 17, 1918. High-speed electromagnetic interrupter.

1,427,369. Circuit Interrupter; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Oct. 17, 1918. Magnet core air gap bridged by armature controlled by current in circuit.

1,427,393. Catenary-Suspension System; P. M. Jorstad, East Pittsburgh, Pa. App. filed Dec. 7, 1920. Two messenger cables on towers hold trolley wire.

1,427,401. Coil Support for Dynamo-Electric Machines; W. K. McAfee, Edgewood Park, Pa. App. filed Oct. 13, 1917. Support for field-magnet coils.

1,427,407. Current-Collecting Device; C. B. Mills, East McKeesport, Pa. App. filed Nov. 26, 1918. Brush-holding device for slip rings.

1,427,416. Electric Motor; W. R. Ray, San Francisco, Cal. App. filed Oct. 22, 1919. For centrifugal atomizing burner with means for supplying air.

1,427,436. Electric Furnace Construction; W. E. F. Bradley, Nyack, N. Y. App. filed July 22, 1918. For reducing iron ore.

1,427,462. Lamp Stand; E. Herbeck, New York, N. Y. App. filed March 5, 1921. Floor or table lamp built in two sections to facilitate shipment.

1,427,473. Automatic Telephone Switch and System; D. S. Hulfish, Toronto, Ont., Can. App. filed Dec. 8, 1917. Power-driven electrically controlled switch and circuit systems for connecting switches for service, with methods of operation.

1,427,485. Governing Mechanism for Internal-Combustion Engines; J. F. Lindberg, Chicago, Ill. App. filed Oct. 25, 1920. Electromagnet controls carburetor.

1,427,494. Cable Splice; J. A. Newberry, Huntington, W. Va. App. filed Sept. 17, 1919. Sleeve compressed around cable joint.

1,427,509. Winding Machine; J. C. Anderson, East Orange, N. J. App. filed June 18, 1920. For winding wire and insulating material on to coils.

1,427,543. Electric Alarm Transmitter; J. D. Nelson, Cincinnati, Ohio. App. filed June 4, 1917. Indicates abnormal conditions in pressure systems.

1,427,548. Electric Bell; E. Raboni, New York, N. Y. App. filed July 21, 1919. Insulated plunger makes and breaks circuit as it strikes bell.

1,427,593. Bearing Alarm; H. L. Henderson, Terre Haute, Ind. App. filed Oct. 18, 1921. Expansion of rod closes circuit when bearing is overheated.

1,427,596. Electric Water Heater; A. C. Hulbert, San Francisco, Cal. App. filed June 11, 1921. Resistance heater is U-shaped.

1,427,621. Insulating Composition; Jerry Najarian, Hartford, Conn. App. filed Feb. 19, 1921. Composed of gum, incense, rag ashes and white of eggs and is not affected by oil and water.

1,427,644. Electric Elevator Control System; S. W. Rushmore, Plainfield, N. J. App. filed Nov. 7, 1919. Several motor fields separately excited and controlled by single generator.

1,427,659. Trolley Harp; J. G. Vinson, Graham, Ky. App. filed March 4, 1922. Sliding contact combined with wheel.

1,427,671. Magneto Electric Machine; A. P. Young, Kenilworth, England. App. filed Nov. 15, 1920. For internal-combustion engines.

Electrical World

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Is Your Family United?

EVERY man in the electrical industry today believes in co-operation. It goes without saying that the local electrical family in every community should organize and harmonize its interests, purposes and policies so that the public will see electrical men agreed on principles and working together in friendly accord.

So well has this been demonstrated that the local electrical league is recognized as the very keystone of the present movement to electrify America for which the entire industry is working. The Joint Committee for Business Development has enlisted the members of the Electrical Supply Jobbers' Association and the National Association of Electrical Contractor-Dealers in the taking of a census for the purpose of determining the best men in every town to lead and form a nucleus of local co-operative associations. The foundation of the movement is to be laid right there.

But what of the cities that already have leagues?

THERE are three kinds of situations in these centers where the local electrical families are already organized. Some are alive and active and doing good work. They will go on and increase their influence under the stimulus of the national campaign. Some are dead and doing nothing. They must be awakened, revitalized and set to some interesting constructive purpose. But there is still another class.

This third class offers the most difficult problem in the whole program of organizing local co-operation. They are the divided leagues in a number of the larger cities—the leagues that have been longest organized and are now split into two camps, with probably the central station and the jobbers on one side and the contractor-dealers on the other. Because of the traditions grown out of past conflicts between antagonistic personalities they refuse to play—or work—together.

Their interests are the same. They are absolutely interdependent. In the minds of the public they are inseparably linked together as "electrical men." But neither will follow the other's lead in any project, and so electrical development in that community walks on one foot and makes slow progress.

WE HAVE a common responsibility in all of this, we electrical men. Either we believe in co-operation or we don't; and if we are for it at all, it is a principle worth promoting in our own towns. If we have no league, therefore, we must aid in getting one started. If our league is dead, we must help man the pulmotor. And if we live in a divided family, there is an even greater thing to do.

Some one must lead these two opposing clubs into a bigger, better, more ambitious organization, where the contentious past may be forgotten in progressive plans and creative activities that offer both groups more interesting opportunity and more profitable achievement. Who is the man? We must go to him now, convince him that it is his job and offer to help.

John E. Zimmermann

Consulting engineer, public utility executive and business man, who is the operating head of many properties controlled by leading financial interests.

THE marvelous growth and splendid standing of electric light and power enterprises in this country have resulted from action taken by farseeing executives in the industry in co-operation with skilled engineers and financiers. The outstanding fact about John E. Zimmermann is that he is a public utility executive and operating head of many properties managed for leading financial interests in this country.

The properties that are under Day & Zimmermann management and are under Mr. Zimmermann's personal direction serve communities in Ohio, Indiana, Pennsylvania, Delaware, Maryland, District of Columbia, Virginia, Georgia and Alabama and include electric light and power systems, electric railways, gas plants and steam-heating systems. Mr. Zimmermann has served as consultant in executive problems relating to utilities and industrial establishments and has negotiated several of the larger power contracts that have been executed between utilities.

Previous to entering the public utility field Mr. Zimmermann's experience as an engineer included the direction of the construction of industrial plants and the direction and administration of manufacturing. He is vice-president of Day & Zimmermann, Inc., New York City, and serves as an officer or director of a large number of public utilities where his executive talents have been utilized to develop and extend the properties.

Mr. Zimmermann was born at Buenos Aires, Argentine Republic, on Jan. 31, 1874. He was graduated from the National College in Buenos Aires in 1894 and later studied at the University of Buenos Aires and at the University of Pennsylvania. He served as mechanical engineering apprentice in the shops of the Great Southern Railway and later was employed as an engineer and chemist with other Argentine companies.

Upon his arrival in this country Mr. Zimmermann became connected with the George V. Cresson Company of Philadelphia, and then with the American Pulley Company as superintendent of construction of its new plant. Later he became secretary of the company, in charge of manufacturing. In 1907 he became a member of the engineering firm of Dodge & Day, now Day & Zimmermann, Inc. He is a member of the N. E. L. A., the A. S. M. E., the Franklin Institute, the Newcomen Society (London), the Pennsylvania Historical Society and the Pennsylvania Museum and School of Industrial Art.

Editorial Comment

Electrical World, September 23, 1922
Volume 80 Number 13

Another Case of Bung and Spigot

A CALLER in the office of a utility the other day sat waiting for the general manager to come out of a conference. He sat not far from the cashier's window and listened to his conversations with the customers who came in to pay or to discuss their bills. The man at the cashier's grill was not cordial, he was not courteous, he was not agreeable, he was not attentive, he was not careful to explain away fully, clearly and satisfactorily the misunderstandings that were brought to him. In other words, he failed to make himself an influence for friendship; he became an influence for discontent, sowing seeds of trouble among countless customers.

The visitor was greeted by the general manager in a few minutes with apologies for having kept him waiting and the explanation that the chief officials had been gathered with the president. They had been discussing the promotion of good will and laying plans for better personal service. And while these high-priced men were talking in the upper room, their honest purposes were being double-crossed by an unguided employee below.

Time for Complete Analysis of Rural-Service Costs

IN ALL the talk about the cost of rural service there has been little or nothing done in the way of a clean-cut analysis of the costs of the service from the foundation up. By this is meant a study that extends back to the power house and ends with a statement of the total cost of all items involved in the service. The practices in financing and maintaining the few lines that exist have been such as more or less to obscure the total costs, because, under the existing conditions, it has been necessary for the consumer to carry a part of the burden and the costs of that burden have not been reduced to the dollars-and-cents cost to the consumer. The cleanest-cut study yet made public has been made in Iowa, and on another page will be found the results of that study embodied in an article by W. J. Greene.

Very soon it will be necessary for the central-station executive to face this problem on the same basis as that on which other central-station business rests. Probably that means the financing of the lines by the utility. It also means that the customer must pay the cost of the service. Central-station commercial departments cannot afford to face the issue without having first made a thorough analysis of the factors that go to make up cost. It is entirely likely that every plan now in use will be subjected to searching scrutiny, and if any weak spots are present, they will be found. The analysis presented in Mr. Greene's article is important because it dodges no issue but, on the other hand, brings out costs of service that are likely to make some men who are attempting to give rural service dodge. There is no reason, however, why they should dodge or why they should fear the figures. The costs are there regardless of how the service is obtained, and unless the facts are faced, an unpleasant reckoning will sooner or later be necessary. There are many cases to be found now where a failure to face the situation has produced serious results, and some executives have on their hands a problem they are without any means of handling successfully. A careful study of the figures in Mr. Greene's article and an analysis of individual situations in the same way will be well repaid.

Some Reasons for Government Interference in Business

AN INDIANA coal operator has been quoted in Chicago papers as making the declaration that enough would be added to the price of coal to insure that the losses of the strike shall be paid by the consumer by next April. A similar statement was made about the same time by a prominent Iowa operator. The assertions do not convey anything new to those who have thought seriously about the situation created by the coal and rail strikes. To those who have not paused to think as well as to those who have, however, such avowals have much the effect of waving a red rag at a bull. All through both strikes many who have been prominent in the public eye have taken a very frank "public-be-damned" attitude, buried, it is true, under a thin camouflage of solicitude for the public good.

It is not many years since the same attitude displayed in these two strikes was all too prevalent in the utility field in matters other than labor controversies. This was conspicuously the case with steam railroads. The result was their regulation by the Interstate Commerce Commission and a general placing of other utilities in the hands of state commissions. Whether the control exercised by governmental agencies is good or bad may be open to debate, but there can be no debate as to the responsibility for the acts which led to such control. The biggest single agency which brought it about was the attitude of mind of those at the head of the business enterprises themselves. The coal industry is rapidly shaping its course so as to bring governmental control that may be good or bad economically. If it comes, neither the owners nor the labor unions will have the power to produce such a situation as that now existing. In the railroad field the actions of labor unions and railroad managements that have produced the present situation are steadily forcing governmental control. Whether such a course be economically right or economically wrong, a continuation of present conditions will compel that such a course be taken.

When such control shall be a fact the industries involved will have only themselves to thank. Today they have in their hands the decision as to whether the government shall withdraw from further interference in their business or whether its activities shall be increased.

All of the activities of radicals and the efforts of political demagogues, bad as they seem, can do little to cause such interference unless the businesses concerned play into their hands. It will pay the interests which are so vociferous about government interference in business to study carefully the reasons why some industries are already under strict governmental regulation.

Economics and Sentiment in Accident Prevention

A HEALTHY tone in the discussion at the National Safety Council meetings in Detroit was observable in that the two principal motives for safety work in industry were properly balanced. These motives are the humanitarian and the economic. Two extreme views of such work are quite likely to be found in any discussion and to lead to serious error. The first is the cold-blooded idea that would balance life and limb against the expense account and sacrifice the welfare of employees unless the balance sheet shows a net profit on safety work. The second is the idea of the sentimentalist who resents the consideration of expense and insists on extreme measures for safety at any cost. One holding this view is quite likely to insist that safety is paramount to everything else and to champion entirely impracticable plans. Either of these extreme views defeats its own ends.

Accident prevention and safety work must be devoted to throwing every reasonable precaution around the work of the shop and the field so that human life and limb shall be protected. In this the question as to whether a few dollars shall be saved and injury to human bodies risked must not enter. If there is a real risk, the cost to industry of eliminating that risk is a justifiable cost. In such work must be included education of the workmen, as one of the most serious problems in any accident prevention program is the protection of men against their own acts and propensity to take chances. On the other hand, there is a very real economic problem that must be considered. Only half of this problem is reflected in the financial balance sheets of industry. That half is the cost of accident prevention and the saving in direct cost of accidents. The other half is the cost of accidents to the men who are the victims. Accident prevention to them and to their families is a direct gain by reason of the saving of life, limb and suffering for which no sum of money can compensate.

To both employer and employee accident prevention has a very real and very valuable economic aspect. Accident prevention, with all the good work that has been done for it in the past twenty years, is neither a matter of cold-blooded calculation on a dollars-and-cents basis nor a matter of sheer sentiment. It is an intensely practical question as to how the tasks of industry can be accomplished so that the greatest measure of human happiness and welfare can be attained with the minimum of suffering. Its results must not be judged either exclusively in money saved or exclusively from the point of humanitarian sentiment, but through a properly balanced consideration of both.

The 165,000-Volt Caribou Development

NOT the least of the achievements of the last year or two in electrical engineering has been that of the Great Western Power Company of California, which in its Caribou development has broken two records and has paved the way for still further progress. The two advances made in this station, although not large steps in themselves, have been important. The first concerns the size of the impulse wheels. These are rated at 15,000 hp. each, two of them being connected to each generator. The effective performance of these wheels has been noted with the greatest interest.

The transmission line, while nominally its tension is only 15,000 volts higher than that of other lines already in operation, is marked by the first extensive use of static shields to reduce the voltage duty of the insulator units nearest the line conductor. It having been found that the troublesome flashovers to which high-voltage lines are subject have been due largely to overstressing of the line units and subsequent cascading of the entire string of insulators, it was thus necessary to reduce the voltage drop across these particular units.

The reason the line end unit has a higher voltage duty is that it must carry the charging current for the entire string of insulators, and inasmuch as its capacity is quite small the comparatively large flow of current results in an excessive potential drop across the unit. Two distinct methods of reducing this voltage duty have been advocated, one through the increase of the capacity of the units by increasing the superficial area of the metallic parts of the insulator, the other by means of static shields from which the excessive charging current for the insulator string would be carried to the second unit from the line conductor. In the case of the Caribou development it was considered most feasible to make use of a static shield. The success of this method of protecting the line end unit will mean much to the 220,000-volt transmission lines which will be placed in operation within the next two or three years in California.

Blind Alleys in the Teaching Profession

THIS is the time of the year when several hundreds of young men become college instructors and assistants in various branches of electrical and mechanical engineering. Some accept an appointment from a college in order to continue their studies, some like teaching, and to some it is just a "job." It is universally recognized that the training of future engineers should be intrusted to much more mature teachers than most American colleges are in a position to hire and the responsibility for such an unsatisfactory state of affairs rests on the country as a whole. But the young teachers themselves should clearly realize the highly responsible nature of their work and should lay out their plans and life aims accordingly.

A young instructor in engineering who neglects his pupils for the sake of his own advanced studies is just as undesirable as one who is so busy with his students or administrative work that he altogether neglects his own education. Both are headed for a blind alley of disappointments and regrets. Somewhere there is a balance between giving to the students from one's own store of knowledge without adding to it and using the vast reservoir of accumulated scientific and professional wisdom for one's own profit only and failing to turn it to that of others.

A correct solution of the life problem of a young instructor in electrical engineering is not possible without a clear understanding of at least the following two propositions: (1) A teaching career is worth while only if continued for a number of years with the ultimate hope of rising into the ranks of the leading professors of the country; (2) success in teaching is inseparably connected with a constant untiring study of the fundamentals of the theory of electricity, from different points of view and in various applications. A young instructor who understands and follows these principles will study his fundamentals systematically, without haste, year after year, each year becoming a better teacher and a better authority for practical men. If we had more teachers of this type, the intellectual output of our large engineering colleges, both in men and in books and articles, would be much higher and we would no longer be referred to as a nation of salesmen.

Efforts for a Lighting Code in England

THE report of the British Home Office departmental committee on lighting of factories and workshops, which became available a short time ago, is the work of eight well-chosen experts. The results of their consideration of industrial lighting are of decided interest as compared with the work in this country which finally culminated in the American standard code of the Engineering Standards Committee. Any committee dealing with this particular subject in the present state of industrial organization finds itself between the devil and the deep sea. It is spurred in one direction by the desire to enforce good illumination and in the other by lack of funds and the stubborn opposition of certain classes of large manufacturers who are willing to sacrifice nearly anything belonging to their workmen to save a little trouble and expense. The result is that while in some respects the British committee has gone further in its recommendations than has American code practice, in others it has stopped far short of doing anything efficient.

For example, an illumination of not less than 0.25 foot-candle is required not only at the floor level over working areas, but in all open exterior workplaces and in ways leading thereto which may be considered to require it; and, specifically, in all working spaces and spaces ordinarily traversed in iron foundries 0.4 foot-candle is required at the floor level. Only a few definite things were taken up in the preliminary report of 1915, but in the second report (1920) the English committee, in preventing glare, went to the length of requiring unshaded lamps to be kept down to an intrinsic brightness of not more than 5 candles per square inch and requiring a cut-off of 20 degrees for all lamps within 100 feet of the workman, to be increased to 30 degrees for lamps within 6 feet of the workman. This requirement is a long way beyond the recommendations of the American code, and in the right direction.

The present report is an attempt to investigate and define adequate illumination for certain processes carried out in factories and workshops, but the committee has not gone far, lacking funds and opportunity for obtaining information. The most interesting feature of the few studies which were made was the effort to ascertain the effect of mixed artificial and natural illumination, concerning which no definite information was finally obtained either to confirm or to disprove the impression, general here, that such a mixture is decidedly trying.

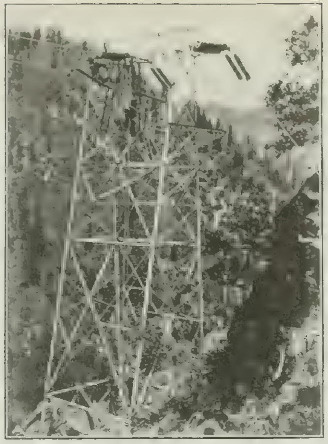
The English committee has tried to classify the types of work requiring illumination under three subdivisions —ordinary work, fine work and very fine work. The recommendations for the two latter classes were 3 foot-candles and 5 foot-candles respectively. But clearly the details of the investigations were not thorough enough to permit recommending any specific intensities for work which would be classified here as rough. One interesting study was made in needlework, the results of which are worth quoting. The particular task was making buttonholes, and the special features to be emphasized are that whereas on white material 3 foot-candles of artificial light was regarded as somewhat insufficient, on black material 6 foot-candles was decidedly too low to permit continuous work, and that this intensity of daylight illumination was materially better than artificial lighting. All of this is quite in keeping with the indications obtained in this country that it is extremely difficult to get light enough when black materials are being worked.

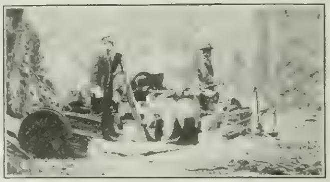
In general, the English committee, although handicapped in divers ways, has made excellent progress in the right direction so far as it has gone. It is feeling its way toward more complete requirements, and we fancy that its later reports, after it has had opportunity for further investigation, will carry it to substantially the same goal that the American Engineering Standards Committee has already reached.

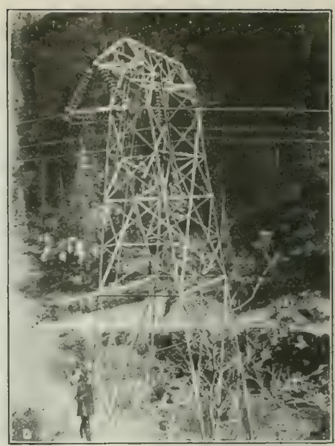
Remote Control of Plant Apparatus by Radio

REMOTE control of plant apparatus by radio has been attracting keen attention among central-station men and has been stimulated by the press reports of the control by this means of oceangoing vessels, as well as by some reports regarding land vehicles that have lately appeared. Of course, some means of translating radio signals into a form that can be utilized in operating switches or other control apparatus is the first necessity, since in the present development of radio apparatus sufficient power to perform the operations directly cannot be transmitted by any known means. Relays that will act as a translating device have recently appeared on the market, largely for use in recording telegraph code signals, and it is possible that they might be utilized to receive and translate remote-control signals. One of these devices, the product of the radio laboratory of the Bureau of Standards, is of particular interest to the central-station man who must study remote-control problems because of its simplicity and the lack of delicate adjustments and from the fact that in one form it dispenses with the use of batteries.

The whole problem is hardly out of the region of speculation, and for some time to come any work done will be frankly experimental. Some promising developments have been made in the naval control field, and the men who like to experiment with such problems cannot afford to overlook the relay development mentioned.







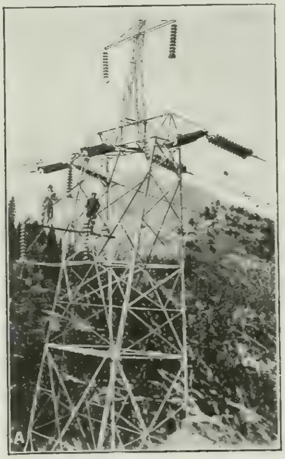
A—Erecting dead-ends and jumper loops on snow towers.

B—View showing reels along the railroad track and conductors being pulled out to right-of-way several hundred feet above on the mountain side.

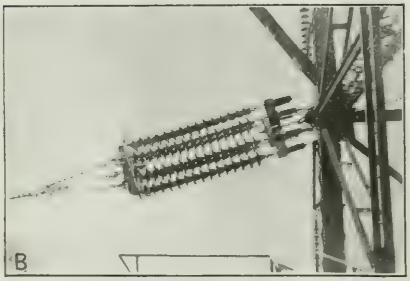
C—Pulling machine in operation drawing in conductors from along railroad track. Note re-reeling device in operation alongside the pulling in drum.

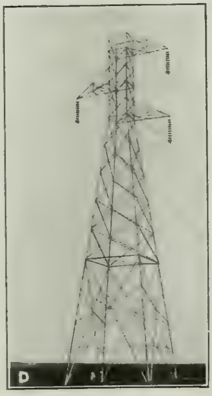
D—Installing section switches which are used for line testing.

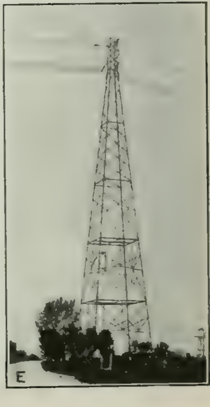
Mountainous Country and Hazards from Sleet and Snow Made Caribou Development Particularly Difficult



THE first 50 miles of 165,000-volt transmission line which the great Western Power Company has constructed from its new Caribou development had to be erected over mountains about as rough as any across which lines can be built. Furthermore, portions of the line are subjected to very severe sleet storms which make the tower and line construction requirements even more rigorous. Some of the difficulties encountered and methods of overcoming them are illustrated on this page and discussed more at length on following pages. The flat construction used in the higher regions, the transposition arrangements and long-span insulators are interesting.







A—Transposition tower-flat construction.

B—Dead-end insulator on Carquinez span (length 4,753 ft.), consisting of eight strings each of fifteen standard 10-in. units. Normal stress on insulator, 8 tons; maximum stress, 10 tons.

C—View of the canyon taken in the eleventh mile. Note location of two towers in the upper left-hand corner and main line of Western Pacific Transcontinental railroad in the lower right-hand corner.

D—Standard tower in valley section.

E—Crossing tower used on Sacramento River—navigable stream.

Caribou 165,000-Volt Development

Noted for Its 15,000-Hp. Impulse Wheels, Its High-Voltage Lines Over Exceptionally Rugged Country and Method of Handling Work and Distributing Material

By **J. A. KOONTZ**

Electrical Engineer Great Western Power Company

THE Caribou station of the Great Western Power Company of California, which was put in service in 1921, is the largest of a series of developments that will ultimately utilize the water power on the north fork of the Feather River between the storage reservoir of Lake Almanor and the Sacramento Valley at Oroville. This section of the river has a drop of 4,300 ft. (1,310 m.) with a developed storage reservoir capacity of 300,000 acre-ft. (369,000,000 cu.m.), and by raising the dam an additional 45 ft. (13.7 m.) the reservoir will have a capacity of 1,250,000 acre-ft. (1,543,500,000 cu.m.), with the spillway crest at an elevation of 4,500 ft. (1,356 m.) above sea level.

Water for the station is brought from Lake Almanor through an 11,200-ft. (3,413-m.) tunnel of 7-ft. x 7-ft. (2.13-m. x 2.13-m.) section to Butt Valley, where it is permitted to flow down Butt Creek for about 6 miles (9.65 km.) to the intake reservoir of 1,700 acre-ft. (2,091,000 cu.m.) capacity, whence it is again taken through a tunnel 9,200 ft. (2,804 m.) in length to the top of the hill above the station.

The second tunnel, No. 2, is of circular section, is lined with concrete and is 10 ft. (3 m.) inside diameter. It terminates in a pressure tunnel and is connected to a 30-ft. (9.14-m.) cylindrical surge chamber. This surge chamber extends 50 ft. (15.2 m.) above the normal water level. The pressure tunnel has been driven through the rock for the first 100 ft. (30.4 m.) of head with a slope of 28 deg. The pressure tunnel was first lined with heavy reinforced concrete, then with a $\frac{3}{16}$-in (4.7-mm.) steel tube of 11 ft. (3.35 m.) inside diameter, and finally with an 8-in. (21.5-cm.) protecting concrete belt on the inside of the steel. This pressure tunnel connects at the bottom with three steel pipes of 66 in. (1.68 m.) inside diameter, two of which extend down the hill and are later reduced to a diameter of 60 in. (1.52 m.). Later each 60-in. pipe is connected into a "Y," where they later branch into two 42-in. (1.07-m.) pipe lines, each of the latter being for a single wheel and two impulse wheels for each generator. The effective head on the wheels is 1,010 ft. (307.8 m.) under load conditions, and the 22,223-kva. units are driven by two wheels. The units are of the two-bearing type. At present only two of the three pipe lines are installed, the third being capped to be utilized when the third unit is installed.

Each impulse wheel is driven by a single 11-in. (28-cm.) water jet which is controlled by a needle and independent governor. Each waterwheel can be operated independently and is capable of carrying half the generator load. The wheels are rated at 15,000 hp., but from test they are known to develop over 16,000 hp. Each nozzle has its own relief valve actuated by the governor and by pressure, so that any wide fluctuations of load or abnormal pressure rises will open the relief valves and relieve the surge conditions. The water pressure in the pipe lines just ahead of the nozzle is 446 lb. per square inch (32.6 kg. per sq.cm.) at full load.

The power house is designed ultimately to accommodate six 22,223-kva. units and to deliver power at 165,000 volts to three outgoing lines. Additional space is provided for one incoming high-tension line which will carry approximately 25,000 kw. from a station to be located at the mouth of tunnel No. 1, where more than 200 ft. (60 m.) of head is capable of being utilized.

The generators are three-phase, 60-cycle, 11,000-volt and operate at 171.4 r.p.m. They are capable of charging 190 miles (305.7 km.) of 165,000-volt line without becoming self-excited.

At present the station has two 600-kw., 250-volt compound interpolar direct-current generators for exciting purposes. Ultimately an additional set will be installed. Each of these exciters is driven by a motor and waterwheel, while the third will be driven by an induction motor. Any two of the sets will have ample capacity for furnishing the entire excitation for the station.

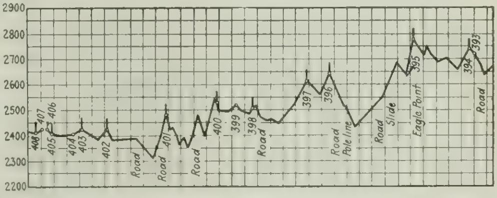


FIG. 1—A COMPREHENSIVE PROFILE OF THE LINE LOCATION WAS OF GREAT AID IN PLACING MATERIAL

On the actual profiles were indicated the horizontal angles, type of insulator connections, tower footings, extensions and type of tower. A section of the profile was given to the foreman on each portion of the line.

One bank of three 7,500-kva. single-phase transformers is used for each generating unit. The transformers are delta-connected on the 11,000-volt side and star-connected on the high-voltage side with the neutrals permanently grounded without resistance. These transformers are of the oil-insulated, water-cooled type.

In designing the station, provision has been made for double buses on both the high-tension and the low-tension side, and the 11,000-volt buses will ultimately be sectionalized with 8 per cent, 22,000-kva. reactors to reduce the short-circuit current which may be handled by the breakers.

The 11,000-volt buses are installed in separate rooms and in addition each bus is again separated by barrier doors into groups of three switches each. This scheme was utilized in an attempt to try to isolate trouble should it ever occur in a particular section. The same general scheme is carried out on the high-tension side, each 165,000-volt bus being on a separate floor and the switches set in concrete compartments.

The power-house building is 120 ft. (36.5 m.) high, 104 ft. (31.6 m.) wide, and the present length is 176 ft. (53.6 m.). The ultimate length of the building will be slightly more than 308 ft. (93.8 m.). The building is of reinforced-concrete construction with a steel frame.

The question of the proper transmission voltage for use in connection with this development received serious consideration, and for numerous reasons the voltage was finally placed at 165,000 instead of a higher figure. Two of the principal reasons for the selection of this voltage were the decrease in the initial investment thus permitted and the ability to utilize developed and tested equipment. This latter point was important at the time the Caribou work was started, which was just after the signing of the armistice and at a time when all manufacturing companies were working under difficulties and in no condition to attempt special development work.

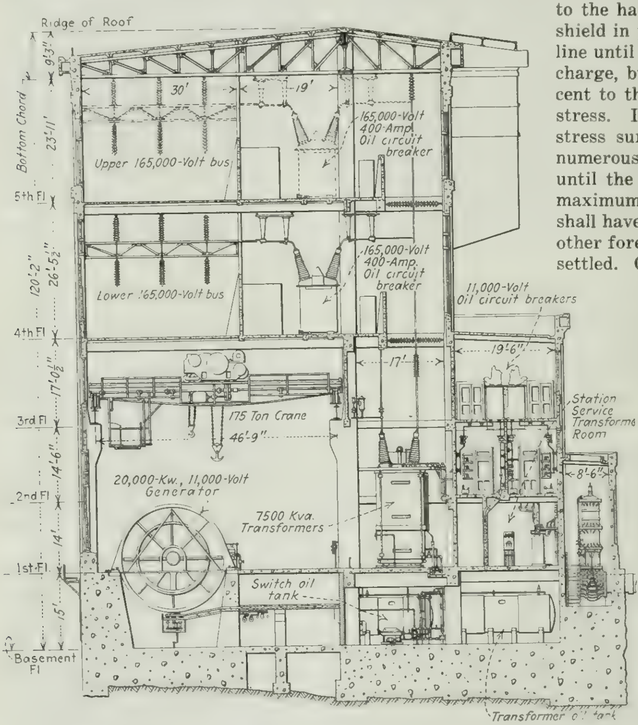


FIG. 2—SECTIONS THROUGH CARIBOU STATION INDICATE THE EXTENT TO WHICH IT HAS BEEN SAFEGUARDED AGAINST DISTURBANCES

As the most serious problem in connection with a high-voltage line is that of insulation, this problem had special attention. It has been shown from the experimental work of Prof. H. J. Ryan that when a suspension insulator string is composed of more than eight or nine units, depending on the physical dimensions, the addition of units to these strings will not reduce the voltage duty of the unit next the line wire for a given impressed voltage.

With this in mind, various schemes were considered and certain tests were made to determine the effectiveness of grading and the use of various guards and shields. Finally a flat 12-in. (30.5-cm.) disk with heavy rolled rims was selected. By the use of this shield the voltage duty on the first unit was reduced from 19,500 to 14,000 volts and the duty on the second unit was raised only from 14,500 to 15,000 volts. All other units, with the exception of those on the tower end, showed a slight reduction in voltage duty.

There are many modifications in shape and size which can be made in the guard shields or rings which will give additional improvement in voltage distribution, but for our particular case it was felt that this simple type would give us ample protection. It was readily attached to the hardware and simple to install. With this shield in place the voltage can be increased on the line until the conductor is covered with corona discharge, but the clamp and wire immediately adjacent to the clamp will be entirely free from overstress. It is hoped through this reduction of air stress surrounding the insulator attachment that numerous flashovers may be eliminated. However, until the line shall have been in operation at the maximum voltage for some time and the insulators shall have acquired the usual collection of dust and other foreign matter this point cannot be definitely settled. One of the main reasons for using a shield in place of the graded string was that use might be made of the standard 10-in. (25.4-cm.) short-coupled units which have been developed and made rather reliable. It was felt that if larger and specially developed units were used there was danger of serious depreciation of insulators.

The diameter of the line wire was selected so that the line would be practically free from corona loss at normal voltage and under normal weather conditions, and for the first time to the knowledge of the writer conductors of different diameter were used on different ends of the line. This was especially advantageous in this case, as there was approximately 15,000 volts additional between conductors at the generating end; but the power house is situated at 3,000 ft. (914 m.) above sea level, this altitude gradually decreasing from the generating station until at Oroville, 50 miles (80.4 km.), there is a sudden drop from 1,500 ft. (457 m.) elevation to about 250 ft. (76.2 m.), the remainder of the line being at less than 500 ft. (152 m.) above sea level. At Oroville the diameter of the wire was changed from 0.86 in. (2.19 cm.) to 0.74 in. (1.88 cm.).

The cable used throughout the line was thirty-seven-strand steel-cored aluminum cable, consisting of thirty strands of aluminum and seven of steel, the smaller cable having a conductivity equal to No. 4/0 copper.

Throughout the mountain section, which is subject to sleet, single-circuit towers were used with conductors in a horizontal plane. This section covers the first 50 miles (80.4 km.) of line and is in the Feather River Canyon, which is about as rough a piece of mountain country as any in which a transmission line can be built.

In the valley section triangular construction was used. In stringing this section of line very few dead-ends were used, in fact only at points where the angle exceeded

20 deg., but at least once every mile "inverted V" construction was used. In general this construction was required by law on account of road or highway crossings, and it served for anchoring the line in place of the ordinary dead-ends. Because of past experience with dead-ends as few were used as possible.

On account of the rough nature of the country for the first 40 miles (64.3 km.) of line, a complete profile and tower location map was plotted, as shown in the drawing. The tower locations were made by use of a parabola template on this profile, and the wire was sketched in approximately to its true location. On this profile also were placed the horizontal angles, the type of insulator connections (whether suspension, tie-downs, "V" or dead ends), the tower footings, the extensions required for each footing, and it was indicated by the location of the footing diagram whether the tower was standard or anchored, the diagram for the standard tower being the square nearest the bottom of the drawing. This profile was found to be of great value throughout the work. A section of the profile was given to each foreman which covered his particular portion of line.

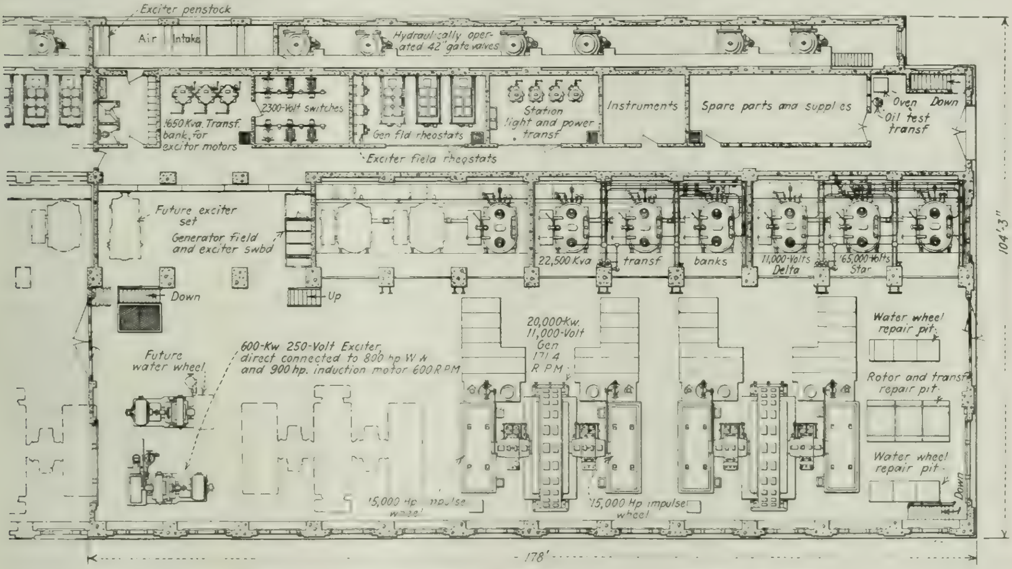


FIG. 3—UNIT TYPE ARRANGEMENT OF GENERATORS AND TRANSFORMERS PROVIDES FOR READY EXPANSION FROM TWO TO SIX GENERATORS

Throughout the mountain section it was necessary to devise special methods of handling the work and distributing materials. In many cases the track of the Western Pacific Railway was the only means of transportation. The material would be distributed by work train at the most accessible point, and from this it had often to be hauled up the mountain side by horses working along the railroad track or trails. At other places rope conveyors were installed.

Special pulling machines were developed for use in the first 12 miles (19.3 km.) of the line. These consisted of 6-hp. gas engines with twenty-to-one worm reduction, the worm driving two drums, one of 15-in. (38-cm.) diameter and the other of 7.5-in. (19-cm.) diameter. This machine was mounted on skids and could be lifted by its own power onto a push car and pulled down the track.

In stringing the conductors, at first a ⅜-in. (9.5-mm.) plow-steel messenger or pilot line was strung out in about 600-ft. (182-m.) lengths and threaded through the tower over suitable blocks. These lengths were equipped with an eye at each end which could be readily jointed to the adjacent sections. In this manner from 4,000 ft. to 8,000 ft. (1,200 m. to 2,400 m.) of line would be connected. At one end of this a special bridle was connected to the three aluminum conductors. The pilot line was then reeled in over the drum of the pulling machine and the conductors were drawn out. The insulators were hung in place before the conductor was pulled out, and a suitable roller-bearing sheave was placed at the bottom of the insulator string. When all three conductors were pulled up close to the tower, the outside conductors with their section of the bridle would be released and placed in the sheaves of their respective insulator strings. The bridle would be reconnected and the pulling continued.

After the conductors were threaded through the towers each one was pulled to approximate tension by the pulling machine and finally transferred to chain blocks for the final tension adjustment.

The pulling machine was so arranged that an empty reel could be placed on the side of the small drum and by running the free end of the cable around a sheave and back to this drum the 600-ft. (180-m.) length could be re-reeled as the cable was drawn through. These reels were of such size and weight that two men could handle them without difficulty.

One of the most difficult engineering and construction problems of the line was that of the crossing over the Carquinez Strait of the upper San Francisco Bay, where it was necessary to install a 4,753-ft. (1,442-m.) span, the wires of which had to clear the water 206 ft. (62.7 m.) at high tide. The wires cross not only the strait but also a railway, a highway and a heavy telephone lead. These had all to be kept open at all times and not interfered with during the process of erecting the wires. The towers are similar, each being 195 ft. (59.4 m.) in height and carrying six wires, three on each side. The wires are spaced 20 ft. (6 m.) in the vertical and 35 ft. (10.6 m.) in the horizontal plane.

Because of the ease of testing and making replacements and renewals the supporting insulators were composed of eight strings of modern 10-in. (25.4-cm.) suspension units, each string consisting of fifteen units. The eight strings are attached at each end to a steel spider, which in turn is attached through eye bolts and cables to the conductor or tower. These attachments are so arranged that by take-up on the eye bolts slight variation in sag can be readily adjusted. On the tower end the individual strings of insulators are fastened to an eye bolt, this eye bolt running through a coil spring which comes in compression against the steel spider on the tower end of the insulator. These eye bolts are threaded, and by proper adjustment of the attached collars the spring tension and hence the load on the insulator strings can be adjusted. The springs used in this work were all carefully tested, and only springs having the same length and compression characteristics were used on the same conductor support, so that by careful measurement of the spring length there is no difficulty in knowing that the various strings are carrying their proper proportion of the load. The total load per conductor support varies from 16,000 lb. to 20,000 lb. (7,200 kg. to 9,000 kg.), depending on wind conditions.

The conductor is a sixty-one-strand cable consisting of thirty-seven strands of double-galvanized plow steel and twenty-four strands of aluminum, the aluminum forming the outer layer of the cable. The steel is depended upon to take care of the mechanical load and the aluminum to carry the electric currents. It was originally planned to use an all-steel cable, but it was found that for the same weight an all-steel cable would be equivalent to adding about 15 miles (24 km.) to the length of the transmission line, while with the steel-aluminum combination it would only be adding approximately 1 mile (1.6 km.).

WORK DONE AT WAR PRICES

The total cost of the Caribou plant, including tunnels sufficient for the operation of 96,000 hp. in generating equipment, has been approximately $12,800,000. The cost of the 165,000-volt steel transmission line from the Caribou station to the Carquinez Strait, including sectionalizing switch gear, was approximately $2,600,000.

It should be borne in mind that this work was done at war prices and that it was necessary to construct more than 9 miles (15 km.) of broad-gage railroad and 13 miles (21 km.) of narrow-gage railroad, together with four inclined railways; also 10 miles (16 km.) of 22,000-volt pole line. All of this work has been completed and can be utilized for the completion of the Caribou station and in the erection of a 25,000-kw. plant at the mouth of No. 1 tunnel and the next plant down stream from Caribou.

It is estimated that the third generating unit can be installed in the power house as now constructed for an additional cost of approximately $1,000,000. A total expenditure of $13,800,000 will therefore enable full utilization of the present capacity.

Because of the enormous storage in Lake Almanor this plant can be operated at its maximum capacity throughout the year, and therefore a better indication of the value of this plant as a producer of electrical energy can be found in the fact that on a basis of full operation the capital cost per 1,000 kw.-hr. of output is $30.44. When the third unit is installed the capital cost of the plant and waterway structures per 1,000 kw.-hr. of output will be reduced to $21.87. Even the installation of the third unit will give only one-half of the ultimate plant capacity.

Constitution or Soviet?

A Denunciation of the Domination by a Minority of the People that Urban Growth Has Made Possible in This Country

BY DR. LOUIS BELL
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THE long deadlock in transportation and coal production now disappearing was no new phenomenon, nor did it display any exceptional features save in its unusually severe bearing on the community at large. It is of no importance here to consider the exact merits of the controversy, the provocation on both sides or the litigious spirit displayed. The point which is important to determine is whether the hundred million people of these United States who are not directly concerned in the struggle shall be made to suffer at the will of a comparatively small number of quarrelsome or stubborn fellow citizens. And more than all it is necessary to discover whether when such emergencies arise the government of the United States purposes to pursue a policy of pussyfooting in the face of danger to 95 per cent of its citizens and to resign, in effect, the powers of government into the hands of private organizations, whether of employers or employees.

We sometimes forget to what extent civilization has degenerated into a condition of unnecessary and dangerous dependence on inconsequentials. Under our modern industrial system, with a program of distribution enormously more intricate and expensive than is in the least necessary, it has become possible for a very small minority of the people to inflict almost unlimited damage on the remainder if they are permitted to do so.

I hold no brief for or against the trade unions as such. I believe that on the whole they have had a good effect by checking, after long struggles, child labor, the twelve-hour day, the company store and other evils and pushing active reform as against the efforts of the baser sort of industrialism. But, as things are in the present organization of society, the average man can be preyed upon in a way that constitutional representative government should make absolutely impossible. For example, suppose, on the one hand, that there should be a general strike of all plumbers or, on the other, a lockout of all grocers on the part of the provision magnates. Either situation would render at least the large cities of the country absolutely uninhabitable within ninety days, and the law has no hold on the trade in provisions, while it has actually played into the hands of the plumbers in some states by restrictive legislation which would make it impossible, without a special session of the Legislature, to permit repairs by any person not of their consecrated body.

The utter dependence of great aggregations of humanity upon transportation of fuel and food, and upon the ministrations of a relatively few trades, in themselves unimportant save as they affect city dwellers, has written an entirely new chapter into political economy and one which is generally forgotten until some such crisis as the coal strike blazons it on the understanding.

To go further, half of humanity, so far at least as this country is concerned, has put itself in a condition of base servility as regards the necessities of life. Only a relatively small proportion of any large urban community is actually engaged in any personal labor, physical or mental, which is in any proper sense necessary to our civilization. Any big city is full of people who are willing to do anything and everything except definite, hard, productive work. Thousands of them are struggling along in retail business, barely able to make both ends meet, or are doing really menial tasks in trading in things good, bad and indifferent, necessary and unnecessary, anything in fact to keep from putting hand to tool and learning how to use it for production.

If one were to compare the number of pupils in real and alleged business schools learning how to sell things to people who do not want them with the total of young men and women who are learning any productive trade or studying any useful profession, the result of the comparison would be appalling. It is a commonplace saying that all the professions are crowded, but trade is ten times more so.

The result of all this is that the inhabitants of a large city are almost wholly dependent on external aid. There are probably a couple of million retail establishments for the sale of various things, tangible and intangible, in the United States, the official return on a comparatively small number of kinds of trade actually running over a million. So, in general terms, there are only fifty or sixty persons at most to carry a shop, and under existing industrial conditions nearly everything which is sold at these two million places is the product of much transportation, back and forth, up and down, sidewise and crosswise, all over this and adjoining countries.

The net result of this enormously complicated system of transportation and distribution reduces those who are from choice or necessity congregated in great communities to a condition of dog-eat-dog in obtaining their daily bread and of absolute dependence on transportation for the materials of this ration. Hence it is here that the recent situation, with its menace of cutting off food and fuel supply, takes on its most serious aspect, and the vital question is how far, in a representative government under a constitution, we are going toward the enslavement of the vast majority of the people to the will of small and quarrelsome factions.

Are we going to have a constitutional government obeyed by all in the interest of all, or are we going to have what is virtually a soviet government set up and maintained in defiance of the constituted authorities? To be sure, one may say that those who decline to produce have brought themselves willfully into a condition of dependence, but it is certain that they will neither freeze nor starve with becoming cheerfulness, and if eventually they rise in anger, they are a power to be reckoned with even by the most insolent and lawless.

We have come at present pretty nearly to the parting of the ways, where we must choose between a constitutional government and an irresponsible soviet. Shall we carry on at all hazards the government established by the fathers of the Republic or shall we have a government set up with violence by small minorities? This is a question that is squarely up to the powers at Washington.

How far political expediency will tempt them further to shuffle in inactivity remains to be seen. We know what Roosevelt did in the previous local strike and what Grover Cleveland did in the railway riots a score of years before. Neither Roosevelt nor Cleveland stopped to argue the ultimate details of the controversies with which they had to deal, each realizing that his duty was to protect from wanton injury, by whatever party inflicted, the people of the country over which he had been set on guard, and both acted promptly and effectively.

The situation has been quite as grave as at either of these previous crises. The influx of population into the cities at the expense of the country, and hence more groveling dependence on transportation, has been steadily increasing. The forces of disorder are more numerous and dangerous. The ferment of anarchy has been working more and more actively and generally. The conservative powers have grown more and more reactionary, striving incessantly to load the safety valve instead of letting down the fires, and for the possible results we have to look almost anywhere across the Atlantic.

Greater than any combinations of so-called labor and capital is the ultimate power of the body of the people who decline to be the victims of either. And it is high time that this power of last resort bore in upon the government, which is its creature, the lesson that the necessity of self-preservation transcends all the petty precepts of expediency.

SHOULD DEMAND ACTION

In a constructive way the civic organizations of the country should realize the danger and serve notice on Washington that no man and no party can disregard public safety without being cast into outer darkness. They should demand that rioting as an economic argument should be put down with an iron hand and that there should be constituted a tribunal, call it what you like, to pass upon disputes which endanger public safety and with power to enforce its decrees. A scheme of arbitration which litigants may flout at will is merely an incentive to anarchy.

Union men, who are on the whole law-abiding like their neighbors, will suffer cold and hunger with them if anarchy triumphs, and should not defend, even by implication, its sinister activities. They stoutly maintain that acts of violence come from vicious outsiders and complain that guards are too often insolent thugs. It is certainly equally against the public welfare that disorder should flourish or that private armies of dubious character should be maintained to prevent it. With the dynamite planting of the Lawrence strike green in one's memory it is difficult to lay all crimes to strikers.

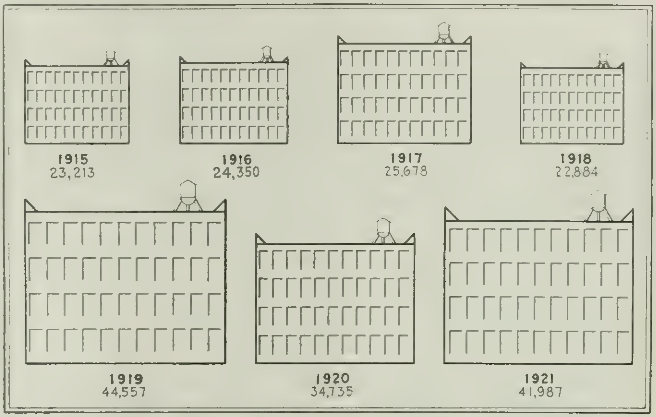
But there is a very simple touchstone to determine guilt, and the sooner it is in active use the better. As a matter of experience it has been uniformly shown that when hastily assembled private guards are replaced by regulars, with orders to shoot, acts of violence suddenly cease. When the malefactors are suppressed the coroner can determine their identity at his leisure. Heaven forbid that we should have government ownership of coal mines and railways, but a government that cannot find a way of effectually regulating both should have scant mercy at the hands of the electorate.

Industrial Power Customers Served by Electric Light and Power Companies

State and Section	Jan. 1, 1916			Jan. 1, 1917			Jan. 1, 1918			Jan. 1, 1919			Jan. 1, 1920			Jan. 1, 1921			Jan. 1, 1922		
	Total Number	New Customers During 1915	Per Cent Gain During 1915	Total Number	New Customers During 1916	Per Cent Gain During 1916	Total Number	New Customers During 1917	Per Cent Gain During 1917	Total Number	New Customers During 1918	Per Cent Gain During 1918	Total Number	New Customers During 1919	Per Cent Gain During 1919	Total Number	New Customers During 1920	Per Cent Gain During 1920	Total Number	New Customers During 1921	Per Cent Gain During 1921
United States	235,393	23,213	11.3	259,743	24,350	10.5	285,421	25,678	9.9	308,305	22,884	8.0	352,862	44,557	14.5	387,597	34,735	9.9	429,584	41,987	10.8
SECTIONS																					
New England	23,770	2,100	9.7	26,190	2,420	10.2	28,820	2,630	10.1	32,000	3,180	11.0	35,770	3,770	11.8	39,010	3,240	9.1	42,783	3,773	9.7
Middle Atlantic	37,500	3,720	11.0	41,920	4,420	11.8	44,040	2,120	5.1	50,630	6,590	15.0	56,600	5,970	11.8	62,260	5,660	10.0	73,050	10,790	17.3
South Atlantic	15,434	1,644	12.4	17,350	1,916	12.4	19,560	2,210	12.8	20,880	1,320	6.8	23,830	2,950	14.1	26,067	2,237	9.4	28,075	2,008	7.7
East North Central	67,000	4,370	7.0	73,330	6,330	9.5	79,450	6,120	8.4	82,890	3,440	4.3	95,180	12,290	14.8	103,690	8,510	9.0	113,970	10,280	9.9
West North Central	26,140	2,750	11.8	29,520	3,380	12.9	32,640	3,120	10.6	34,650	2,010	6.2	38,550	3,900	11.2	42,433	3,883	10.1	45,574	3,141	7.4
East South Central	6,960	610	9.6	7,450	490	7.1	8,030	580	6.7	8,290	260	3.2	9,580	1,290	15.5	10,271	691	7.2	11,063	792	7.7
West South Central	9,630	1,480	18.2	10,650	1,020	10.6	12,340	1,690	15.9	13,780	1,440	11.7	17,350	3,570	25.9	20,192	2,842	16.4	22,537	2,345	11.6
Mountain	8,539	949	12.4	9,013	474	5.6	10,391	1,378	15.3	10,755	364	3.5	11,402	647	6.0	12,704	1,302	11.4	14,232	1,528	12.0
Pacific	40,420	5,590	16.1	44,320	3,900	9.7	50,150	5,830	13.2	54,430	4,280	8.6	64,600	10,170	18.7	70,970	6,370	9.9	78,300	7,330	10.3
NEW ENGLAND:																					
Maine	4,290	530	14.1	4,600	310	7.2	5,250	650	14.2	5,520	270	5.1	6,080	560	10.2	6,700	620	10.2	7,200	500	7.5
New Hampshire	1,220	40	3.4	1,380	160	13.1	1,610	230	16.7	1,720	110	6.8	1,900	180	10.5	2,150	250	13.2	2,370	220	10.2
Vermont	1,450	—80	5.2	1,640	190	13.1	1,820	180	11.0	1,890	70	3.9	1,830	60	—3.2	2,080	250	13.7	2,263	183	8.8
Massachusetts	9,490	990	11.7	10,520	1,030	10.9	11,380	860	8.2	13,610	2,230	19.6	15,300	1,690	12.4	16,530	1,230	8.1	18,620	2,090	12.7
Rhode Island	2,220	240	12.1	2,470	250	11.3	2,700	230	9.3	2,980	280	10.4	3,260	280	9.4	3,400	140	4.3	3,580	180	5.3
Connecticut	5,100	380	8.1	5,580	480	9.4	6,060	480	8.6	6,280	220	3.6	7,400	1,120	17.8	8,150	750	10.1	8,750	600	7.3
MIDDLE ATLANTIC:																					
New York	13,140	1,130	9.4	13,920	780	5.9	15,340	1,420	10.2	16,380	1,040	6.8	19,350	2,970	18.1	21,130	1,780	9.2	25,550	4,420	20.9
New Jersey	13,070	1,200	10.1	14,050	980	7.5	12,470	—1,580	—11.2	14,200	1,730	13.9	15,150	950	6.7	15,930	780	5.2	17,200	1,270	8.0
Pennsylvania	11,290	1,390	14.0	13,950	2,660	23.6	16,230	2,280	16.3	20,050	3,820	23.6	22,100	2,050	10.3	25,200	3,100	14.0	30,300	5,100	20.2
SOUTH ATLANTIC:																					
Delaware	300	60	25.0	310	10	3.3	420	110	33.5	420	0	0.0	440	20	4.8	480	40	9.1	630	150	31.3
Maryland	3,434	574	20.0	3,940	506	14.7	4,600	660	16.8	4,700	100	2.2	5,060	360	7.7	5,525	465	9.2	6,050	525	9.5
District of Columbia	940	70	8.1	1,040	100	10.6	1,090	50	4.8	1,290	200	18.4	1,390	100	7.8	1,514	124	8.9	2,000	486	32.1
Virginia	3,160	380	13.7	3,500	340	10.8	4,370	870	24.9	4,410	40	9.2	5,100	690	15.7	5,590	490	9.6	6,160	570	10.2
West Virginia	760	90	13.4	820	60	7.9	1,150	330	40.3	1,320	170	14.8	1,700	380	28.8	1,780	80	4.7	1,865	85	4.8
North Carolina	2,140	90	4.4	2,390	250	11.7	2,490	100	4.2	2,940	450	18.1	3,410	470	16.0	3,700	290	8.5	3,700	0	0.0
South Carolina	960	80	9.2	1,100	140	14.6	1,090	10	0.9	1,150	60	5.5	1,380	230	20.0	1,658	278	20.8	1,660	2	0.0
Georgia	2,280	190	9.1	2,660	380	16.7	2,660	0	0.0	2,830	170	6.4	3,390	560	19.8	3,750	360	10.6	3,760	10	0.0
Florida	1,460	110	9.7	1,590	130	8.9	1,690	100	6.3	1,820	130	7.7	1,960	140	7.7	2,070	110	5.6	2,250	180	8.7
EAST NORTH CENTRAL:																					
Ohio	16,560	1,460	9.7	17,930	1,370	8.3	19,850	1,920	10.7	20,130	280	14.1	23,400	3,270	16.2	25,050	1,650	7.1	27,350	2,300	9.2
Indiana	8,600	830	10.7	9,530	930	10.8	10,180	650	6.8	10,740	560	5.5	12,100	1,360	12.7	13,200	1,100	9.1	13,900	700	5.3
Illinois	22,240	1,220	5.8	25,070	2,830	12.7	27,600	2,530	10.2	29,930	2,330	8.5	35,600	5,670	19.0	39,200	3,600	10.1	42,600	3,400	8.7
Michigan	9,670	750	8.4	10,340	670	6.9	11,130	790	7.6	11,400	270	2.4	12,580	1,180	10.3	13,720	1,140	9.1	15,100	1,380	10.1
Wisconsin	9,930	110	11.2	10,460	530	5.3	10,690	230	2.2	10,690	0	0.0	11,500	810	7.6	12,520	1,020	8.9	15,020	2,500	20.0
WEST NORTH CENTRAL:																					
Minnesota	5,150	990	23.8	6,240	1,090	21.2	6,870	630	10.1	7,060	190	2.8	7,660	600	8.5	8,650	990	12.9	9,300	650	7.5
Iowa	5,970	100	17.1	6,460	490	8.2	6,880	420	6.5	6,930	50	7.3	7,300	370	5.3	7,410	110	1.5	7,630	220	3.0
Missouri	7,620	890	13.2	8,570	950	12.5	9,650	1,080	12.6	10,710	1,060	11.0	12,340	1,630	15.2	14,150	1,810	14.7	15,400	1,250	8.8
North Dakota	820	170	26.2	950	130	15.9	1,110	160	16.9	1,120	10	1.0	1,120	0	0.0	1,233	113	10.1	1,324	91	7.4
South Dakota	1,320	0	0.0	1,400	80	6.1	1,410	10	1.0	1,440	30	2.1	1,440	0	0.0	1,680	240	16.7	1,840	160	9.5
Nebraska	2,360	270	12.9	2,630	270	11.4	3,040	410	15.6	3,310	270	8.9	3,980	670	20.3	4,360	380	9.6	4,710	350	8.0
Kansas	2,900	330	12.8	3,270	370	12.8	3,680	410	12.5	4,080	400	10.9	4,710	630	15.4	4,950	240	5.1	5,370	420	8.5
EAST SOUTH CENTRAL:																					
Kentucky	1,930	110	6.1	2,160	230	11.9	2,380	220	10.2	2,520	140	5.9	3,060	540	21.4	3,275	215	7.0	3,580	305	9.3
Tennessee	2,490	280	12.7	2,740	250	10.1	2,910	170	6.2	3,090	180	6.2	3,490	400	12.9	3,810	320	9.2	4,040	230	6.0
Alabama	2,040	180	9.7	1,970	—70	—3.4	2,160	190	9.7	2,060	—100	—4.6	2,370	310	15.1	2,540	170	7.2	2,720	180	7.1
Mississippi	500	40	8.7	580	80	16.0	580	0	0.0	620	40	6.8	660	40	6.5	646	—14	—2.1	723	77	11.9
WEST SOUTH CENTRAL:																					
Arkansas	1,480	150	11.3	1,350	—130	—8.8	1,580	230	17.0	1,630	50	3.2	1,900	270	16.5	2,195	295	15.6	2,680	485	22.2
Louisiana	1,260	120	10.5	1,150	—110	—8.7	1,340	190	16.5	1,380	40	3.0	1,620	240	17.4	1,877	257	15.9	2,147	270	14.4
Oklahoma	3,680	310	9.2	4,060	380	10.3	4,310	250	6.2	4,840	530	12.3	6,390	1,550	35.7	7,300	910	14.3	7,760	460	6.3
Texas	3,210	900	39.0	4,090	880	27.4	5,110	1,020	24.9	5,930	820	16.1	7,440	1,510	25.5	8,820	1,380	18.6	9,950	1,130	12.8
MOUNTAIN:																					
Montana	1,330	80	6.4	1,420	90	6.8	1,440	20	1.4	1,870	430	29.9	2,000	130	7.0	2,172	172	8.6	2,240	68	3.1
Idaho	660	80	13.8	740	80	12.1	850	110	14.9	930	80	9.4	1,120	190	20.2	1,250	130	11.6	1,390	140	11.2
Wyoming	320	40	14.3	360	40	12.5	410	50	13.9	450	40	9.8	540	90	20.0	603	63	11.7	671	68	11.3
Colorado	3,800	250	7.1	4,070	270	7.1	4,270	200	4.9	4,480	210	4.9	4,520	40	8.9	5,000	480	11.6	5,800	800	16.0
New Mexico	290	0	0.0	270	20	—6.9	330	60	22.2	270	—60	18.2	250	—20	—7.4	193	—57	—22.8	215	22	11.4
Arizona	169	49	41.0	203	34	20.1	271	68	33.5	305	34	12.6	372	67	22.0	606	234	63.0	616	10	1.7
Utah	1,640	450	37.8	1,640	0	0.0	2,530	890	54.3	2,220	310	—12.3	2,350	130	5.9	2,630	280	11.9	3,050	420	16.0
Nevada	330	0	0.0	310	20	6.1	290	20	6.5	230	60	20.7	250	20	8.7	250	0	0.0	250	0	0.0
PACIFIC:																					
Washington	6,240	970	18.4	7,180	940	15.1	7,000	180	2.5	7,300	300	4.3	7,680	380	5.2	8,180	500	6.5	8,700	520	6.4
Oregon	3,230	820	34.0	3,840	610	18.9	4,250	410	10.7	4,380	130	3.1	4,720	340	7.8	5,190	470	10.0	5,600	410	7.9
California	30,950	3,800	14.0	33,300	2,350	7.6	38,900	5,600	16.8	42,750	3,850	9.9	52,200	9,450	22.1	57,600	5,400	10.3	64,000	6,400	11.1

42,000 New Power Customers in 1921

Industrial Depression Failed to Halt Addition of New Consumers of This Class to Central-Station Lines—Customers Totaled 429,584 on Jan. 1, 1922



NUMBER OF NEW INDUSTRIAL POWER CUSTOMERS PER YEAR FROM 1915 TO 1921 INCLUSIVE

A LARGE amount of publicity has been given to the extensive domestic wiring campaigns which central distributing companies have conducted during the past year to acquire new load to take the place of the greatly curtailed industrial power load. It has often been made to appear that the acquisition of new industrial power customers during the industrial depression was practically out of the question and that the increase of residential load was the only resource. In some districts this has probably been a fact, but throughout the country as a whole strenuous work has been done during the past year by new-business departments to build up the industrial load as well as the domestic lighting load.

The extent to which the industrial power customer has been cultivated by the central electric distributing companies of the country is clearly indicated by a survey recently made by the *Electrical World*. In spite of the industrial depression from which the nation is just emerging, the number of industrial power customers was increased by 41,987 during 1921. During the same period 1,001,700 domestic lighting customers and 175,000 commercial lighting customers were also added to the service lines of the industry. About one and a quarter million customers were, therefore, added to the distributing systems of the country during a year of unprecedented business and industrial inactivity. Such a record is one of which the industry may well be proud.

There was a total of 429,584 industrial power customers on Jan. 1, 1922, an increase of 194,191 during the six-year period from Jan. 1, 1916. The greatest yearly growth took place in 1919, when 44,557 customers of this class were added to the service lines of the industry. While these various figures for power customers are only about 5 per cent of the total number of new residential customers added during the same periods, it must be remembered that one industrial power customer may consume several hundred times as much electrical energy as a single residential lighting customer.

As would be expected, the intensely industrial section of the country which comprises the five East North Central States easily leads in total number of industrial customers, the figure being 113,970. A recent survey indicates that this group of states also leads the country in the total number of domestic lighting customers. This section has a total of about 2,850,000 customers of all classes, or about 26 per cent of the total number in the whole country. The three Pacific Coast States, taken as a whole, are second with 78,300 industrial power customers.

California far outstrips any other state in the number of industrial power customers, with 64,000, or almost one-sixth of the total for the entire country. This state also added the most customers of this class to its lines during 1921. The predominance of California in industrial customers is due primarily to the extensive use of electrical energy for irrigation and other farming purposes. The transmission and distribution systems of the central stations of that great agricultural state cover practically every farming community. If electrical energy is not used by the farmer to run a private pumping plant, it is used in other ways to lighten the burden of farm duties. Moreover, California's manufacturing growth is recent as compared with that in the industrial states of the East, and it is but natural that as manufacturing in this state has advanced almost contemporaneously with the growth of the electrical industry it should become very highly electrified. In addition, the presence of large water powers within the state, and a consequent low cost of energy production, has enabled the central distributing companies to offer special inducements to consumers of bulk energy which can be duplicated in few of the older industrial states of the East.

Illinois is second in number of industrial power customers, with 42,600, and Pennsylvania is third, with 30,300 customers. New York, the leading manufacturing state of the Union, is fifth.

The results of a survey to ascertain the growth in residential lighting customers appeared in the Jan. 14, 1922, issue of the *Electrical World*. A similar tabulation is being made of the growth in number of commercial lighting customers and will appear in an early issue. These surveys are made every two years and are believed to represent very accurately conditions in the electric light and power industry.

Rural Electric Service Costs Analyzed

Costs of Service from the Power House to the Consumer Analyzed for Iowa Situation—Monthly Costs to Consumer Under Various Financing and Maintenance Arrangements

By W. J. GREENE
Iowa Railway & Light Company

IN AN effort to determine the real situation as to the cost of rendering rural electric service an extensive study of actual conditions existing on a part of the system of the Iowa Railway & Light Company has been made. In making the study it was felt that attention should be given to the entire costs from the power house to the consumer's meter and that the study should not be stated with the assumption of adequacy of the present urban rates, and rural rates be made by simply adding the excess cost of rural service to present urban rate schedules. If errors exist in any present urban rate, it was thought best to eliminate such errors from the rural rates before the rural business became extensive. We feel that our rural business should be developed on economic principles and that we have the opportunity to direct its growth on a sound business basis, profiting by our errors in the past. Although in many cases it will undoubtedly be easier for the sales department to start with present urban rates, and although from an educational standpoint that may be the best way, yet it is certain that eventually power-plant and transmission demand costs must be introduced accurately. Rural consumers represent a distinct class of service and the elements entering into the cost of that service should be determined without regard to the other classes of service. The figures in the following tables are based on average conditions as found, though careful consideration has been given to specific situations. Energy costs are taken at 3 cents per kilowatt-hour delivered to the consumer. All other costs are taken at the figures given in the tables. It is assumed that each consumer has a demand of 1 kw. and will be served by a 1½-kva., 6,600-volt transformer. Fifteen years is taken as the natural life of the rural equipment.

TABLE I—PRIMARY COST DATA IN RURAL SERVICE ANALYSIS

	Particulars		Costs per Consumer	
	Urban	Rural	Urban	Rura
Meters installed	$9.15	$10.40	$1.65	$2.08
Meter shunt losses, at 3 cents per kw.-hr.	.....	....	.48	.48
Services, per consumer	6.83	25.00	1.23	5.00
Transformer capacity per consumer in volt-amperes	294	1,500	....	....
Average kva. transformer capacity	9.7	1.5	....	....
Consumers per transformer	33	1	....	....
Transformer investment per consumer installed	$4.80	$164.00	.86	32.80
Transformer core losses, at 3 cents per kw.-hr.	....	....	.57	7.20
Poles, fixtures and conductors per mile	$2,400.00	$900.00	....	....
Consumers per mile	54	2.5	....	....
Investment in poles, fixtures and conductors per consumer	$44.20	$360.00	7.96	72.00
Portion of city distribution	.....	....	3.15	3.15
Commercial service expenses	...	....	14.40	14.40
Generation and transmission	.	......	14.40	14.40
Consumer element of general expenses	....	....	2.00	2.00
Total annual cost			$32.70	$143.07
Monthly cost		....	2.72	11.92
			Per Cent	Per Cent
Rate of return			8	8
Insurance			0.5	0.5
Taxes			1.5	1.5
Maintenance			3	5
Depreciation and retirement from all causes			5	5
Total investment rates			18	20

TABLE II—CITY DISTRIBUTION LINE COSTS INVOLVED IN RURAL SERVICE

	Total Investment per Consumer	Consumer Portion	Demand Portions
Poles and fixtures	$27.98	$13.99	13.99
Conductors	16.22	8.11	8.11
Total	$44.20	$22.10	$22.10

Monthly consumer investment expense = 0.18 × 22.10 ÷ 12 = 33 cents.

MEANING OF TABLES

The study of costs of the service to the farmer is based on the primary cost data given in Table I. In this table both urban and rural service costs are presented for comparative purposes. It will be noted that the value for commercial service expenses is made the same for urban and rural service. It is assumed that farmers will read meters and report on post cards, or meters will be read by the company not oftener than six times a year. Monthly bills will be rendered and collected either for an estimated consumption and demand and adjustments made when the meters are read, or the consumer portion, which will be more than 80 per cent of the charge, may be collected monthly and the balance every two or three months.

TABLE III—FIXED COSTS ON CERTAIN INVESTMENTS IN RURAL ELECTRIC SERVICE

	Investment	Annual Investment Expenses	Monthly Investment Expenses	Monthly Investment Expenses Less Interest	Monthly Investment Expenses Less Interest and Depreciation
Service lines per consumer	$25.00	$5.00	$0.42	$0.25	$0.15
1½-kva., 6,600-volt transformer	164.00	32.80	2.73	1.64	.96
Pole-line per mile	900.00	180.00	15.00	9.00	5.25

Table II gives the value of distribution lines within the corporate limits of adjoining cities or towns, from which is determined the amount chargeable to rural consumers for transmitting electricity to the corporate limits. Table III is a reduction of the fixed charges on certain investments to a monthly basis of cost. Table IV gives on a monthly basis certain items of costs from Tables I, II and III incurred by the utility and chargeable against the rural consumer under any arrangements for the construction and maintenance of the rural lines. Power-plant and transmission demand costs are included in the generation and transmission item of $1.20 in Table IV. Transmission lines are considered as an extension of power-plant busbars and therefore transmission costs are included with the power-plant demand costs. The value is based on a determination of demand costs in a specific situation covering the determination of such costs for eight towns served from 65 miles of transmission lines, and it is felt to be representative, although variable for different situations.

Tables V, VI and VII give the costs to consumers for maintenance items on several bases and with different numbers of consumers per mile. Table V shows the probable cost to consumers for maintenance of line and transformers and public liability insurance where the consumer finances and maintains the lines himself or contracts with the utility for the maintenance. No investment cost is included because the lines are financed and owned by the consumer. Table VI shows the probable line and transformer costs to consumers where the lines are financed by the consumer but ownership and perpetual maintenance is assumed by the utility. Table VII shows the probable line and transformer costs to consumers where the utility finances, owns, operates and maintains the lines and transformers. The derivation of these tables can be traced from Table III, where the rural line and transformer investment expenses are presented on several bases.

TABLE IV—CERTAIN MONTHLY COSTS INVOLVED IN RURAL ELECTRIC SERVICE PER CONSUMER BASED ON 1 KW. DEMAND

Meters	$0.17
Meter shunt-coil losses	.04
Transformer core losses, 1½ kva., 6,600 volts	.60
Portion of city distribution line	.33
Generation and transmission	1.20
Commercial office	.26
Consumer element of general expense	.17
Total	$2.77

Taking these seven tables as a foundation, Tables VIII, IX, X and XI show the probable cost in cash to a consumer under the various methods of providing service. These costs are given on the basis of several numbers of consumers per mile from one to fifteen and for monthly consumptions of 0, 13, 20, 30 and 60 kw.-hr. In Table VIII is given the cost to consumers, excluding maintenance of line and transformers, public liability and investment costs of lines and transformers. Investment costs are insurance, taxes, depreciation and money costs. In Table IX are given the probable expenses in cash for each month of the first fifteen years for consumer ownership of the lines. At the end of the fifteen years the farmer will begin to be confronted with a replacement of the lines and transformers. The make-up of the figures is illustrated by attention to the first figure, $9.48, in the column headed 0 kw.-hr. The item is made up of $6.71 from first column, Table V, giving the cost of maintenance and insurance and the item of $2.77 from Table IV, which is the utility service cost exclusive of any energy sold. The item of $9.87 at the head of the following column is made up of the $9.48 item plus the energy cost of 13 kw.-hr. at 3 cents. No provision is made for interest and depreciation or the creation of a reserve for the replacement of the property, since the consumer assumes this burden. The data in Table X are based on the assumption that the consumers finance the lines and transformer and the utility accepts ownership and perpetual obligation of maintenance. The values are obtained from Tables IV and VI, with the energy costs at 3 cents added. Table XI shows the payments by the consumer on a monthly basis where the utility takes the entire responsibility of financing, operating and maintenance of the lines and transformers just as is done with urban consumers. The values are obtained from Tables IV and VII with energy costs added as in the case of the two preceding tables.

TABLE V—PROBABLE AVERAGE COST FOR MAINTENANCE OF LINES AND TRANSFORMERS, AND PUBLIC LIABILITY INSURANCE

	Costs per Consumer per Month					
Consumers per Mile	1	2½	3	5	10	15
Service lines	$0.15	$0.15	$0.15	$0.15	$0.15	$0.15
Transformer	.96	.96	.96	96	.96	.96
Pole line	5.25	2.10	1.75	1.05	.53	.35
Public liability	.35	.35	.35	.35	35	.35
Total	$6.71	$3.56	$3.21	$2.51	$1.99	$1.81

TABLE VI—LINES AND TRANSFORMERS FINANCED BY THE CONSUMER AND MAINTAINED BY THE UTILITY

This table shows the cost to the consumer of the utility expenditures involved in upkeep of the property.

	Costs per Consumer per Month					
Consumers per mile	1	2½	3	5	10	15
Service lines	$0.25	$0.25	$0.25	$0.25	$0.25	$0.25
Transformer	1.64	1.64	1.64	1.64	1.64	1.64
Pole line	9.00	3.60	3.00	1.80	90	.60
Total	$10.89	$5.49	$4.89	$3.69	$2.79	$2.49

The data in Table XI indicate a monthly cost for all items without any energy from $6.92 per month per consumer for fifteen consumers per mile to $20.92 for one consumer per mile. In other words, this group of figures represents the total fixed and operating charges incurred in establishing and maintaining the service from the power house to the consumer without any allowance for general expenses, contingencies and profit to the utility except the very small amount represented by the difference between 8 per cent and the actual money cost rate applied to the investments in property required for rendering the service. No allowance is made for contingencies and profit on the energy cost in the items where energy costs are included. The same is true of Tables IX and X, the only difference in them being that the farm customer carries certain items of cost by making investments himself and assuming cost of maintenance and liability, and consequently makes smaller cash payments per month. In the final analysis the consumer actually incurs the total costs shown in Table XI just as fully where the lines and transformers are financed, owned and maintained by the consumers as where they are the property of the utility, even though all the cost is not reflected in the monthly cash payments.

TABLE VII—LINES AND TRANSFORMERS FINANCED, OWNED, MAINTAINED AND OPERATED BY THE UTILITY

	Cost per Consumer per Month					
Consumers per mile	1	2½	3	5	10	15
Service line	$0.42	$0.42	$0.42	$0.42	$0.42	$0.42
Transformer	2.73	2.73	2.73	2.73	2.73	2.73
Pole line	15.00	6.00	5.00	3.00	1.50	1.00
Total	$18.15	$9.15	$8.15	$6.15	$4.65	$4.15

Another interesting part of the study is shown in Table XII. In this the percentage of energy costs to the total costs of service are shown. In the case of the rural consumer who uses 30 kw.-hr. per month and is served from a line with three or fewer consumers per mile, the energy costs are less than 8 per cent of

TABLE VIII—CONSUMER OWNS AND MAINTAINS HIS OWN LINES AND EQUIPMENT

	Cost per Consumer per Month				
Kilowatt-hours per month	0	13	20	30	60
Cost basis	$2.77	$3.16	$3.37	$3.67	$4.57

TABLE IX—CONSUMER OWNS AND MAINTAINS HIS OWN LINES AND EQUIPMENT

	Cost per Consumer per Month				
Kilowatt-hours	0	13	20	30	60
Consumers per mile:					
One	$9.48	$9.87	$10.08	$10.38	$11.28
Two and one-half	6.33	6.72	6.93	7.23	8.13
Three	5.98	6.37	6.58	6.88	7.78
Five	5.28	5.67	5.88	6.18	7.08
Ten	4.76	5.15	5.36	6.66	6.56
Fifteen	4.58	4.97	5.18	5.48	6.38

the total costs, whereas with the average city residence consumer taking 13 kw.-hr. such costs are 18 per cent. The load factors given in the table are those for a consumer with 1 kw. demand and the various consumptions indicated.

The most significant figures are those in Table XI because they represent the total costs of service regardless of what plan of giving service is adopted. For one consumer per mile the yearly revenue required to render the service without the use of any electricity is $251 per mile of line per year. With three consumers per mile the yearly revenue without the use of any electricity is $393 per mile, or $131 per customer per year. If rates are made in the same manner as the values are presented, a very low energy rate would be had, so that the cost for even large amounts of electricity would be small as compared with the fixed costs.

If rates are to be based purely on the kilowatt-hours used, economical methods for a large use of electricity on the farm must be developed. The rural consumer would have to guarantee a large use of electricity before the utility would be insured of a return sufficient to cover costs. Even at three consumers per mile and a consumption of 100 kw.-hr. per month per consumer, which would be a heavy consumption for a rural consumer with no device installed taking more than 1 kw., the rate per kilowatt-hour would be fully 11 cents. If the consumption were 30 kw.-hr. per month, the rate would be fully 29 cents per kilowatt-hour. With demands over 1 kw. the cost of the extra demand must be considered.

It is not intended that the values given in this study are to be accepted for other situations, nor is it intended to advocate any form of rate by the "set-up" of the figures. The intention is to present such a set-up as will give an accurate vision of costs and forms that any one may use. If values applying to any utility's specific situation are substituted in the forms, the utility cannot only arrive at the true costs covering its situation and ascertain what minimum amounts of revenue must be provided to cover all items of cost from the consumers' meters back to the power house. but it will have the necessary data upon which to build rates.

The four main problems involved in the rural business are:

1. The rate under which utilities can undertake the business with lines and transformers financed, owned and operated by the utilities.

2. The economic value of the service to the farmer—that is, the value of the labor saved and the increased output of the farm business.

TABLE X—CONSUMER FINANCES LINE BUT GIVES OWNERSHIP TO UTILITY WHICH ACCEPTS RESPONSIBILITY FOR MAINTENANCE, OPERATION AND RECONSTRUCTION

	Cost per Consumer per Month				
Kilowatt-hours	0	13	20	30	60
Consumers per mile:					
One	$13.66	$14.05	$14.26	$14.56	$15.46
Two and one-half	8.26	8.65	8.85	9.16	10.06
Three	7.66	8.05	8.26	8.56	9.46
Five	6.46	6.85	7.06	7.36	8.26
Ten	5.56	5.95	6.16	6.46	7.36
Fifteen	5.26	5.65	5.86	6.16	7.06

3. The better living value of the service to the farmers—that is, the greater value of electricity for home lighting and other house uses over other methods.

4. How to insure the utility of adequate revenue for a period of at least fifteen years in those cases where the economic value of the service is less than the cost of the service, or the farmer fails to utilize the service to its full economic value, or the farmer cannot afford to pay the excess cost over other methods of the better-living value.

From such information as has been collected it is evident that the economic value of the service to a large number of farmers will be many times the cost, and that very few cases will be found where the economic value will not exceed the costs, provided the farmer utilizes the electric service to its full extent. If such should prove to be the fact, most rural consumers would be enabled to take advantage of the better-living value without any extra cost, and the stability of the business would be assured.

TABLE XI—UTILITY FINANCES, OWNS, MAINTAINS AND OPERATES AS IN THE ORDINARY CASE OF URBAN SERVICE

	Cost per Consumer per Month				
Kilowatt-hours	0	13	20	30	60
Consumers per mile:					
One	$20.92	$21.31	$21.52	$21.82	$22.72
Two and one-half	11.92	12.31	12.52	12.82	13.72
Three	10.92	11.31	11.52	11.82	12.72
Five	8.92	9.31	9.82	9.82	10.72
Ten	7.42	7.81	8.02	8.32	9.22
Fifteen	6.92	7.31	7.52	7.82	8.72

Utility operators generally agree that utilities should, in theory, finance, maintain and operate the rural lines and transformers and incorporate the costs in rates, just as is done in cities. Some operators realize that it is up to the utility to prepare rates and contracts on this basis and be prepared to offer them to the farmers.

TABLE XII—RATIOS OF ENERGY COSTS TO TOTAL COSTS GIVEN IN TABLE IX, AND LOAD FACTORS

	Percentage of Cost per Consumer per Month			
Kilowatt-hours	13	20	30	60
Consumers per mile:				
One	1.83	2.78	4.12	7.92
Two and one-half	3.17	4.79	7.02	13.12
Three	3.45	5.21	7.61	14.15
Five	4.19	6.30	9.16	16.79
Ten	4.99	7.48	10.82	19.52
Fifteen	5.33	7.98	11.51	20.64
Urban customers	18.5	22.6	30.4	46.7
Load factors, per cent	1.80	2.70	4.10	8.20

It would be of great economic value for all utilities to use the same form of rates and contracts, although rates will naturally vary in different places; and the National Electric Light Association might encourage the adoption of uniform forms and contracts by having forms prepared which it can recommend for use by its members.

Believing that utilities should take the lead in bringing together representatives of the utilities, the practical farmers, the various farm organizations, the agricultural colleges and the farm press for the purpose of making a careful study of the conditions and determining the economic value of the service, the better living value of service, and to what extent the rural consumers can guarantee continuity of service for a long enough period to warrant utilities in financing the lines and transformers, some operators have started efforts that should result in practical results along these lines.

A Word to Utility Stock Salesmen

Being a Little Sermon on the Salesman and Wherein He Differs from the Solicitor in Appearance, Speech, Judgment, Knowledge, Enthusiasm, Cheerfulness and His Worth in the World

By **WARREN R. VOORHIS**
American Water Works & Electric Company, New York

A SOLICITOR is a person who asks other people to buy goods.

A salesman is one who sells goods.

Solicitors are as the sands of the sea for numbers, and landlords put up signs against their intrusion.

But they who have articles for sale will scour the seven seas on the bare chance of finding a salesman.

For the visit of a solicitor is sore affliction.

But a salesman is as welcome as a breath of spring at the end of a hard winter.

When a solicitor calls upon me with an article which I do not want, a wave of the hand, or, at the very worst, the jog of an elbow, will dispose of the matter.

When a solicitor calls upon me with an article which I have sometimes thought I wanted, the encounter takes more time, but, by bringing up reserves, I usually rout him.

But on the day when I am lucky enough to receive a salesman, all my defences crumble even before we have finished our consideration of the weather; I am as clay in the hand of the potter, yea, even as green grass before the sickle.

I can remember every salesman who ever operated on me, but I have forgotten what it was he sold me.

So I conclude that in salesmanship the salesman is a factor.

I imagine that a salesman first sells himself and then his goods.

THE SALESMAN'S APPEARANCE

Now, then, I will write about these salesmen who have come, seen and conquered me, so that knowledge of their ways and habits may be more generally known.

A salesman, being about to sell himself, takes thought about his appearance.

No personal property ever pays higher dividends to the salesman than a clothesbrush, a shoebrush and a safety razor.

In these days ready-to-wear clothing is as good as any—as the magazine pictures testify—and apparel of moderate price is better than expensive display. Indeed, I should think a public utility stock salesman, expecting to find his customers among sober, thrifty people, would do well to dress soberly and quietly, but with cleanness and neatness everywhere apparent.

Long hair is a profession in itself and amateurs should not attempt it. Be fair to the barber.

Remember that a white collar is right out on the firing line; in the area of very high visibility it can stand a limited amount of exposure only. When you consider your collar in the gray morning light, resolve all doubts in favor of a fresh one.

I have heard that when a salesman is clean and trim and well brushed and well turned out generally this has its effect on the salesman, giving him assurance, confidence and self-respect and makes him more dangerous and deadly in attack.

I know nothing of this, for I consider a salesman from the viewpoint of the buyer.

When a man who has evidently taken thought of his personal appearance calls on me I am complimented and at once straighten my own tie and try to polish my shoe on my trouser leg.

A salesman seems to think it helpful to make a good impression to begin with. I suppose this is the reason that he is careful about his appearance.

THE SALESMAN'S SPEECH

I have noticed that a salesman is rather careful to use good, plain, serviceable language. He appears to have no rooted dislike for the common rules of grammar.

He avoids extravagant and irresponsible statements. There is a world of difference between a slick-tongued solicitor and an enthusiastic salesman.

A salesman believes that the slang of the street belongs in the street and that it is not an essential part of a business interview.

I have had solicitors swear a little and tell me a story in order to put me at ease and to make me feel that we were both perfectly at home.

A salesman seems to assume that his interview with me is in the nature of a business engagement and that his time has some value. A very high-grade salesman will even assume that my time is of some possible value to me.

I would not think of advising which is the better way.

I recall, though, that I have been frequently entertained by solicitors—but the salesman got my money.

I should think that a public utility stock salesman whose business it is to induce people to save their money and to invest it wisely would do well to cultivate the habit of using plain, direct speech.

THE SALESMAN CHOOSES THE OCCASION

Salesmen have always taken an unfair advantage of me. If I could encounter a salesman before I have had a cup of coffee in the morning, or on the day I pay my taxes, or when I have just lost a lawsuit, or when I have a cold in my head, I believe I would have a sporting chance against even the best of them.

But a salesman awaits occasions; nay, more, and worse, a salesman makes occasions.

He seems to think that a good appearance, good language and address is all lost on a poor opportunity.

All times and seasons are alike to the solicitor. He regards neither time, place nor circumstance. Solicitors rush in where salesmen fear to tread.

A salesman awaits that rare combination—the man, the hour and the place—but not long. If nothing happens, he makes it happen.

All salesmen must read and believe that saying of

Napoleon that he won battles because he always chose the time and the place.

I reject the theory that salesmen are always cheerful and smiling and happy people—although I never saw one any other way. Upon reflection I am of opinion that when a salesman is blue or downcast, or has any kind of a misery, he simply holes up and waits for his sky to clear.

I believe if I could meet a salesman when he is down in the mouth I could win out against him, but I have never had the opportunity.

A salesman seems to consider his friendly smile, his air of genuine, hearty, prosperous good feeling an important element of a business transaction.

All my life it has been hard for me to dislike or resist cheerful, friendly, hearty people. Lots of men are that way.

A salesman braces me up. He makes me wonder whether it would pay *me* to smile and be happy in *my* business.

THE SALESMAN HAS OPINIONS

Solicitors and salesmen are both invariably courteous to me. It would be most discourteous of me to assert the contrary.

For instance, a solicitor always agrees with me. I have yet to meet a solicitor whose views on religion, politics, morals or the weather did not agree precisely with my own.

This is either a remarkable coincidence or else these solicitors have believed that I would be angered and repelled by their slightest expression of independent or original thought.

I state it as a fact that salesmen undoubtedly have views about general topics, for in my own office many times I have held conversation with salesmen and taken much profit therefrom.

I think it very likely that salesmen read newspapers and books and observe a good deal for the very purpose of being generally alert and well informed.

I am afraid there is a disposition to look down on a solicitor, but you try hard to live up to a salesman.

Of all men I believe solicitors have the best memories.

Somebody must teach solicitors all that they shall say and do from the "Good morning, Mr. Jones," to "Good afternoon" or "Good night," depending on the length of the engagement.

They recite beautifully, and I love to hear it, for it always takes me back to my boyhood, when I used to render "The Wreck of the Hesperus" on Friday afternoon at school.

It is really quite an effort to memorize an hour's talk and say it without leaving out a comma, or hardly stopping to take breath, and I always try to be careful not to ask any question or say anything to a solicitor which might throw him off the track.

THE SALESMAN KNOWS HIS SUBJECT

But there is one thing I do know for certain and here bear testimony:

A salesman really does know all he can find out about his subject, whether it is brooms or bonds.

In my earlier years, hoping to confound the salesmen, I have at times asked questions. I thought more highly of myself than I should, for a salesman merely uses a question as a text for a new and stronger argument. A salesman welcomes an interruption.

I am sure that a public utilities stock salesman will find it useful to know all about the general subject of public utilities.

He will want to know how they serve the public. He will be interested in the fact that public utilities are managed, regulated and controlled under close public supervision.

He will want some knowledge of the vast and vital part which the public utilities have in our modern civilization.

Nor will he be content with a superficial knowledge of the character of the securities he offers. He will want to know all about the financing of public utilities as a modern business problem.

He will be interested and will interest other people in the fact that public utilities do not have periods of sharp expansion and depression in earnings, but that they earn moderately yet steadily.

The salesman of stock securities will never fail to keep in mind that his business is with people who are vitally concerned in the safe investment of their money. He is not selling articles of trifling value for immediate consumption, but he is endeavoring to interest people in that most vital of all subjects—the investment of hard-earned money.

THE SALESMAN HAS ENTHUSIASM

I have mentioned some of the characteristics of the salesmen I have known, but so far I have omitted perhaps the most important. Of course I mean enthusiasm.

I am always attracted by the appearance, speech, tact and knowledge of a real salesman, but I believe that it has been the enthusiasm of the salesman which has convinced and captured me.

I wish I could define enthusiasm. It seems to be some strong, inward, mental force which gives life, fire and vigor to all other qualities. It is imagination; it is personality. It does not seem to come out of books, nor is it taught in the schools. It is easier to describe its absence than its presence.

After a salesman leaves me I usually permit myself a few moments for reflection. I consider that nearly everything of good that has come to this world has arrived as a result of salesmanship.

It has been the knowledge, power, energy and enthusiasm—always the enthusiasm—of the salesman that has forced the world to adopt new courses for its improvement.

THREE GREAT SALESMEN

William Pitt was a great salesman; he sold the idea of the British Empire to Little England. And Benjamin Franklin was a very great salesman indeed; he sold the idea of a successful American commonwealth to France at a time when its success could not be seen except by its closest friends. Daniel Webster was a remarkable salesman who devoted his whole life and genius to the delivery to this country of one idea—its unity and indivisibility.

This is all I set out to say about salesmen and salesmanship.

Except that I want salesmen to keep on coming to see me.

When the time comes that a salesman can no longer interest me, instruct, fill me with enthusiasm and sell me, I will know that I am, in fact, stone dead, even though continuing to walk abroad as one in life.

Steel Engineers Desire Standardization

The Association of Iron and Steel Electrical Engineers at Their Annual Convention Discuss Anti-Friction Bearing, Control Standardization and Economy in Power Production

STANDARDIZATION and development were the keynotes in the convention of the Association of Iron and Steel Electrical Engineers held at Cleveland on Sept. 11-15. More than 900 engineers and manufacturers connected with the steel industry met, as reported in last week's issue, threshed out many common problems and renewed acquaintanceship.

This association has developed very rapidly and has gained recognition as one of the most active organizations in the country, and the tremendous power and bulk of the steel industry affords every incentive for the manufacturers to co-operate in its work.

Not the least impressive part of the convention was the exhibit display. The ground floor of the mammoth Public Hall of Cleveland was covered with booths representing more than ninety manufacturers of equipment used in steel mills, and their splendid displays created a great deal of interest among the attending engineers.

One of the most interesting sessions occurred Monday afternoon, when the committee reports were presented. They created lively discussion.

MOTORS TO BE STANDARDIZED

Motor standardization and anti-friction bearings were the chief subjects considered by the sub-committee on motors, D. M. Petty, chairman. Since no definite co-operation could be secured from the manufacturers in motor standardization, it was recommended that the matter be taken up with the Power Club. To ascertain the cause of breakdown of motors the committee sent a questionnaire to hundreds of engineers with the results tabulated below:

	Per Cent of Total Failures	
Cause of Breakdown	A.C. Motors	D.C. Motors
Burn-outs due to overheating	8	6
Breakdown due to insulation failure caused by:		
Oil	37	41
Moisture	5	15
Outside influence	34	17
Breakdown due to mechanical failure	16	21
Total	100	100

Many plants reported that 75 to 95 per cent of the mechanical failures could be eliminated by using ball or roller bearings and a proper lubricant. With this object in view the committee asked the manufacturers to develop anti-friction bearings that are interchangeable for all makes of motors.

There are many obstacles to the attainment of standardization in the outside casing dimensions of mill-type motors, said D. M. Petty in discussing the report, but such a step must be taken. He expressed a willingness to use all types of ball-bearing and roller-bearing motors but desired to secure co-operative action among the manufacturers first through the Power Club, so that the economy resulting from standardization could be obtained. E. S. Jefferies urged that standardization be attacked from the user's viewpoint. When standards are adopted they should be enforced. R. B. Gerhardt considered anti-friction bearings a good starting point in motor standardization. W. B. McMasters declared that the Wheeling Mould & Foundry has thirty ball-bearing motors in successful use. George Schaeffer pointed out that his company has been greatly inconvenienced because of dimensional changes in motor bedplates. He expressed the belief that 50 per cent of the breakdowns on alternating-current motors are due to oil getting in the windings and that anti-friction bearings would stop such action.

D. B. Rushmore agreed that the manufacturers should and would co-operate in giving the steel engineers what they desired, but pointed out the tendency to eliminate competition when standardization was carried to the extreme. J. M. Hipple of the Westinghouse company said it was the desire of the manufacturers to supply the consumers with what they desired and needed, but that standardization comes as a result of good practice and not of experimental developments. He questioned whether practice had proved the anti-friction bearing to be the best. He also pointed to the large number of installations already in operation where equipment would have to be replaced.

F. Hess of the Youngstown Sheet & Tube Company asserted that four years ago his company had made a specification on roller bearings to fit all motor frames and that his experience with them had been very satisfactory. Twenty per cent of motor troubles had been eliminated by their use, and the cost in lots of ten for a motor of the Crocker-Wheeler EW type was $65. He thought manufacturers would soon find it necessary to use roller bearings on all heavy-duty motors.

Eleven men reported satisfactory experience with roller or ball bearings, and one man reported unsatisfactory experience. The meeting voted to appoint a committee to co-operate with a committee from the Power Club in an attempt to secure standardization of mill-type motors and to work on the question of anti-friction bearings.

DEVELOPMENTS IN 1922

The past year in the steel industry has been marked chiefly by a recovery from the after-war slump, and no very marked electrical developments have occurred, according to R. B. Gerhardt, chairman of the electrical development committee. Of the new electrical developments the double-range Scherbius speed-regulating sets of the Lackawanna Steel Company and the Illinois Steel Company are particularly interesting. Several mills of the continuous type utilize individual motors for the separate stands, and there is a tendency to use direct current supplied from motor-generator sets or rotary converters in preference to several auxiliary schemes for obtaining adjustable speed.

The new rod-mill drive with control to insure fixed relative speeds and the new main-mill drive using slip-ring induction motors with frequency-changer sets for recovering the slip energy were the two most original developments, Mr. Gerhardt said. The use of the brush-shifting adjustable-speed alternating-current motor is increasing to a greater degree.

The single-cell type of oil breaker is gaining in favor, and the increasing use of the Peterson coil and oxide-film arrester indicates that they are advantageous. Temperature indicators and other auxiliaries on transformers have helped obtain more reliable operation.

Electric heaters and yard electrification are new problems which have great possibilities and about which more data will soon be available. A new ring-filament lamp has been developed which is especially serviceable for portable lamps.

INTERNAL-COMBUSTION ENGINES FOR MILLS

Gas and oil engines have economic justification in steel mills, said D. M. Petty in presenting his paper entitled "Internal-Combustion Engines for Power Generation in Steel Plants." In support of this statement he submitted data showing a net operating cost of $0.00246 per kilowatt-hour for a gas-engine power plant made up of six 3,000-kw. units and one 4,000-kw. unit and a fuel cost of $0.004018 per kilowatt-hour for a Diesel-engine plant. Consequently these prime movers should receive serious consideration for standby power or as peak-load absorbers, he declared.

W. M. Hampton of the Illinois Steel Company asserted that reliability and service are the predominating factors in steel-mill power supply. The Gary plant operates both steam and gas-engine units, there being fifty-six of the latter, with a total rating of 104,000 kw. The gas-engine units carry the base load and the turbines take the fluctuations. One of the gas engines can be started from a cold state and be put on the line in one and one-half minutes. Fifteen years' experience with them has proved them very satisfactory.

Frank Egan, in a written discussion, pointed out that the tables in the paper for gas-engine operating costs were based on coal at $2.50 and an installation charge of $162 per kilowatt, while the steam plant used coal at $7.50. He showed figures indicating equal operating charges for steam and gas-engine plants, but with a much lower fixed charge on a steam-turbine plant. The space requirement of 1 kw. per square foot for gas-engine installations compares unfavorably with 5 kw. to 5.5 kw. per square foot for turbine installations, he pointed out.

R. B. Gerhardt favored using both steam and gas units. E. Pragst declared the total cost of energy is the deciding element. W. I. Schneider laid stress on the importance of securing a good operating organization for either type of installation. Other members in discussing the papers favored a judicious combination of steam and gas units, depending on local conditions, and the majority opinion was to the effect that general conclusions as to relative merits are unsafe when based on a particular installation.

TRENDS IN BOILER DEVELOPMENT

A group of papers on the practice and tendencies in the use of boilers were presented by J. B. Crane, R. E. Butler, R. M. Rush and by E. R. Fish and Alfred Cotton. These gentlement talked largely from the experiences of their respective boiler companies, but agreed that large high-pressure boilers have come to stay. The items on which differences of opinion were expressed were size, pressure, combustion chamber and economizers. J. B. Crane pointed out that large boilers are not cheaper per horsepower than small ones, although a saving in floor space, building volume, amount of piping, valves, instruments, etc., is gained through their use. He declared that the Ladd Company is ready to build 9,000-hp. boilers (normal rating) capable of operating at 300 to 400 per cent rating. Whether to use high pressure and low superheat or low pressure and high superheat was a question which had warm advocates on each side; the limiting factor seems to be the requirement of the turbines to operate on steam under 700 deg. F.

Economizers of the cast-steel type are useful auxiliaries in modern boiler practice, declared R. E. Butler, when built with oxygen filters and for low velocity of water through the tubes. He pointed out that more heating surface is required when burning blast-furnace or metallurgical-furnace gases than is used in coal-fired applications, because high gas velocities are necessary to insure good heat absorption. R. M. Rush alluded to the advantages of the sectional header boiler with straight and bent tubes, saying that the cross-drum, straight-tube type is used in the majority of large central stations. Messrs. Fish and Cotton discussed baffling as applied to the Heine boiler and called attention to the advantages of horizontal baffling and the new bent-tube type of boiler which resembles the Stirling arrangement. This boiler, according to them, utilizes more radiant heat, assures better circulation and divides the gas flow.

GENERATING STATION PROGRESS

The subject of generating-station development was covered by D. B. Rushmore and E. Pragst with a breadth and perspective that are admirable. The advance in generating-station design, which has been largely the result of the development of equipment, according to the authors, was shown graphically by charts and curves indicating the changes in efficiency, size, water rate and transmission voltages for all types of generating-station apparatus. They also dealt with Diesel engines, the burning of blast-furnace gases and the use of powdered coal and showed the relative fields of the central-station and the isolated plant in steel-mill applications.

With regard to the future the authors predicted an increasing use of power, an increase in the price of present fuels, an improvement in the efficiency and cost of apparatus, the development of new fuels and high-speed rotating apparatus to utilize the fuels directly. If the atomic energy of coal could be released, Mr. Rushmore said, one pound would supply Schenectady for eight years, where 300,000 tons are consumed per year with existing methods of fuel utilization.

F. D. Newbury, in a written discussion, pointed out the changes in design and also showed the possibility of the multiple-unit turbo-generator, particularly for base-load plants. Mr. Stoltz of the Westinghouse company stated that a steel-mill power plant should operate on 20,000 to 21,000 B.t.u. per boiler.

Mr. Crane referred to the objections of insurance people to welded boilers because even riveted boilers sometimes failed near the joints. More study is needed of metal molecular structure before they will accept welded boilers. The Ford boilers at River Rouge, which have been burning powdered coal, gas, blast-furnace gas, tar and oil, have operated satisfactorily on all the fuels, the speaker declared.

Mr. Rushmore closed the discussion by explaining different ways of obtaining a heat balance and pointing out that the small clearances and overhung blades made it difficult to construct large Lungstrom turbines. He also stated that standard designs in this country give better economies. He thought welded boilers would be used in the future and that a method for testing welds was needed most.

Electrification of the Huntington (W. Va.) plant of the International Nickel Company was discussed in a paper presented by F. C. Watson. This new plant embodies some of the latest practices in wiring, motoring and lighting. Safety-truck-type switchboards are used in the control room, and every precaution is taken to insure safe and automatic control of all electrical equipment.

Two new features were incorporated in the plant. The first is a Westinghouse adjustable-speed wound-rotor induction-motor set with auxiliary motors whereby the slip frequency is utilized to make useful the slip energy which has heretofore been wasted in rotor resistance. The second is a sectional drive installation on a rod mill whereby each section has a fixed relative speed and yet the whole unit may have adjustable speed control.

EFFICIENCY, FLEXIBILITY OF OPERATION AND EASE OF DETERMINING PRODUCTION EXPENSES ARE INHERENT ADVANTAGES OF ELECTRIC DRIVE IN STEEL MILLS

The detailed treatment and specific tabulation of equipment will make Mr. Watson's paper very useful to other engineers. Ball-bearing motors are used in many applications, and in virtually all cases motors are used which have been designed to enable repairs to be made readily.

G. E. Stoltz stated that 2,300-volt distribution is used in the International Nickel Company's plant because of the compact arrangement of buildings. Overhead construction on steel towers is used in preference to underground cable because of the damp character of the soil. In answer to James Farrington, who questioned the use of two transformer banks, Mr. Watson explained that the main load is carried on a bank of three units and that another bank of two transformers in open delta is held as reserve. Mr. Watson also pointed out that the maximum transmission distance is about 1,000 ft. About 500 RLM dome reflectors are used in the mills, staggered at 50-ft. intervals, and all lighting is supplied by independent circuits from the substation. O. Needham suggested that accurate records be kept on the operation of the ball-bearing motors installed in different parts of this plant.

No changes of importance have occurred in steam-turbine operation, according to L. W. Heller, who presented a paper on the subject. He showed, in tabulated form, the performance of a cross-compound 40,000-kw. turbo-generator placed in operation in 1917 and then considered the new Colfax station, showing that the operating production was 8,000 kw.-hr. per man-hour with one unit and 9,000 kw.-hr. to 12,000 kw.-hr. per man-hour with two units. The operating organization for the main units and auxiliaries was presented. Considering the operation of Brunot Island station, the speaker pointed out that condensers have developed an average heat transfer of 250 B.t.u. per square foot per hour, during the past seven years, with 75-deg. (F.) water at the condenser outlet and a velocity of 5 ft. per second. Oil for lubrication, auxiliaries and changes in practice were also treated by the author in some detail. An extremely valuable portion of the paper was based on the operating practice and record system of the Duquesne Light Company.

STANDARDIZATION OF CONTROL

Opinions regarding the advisability of standardizing the rating of contactors, resistance boxes, coils, resistance tubes and terminal boards were presented by the control committee, F. W. Cramer, chairman. A great diversity of opinion and practice was indicated but, at least, a start has been made to secure results. The committee expressed itself in favor of standardization and recommended co-operation with the Power Club to secure definite action.

Mr. Albrecht, a member of the committee, pointed out that no reasonable basis for rating had been found. Three ratings now exist—continuous, arc-rupturing capacity and motor horsepower. The committee has prepared a data sheet, he announced, which is to be submitted to manufacturers to enable users to compare ratings. The information that should be furnished the customer before the actual installation was outlined so that time might be saved in assembling material and allotting space. He also pointed out that the committee had not agreed concerning the apparatus or devices which should be standardized. The Power Club has standard wiring-diagram symbols, but they are not followed by the manufacturers.

Gordon Fox agreed that standardization should be required and that the design of control apparatus should be improved, but said that no unanimity of opinion existed on various points. He advocated a piecemeal program.

H. E. Pierce suggested standardizing application and methods of control but not equipment. However, Mr. Petty and Mr. Fox thought this impossible even in a given plant. The question of standardization of control was referred to a sub-committee to work with a similar committee of the Power Club.

R. S. Shoemaker reported for the sub-committee on cranes, and the sentiment seemed to be that the crane specifications adopted last year were satisfactory.

MILL LIGHTING

Mill lighting was a subject on which much attention was concentrated during the year by the sub-committee on illumination, R. G. Bauer chairman. Investigation showed that the incandescent lamp is now almost universally used, the RLM dome is gaining in favor, and safety requirements are being followed more closely. Laws based on the Illuminating Engineering Society's factory-lighting code have been put into effect in Pennsylvania, New Jersey, New York, Wisconsin, Oregon, California and Ohio. The committee advocated the keeping of accurate records of replacements and renewals since they facilitate the detection of conditions that should be changed.

GAS ANALYSES PREDETERMINE EFFICIENCY

An elaborate discussion of the importance of making gas analyses to predetermine the combustion performance, telling how to make the tests and how to interpret them, was the chief substance of a paper by A. G. Witting. He considered blast-furnace gas, coke-oven gas and producer gas and developed formulas for determining the efficiency of combustion using these gases.

In discussing the paper of Mr. Witting nearly every member brought out the fact that the field of gas analysis is very important and relatively unexplored. They agreed that radiation is a large but unknown factor in gas efficiency and that existing analyses when used in efficiency calculations may lead to incorrect conclusions regarding gas-fired boiler efficiency. It is essential to know the luminosity of gas as well as the B.t.u. content in determining the desirability of gas for combustion purposes, it was asserted.

INSULATORS INVESTIGATED

The work which has been done to investigate insulators for steel-mill service was outlined by the sub-committee on transmission, A. R. Leavitt chairman. It was reported that deposits of dirt on insulation give the greatest trouble by allowing leakage; however, test data were given proving that the kind of dirt has little effect. The arc-over voltage is the limiting factor in steel-mill service, but the self-cleaning type is of questionable value owing to the low dielectric field intensities involved. More definite data and reports were urged by the committee.

Mr. Walberg of the Westinghouse company, in a written discussion, advocated the self-cleaning type of insulator because it has given good service in cement-mill installations.

SAFETY PRECAUTIONS

Assuring safety is a dual problem involving safeguarding and education, declared the committee on safety, F. A. Wiley chairman. Detailed methods for carrying out these two activities in a mill were tabulated. Great similarity exists in the safety rules of all the plants, it was found. As a result of its investigations the committee advocates the inclosure of all electrical apparatus.

YARD ELECTRIFICATION AN IMPORTANT PROBLEM

Yard transportation constitutes one of the most important problems in a steel plant, declared R. B. Gerhardt, who briefly presented the elements to be considered under the general headings—power supply, conductor-rail location and construction, and locomotives. A grounded direct-current system, it was pointed out, enables the existing plant equipment to be used. The under-running contact possesses many advantages over other types, a 3-in. x 3-in. billet section serving as a very good conductor rail. Attention was called to the fact that steel men would like to use mill-type motors for their electric locomotives. Swing-bolster trucks and steeple-type cabs are preferred.

IMPROVING EFFICIENCY OF POWER SUPPLY

A generalized and philosophical paper entitled "Improvement in Efficiency of Electric Power Supply" was presented by Dr. C. P. Steinmetz. It was full of suggestions and fundamental economic conceptions. Best economy, he declared, required the separation of power production from the industry served by it, but by-product power should be utilized by the power producer. A splendid discussion of the economic field for the isolated plant, the central station and the central and by-product station constituted the major portion of the paper.

STEEL-MILL ELECTRIFICATION REVIEWED

In itself the equipment and power cost of the electrified mills may not be lower than the same items for mechanical and steam operation, but when all production figures are considered the electrified mill is cheapest, B. G. Lamme and W. Sykes asserted in their paper entitled "A Review of Steel-Mill Electrification." The efficiency of the electrified system, the knowledge of production costs made possible by electrical operation, the flexibility of the installation and the possibility of adjustable speed control are great assets to the electrified mill.

For a long time Europe led America in steel-mill electrification, but today, it was claimed, America builds stronger motors with superior constructional features. In conclusion, the authors assert the possibility of saving about $2.50 per ton of material shipped with electrified mills.

J. S. Unger, Carnegie Steel Company, while discussing B. G. Lamme's and W. Sykes' paper on steel-mill electrification, declared that the steel industry would be completely electrified by 1950. Although the present equipment often develops trouble, he predicted that few shutdowns will be experienced at the end of thirty more years of development.

Dr. C. P. Steinmetz, commenting on present yard electrification systems, maintained that the storage-battery locomotive had not arrived at its ultimate economical development. The choice between third-rail and overhead construction is determined by local conditions and the type of service desired. Alluding to troubles from electrolysis, he dealt with the usual trolley system with the overhead construction and the rail negative and grounded. He felt that where this positive wire is of sufficient size and where a good ground is maintained trouble from electrolysis should be a minimum.

The annual banquet was held Thursday evening at the Statler Hotel, with Col. H. P. Bope as toastmaster. J. S. Unger drew an amusingly dismal picture of a recurrence of the Dark Ages should iron lose its one essentially important property for the production of electricity, namely, magnetism.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Income from Range and Water-Heater Loads

To the Editors of the Electrical World:

I was interested in the article in the Sept. 2 issue of the *Electrical World* entitled "Income from Range and Water-Heater Loads," but it contains misleading information regarding the utilization of energy for water heating.

Where heaters of large capacity (2½ kw. to 5 kw.) are used with no attempt made to hold hot water in storage for any length of time, the kilowatt-hours used for water heating average for the year about the same as for the electric range. Billed at the figures given in the article cited, the charge for the month for cooking and heating water would be $22.23, of which amount the water heating would amount to $18. As a matter of fact, this statement needs to be qualified by making it clear that the figures given refer to a particular kind of installation—only approved where flat rates for water heating are available—and that the heater is turned on all the time, whether hot water is needed or not.

R. J. Patterson,
Electric Range Department.
Walker & Pratt Manufacturing Company,
Boston, Mass.

Transmission-Line Calculations

To the Editors of the Electrical World:

It is well known that a circuit of impedance $\sqrt{R^2 + X^2}$ has a conductance of $R/(R^2 + X^2)$ and that this conductance (as is easily proved by differentiating and equating to zero in the usual way) will be a maximum when the variable R is made equal to constant X. But it appears to have been generally overlooked that the conductance may not be as great as possible when R is as near as possible to X, whereas it always will be as great as possible when $\log R$ is as near as possible to $\log X$.

As the essential point of this arises in connection with many engineering investigations relating to the electrical transmission of energy and other important matters, I will here state and prove the proposition in its most general form.

For all positive and negative values of the variable v, the function $w = av/(bv^2 + c)$ is evidently equal to $a/(bv + c/v)$, a, b and c being constants, some or all of which may be negative. The function will therefore be numerically as great as possible when $bv + c/v$ is numerically as small as possible; or, expressing the same thing in mathematical language that is now fairly usual, $\mathrm{mod}\, w$ will be as great as possible when $\mathrm{mod}\,(bv + c/v)$ is as small as possible. But $\mathrm{mod}\,(bv + c/v)$ and $\mathrm{mod}\,(bv - c/v)$ will be both rising or both falling in value simultaneously. This will be evident from the fact that the squares of these bracketed expressions differ only by the constant $4(bv)(c/v)$. It will thus be seen that $\mathrm{mod}\, w$ is as great as possible when $\mathrm{mod}\, bv$ is as near as possible to $\mathrm{mod}\, c/v$, or (since b is constant) when $\mathrm{mod}\, v$ is as near as possible to $\mathrm{mod}\, c/bv$.

For all values of v, however, the geometrical mean of $\mathrm{mod}\, v$ and $\mathrm{mod}\, c/bv$ will be $\sqrt{\mathrm{mod}\, c/b}$. Therefore, logarithms being in arithmetical progression when the corresponding antilogarithms are in geometrical progression, we shall obtain the greatest value of $\mathrm{mod}\, w$ by making $\log \mathrm{mod}\, v$ as near as possible to $\log \sqrt{\mathrm{mod}\, c/b}$. This is very quickly done with the help of an ordinary slide rule; we merely have to set the cursor to c/b on the top fixed scale and to see which of the possible values of $\mathrm{mod}\, v$ is then nearest to the point that the cursor indicates on the bottom fixed scale (this scale being extended to right or left, as may be necessary, with the help of the slide).

W. F. Dunton.
Newcastle on Tyne, England.

Provisions of Massachusetts Lighting Code

To the Editors of the Electrical World:

I was much interested in R. G. Cushing's letter to you which was printed in the Sept. 2 issue of the *Electrical World* (page 485) and which cited the principal objections raised by electrical engineers to the adoption of an industrial lighting code in the State of Massachusetts. I would like to take this opportunity to correct a wrong impression which otherwise might arise from the third paragraph of Mr. Cushing's letter, in which he states that the proposed code would permit the use of only one specific type of reflector for general lighting, namely, the "RLM" dome. The draft of the Massachusetts code which has come to my attention is entitled "Tentative Lighting Code" and dated January, 1922. The glare rule as it appears in this code is as follows:

> 1. All lamps in working spaces and placed more than 7 ft. and less than 20 ft. above the floor shall be so shaded that direct light from them shall be cut off down to an angle of at least 15 deg. below the horizontal through the lower end of the filament, except that lamps having an apparent surface brilliancy not anywhere exceeding an intensity equivalent to 15 cp. per square inch and 10 ft. or more above the floor, and lamps neither exceeding this surface brilliancy nor 50 mean spherical candlepower and at least 7 ft. above the floor, need not be so shaded.
>
> 2. Lamps in working spaces less than 7 ft. above the floor shall be regarded as for local lighting, and shall be so shaded that direct light from them shall be intercepted down to an angle of at least 30 deg. below the horizontal, and where the work illuminated by them is such as to produce brilliant reflections shall in addition be screened by diffusing surfaces, except for lamps below the workers' eyes and so placed as not to shine therein.

It is obvious that so far as this rule is concerned almost any reflector, whether of metal or of glass, may be employed for general lighting, except those few styles in which the cut-off is less than 15 deg., that is, less than the shielding angle obtained with such reflectors as the "RLM" dome. The bowl-shaped steel reflectors which have been in use for many years in both porcelain and aluminum finish, and even the tin cone, are all permitted under this rule. Since the code does not require a 15-deg. or any specific angle of cut-off where the brightness of the light source is less than 15 cp. per square inch, it is evident that by the installation of bowl-enameled lamps even shallower reflectors than those listed above may be utilized.

Rule 4—Distribution of Light on Work.—Lamps shall be installed in regard to height, spacing, reflectors or other accessories so as to secure a good distribution of light on the work, avoiding objectionable shadows and sharp contrasts of intensity.

As regards Rule 4, I would concede Mr. Cushing's point that the electrical engineer of a manufacturing plant in endeavoring to comply with the code might be at a loss to know just how far it was necessary for him to go into the matter of providing general illumination. On the other hand, as to the point that better general lighting in turn requires more powerful local lighting, it would appear that this is contrary both to theory and common experience, for otherwise plants receiving the best natural light would be forced to use local lamps of extremely high power. The fact is that where daylight is available in abundance local lamps are seldom, if ever, required.

WARD HARRISON.

National Lamp Works of General Electric Company,
Cleveland, Ohio.

Another Electrical Anniversary

To the Editors of the Electrical World:

The celebration of the birthday of electric lighting which was held in New York on Labor Day brings to mind another anniversary connected with the development of electricity in the last century. Fifty-six years ago, on Sept. 19, the steamer Great Eastern arrived at Liverpool after having completed the laying of the first Anglo-American cable to prove successful. Two cables which had been laid previously had failed to work after short intervals of time.

Upon the arrival of the Great Eastern a big celebration was held in Liverpool and London. Samuel Canning, Daniel Gooch and Captain Anderson were knighted. The following March the United States Congress voted a gold medal to Cyrus W. Field for his exertions in behalf of the transatlantic cable. Even in 1867 Congress could be depended upon to be behindhand in the recognition of home talent.

The original projectors of the Atlantic cable were American capitalists, embracing Peter Cooper, Cyrus Field, Moses Taylor, Marshall Roberts and others, including Professor Morse. The first attempt was a failure, the cable snapping. The second attempt, in June, 1858, also failed during a violent storm. The third attempt was successful as far as laying the cable was concerned, but the insulation gradually became faulty and communication stopped Sept. 4, 1858, a month after it was laid. The second cable to be laid successfully also failed in a short time through insufficient insulation. The third one was the one laid by the Great Eastern.

September seems to have been a good month for cables. In September, 1873, the Anglo-Brazilian cable was successfully laid, and in September of the following year the sixth Anglo-American cable was laid.

Eltingville, N. Y. ROBERT N. STANNARD.

Who Invented the Telephone?

To the Editors of the Electrical World:

The news of the death of Alexander Graham Bell has received conspicuous attention from the European press, but has given rise once more to the "vexata quaestio" as to who was the inventor of the telephone. The question was settled long ago, apparently in a final manner, by the American courts, but the Italian press, while exalting the undeniable merits of Dr. Bell as the first scientist to give the telephone a universal diffusion (in 1876), insist on claiming for Antonio Meucci the credit for the invention. It may be remembered that Meucci was a refugee from Italy at Staten Island, with Garibaldi, and that he sued Dr. Bell when the first practical telephone was placed on the market in the United States.

Sincronizzando, the monthly house organ of the group of Piedmontese Electric Companies in Turin, Italy, says in its August issue:

"On Aug. 2 the American scientist Alexander Graham Bell, generally considered as the inventor of the telephone, died in Nova Scotia. Just now, when we see the insignia of the French Legion of Honor given to a Professor Brauly with the legend 'He invented wireless telegraphy,' while the Italian inventor is still alive, it would be useless to try to claim the invention of the first practical telephone for an Italian, the late Antonio Meucci, who died destitute in New York more than thirty-two years ago.

"But in the case of Dr. Bell even the American courts, surely not suspected of extreme sympathy for poor Meucci, who was dying of starvation on Staten Island with Garibaldi, had to acknowledge that the instrument commercially exploited by Dr. Bell under his own name was but a reproduction, without substantial changes, of the telephone invented by Meucci.

"But even Meucci had been preceded by another Italian from Piedmont, Innocenzo Manzetti. This man had tried successfully as far back as 1861 the first 'talking telephone,' with which he talked clearly from a distance of nearly two miles. According to the news of the times, the invention created quite a sensation in Europe."

The magazine goes on to relate a curious coincidence confirmed by the daily *Corriere della Sera.* It is stated that a few months after these successful experiments in 1861 a stranger called on Mr. Manzetti and was shown the instrument and allowed to test it. On leaving the laboratory, the foreigner handed to Mr. Manzetti his visiting card. It read "Alexander Graham Bell." The card is now in the possession of E. Berardin of Aosta.

EMIL BOSCHETTI.

Turin, Italy.

[The "coincidence" related by our correspondent is indeed "curious," because, according to the biographical dictionaries, in 1861 Bell, then a lad of fourteen, was still living in his native Scotland. Johann Philipp Reis, a German physicist, did, however, produce a telephone in 1860 which not only transmitted musical tones but, according to the late Prof. Sylvanus P. Thompson, Reis' biographer, was expressly intended to and did actually transmit speech as well. An interesting account of the conflicting claims for early telephonic workers, including Reis, Bell, Gray and Dolbear, will be found in the late Prof. E. J. Houston's "Electricity in Every-Day Life"; but no undeveloped invention can detract from the independent and successful achievement of Bell.—EDITORS.]

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Paralleling Three-Phase Transformers

Essential to Ascertain the Internal Connections and to Draw Voltage Diagrams—Methods of Connecting and Possibilities of Paralleling Transformers Outlined

THERE are four fundamental methods of connecting three-phase transformers, namely, delta-delta, star-star, star-delta and delta-star, these methods referring to the arrangements of the primary and secondary windings. By various internal connections there are twelve combinations of voltage relations possible for each of the four fundamental methods. These can be shown conveniently as vector diagrams, the vectors (see *N*, *O*, *P* & *Q* of Fig. 1) representing the primary and secondary voltages and their relations as observed under particular test conditions. By the use of such diagrams transformers may be investigated, and the possibility of paralleling them can be determined. Two transformers having equal voltages and the same connection may be paralleled without change. If their low-tension sides have vector diagrams whose vectors are parallel but of different combinations, simple changes in internal connections will make paralleling possible.

Certain fundamental connections will not parallel and their vectors do not form similar diagrams. These are as follows: Delta-delta cannot parallel with delta-star or with star-delta; star-star cannot parallel with delta-star or with star-delta. Any other arrangements can be paralleled, and by constructing the vector diagrams the combination of connections in any transformers and the necessary changes, if any, can be determined.

The fundamental connection—that is, star or delta in primary and in secondary—must be known in advance. The method of investigation is as follows:

Looking at the high-tension side of the transformer under consideration, letter the three terminals *A*, *B*, *C* from left to right and the low-tension terminals on the opposite side *A′*, *B′*, *C′*, as in *M*, Fig. 1. Connect *C* and *C′* and apply three-phase voltage of low value to the high-tension winding. Then read the high-tension terminal voltages *AB*—*BC*—*AC*, low-tension voltages *A′B′*—*B′C′*—*A′C′*, and take the four other readings of voltage, *AA′*, *BB′*, *BA′* and *B′A*. From these ten voltage readings and the accompanying table it will be evident which combination exists in any transformer. By means of *N*, *O*, *P* and *Q* in Fig. 1, its voltage diagram can be picked out and sketched. By doing this for both transformers it can be determined whether they can be paralleled.

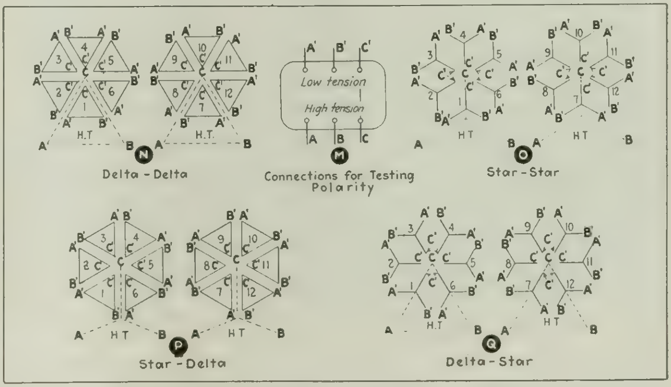


FIG. 1—STANDARD CONNECTIONS FOR THREE-PHASE TRANSFORMERS

There are twelve combinations for each of the four methods of connection, or forty-eight possible combinations in all. If after drawing the vector diagrams they are found to be made up of similar triangles or stars, then the transformers can be paralleled without internal changes by connecting to the same line the leads represented by the corners of the triangles that correspond. For instance, in Fig. 2 (*R*-1) the triangles are similar, though not arranged exactly alike, and the two transformers will parallel on the low-tension side if connected as in (Fig. *R*-2), putting A'_1 and C'_2 together, B'_1 and A'_2 together, and C'_1 and B'_2 together. If the diagram of the two transformers were as shown in Fig. 2 (*S*), one of the low-tension diagrams standing on its point and the other on one of its sides, the two transformers would not parallel without a change in the internal connections of one of them.

To draw the vector diagrams for a given transformer connection proceed as follows: Assuming a transformer which is delta-connected on both high and low tension as an example, draw the diagram of the coils as in Fig. 2 (*T*-1) and number the start and finish of each coil. Then, as both high tension and low tension are connected delta, the lead *A*, *B* or *C* joins the ends of windings on two legs of the core. Thus *A* joins 1 and 4 on the high tension, etc. Start the vector diagram by drawing a triangle to represent the high-tension windings and lettering it as shown in Fig. 2 (*T*-2) (always letter the high-tension diagram in the order shown, *A*, *B*, and *C*, left-hand rotation). Looking at Fig. 2 (*T*-1), the ends of the windings that are connected together at lead *A* are 1 and 4; *B*, 3 and 6; *C*, 5 and 2; so similar numbers can be placed on lines *AB*, *BC*, and *CA*, as shown in Fig. 2 (*T*-2). To draw the low-ten-

VOLTAGE READINGS FOR CONSTRUCTING VECTOR DIAGRAMS OF THREE-PHASE TRANSFORMERS

Sign ">" means "greater than" and "<" means "less than." See drawing for meaning of AB, etc. Combination numbers and letters N, O, P and Q refer to drawing.

DELTA TO DELTA (SEE FIG. 1, N)

Combination			
1	$AA' = BB'$ and $< AB'$	$BA' > BB'$	$AA' = AC - C'A'$
2	$AA' = BB'$ and $> AB'$	$BA' > BB'$	$AB' = AC - C'B'$
3	$AA' = BB'$ and $> AB$	$BA' > BB'$	$BA' = BC + C'A'$
4	$AA' = BB$ and $> AB'$	$BA' < BB'$	$BB' = BC + C'B'$
5	$AA' = BB'$ and $< AB'$	$BA' < BB'$	$AB' = AC - C'B'$
6	$AA' = BB$ and $< AB$	$BA' < BB'$	$BA' = BC - C'A'$
7	$AA' = BB'$ and $> AB'$	$BA' < BB'$	$AB' = AC - C'B'$
8	$AA' < BB'$ and $< AB'$	$BA' < BB'$	$AA' = AC - C'A'$
9	$AA' < BB'$ and $< AB'$	$BA' < BB'$	$BB' = BC + C'B'$
10	$AA' = BB'$ and $< AB$	$BA' > BB'$	$BA' = BC + C'A'$
11	$AA' > BB'$ and $> AB'$	$BA' > BB'$	$AA' = AC - C'A'$
12	$AA' > BB'$ and $> AB'$	$BA' > BB'$	$BB' = BC - C'B'$

STAR TO STAR (SEE FIG. 1, O)

Combination			
1	$AA' = BB'$ and $< AB'$	$BA' > BB'$	$AA' = AC - C'A'$
2	$AA' = BB'$ and $> AB'$	$BA' > BB'$	$AB' = AC - C'B'$
3	$AA' = BB'$ and $> AB'$	$BA' > BB'$	$BA' = BC + C'A'$
4	$AA' = BB'$ and $> AB'$	$BA' < BB'$	$BB' = BC - C'B'$
5	$AA' = BB'$ and $< AB'$	$BA' < BB'$	$AB' = AC + C'B'$
6	$AA' = BB'$ and $< AB'$	$BA' < BB'$	$BA' = BC - C'A'$
7	$AA' = BB'$ and $> AB'$	$BA' < BB'$	$AB' = AC - C'B'$
8	$AA' < BB'$ and $< AB'$	$BA' < BB'$	$AA' = AC - C'A'$
9	$AA' < BB'$ and $< AB'$	$BA' < BB'$	$BB' = BC - C'B'$
10	$AA' = BB'$ and $< AB'$	$BA' > BB'$	$BA' = BC + C'A'$
11	$AA' > BB'$ and $> AB'$	$BA' > BB'$	$AA' = AC + C'A'$
12	$AA' > BB'$ and $> AB'$	$BA' > BB'$	$BB' = BC - C'B'$

STAR TO DELTA (SEE FIG. 1, P)
OR
DELTA TO STAR (SEE FIG. 1, Q)

Combination		
1	$AA' = BB'$ and $= AB'$	$BA' > BB'$
2	$AA' = BB'$ and $> AB'$	$BA' > BB'$
3	$AA' = BB'$ and $> AB'$	$BA' = BB'$
4	$AA' = BB'$ and $= AB'$	$BA' < BB'$
5	$AA' = BB'$ and $< AB'$	$BA' < BB'$
6	$AA' = BB'$ and $< AB'$	$BA' = BB'$
7	$AA' < BB'$ and $= AB'$	$BA' < BB'$
8	$AA' < BB'$ and $< AB'$	$BA' < BB'$
9	$AA' < BB'$ and $< AB'$	$BA' = BB'$
10	$AA' > BB'$ and $= AB'$	$BA' > BB'$
11	$AA' > BB'$ and $> AB'$	$BA' > BB'$
12	$AA' > BB'$ and $> AB'$	$BA' = BB'$

sion diagram draw lines parallel to the three sides of the high-tension diagram and number them in the reverse order to indicate that the secondary induced voltage is opposite in phase to the impressed voltage. This gives Fig. 2 (T-3), and referring back to Fig. 2 (T-1), the low-tension sides 1 and 4 are connected and brought out at A', 3 and 6 are connected together to make B', and 5 and 2 are connected to make C'. Rearranging the two diagrams and connecting C' and C, Fig. 2 (T-4) is obtained, which, on comparison with Fig. 1 (N) proves to be combination No. 4.

Assume that this transformer, connected according to combination No. 4, is to be reconnected to parallel with a transformer connected according to No. 3 of the delta-delta group, a vector diagram of which is shown in Fig. 2 (U-1). Assume that the reconnecting is to be done on the low-tension windings. The high-tension winding being connected the same as Fig. 2 (T-1), its vector diagram will be the same and will be numbered like Fig. 2 (U-2). Numbering the sides of the low-tension triangle in the same way as Fig. 2 (T-3) (voltages opposite to primary) gives Fig. 2 (U-3). By comparing this with Fig. 2 (T-3) it is seen that B' of Fig. 2 (U-3) can be formed by connecting 2 and 3 of Fig. 2 (T-3), C' is 4 and 5, and A' is 1 and 6. The original low-tension connections, combination No. 4 shown in Fig. 2 (T-1), must therefore be changed to be as shown in Fig. 2 (V), which is combination No. 3 of the delta-delta group.

James Dixon.

Reliance Electric & Engineering Company,
Cleveland, Ohio

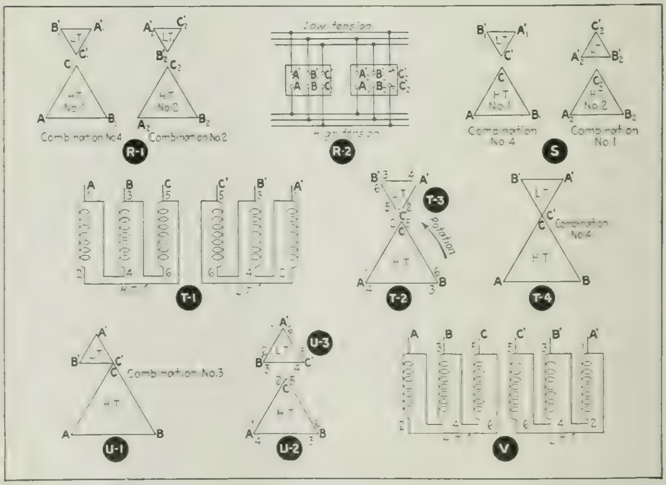


FIG. 2—DIAGRAMS SHOWING HOW POLARITY OF UNMARKED TRANSFORMER IS DETERMINED

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Carrier-Current Sets for Central Stations

CONSIDERABLE progress has been made in the development of carrier current, or "wired wireless," applicable to communication between power stations over the transmission circuits of the system, according to the report of the electrical apparatus committee of the Pennsylvania Electric Association presented at the annual convention held at Bedford Springs, Pa., on Sept. 6-9.

The 50-watt sets now on the market have a range of 85 miles on untapped transmission lines. Designs are now under way for 250-watt sets having a range of 250 miles when used with single-span antenna placed approximately 15 ft. below the power cables. Taps to transmission lines reduce this range approximately 10 miles per tap, irrespective of length of branch line.

A call-bell system is used as in standard commercial telephones, so that the constant attention of an attendant is not necessary. A licensed operator is not required, as these sets will not broadcast over any great range—the transmission circuits serve to limit this feature. Similarly, the carrier-current system is unaffected by external broadcasting and by atmospheric disturbances. Thunderstorms cause no greater disturbance than the usual click on the receiver.

The present sets now developed are not suitable for duplex use, as in standard telephones, as it is necessary to press a button while talking and release the button while listening. Developments are now under way to make duplex conversations possible.

The power required for transmitting is derived from a ½-kw. motor-generator set, which furnishes 1,000 volts direct curent for the plate circuits and 88 volts single-phase for the step-down transformers for heating the filaments of the transmitting tubes. A storage battery furnishes current for the filaments of the receiving tubes and for the relays used in the call-bell system.

Lifting the receiver from the hook automatically starts the motor-generator set and places the transmitting tubes in service. The receiving tubes are normally in circuit at all times as they operate the call-bell system.

The maintenance of these stations consists primarily of "radiotrone" renewals and amounts to approximately $20 per month per station. The cost of this equipment is approximately $2,000 per station.

There are at present about twenty-five sets in process of manufacture in Connecticut and New York State for several of the large power companies of the South. None of the sets is in commercial use as yet, although it is anticipated that delivery will be made this fall.

An experimental set is transmitting very satisfactorily over a 30-mile transmission line, operating at 33,000 volts. The quality of speech is much clearer and rounder than in the standard telephone circuits between the two points.

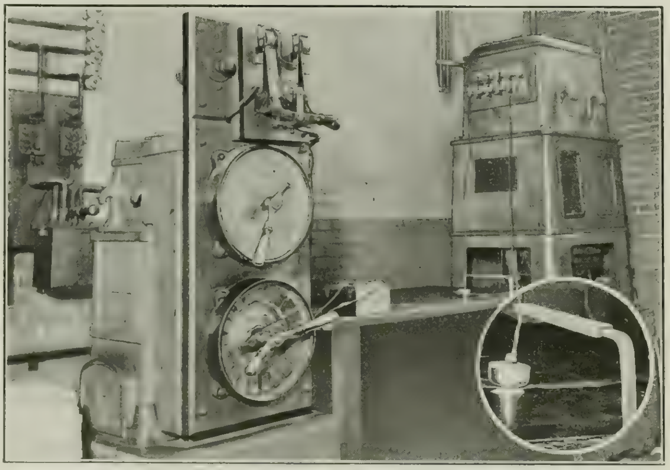
Portable stations now under developments for use on motor trucks will be able to send, receive and signal the power stations when brought into close proximity to the transmission lines. Portable sets for patrolmen will also be available later for sending and receiving, but not for calling.

Among the advantages of the carrier-current system over standard metallic lines are freedom from inductive interference, freedom from interference due to broken telephone circuits, elimination of lighting disturbances, reduced cost of construction and maintenance, and clear and better transmission than can be obtained on private transmission-line telephone circuits.

Field Editor Electrical World.
New York, N. Y.

Test for Dielectric Strength of Sheet Insulation

A NEW method of testing the momentary dielectric strength of sheet-insulating materials like varnished cambric has been proposed by the American Society for Testing Materials. It is not to be considered as indicating the permanent dielectric strength of the material, as breakdown will take place at a lower voltage when applied for a greater length of time. Criticisms are solicited by the committee on electrical insulating materials and should be directed to H. S. Vassar, secretary of the committee, 102 River Street, Newark, N. J.



METHOD OF DETERMINING MOMENTARY DIELECTRIC STRENGTH OF SHEET INSULATING MATERIAL

The character of apparatus necessary to make the test, the nature of electrodes and test specimen and the mode of procedure are given in the paragraphs that follow:

I. *Apparatus.* — Any well-designed, high-tension transformer connected to an alternating-current supply, having as nearly a true sine wave as possible, may be used. The transformer and the source of supply of energy shall be not less than 2 kva. for voltages of 50,000 volts or less, and not less than 5 kva. for voltages above 50,000 volts. The frequency shall not exceed 100 cycles per second.

Regulation shall be so controlled that the high-tension testing voltage taken from the secondary of the testing transformer can be raised gradually from any point and in no case more than 500 volts at a step. The control may be made by generator-field regulation, with an induction regulator, or with a variable-ratio auto-transformer. Any method of regulating the voltage is satisfactory which does not distort the wave more than 10 per cent from a sinusoidal shape.

The voltage may be measured by any approved method which gives root-mean-square values, preferably by means of a voltmeter connected to a special voltmeter coil in the high-tension winding of the testing transformer, or to a separate step-down-instrument potential transformer. A voltmeter on the low-tension side of the transformer is satisfactory, if the ratio of transformation does not change under any test condition. An electrostatic voltmeter properly calibrated in the high-tension circuit is also satisfactory. A spark gap may be used to check the readings at very high potentials.

Some protection is desirable in the high-tension circuit of testing transformers where the potential is 25,000 volts or over, to prevent dangerous surges and limit the current when the test specimen is punctured. It is, however, desirable to have as much energy available as possible when puncture occurs. If impedance in the form of choke coils is used in series with the high-tension terminals, it should not be greater than that which will limit the high-tension current to double the normal rated current of the testing transformer.

When a spark gap is used, a non-inductive resistance of about 1 ohm per volt should be inserted in series with one terminal of the spark gap, to damp high-frequency oscillations at the time of breakdown and limit the current flow. This resistance shall be as near the gap as possible. If the test is made with one side grounded, this resistance shall be on the ungrounded side of the circuit, and if neither side is grounded, the resistance shall be inserted one-half on each side of the spark gap. Water-tube resistors are preferable to carbon for this purpose, as carbon resistance may be materially decreased by the passage of current.

The apparatus used and the method of measuring the voltage shall meet the requirements of the standardization rules of the American Institute of Electrical Engineers.

II. *Test Specimens.* — The electrodes shall be of brass or copper, 1 in. thick and 2 in. in diameter. The edges shall be rounded to a radius of ¼ in. The contact surfaces shall be flat and polished.

The test specimens may be of any convenient size, but the total area of the specimens of one sample of material shall be sufficient to permit making at least ten satisfactory tests. The specimens shall be representative of the material to be tested, care being taken to select material which is free from abnormal defects such as blisters, wrinkles, cracks, etc.

III. *Procedure.* — The tests shall be made in air with the specimen at room temperature.

The testing electrodes shall be kept clean and polished. The electrodes shall be self-aligning and shall be placed exactly opposite one another.

Starting at zero, the testing voltage shall be increased uniformly at such a rate that puncture will take place in from ten to fifteen seconds. Ten tests shall be made, and the average of these ten puncturing voltages shall be taken as the momentary dielectric strength.

The thickness of the specimen shall be measured at each puncture, using a ratchet micrometer graduated to 0.001 in. and having a circular foot not less than 0.240 in. nor more than 0.260 in. in diameter.

The report shall include the following: (a) The thickness of the specimen at each puncture; (b) total volts and volts per mil of thickness at each puncture; (c) the average, maximum and minimum volts at puncture per mil thickness for each sample; (d) the room temperature, and (e) the relative humidity, in per cent.

F. M. Farmer,

Chairman Committee on
Electrical Insulating Materials.
American Society for Testing Materials,
New York.

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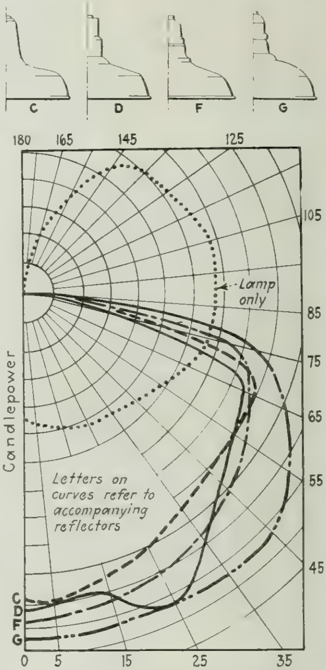
"RLM" Dome Reflectors with Certified Labels

The results of tests made by the writer on seven makes of reflectors furnished by the manufacturers early in the "RLM" standardization movement were published in the *Electrical World* of Aug. 12, 1922, page 330. These reflectors were not labeled by the Electrical Testing Laboratories.

The accompanying data are the result of a second series of tests on new "RLM" reflectors with 400-watt, 125-volt "Mazda C" lamps. These reflectors have the "RLM" label. It may be noted that much more uniform results are now obtained in the candlepower curves. Mechanical and thermal improvements have also been made. On the curves and outlines the same letters are used on the respective makes of reflectors as in the first series of tests. It is believed that all four of the reflectors treated herein show improvements because of the testing and labeling of the Electrical Testing Laboratories. The user may be sure that he is receiving the "RLM" standard-dome reflector when he sees the certified label.



REFLECTORS LABELED BY ELECTRICAL TESTING LABORATORIES SHOW IMPROVEMENT IN LIGHT DISTRIBUTION

It is believed that the distribution values and the efficiencies shown by the candlepower curves are so alike in all "RLM" reflectors that mechanical and thermal characteristics alone need be considered when standardizing on a make of reflector of this specification.

D. W. Blakeslee,

Electrical Engineer.
Jones & Laughlin Steel Company,
Pittsburgh, Pa.

MECHANICAL, THERMAL AND ILLUMINATION COMPARISONS OF "RLM" STANDARD DOME REFLECTORS

	Reflector C	Reflector D	Reflector F	Reflector G
Enamel	Slightly pitted and spotted	Slightly pitted and spotted	Slightly pitted and spotted	Pitted and spotted
Cracking of enamel under pressure at largest diameter	None	None	At edge	At center and edge
Socket	Light, two-piece	Heavy, two-piece	Light, two-piece	Very heavy one-piece
Socket held from turning	Yes	Yes	Yes	Yes
Number of outside pieces	One	Two	Two	Two steel, one cast iron
Nut	Heavy	Heavy	Light	Very heavy
Gaskets	Fiber	Rubber	Lead, asbestos	Fiber, copper
Reflector rolled	Under	Under	Over, well filled	Under
Weight in pounds	5	5	4½	5½
Temperature rise in socket, deg. F.	103	80	86	73

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Limiting Sapwood a Fallacy

A common fault of engineers is to use the same specification for timber which is to have an effective preservative treatment as for timber to be used untreated. A much better treatment is insured by specifying timber without sapwood limitations, since the sapwood takes the preservative much more readily than the heartwood. When timber is to be used untreated, however, and durability is desired, a large percentage of heartwood should be specified, since the heartwood of most species is considerably more durable than the sapwood.

Material which contains considerable sapwood, particularly Southern pine, can be obtained at less cost than that which contains a large percentage of heartwood; therefore failure to distinguish between specifications for timber to have a preservative treatment and that to be used untreated is not only inconsistent with best practice but results in an increased cost.

These facts are also recognized by the American Society for Testing Materials, and their specifications for Southern pine timber to be creosoted require at least 30 per cent sapwood in cross-section. "All-heart" or "85 per cent heart" pine is frequently specified by engineers not particularly familiar with timber, since they undoubtedly believe the heartwood is actually stronger than the sapwood. This is an erroneous impression, however, and in more than 300,000 tests made by the Forest Products Laboratory no effect on the mechanical properties of wood due to the change from sapwood to heartwood has ever been noticed.

P. R. Hicks,

Secretary-Manager.
American Wood Preservers' Association,
Service Bureau,
Chicago, Ill.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Functions of a Merchandising Department

Appliance Sales Should Increase Load, Earn a Profit and Build Good Will for the Central Station

By C. Ernest Greenwood
Superintendent Appliance Department,
Edison Electric Illuminating Company of Boston

CENTRAL-STATION commercial men will no doubt agree that until very recent years no department of the business has had to travel such a rough road or been subject to such an atmosphere of mere toleration as have the merchandising departments. There was no one particular reason for this attitude, but if all cases were analyzed, it is a fair guess that in general the merchandise department was considered a necessary evil and treated as such. Frequently it was found that the supervision of selling appliances had been placed in the hands of an engineer as a side issue or in the hands of some one unfitted because of his lack of merchandising knowledge or merchandising instinct. The management of the merchandising department not being considered a full-sized job, the result was often supervision by a person without much business ability. His job was to "oversee" the sale of appliances.

The result was natural enough. A department that should have been a distinct asset became a liability, an expense seemingly unjustified. Customers became dissatisfied, the trade likewise, and the small business became smaller and died out.

A live man in charge of merchandising appliances was looked upon by men in other departments of the company as a mild bolshevist. His merchandising viewpoint could not be appreciated by those not having to cope with his problems, the greatest of which was to synchronize his work with the other activities of the company.

Fortunately, the standing of the central-station merchandise branch has now reached a much higher plane. It has had consideration by the executives of the company. By reason of the manufacture of new and more efficient electrical labor savers, because of millions of dollars' worth of national advertising to tell the public about them, because of year-round diligence on the part of progressive central-station companies to bring the manufacturer's story to users of electricity and create a market, a demand has arisen for electrical devices in home, office and factory.

C. E. GREENWOOD

The electric service customer looks to the central-station company for guidance in selection, for instruction in proper use and for maintenance service or a medium for that service.

A discussion of whether the central-station company should take upon itself the merchandising of the devices or simply promote them is irrelevant here. Generally speaking, it is a local problem, but in passing I would venture the opinion that through aggressive promotion and sales of electrical devices by the central-station company with high-class service stores, operated on strictly merchandising principles and in fair competition, a healthier merchandising business can be built up for other electrical merchants in most communities. Statistics show that in many communities where the electric light and power companies do not merchandise a thriving business is done by dealers. But there are no statistics to prove that a more vigorous business might not be done by all dealers if the same companies were aggressively merchandising on true cost principles.

The modern merchandising branch of the central station has a threefold value:

1. From a load-building point of view it is placing "current-consuming" devices on the lines. "They are seldom used," says an anti-merchandiser. Some may not be used often, but the day when from $10 to $25 is invested in a nickel-plated electrical device just to fill an ornamental purpose along with bric-à-brac has, in the writer's opinion, disappeared. It is generally agreed that the larger labor savers—washing machines, vacuum cleaners, etc.—when once in the home, mean to the supply company added income without added investment.

2. Unlike the commercial departments, the merchandising department has the problem of increasing the load and in addition making a profit on the sale of appliances. To the merchandise man this is the all-important factor. To make profit means operation on a cost basis and precludes running a so-called cut-price establishment. It is easy to put appliances on the line for the purpose of load building only. It is a real job, though, to put them on the lines at a profit. This is of paramount importance and is the vital point in successful merchandising.

3. Finally, the merchandising department creates good will and helps strengthen this important asset of any public utility. If the department functions properly, it sells a service with every device. Every de-

vice enhances the value of the company's service.

Each appliance represents a point of contact. Light is a beautifier and comforter in the home, but the great appeal of electric service comes through the easing of laborious tasks such as clothes washing, dish washing, ironing and sewing and making cooking processes more pleasant and interesting. Many separate services are rendered by the central-station company through appliances. In fact, the term "lighting bill" has become a misnomer; it is now a "service bill." And the price the customer pays for all these services in any one month is of diminishing importance in his mind as the number of appliances or the number of home services rendered increases. Even the use of energy for light is built up through merchandising if portable lamps are sold.

All these touches of satisfaction, in addition to the all-important one of the personal, courteous contact in the numerous calls to buy merchandise, make closer the bond between central-station company and customer. They promote good will.

We must bear in mind, too, that because of the many points of contact and the dependence of customers on the electrical conveniences there are just that many chances of a slip-up in the service. The human element enters into every transaction, and personnel and personal service, which are vital factors in successful management, must be kept at a high standard.

More central-station merchandising departments are on a substantial basis both financial and ethical than ever before. They are functioning properly, and the recognition of their true value to the electric light and power company has earned them the place they have so long deserved. No successful business can afford to give its sales department secondary consideration, least of all a public utility which depends upon public good will for its existence. It only remains for those men in charge of appliance sales to conduct their merchandising activity with sound business sense and along ethical lines.

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Investment Cost of New Customers Averages $250

BASED upon the records showing that the increase of customers of the Dallas (Tex.) Power & Light Company has averaged 3,175 a year for the last two years, it is estimated by C. E. Calder, president of the company, that the amount of capital to be required for the next several years in providing new equipment adequate to meet the demand for electricity will amount to $793,750 a year. This estimate is based on the records of the company, which show that the average total investment cost per new customer has been $250.

The growth of Dallas and the increasing use of electricity for light and power makes the demand for plant extension in this city unusually heavy. The company is now arranging for an addition to its plant to be built at a cost of $2,000,000, which is needed at this time to meet demand for increased electrical energy by Dallas consumers.

The Dallas Power & Light Company is meeting the demand for new capital to provide necessary extensions and improvements in its plants by the sale of securities to its customers, and a campaign is now being conducted for the sale of 7 per cent preferred cumulative stock to users of electricity in that city.

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Electric Clock Advertises Reliability of Service

A VALUABLE bit of advertising for its service is obtained by the United Electric Light & Power Company of New York City through the illuminated outdoor billboard shown here, the feature of which is a large clock electrically operated by the company's 110-volt service. The clock was developed and built by the company, and it is believed to be the first time that a synchronous motor has been used for an outdoor clock, especially for one which in size is the second largest in all New York.

The hands of this clock are operated by a 4-watt, 60-cycle synchronous Warren motor and a ⅛-hp. motor through a relay as shown in the schematic diagram. The synchronous motor, through reduction gears, revolves contact *A* at the rate of four revolutions per minute. As contact *A* revolves it touches contact *B*, energizing the relay, which feeds a ⅛-hp. single-phase motor driving the hands of the clock. Contact *B* is attached to the minute-hand shaft, thus rotating with the minute hand approximately one-fourth of a minute, setting the clock three or four times per minute.

The clock has now been in operation for nearly five months and has required virtually no attention as it has kept absolutely accurate time with the Warren master clock located at the company's Sherman Creek station.

Because of the accurate time this

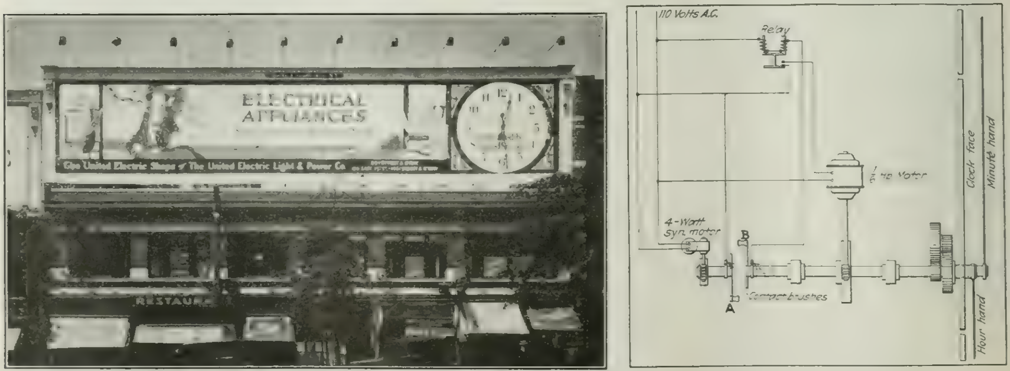
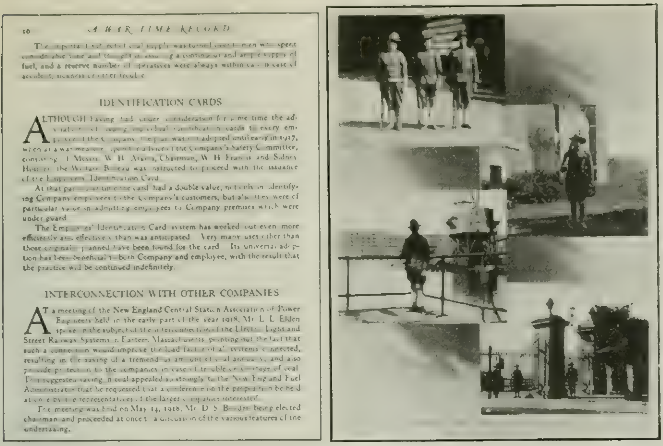


DIAGRAM SHOWING BILLBOARD AND CONNECTIONS FOR ELECTRICALLY OPERATED CLOCK



TWO PAGES FROM BOSTON EDISON COMPANY'S "WAR-TIME RECORD"

billboard has come to be a landmark in the neighborhood, and the clock is a constant reminder of the reliability of the company's service.

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War-Time Record of Boston Edison in Book Form

ELECTRIC light and power companies in the United States played an amazingly important and diversified part in the world war, but few people have realized the scope and value of this service outside governmental offices and the higher executive circles of the public utility industry. The main task of supplying energy for the production of munitions, transportation of troops and supplies, lighting of cantonments, operation of naval bases, etc., has received more or less publicity as the central corporate activity of the electric service organization, and the splendid record of individual employees with the colors, of course, surpasses all other achievements. What a range of activities a single company and its personnel attained, however, is admirably illustrated in "A War-Time Record," published privately by the Edison Electric Illuminating Company of Boston, under the able editorship of Edward S. Mansfield, historian of the organization and in charge of the department of field-service statistics.

The Boston company's record as printed is believed to be the first of its kind among American central-station companies. It reviews in 108 pages all the major activities of the organization as an auxiliary to war preparation and service, and the work of individuals in that connection is outlined. The effect of the war upon operation, the problem of plant enlargements, the work required for fuel supply, the trend of economies in station performance and the construction of additional lines and substations to serve arsenal, shipyard and munition-plant requirements are outlined. Interesting accounts are made of the company's preparedness activities, the work of President C. L. Edgar upon the Naval Consulting Board of the United States, the Organization for Industrial Preparedness, the National Committee on Gas and Electric Service, and work in other important fields, and the co-operation of the company and its employees in welfare and relief work, the raising of Liberty loan funds, interconnection with other companies, and many other topics are discussed. Measures adopted to protect company property, the treatment of employees, use of women operators in substation and stockroom service, the trend of rates during the war, canvass of aliens of the company, food production, the N. E. L. A. convention of 1918 and special services rendered by members of the company, are touched upon, with many illustrations at home and in the field, here and overseas.

The record closes with an "honor roll" giving the military and naval records of all employees who were with the colors, accompanied by reproductions of photographs taken at the front by members of the company and a casualty list with photographs and records of the eleven employees who lost their lives. The total number of employees listed as in the service is 444, nearly one in five of those on the payroll having been with the colors.

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What Other Companies Are Doing

Worcester, Mass.—A residential survey has just been completed by the Worcester Electric Light Company, with the result that 31,425 installed meters were disclosed out of a total prospective installation of 41,683, or a saturation of 75.4 per cent. It required seven months and twenty-five days to complete the survey at a cost of $882.10, of which $816 represented wages and the balance car fares. Streets were covered in alphabetical order. The company's total number of commercial lighting meters has increased 1,270 per cent in eleven years.

Augusta, Me.—In a five weeks' campaign for house-wiring contracts recently concluded by the Central Maine Power Company 2,214 contracts were secured at a total cost of soliciting, advertising and clerical service of about $1,800. The quota assigned was 2,000 contracts. Personal solicitation by employees, preceded by newspaper advertising and a few letters sent directly to prospective customers achieved the above result. R. G. Webber was in charge of the campaign.

Joliet, Ill.—A historical exhibit is being staged by the Public Service Company of Northern Illinois in its salesroom which traces the evolution of electric appliances from the crude beginnings to their present status of development. One exhibit shows the complete evolution of artificial lighting devices.

Boston, Mass.—Additional energy to the extent of 4,000,000 kw.-hr. over and above the normal growth of lighting business has been sold by the Edison Electric Illuminating Company as a result of the activities of its illuminating engineering department. Betterment installations in industrial plants and mercantile establishments of the Boston metropolitan district constitute an important part of this service, supplemented by a "Bureau for Better Illumination" maintained in Boston along co-operative lines by the various branches of the local electrical industry. J. Daniels is illuminating engineer of the Boston company.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Fuel Economy in Steam-Power Plants.—John B. C. Kershaw.—The prevention of waste in connection with the industrial use of fuel for power generation is of utmost importance, and in a series of articles commencing in this issue the author presents information and data pertinent to the subject. In the first article he considers the composition and constitution of natural and artificial fuels and the chemistry of the combustion process. The fuels include wood, peat, lignite, bituminous coal, semi-bituminous coal and anthracite coal.—*Beama*, July, 1922.

Nipigon Hydro-Electric Power Development. — Characteristics of the plant and reasons for its construction are set forth. This development is on the Nipigon River, which flows from Lake Nipigon to Lake Superior in Ontario. The ultimate development will be for 75,000 hp., while at present two units are completed and in operation for 12,500 hp. each. A description is given of the power house, electrical equipment, pumping equipment, etc.—*Canadian Engineer*, Aug. 1, 1922.

Hydro-Electric Power-Plant Design.—J. A. Sirnit.—The best way to maintain the full capacity of a hydraulic power plant during flood periods is to remove the high tailwater from the discharge opening. This may be successfully accomplished by a backwater suppressor utilizing the waste water, and the article is chiefly devoted to the development and application of this method. Two testing models are described and the results presented, while the design of the draft-tube orifice is discussed at some length. The plant of the Alabama Power Company at Mitchell Dam on the Coosa River in Alabama, where the Thurlow type of suppressor is applied, is described. — *Mechanical Engineering*, August, 1922.

Transmission, Substations and Distribution

Combination Transformer and Converter.—A machine called the "transverter" is described which is a combination of the transformer and converter as ordinarily used. Instead of transmitting by three-phase alternating current this machine makes it possible to supply at once to the distribution system high-pressure direct current. The apparatus consists in the main of a transformer for stepping up the pressure of the three-phase current and has several rotating commutators for converting the alternating current into direct current. The commutators are connected in series so that the direct-current pressure of each is added to the one preceding it. An experimental unit has been working for sixteen months at a pressure of 100,000 volts, but it is estimated that this might be increased to a probable limit of 200,000 volts.—*Bulletin of the Department of Overseas Trade*, August, 1922.

Centrifugally Cast Reinforced-Concrete Poles.—M. Foerster.—A large part of a 200-mile transmission line in Sweden, operating at 110,000 volts, was equipped with round reinforced-concrete poles made by the centrifugal casting method. The poles consist of two vertical members connected near their upper end with a horizontal bar made likewise of concrete. According to the different wire-load conditions, four different sizes of poles have been used, the average dimensions being a height of 57 ft., a bottom diameter of 20 in. and a top diameter of 9 in. More than 5 per cent of the poles have been subjected to mechanical tests. They have withstood double the guaranteed top pull without visible deformation and began to develop cracks at eight times this stress. In no case did an actual break occur. The poles were transported, ready for use, over a long distance by rail and water, with no detrimental effects.—*Elektrische Kraftbetriebe und Bahnen*, July 24, 1922.

Units, Measurements and Instruments

Influence of the Conductivity of Water Upon the "Wet-Flash-Over" of Insulators.—W. Weiker.—To determine the wet breakdown strength of insulators, water from city mains is used generally. The author shows that very great variations exist in the electrical conductivity of the water in different localities and that the results obtained will vary considerably. City water from twenty German cities has been measured as to its specific conductivity, and it was found to vary from 80 microhms to 1,010 microhms per cubic centimeter. To show the effect of differently conducting water upon the flashover, a pin-type insulator and two chains of suspension insulators were tested under a spray of the various water supplies and with rainwater. Very large differences were found, and it is recommended that mention be made in all "wet ratings" of insulators of conductivity of water used.—*Elektrische Kraftbetriebe und Bahnen*, July 10, 1922.

Indicating Wave Meter.—E. Kohlhauer.—A direct-indicating wave meter is described for currents between 200 amp. and 700 amp. The instruments are adjusted to measure wave lengths of from 1,500 m. to 30,000 m.—*Elektrotechnische Zeitschrift*, Aug. 3, 1922.

Electrical and Magnetic Weld Testing.—T. Spooner and I. F. Kinnard.—Laboratory tests to determine the possibility of applying electrical and magnetic methods for testing the quality of butt-welded steel plates were carried out, and the conclusion seems to be that such tests will pick out faults in the weld irrespective of what type they may be. The method of testing consisted in measuring the electrical and magnetic potential drop across the weld with a definite emf. or magnetic potential applied on opposite sides. This drop was compared with the drop over an equal length of unwelded plate.—*Iron Age*, July 20, 1922.

Illumination

Lighting of Small Stores.—A. L. Powell.—In order to obtain information on the present practice in small-store lighting, approximately 600 typical stores of this class were inspected. Data were obtained on the dimensions, height of lamps, size and number of lamps, etc., and with the aid of the foot-candle meter, minimum, maximum and average values of illumination were obtained, some of which are given in the accompanying table. Typical layouts for various kinds and sizes of small stores are shown, together with numerous illustrations. The subject of lighting show windows is discussed and mention made of the effects obtained

AVERAGES OF INTENSITIES IN VARIOUS CLASSES OF STORES FOLLOW FAIRLY CLOSELY THE RECOMMENDED VALUES

	No. In-spected	Watts per Square Foot			Average Foot Candles			Type of Equipment			
		Mini-mum	Maxi-mum	Aver-age	Mini-mum	Maxi-mum	Aver-age	Inclos-ing	Semi-Indi-rect	Bowl Re-flector	Other Forms
Bakery	14	0.3	1.3	0.85	2.5	7.5	5.7	10	3	1	..
Barber shop	30	0.7	2.5	1.5	2.5	10.0	6.5	26	3	1	..
Cigar store	20	0.8	4.4	1.6	3.5	11.0	7.1	8	..	12	..
Clothing	37	0.6	2.5	1.2	3.5	9.0	6.0	34	2	1	..
Confectionery	38	0.5	2.3	1.1	3.0	12.0	5.3	24	5	7	2
Delicatessen	40	0.5	2.5	1.1	3.0	11.0	5.7	34	1	4	1
Drug	41	0.3	1.5	1.0	2.0	11.0	6.0	25	5	11	..
Dry goods	19	0.4	2.5	1.1	3.0	10.0	5.3	14	1	4	..
Florist	19	0.5	4.0	1.2	2.0	8.0	5.0	12	4	1	2
Furniture and carpet	9	0.7	2.0	1.0	3.0	7.5	5.4	6	..	2	1
Grocery	35	0.2	2.0	1.0	2.0	10.0	5.1	20	2	12	1
Haberdashery	35	0.7	2.5	1.5	4.5	13.0	7.0	23	1	7	2
Hardware	27	0.3	2.3	1.0	3.0	9.0	5.0	16	1	8	2
Jewelry	14	0.9	2.2	1.3	3.5	10.0	6.4	7	1	6	..
Meat market	25	0.5	2.2	0.9	3.0	9.0	5.2	23	1	1	..
Millinery	32	0.5	3.3	1.3	3.5	10.0	6.6	21	4	6	1
Music	22	0.5	2.6	1.2	3.0	12.0	5.3	16	4	2	..
Restaurant	37	0.3	1.8	0.9	2.0	8.0	5.1	32	2	3	..
Shoe	36	0.6	2.8	1.2	3.5	11.0	5.8	21	7	6	2
Stationery	39	0.3	1.7	0.9	1.0	8.0	4.3	22	6	11	..
Women's wear	34	0.6	2.6	1.2	3.5	10.0	6.0	25	8	1	..

through the use of colored lights and spotlights.—*Bulletin L. D. 139 of Edison Lamp Works, General Electric Company.*

Motors and Control

Large Electric Tower Clock. — R. Bügler.—Description of a novel drive for a very large clock, 140 ft. above the ground, the hands of which are 9½ ft. and 6 ft. long respectively, sweeping over a dial 20 ft. in diameter. The hands, which are made of steel, contain a number of electric lamps to illuminate them uniformly. For the twelve numerals of the clock circular holes 2 ft. in diameter are provided in the face of the clock, in each of which is placed a nest of electric lamps. The four sides of the square tower carry each one clock, which is driven individually. The driving mechanism is remarkably simple, the entire work consisting of a 125-watt motor, four shafts and seven gear wheels. A master clock placed somewhere in the tower closes every minute a contact for a time interval just long enough to operate the small motor of the tower clock for such a time as to move the hands forward one-sixtieth of the dial circumference. A second motor is provided in case the first fails.—*Siemens Zeitschrift,* July, 1922.

Effect of Saturation of Magnetic Leakage Path on the Circle Diagram of the Three-Phase Induction Motor.—J. T. Takeuchi.—Former investigations on the saturation of the magnetic leakage path and the manner in which it affects the circle diagram have only given the results of experiments and give no idea of how to correct the circle diagram for this effect. The author explains a new idea along this line.—*Journal of Institute of Electrical Engineers of Japan,* July, 1922.

Cutting Out Coils in Direct-Current Windings.—A. C. Roe.—Speedy repairs are sometimes possible by cutting out defective coils in a direct-current motor or generator. The methods of where and how to open the coils and how to put on jumpers from one commutator bar to another are explained.—*Industrial Engineer,* August, 1922.

Protecting Alternating-Current Motors.—B. W. Jones.—The problem of properly protecting alternating-current motors against open phase, reverse phase and overloads is outlined and equipment to give this protection described.—*Power,* Aug. 22, 1922.

Heat Applications and Material Handling

Use and Abuse of Electric Arc Welding in Locomotive Work.—C. W. Roberts.—In all processes of autogenous welding there is an intense local heating that is unavoidable and in cooling there is liable to be a certain quantity of locked-up stresses. The question the author raises is whether these stresses are great enough and so menacing as to warrant the discontinuance of a large amount of welding. Various locomotive parts have been electrically welded and after a time have failed. Similar parts that have never been welded have also failed. An investigation of these failures is carried out for the purpose of finding whether the failure was caused by locked-up stresses, fatigued metal, faulty or inferior castings and forgings, or by an inefficient and careless welder or supervisor. Much emphasis is placed on the proper preparations before welding any job. — *Journal of American Welding Society,* July, 1922.

Manufacture of Phosphoric Acid in the Electric Furnace. — Theodore Swann.—The commercial production of phosphoric acid in the electric furnace by condensation and electrical precipitation is now being successfully conducted. Methods of purification have been worked out and are in operation.—*Journal of Industrial and Engineering Chemistry,* July, 1922.

Acid Electric Furnace Practice.—C. W. Francis.—Basic scrap and how to charge it, methods of making a new bottom, when to tap and how to pour and alloy additions in the furnace are the main considerations in this article. —*Iron Age,* Aug. 10, 1922.

Electrophysics, Electrochemistry and Batteries

Electric Dust Precipitation.—J. Körting.—The author gives a history of the development of the Cottrell precipitation process, describes the equipment of modern plants and compares the American and European practices. The tube type as well as the plate type precipitator is considered, and the necessary mechanical and electrical data are given for both. The average current requirement for a precipitator may be estimated to about ½ milliampere per one meter of high-voltage wire, or about 20 watts per meter.—*Zeitschrift des Vereines Deutscher Ingenieure,* July 22, 1922.

Engineering Problems Involving Atmospheric Moisture.—W. H. Carrier.—The principal problems relating to atmospheric moisture that are encountered by the engineer are (a) removal of moisture from materials by drying, (b) cooling of water and of materials containing water by evaporation, (c) cooling of air or other gas by evaporation of moisture in it, (d) the artificial regulation of moisture content and the relative humidity of air for industrial purposes and for ventilation, (e) the control of moisture content of hygroscopic materials, and (f) the control of chemical reactions. These problems and their practical application to various industries are discussed in detail.—*Bulletin of the School of Engineering, Johns Hopkins University.*

Traction

An Analysis of Regenerative Braking on Electric Locomotives.—C. E. Fairburn and M. A. Harper.—Characteristics and curves for considering the performance of direct-current electric locomotives are given for regenerating energy. These are calculated on the same basis as the well-known characteristic curves for motors and show the horsepower, the tractive effort, speed and efficiency plotted against the current output. — *Electric Journal* (England), July, 1922.

Telegraphy, Telephony, Radio and Signals

Fundamental Principles of Radio Telephony.—L. W. Chubb.—As it is the universal experience that an electrical engineer is considered by his friends to be an authority on all electrical matters regardless of how divergent they may be from his particular line of work, this article on the fundamental principles of radio telephony is written with the purpose of broadening knowledge. It covers the theory of wireless waves, methods of tuning, principles of transmitting and receiving circuits for telephony, the part played by detectors and applications of vacuum tubes.—*Electric Journal,* July, 1922.

Short Electric Waves Obtained by Valves.—E. W. B. Gill and J. H. Morrell.—Various methods have been recently discovered for the generation of continuous oscillations of short wave lengths by means of three electrode valves. The authors do not think that any special assumptions are necessary to give an explanation of the way in which the oscillations are sustained and hold that the ordinary conditions for the maintenance of oscillations by continuous emission will account for all the facts that have been observed. Only oscillations of the Barkhausen type are considered in detail, but the theory can be extended to cover all the types.—*Philosophical Magazine,* July, 1922.

Performance of a Radio-Telegraphic Transmitter.—N. Lea.—The paper deals with the performance of a commercial type of spark transmitter, and experimental results are given which enable a complete analysis of the losses to be arrived at. Particulars of the performance of this type of installation under traffic conditions show that the type of signal emitted shows high commercial efficiency.—*Electrician,* Aug. 11, 1922.

Miscellaneous

Shipping of Very Large Transformers.—E. Klein.—The paper describes a railway car which permits a safe shipment of a completely assembled transformer with a capacity as high as 100,000 kva. The new car consists of two five-axle trucks over which are placed two huge girders, between which the transformer is suspended. To stand the stress of this suspension, the tank walls of the transformer have to be properly reinforced. This construction will permit distributing the weight of the transformer and the car so as not to exceed 16 tons per car axle.—*Elektrotechnische Zeitschrift,* July 22, 1922.

Storing and Clarifying Oil.—Where oil reclamation is practiced the use of standard separating machines of the centrifugal type seems to be almost universal. For cleansing and purifying, the oil is led from the separating machines to reservoirs, filters and clarifying apparatus in turn. New oil is added in some cases to maintain the standard necessary for good work. Sterilizing and clarifying oils may eliminate skin affections which are common in many shops.—*American Machinist,* July 27, 1922.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

N.E.L.A. Convention Fixed

New York Chosen for the 1923 Meeting and Arrangements Made for Public Policy Meeting

AT THE session of the executive committee of the National Electric Light Association held in New York on Wednesday it was decided, on the recommendation of the committee headed by Arthur Williams, to hold the next convention in New York City. The New York Chamber of Commerce and other business organizations also urged favorable consideration of New York as the next convention city.

Headquarters will be established at the Commodore Hotel, where all meetings, with the exception of the public policy meeting, will be held. It is the expectation to stage the public policy meeting either in Carnegie Hall, the Metropolitan Opera House or some suitable theater. The date for the convention has been tentatively fixed as the week beginning June 4, 1923.

At the same executive committee meeting budgets of the headquarters staff and geographic sections were passed and approved.

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New Resolution Before House on Muscle Shoals

Representative Hull of Iowa introduced in the House of Representatives on Wednesday a resolution authorizing the Secretary of War to sell to the Alabama Power Company the government-owned steam plant and substation at Gorgas and the transmission line to Sheffield, together with the substation and its appurtenances at the latter place, for a sum not less than $3,000,000. Provision is also made for the completion of Dams No. 2 and No. 3 by the government and for the leasing of them and also of the nitrate plants for a period of fifty years.

Congressman Hull says his resolution is designed to find a solution for the vexed problems that confront the government at the nitrate and power plants on the Tennessee River. Under it the Alabama Power Company, Henry Ford or any other person or organization may contract for the entire properties. The Gorgas plant, however, would be returned to the Alabama Power Company, which, Mr. Hull contends, is entitled to it provided the utility pays a fair price. This he places at not less than $3,000,000.

Active support for the completion of the Muscle Shoals power project is being given by the American Mining Congress, which will hold a convention at Chattanooga, Tenn., on Sept. 29 for the purpose of organizing a Southern division of the organization. The governors of the Southern States, mining operators and others have been invited to assist in the movement, which, it is claimed, will result in the creation of a great Southern "mineral empire."

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Production of Soft Coal Now 9,500,000 Tons a Week

The Interstate Commerce Commission has issued a service order increasing the list of articles entitled to priority shipments. It includes all coal shipments in that class. Use of open-top cars for commodities other than fuel is permitted only when their destination is in the direction in which the cars are destined for coal loading.

"The production of bituminous coal," the commission said, in announcing its action, "has increased to approximately 9,500,000 tons a week and should, with reasonable use, take care of current needs, if new storage and waste of fuel and equipment are carefully avoided. The commission, therefore, feels that it can now relax its previous order."

Approval by both House and Senate of the conference report on the bill intended to prevent profiteering in coal and providing for the control of distribution has sent the measure to the President for signature. Only twelve votes were cast against it in the Senate, despite the vigorous opposition of Senators Underwood and Sutherland.

◆

Appleton, Wis., to Celebrate Electrical Anniversary

Appleton, Wis., which, as told in the *Electrical World* for Sept. 16, page 628, has the distinction of having started the first hydro-electric incandescent lighting plant and the second electric central station in the country, will celebrate the fortieth anniversary of that event on Saturday, Sept. 30, under the auspices of the Wisconsin Utilities Association. A tablet is to be erected at one of the older paper mills where electric power was first applied, the association being joined by state engineering bodies in defraying its cost. A temporary wooden memorial will be put up on Sept. 30 and replaced by a permanent metal tablet later. A. K. Ellis, general manager of the Wisconsin Traction, Light, Heat & Power Company, and A. C. Langstadt, one of the original operators of the first plant, are to assist in preparations for the dedication.

Murray Answers Beck

Acknowledges Four Errors Which in No Way Change His Fundamental Conclusions

W. S. MURRAY of the firm of Murray & Flood, consulting engineers of New York City, has replied to the statements of Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, contained in the pamphlet "Refutation of Unjust Statements Contained in a Report Published by the National Electric Light Association," etc., published by the Hydro-Electric commission. The main contentions of Sir Adam were given in outline in the *Electrical World* for Aug. 19, page 389.

Mr. Murray acknowledges four errors in his report, which he maintains are inconsequential in character and in no way disturb or change the fundamental conclusions. He complains of the prevalence of abuse in place of argument in Sir Adam's reply, stating that "the standard practice employed by those in charge of the municipal or governmental operations is easily recognized in the reply, first, by the employment of abusive language and an attempt to challenge my personal integrity and professional standing, and, second, in his expression of the absolute infallibility of the Hydro-Electric Power Commission." Municipal operators, Mr. Murray maintains, have never been known to tolerate the light of searching analysis.

THE ERRORS ACKNOWLEDGED

In transcribing one of the seventy-one laws as prescribed under the Hydro-Electric Power Commission acts, Mr. Murray admits that the exact words of that law were not used. Its intent, however, he maintains was not changed, and in checking he failed to catch the error in transcription.

With reference to the issuance of fiats permitting suit to be brought against the commission, Mr. Murray has this to say: "Our interview with many of the officials of the commission and people of prominence in Ontario left the impression that no fiats had ever been granted. This impression was confirmed by the fact that one was not granted in the important case brought against the Hydro-Electric Power Commission by the Electrical Development Company. Sir Adam Beck replies that more than twenty-four have been granted. It would be of interest to develop of what importance they were. They at least were not of sufficient importance to have been brought to my attention. When discussing the fiat which was not granted in the case of the Electrical Development Company, Mr. Clarkson, the public accountant for the Hydro-Electric Power Commission, made no mention of those that had been granted.

"By far, however, the most important aspect of the fiat situation is not whether they are or are not granted, but the fact that a fiat must be obtained before suit can be brought against the commission. Why should such discrimination be made in favor of the Hydro-Electric Power Commission? Why should not the commission be open to suit the same as a person or corporation? It is enough to dwell upon the weak and unsatisfactory answer offered in the so-called 'refutation,' which reads 'simply to avoid litigation of an unnecessary and vexatious nature,' and then visualize the uncontrolled and unfair position the commission possesses over the people."

BUFFALO AND TORONTO STREET-LIGHTING COSTS

In the case of the comparison between street lighting for Buffalo and Toronto, Mr. Murray admits that he omitted to refer to the fact that Buffalo is partly lighted by gas. An inadvertent injustice was thereby done to Toronto. Mr. Murray says, however, that, not content with pointing to the fact, the Hydro commission "then proceeds to fabricate a most remarkable tabulation which purports to prove that electric power in Buffalo is 35 per cent more costly than that in Toronto. In this table 1919 rates are confused with 1920 rates and kilowatt-hours used in Toronto are transferred indiscriminately to Buffalo and vice versa."

COST OF POWER DELIVERED

In the Murray and Flood report the capital investment in the Chippawa plant (550,000 hp.) and the Ontario Power Company is given as $97,757,614. In calculating the total production costs at Niagara Falls upon the basis of General Taylor's recommendation the annual interest (5.75 per cent) on the Chippawa development was charged out on $97,757,614 instead of on $69,000,000. According to Mr. Murray, this mechanical error can be quickly detected and is acknowledged. He says, however, that it is important to point out that on Dec. 14 Sir Adam Beck asserted, as stated in the Murray and Flood report, that the costs of the Chippawa development would be in the neighborhood of $60,000,000, while two months prior to that time Sir Adam had officially told Premier Drury that they would be more than $65,000,000. "Consequently," said Mr. Murray, "our production costs, through this error of statement on his part, were low in the amount of the additional annual interest and other fixed charges on the sum of $5,000,000. Deducting, therefore, the annual fixed charges on the Ontario plant, the resulting and correct charge for the power delivered to the municipalities is $28.55 instead of $31.70 per horsepower-year."

Many Topics at Glenwood Springs

Development in Lighting and Other Lines of Business, Security Issues, Rates and Newspaper Publicity Among Them—Local Electrical Activity Urged

DESPITE a more or less general feeling of business depression all over agricultural Colorado, the joint convention of the Colorado Electric Light, Power and Railway Association and the Rocky Mountain Geographic Division of the National Electric Light Association was one of the most successful and well-attended utility meetings ever held in the Rocky Mountain region. That this was so was the emphatic statement of the honorary life vice-president, S. E. Doane of New York, who has attended all of the nineteen conventions of the Colorado association. This was the third convention of the Rocky Mountain N. E. L. A. Division. The number of those in attendance was 115.

Sound business development, with particular attention to illumination, was the principal topic at the convention, though other subjects, such as taxation, the banker and the editor in their relation to public utilities, adequate rates and the better use of budgeting received attention. President Fred Norcross of Greeley, Col., said that the problem of the correct financing of rural extensions and the proper method of charging for service on them is the most important single problem now facing Rocky Mountain central-station companies. He urged more thought and co-operation in reaching an adequate answer to this most perplexing and yet important problem.

F. E. Hazard, Conlon Electric Washer Company, Cicero, Ill., urged central-station men to advertise their service on the basis of the benefits to be derived by the public rather than with an eye to the kilowatt-hour. He said the average central-station man cannot see the public over the top of the power house. The customer does not buy electrical energy or even electric service, but rather is willing to pay for that service to gain the benefits derived from its use. In the case of labor-saving appliances these include more leisure, better health, lengthened life and so forth.

S. E. Doane, speaking for H. A. Lane of the Joint Committee for Electrical Development, outlined the committee's program and told how local effort had been decided on as the way to handle the work. Mr. Doane also discussed practical ways and means to improve lighting business, giving many examples to prove that actual demonstration of illumination effects was the only real way to sell illumination and build a better lighting load. Each central station, he said, can find some scheme of demonstration to fit its particular needs.

P. L. Thompson, Western Electric Company, New York, developed the philosophy of and necessity for building public confidence. Examples of good-will advertising served to give concrete inspiration to those present. W. S. Scott, East Pittsburgh, Pa., showed the advantage of industrial heating load to the central station, giving examples and statistics and dwelling on some of the technical questions involved.

W. D'Arcy Ryan, Schenectady, N. Y., showed the field for artistic outdoor illumination, giving an extensive lantern slide demonstration.

THE BANKER AND THE UTILITY

There is a very close community of interest between the banker and the utility man, said Frank J. Denison, vice-president Hamilton National Bank of Denver. The responsibility for the soundness of the security rests with the public utility, however. Especially in these days of the small purchaser and the extension of customer ownership, when the uninitiated public does not scrutinize too closely, does responsibility devolve on the company.

J. E. Davidson, Omaha, vice-president N. E. L. A., representing the national association, told of the various phases of the association's work and urged promotion of the "Electrify America" program through local effort.

H. B. Dwight, electrical engineer of the Colorado Public Utilities Commission, challenged the central-station men to give the same attention to an adequate solution of the rate fabric problem that they give to the other factors of central-station management, such as engineering, accounting and financing. The present rates on file with the commission, he said, indicate a "feeling around" or experimenting by each company to see what can be done without disturbing the public rather than an earnest endeavor to work out substantially correct rates on any logical basis.

Budgeting as a better aid to management was discussed by O. A. Weller of Denver, and taxation, particularly the effect of proposed measures in Colorado, was the topic of R. J. Bardwell of the same city.

THE NEWSPAPER AND THE UTILITY

E. A. Bemis, president Colorado Editorial Association, told the utility men how to educate and win over editors to understand utility problems. The much-mooted question of the relation of paid advertising and newspaper editorial policy was answered by Mr. Bemis, who said that the paid advertising merely made the editor think and that the facts would speak for themselves. The editor is human and must be educated like any one else. As to the effect of newspaper advertising on the public, one year only gets attention, two to three years is not effective, but five years is sure, and after ten years of advertising it is indispensable. The newspaper is of all means of reaching the public, other than by the spoken word the best, said Mr. Bemis, because of the reader's receptive mood.

The convention paid tribute to the effective work of both the Electrical Co-operative League and the Rocky Mountain Committee on Public Utility Information.

OFFICERS ELECTED

At the business sessions the name of the state association was changed to the Colorado Utilities Association and the fiscal year of the N. E. L. A. division was changed to correspond to that of the national association. Officers of the state association were elected as follows: President, W. F. Brown, Mountain State Telephone Company, Denver, first vice-president, E. C. Stenger, receiver Denver Tramways Company; second vice-president, C. N. Stannard, Denver Gas & Electric Company.

The executive committee will comprise C. N. Stannard of Denver, C. A. Semrad of Boulder, Col.; W. F. Raber of Pueblo, Col.; J. A. Clay of Durango, Col., and Norman Read of Denver.

Officers of the Rocky Mountain Division, N. E. L. A., elected to serve until June 30, 1923, are: President, J. F. Dostal, Colorado Springs; first vice-president, D. C. McClure, Denver; second vice-president, Norman Read, Denver; treasurer, A. C. Cornell, Denver. Members-at-large of the executive committee are E. P. Bacon of Casper, Wyo.; E. A. Phinney of Golden, Col.; Arthur Prager of Albuquerque, N. M., and J. J. Cooper of Denver.

Officers elected for the year from July 1, 1923, to June 30, 1924, are: President, D. C. McClure, Denver; first vice-president, Norman Read, Denver; second vice-president, C. A. Semrad, Boulder; treasurer, A. C. Cornell, Denver. Members-at-large of the executive committee are J. F. Dostal of Colorado Springs, Col.; E. A. Phinney of Golden, Col.; Arthur Prager of Albuquerque, N. M., and E. P. Bacon of Casper, Wyo.

Atlanta Convention Is Largely Attended

Members of Southeastern Division, N. E. L. A., Discuss General and Local Problems in Technical, Commercial, Accounting and Public Relations Sessions

CELEBRATING its tenth anniversary, the Southeastern Geographic Division of the National Electric Light Association held a well attended and very successful convention at Atlanta, beginning Tuesday, Sept. 12. The subjects of public relations and of electrical development in the Southeastern territory vied with each other for the center of the stage, although other very important matters in the Accounting, Commercial and Technical Sections were also presented and had careful consideration.

Perhaps the outstanding and best-attended session, aside from the general meetings, was that of the Public Relations Section, Preston S. Arkwright of the Georgia Railway & Power Company, chairman of that section, presiding. The feature of this session was an address by W. F. Woodruff of the Atlanta *Constitution*, who spoke on relations between public utilities and newspapers. Brief remarks were also made by President Frank W. Smith, Executive Manager M. H. Aylesworth and Director of Publicity George F. Oxley of the parent body, in addition to the scheduled afternoon program, which called for a paper entitled "Publicity," by John Paul Lucas, director of publicity of the Southern Public Utilities Company, and one on the Georgia State Committee on Public Utility Information by J. L. Murphey, its chairman.

PRESIDENT CHENEY'S ADDRESS

The convention was welcomed to Atlanta by James L. Key, Mayor of the city, and C. D. Flanigen, as past-president of the Southeastern Division, responded. President D. A. Cheney, in his address, called attention to the national work on inductive co-ordination being done jointly by the N.E.L.A. and the Associated Bell Telephone Companies, stating that H. L. Wills, engineer of the Georgia Railway & Power Company, is actively participating in the work at national headquarters through the courtesy of his employers. He called attention to a seeming lack of interest on the part of a few executives of company members of the Southeastern Division in the work of the division, although employees of companies headed by those men are active in association affairs, and suggested that wherever possible subordinates should endeavor to interest their chief executives and urge upon them the necessity and advantage of personal interest.

Concerning the work of the national association, Mr. Cheney said: "We can well take pride in our great industry, which expresses itself through the association in such a splendid record of achievement and service. The work of the committees is rapidly bringing about a better understanding of our problems among our membership, while through research and study a large volume of information and data of great practical value to the industry are being collected and put into available form. Indeed, many of the national committee reports are in themselves veritable textbooks, which, being based on actual workaday conditions of operation, are proving to be acceptable and useful guides to that better practice and economy that are the aim of every central-station man worthy of his salt."

President Cheney also touched on the national good-will publicity campaign, customer ownership and water-power development. In closing he said: "Undoubtedly we of the Southeast stand today on the very threshold of an era of rapid and substantial development in every line of human activity—an era in which the electrical industry is destined to take a leading part—and the movement is unfolding before our eyes. Our industry occupies a position of peculiar opportunity, and with our opportunity goes a commensurate responsibility to measure up to the job. As we succeed or fall short, so will it be with the communities and territories we serve."

DELEGATES VISIT TALLULAH FALLS

On Tuesday afternoon there were parallel sessions of the Technical and Commercial Sections, and Tuesday evening was held the second general session, including an address by C. Murphy Candler, chairman of the Georgia Public Service Commission. An address upon the uniform classification of accounts was delivered by W. J. Meyers, and Dr. Samuel R. Benedict, chief surgeon of the Alabama Power Company, gave a talk upon the prone-pressure method of resuscitation, with demonstrations. All sessions were omitted Wednesday, delegates and guests visiting the development of the Georgia Railway & Power Company at Tallulah Falls.

The third general session on Thursday morning was addressed by President Smith and Executive Manager Aylesworth of the National Electric Light Association. The Muscle Shoals situation was explained in detail by Thomas W. Martin, president of the Alabama Power Company, and addresses on accident prevention by Harry T. Edgar, Stone & Webster, Boston, and on meters and metering practice by F. G. Vaughen, sales manager of the General Electric Company, meter department, Schenectady, were given.

Paralleling the public relations session on Thursday afternoon was the meeting of the Accounting Section, and on Friday morning the fourth and last general session was held, with reports of the officers and election of new officers, preceded by addresses on the "Power Development of the Southeast," by Charles G. Adsit, executive engineer of the Georgia Railway & Power Company; "Public Utility Financing," by H. M. Addinsell, Harris, Forbes & Company, and "Central-Station Development," by C. W. Stone, manager of the lighting department of the General Electric Company.

ELECTION OF OFFICERS

At the executive meeting the following officers were elected for the coming year: President, W. R. Sammons, Knoxville Railway & Electric Company, Knoxville, Tenn.; first vice-president, T. W. Martin, Alabama Power Company, Birmingham; second vice-president, R. L. Lindsey, Durham Traction Company, Durham, N. C.; third vice-president, Howard Hall, Western Electric Company, Atlanta; secretary, Charles A. Collier, Georgia Railway & Power Company, Atlanta. The treasurer will be appointed by the president.

The following were elected members of the executive committee: F. L. Butler, Georgia Railway & Power Company, Atlanta; E. H. Ginn, General Electric Company, Atlanta; L. L. Newman, Birmingham Railway, Light & Power Company, Birmingham; P. A. Tillery, Carolina Power & Light Company, Raleigh, N. C.; H. B. Whiteman, Chattanooga Railway & Light Company, Chattanooga, Tenn.; Henry Coles, Westinghouse Electric & Manufacturing Company, Atlanta; T. J. Hanlin, Tampa Electric Company, Tampa, Fla.; W. R. Marshall, Southern Public Utilities Company, Charlotte, N. C., and D. A. Cheney (ex officio), Orlando Water & Light Company, Orlando, Fla.

Electric Mining Men Meet

West Virginia and Kentucky Engineers Discuss Problems of the Bituminous Fields

REPRESENTATIVES of the soft-coal industry, including manufacturers, operators and engineers, gathered in Huntington, W. Va., on Tuesday last, for the coal exposition and the convention of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers. The exposition was opened by addresses from ex-Governor Hatfield and Congressman Goodykoontz. Exhibits from more than seventy manufacturers were displayed. The technical sessions were well attended and the papers brought out good discussions.

On Tuesday the committees on checking power costs and on mine locomotive wheels and tires rendered their reports. The discussion brought out the importance of these points in securing economic coal production. Power mining is now almost universal and record systems are essential to the industry. A paper by M. A. Whiting on "Automatic Electrical Apparatus as Applied to Coal Mining," a report from the committee on underground transmission and distribution and a report from the committee on the relative merits of storage-battery, combination and conductor-cable reel-gathering locomotives followed. These reports indicated a decided trend toward using automatic hoists and substations in mining work, as well as a tendency to use more alternating-current motor equipment, and the discussion brought out a majority opinion in favor of electrically welded bonds for mine tracks.

Committees reporting Thursday were those on all-rubber insulation as compared with braid-covered cables for mine cables and on the use of cast or rolled-steel resistance grids on mine locomotives. A paper was presented by W. C. Shunk, general superintendent Stonega Coal & Coke Company, on "How Mechanical and Electrical Men Can Increase Their Usefulness."

The wireless telephone and a radio demonstration were the feature for Friday, and in addition a report was made by the committee on the proper handling and care of insulating oils. Following this came the election of officers. More abstracts of the papers and a more complete report of the convention will be given in the next issue of the *Electrical World.*

Cities Service Gets Plant in Antwerp, Belgium

The Cities Service Company has just completed arrangements for taking over the plant and facilities of the Société pour le Commerce et l'Industrie des Huiles Minerales of Antwerp, Belgium.

The plant is a complete importing station at Antwerp, consisting of tankage for lubricating oils, gasoline, kerosene, gas oil, etc., with facilities to barrel and can, also tank cars and barges for distribution to the wide trade territory supplied by the port, including Belgium, Holland, Switzerland, Alsace-Lorraine and the Rhine Valley in Germany. This will prove an important export outlet for the products of Cities Service Company oil subsidiaries. Captain Fernand Petit of Antwerp will have charge of the property.

Investment Bankers to Discuss California Power Act

The Investment Bankers' Association of America will hold its eleventh annual convention at Del Monte, Cal., Oct. 9-12. In addition to an address by Howard Beebe of Harris, Forbes & Company, president of the association, there will be numerous committee reports and discussions on municipal affairs. The California water and power act will come up for consideration on Oct. 11, at which time an address on the situation will be made by W. E. Creed, president of the Pacific Gas & Electric Company.

Tennessee Injunction Modified

The temporary injunction recently obtained by Tennessee state officials to prevent the organization of the Tennessee Electric Power Company from going into effect, on the ground that it violated the state anti-monopoly law, has been modified to permit the company to perform its corporate business until a final decree is rendered. The new company is a reorganization of the former Tennessee Railway, Light & Power Company and its subsidiaries together with the acquisition of the Chattanooga & Tennessee River Power Company.

Undeveloped Power on Hudson Put at 222,000 Hp.

According to a report of the New York State Water Commission, there is still 222,000 hp. of undeveloped power on the upper Hudson River, including its tributary, the Sacandaga. With the exception of the Niagara and St. Lawrence Rivers, the report says, the Hudson is the most important stream as regards water power in the state. Data given in the report show that 368,000 hp. on the upper Hudson is available, of which a little over one-third is now developed.

The development of this unused power depends on the construction of a system of fourteen storage reservoirs, having a total capacity of 70,000,000,000 cu.ft. Such reservoirs, with the principal ones at Sacandaga, Gooley, Piseco Lake and Schroon Falls, would cost $24,292,000.

The storage value of these reservoirs would many times exceed their cost, and they would not only increase the available water power of the Hudson, Sacandaga and Schroon Rivers, but also mitigate flood damage with its unsanitary conditions and improve navigation as well, the report states. It estimates the annual saving of coal through the proposed development at 2,000,000 tons.

Regulate Trade Societies

Governor Miller Feels that Public Is Mulcted Unless State Prevents Abuse of Power

SPEAKING at the New York State Fair Grounds at Syracuse on Sept. 14, Governor Miller denounced the action of the coal and railroad strikers in trying to force a decision in their favor through causing the public to suffer. He also threw down the gauntlet to trade associations. As touching the latter, Governor Miller spoke as follows:

"Agriculture is the basic industry of the country, upon which its prosperity largely depends, but in an age of co-operation and organization the farmer is still the individualist of former times, though directly affected, as the general public is affected, by the modern spirit of combination. Other industries are organized on a national scale through great aggregations of capital in corporate form and associations whose organization was greatly stimulated during the war. Our notions of individual liberty and of the freedom of restraint of individual initiative from state interference must be adjusted to these modern conditions.

"When there are a large number of producers in any line of industry acting independently and freely competing, the public is safe from oppression, but when any line of production is largely controlled by a single aggregation of capital or by different groups in association, the public is at the mercy of such aggregations or associations, unless the state intervenes to prevent the abuse of power, and human nature is such that unrestrained power cannot safely be left to any private group or association. The abuses incident to such associations have been revealed by legislative investigations and the power of the criminal law to prevent them has proved inadequate. In my judgment the state must either prevent such associations entirely or intervene to regulate them and to protect the public from their abuses.

"I am a firm believer in the utmost freedom of individual initiative and enterprise, but that doctrine has its limitations, and the limit of such freedom is reached when it becomes a public menace, and that menace arises whenever the production, transportation or distribution of any essential article is controlled by a few."

Triangular Power Controversy at Holyoke

A controversy has arisen in Holyoke, Mass., over the right of the Holyoke Water Power Company to sell electricity to William Skinner & Sons which this firm, by use of its own machinery, employs to light its mills. The city solicitor has served notice on the company that any use of such energy by the Skinner firm for lighting is illegal, as the company's charter permits it to sell electricity for power purposes only.

In answering the city's complaint, the company replied that all the power supplied to Skinner & Sons was being used as power, though a portion of it was used to produce a separate and independent current that operates to light the mills when the power is used. The company asserted that Skinner & Sons use the same transformers for this light that they formerly employed when buying power from the city, and that whereas the city has always maintained a higher rate for energy used for lighting than for energy used for power, it made no such distinction in respect to the energy sold to the Skinner mills, basing its charges entirely on the rate for power. The Holyoke Chamber of Commerce has appointed a committee to try to adjust the dispute, which may be carried to the Massachusetts Department of Public Utilities.

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Hydro-Electric Development in Kentucky

Formation of a syndicate to construct a seven-million-dollar hydro-electric plant on Licking River, a few miles from Falmouth, Ky., has just been announced by J. V. Oldham of Falmouth, who with S. A. Techer of Indianapolis will back the project. The dam will be built in a narrow gorge and will be more than 100 ft. long and 300 ft. high. It is intended to furnish light and power to many towns and cities in central and eastern Kentucky, including Falmouth, Cynthiana, Georgetown, Lexington, Maysville, Covington, Vanceburg, Ashland, Winchester, Brooksville, Augusta and Newport, and should make Licking River navigable for 150 miles or more.

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New England Power Company to Build Tie Line

Increasing interchange requirements between the systems of the New England Power Company and the Narragansett Electric Lighting Company of Providence will soon result in the construction of a 110,000-volt tie line between Lincoln, R. I. and Swansea, Mass., which will enable high-tension energy to be directly transferred between the two companies. The Massachusetts Department of Public Utilities has approved the construction of the Massachusetts section of the line, 11.4 miles in length. About 2.9 miles will be built in northern Rhode Island. The line will connect the southbound trunk lines of the New England system with the Providence-Fall River 66,000-volt tie line and will be operated at the lower voltage for the present.

The estimated cost is $196,000. At a recent hearing President H. I. Harriman of the New England Power Company stated that the line will be designed for the ultimate operation of two circuits and when forced to the maximum transmission voltage will enable about 75,000 kw. to be interchanged. At present the New England and Narragansett system, are interconnected by a 22,000-volt line via Pawtucket. This line is becoming so heavily loaded that additional facilities are imperative. The new line will be constructed with wooden poles and steel cross-arms, the poles being set sixteen per mile.

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Naval Officers Take Course in Applied Engineering

Seven naval officers, post-graduate students of the United States Naval Academy, are taking a six weeks' course in applied engineering at the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company. The course includes lectures by Westinghouse engineers, inspection of the shops and processes, visits to other large manufacturing plants and inspection of the Westinghouse-equipped battleship Colorado at the New York Shipbuilding Corporation's docks, Camden, N. J. The course is intended to give the officers a knowledge of the design, application and manufacture of naval equipment. Four of them are studying marine propulsion equipment and the other three radio development, research and manufacturing problems. The subjects of some of the lectures are "The Design of Power Generators for Marine Application," "Temperature Limits and Insulation in Large Generators," "The Design of Main Propelling Motors" and "Propelling Machinery Control Equipment."

NAVAL OFFICERS AT EAST PITTSBURGH

Back row, left to right—Lieuts. R. D. Tisdale, D. D. Dupre, A. C. Thomas and R. W. Bates.

Front row, left to right—Lieuts. L. R. Moore, C. A. Macgowan and J. F. Bates, Jr.

Wisconsin Opposes St. Paul's St. Croix Project

In response to a vigorous protest by the Wisconsin Railroad Commission against the use by the city of St. Paul of the water power of the St. Croix River, which forms part of the boundary between Minnesota and Wisconsin, the Attorney-General's Department of the latter state has declared that the Minnesota city has no legal right to construct a dam in the river or exploit its power resources. The opinion sets forth that each state has complete jurisdiction over the river to the middle of the current for water-power purposes and that "concurrent jurisdiction" whereby each state has control over all of it applies only to logs and other floating objects. The opinion says that the only legal right St. Paul may have to construct a dam lies in the possibility that it may have in its possession by assignment one of the several franchises granted by the Wisconsin Legislature several years ago to individuals for the maintenance of dams in the St. Croix River.

Three applications for water-power permits on the St. Croix are pending before the Federal Power Commission—one by the Northern States Power Company of Minneapolis, another by the city of St. Paul and a third by the association of Markham, Kelsey & Draur of St. Paul. Hearings have been ordered by the commission to determine the rights of the contending parties, and the city of St. Paul has been directed to submit such evidence as it may have of its authority to make a power development partly within Wisconsin.

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Radio Manufacturers Plan to Support Broadcasting

At a recent meeting of the members of the Radio Section of the Associated Manufacturers of Electrical Supplies plans were laid to stabilize the industry and prevent the confusion that resulted from improper organization last year. The committee on broadcasting, of which M. C. Mallory of the Westinghouse Electric & Manufacturing Company is chairman, recommended that the manufacturers devote a certain percentage of their sales to the support of existing broadcasting stations and establishing others. Dr. Alfred N. Goldsmith, as chairman of the standardization committee, advocated supplying the public with devices that, even though they were made by different manufacturers, would work efficiently together. This committee also recommended co-operation with the Bureau of Standards at Washington in working out standardization. A standard method of testing receivers of the crystal type was covered in the report.

The matter of radio shows was left to the publicity committee, of which R. F. Yates is chairman. The committee on aural devices, headed by Daniel Murdock, recommended concerted action on the part of the manufacturers.

Hoover on Coal Mining

Points to a Few Lines Along Which the Projected National Coal Commission May Work

IN AN address prepared for the Salesmen's Association of the American Chemical Industry, which met last week in New York, Herbert Hoover, Secretary of Commerce, made an analysis of the conditions in the coal industry and a plea for its stabilization. Among other things, he said:

"The favorable progress of legislation for the creation of a national coal commission fully empowered to get to the bottom of the troubles in this industry is the first step in one of the most vital problems we have. I have been earnestly recommending such a commission for the last three years, because I do not believe great solutions will arise out of emotional denunciation, but out of sober scientific examination.

"There is much in the industry that needs public ventilation, but more important than this, there are two distinct lines of problems for which constructive solutions are needed that can only be furnished after more considered investigation. The first of these problems is the employer-employee relationship; the second is economic reorganization of the industry.

SOME PROPOSED REMEDIES

"There are 2,500 too many bituminous mines and 200,000 too many people in the business. This waste of labor, of capital and of coal levies tremendous tribute on the entire country. Investment in the industry is extremely speculative. Distribution costs are excessive. The operators vibrate between bankruptcy and high profits, and the public in ordinary times is paying far more for its coal than would be necessary from a stabilized industry.

"The perpetual labor difficulties are but one of the inevitable byproducts of this poor organization. Labor is struggling on one side to set up remuneration based on such day's pay and such piecework rates as will give a standard of living with 60 per cent of time employed. Labor is thus honeycombed with the worst of stimulants to unrest, insecurity of employment. At the same time, men who have the opportunity to work full time in regularly operating mines earn returns far above the average income of our most prosperous farmers and other workers. There can be no solution either for the operators or for the workers as long as this condition continues.

"Aside from relief from national stoppage in production from strikes and lockouts, there are proposals of constructive and practical remedies which should be investigated and which do not lead to socialism and destruction of American freedom and initiative. For instance, an extra annual storage of 20 per cent of railway consumption would equalize the seasonal fluctuation. Larger storage is possible by the railways at those times when public demand for coal is slack, instead of competition by the railways themselves with the public for coal, and thus for the use of cars, at the annual period of car shortage. A system of car distribution that would not itself break into regular operation would help. Larger storage by public utilities would assist and would give greater security to the public.

"A contributing remedy that will need the most earnest consideration is the possibility of permitting the co-operative system of marketing developed by the farmers to be applied by such mines as wish to adopt it, under circumstances that would assure competitive conditions. Such an arrangement would decrease distribution costs, would give more regular flow to orders, would get better car distribution, would decrease transportation, would enable the laying down of coal in storage at points of consumption, and would consequently give more regular operation with reduced working costs. More accurate statistics of capacity, production, consumption stocks and prices would greatly promote stability and would be in the true interest of the operators, who are now blamed for much that is not their fault."

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Fall Meeting of American Welding Society

On Oct. 2 to Oct. 5 the American Welding Society will hold its fall meeting in Chicago. There will be committee reports on specifications for steel to be welded, electric arc welding, gas welding, properties of cast iron affecting its weldability, training of operatives, welded rail joints and other subjects. Papers announced are as follows: "Electric Arc Welding of Cast Iron," William Namack; "American Welding Society and Need for Research and Standardization," C. A. McCune; "American Bureau of Welding and Organized Research," William Spraragen; "Welded Rail-Joint Problems," E. M. T. Ryder, and "Applications of Welding in the Electric Railway Shops," J. S. McWhirter. There will be a joint meeting with the American Electric Railway Association on Oct. 4, at which the papers just named will be presented.

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A. E. R. A. to Meet in Chicago on Oct. 2 to Oct. 6

The American Electric Railway Association will hold its annual convention on the Municipal Pier, Chicago, on Monday to Friday, Oct. 2 to Oct. 6. Among addresses by prominent public officials will be one on taxation of public utilities and one by Carl D. Jackson, chairman of the Wisconsin Railroad Commission. As usual, there will be abundant and comprehensive committee reports, including those on the National Electrical Safety Code, automatic substations, power distribution, lightning protection, pole reclamation and preservation, aluminum wire and one concerning the work of the Joint Committee of National Utility Associations. Edwin D. Dreyfus, engineer West Penn Railways, will present a paper on "The Related Function of Engineer and Accountant in Public Utility Development"; Walter H. Timm, New Hampshire Public Service Commission, one on "Public Utility Accounting," and Harry A. Snow, Detroit Edison Company, one on "Budget Control." A joint session with the American Welding Society will be held on Oct. 4, as announced above.

Brief News Notes

West Tulsa Plant to Be Doubled.—An addition to the West Tulsa plant of the Oklahoma Power Company that will double its present capacity, bringing it up to 20,000 kw., is to be built this fall at a cost of about $750,000.

Fire Prevention Week.—The National Fire Protection Association has planned for a wider celebration than ever before of Fire Prevention Week, which this year will be observed in the United States and Canada from Oct. 2 to Oct. 9. The national, state and municipal governments are expected to co-operate, as in former years.

Scientific Journal of Instruments.—Word comes from the Institute of Physics, 10 Essex Street, Strand, London, that it is about to issue a new monthly magazine devoted to the principles, construction and use of scientific instruments. It will be produced with the co-operation of the National Physical Laboratory. Leading British physicists are on the advisory committee.

Logging with Electricity.—Logging with electricity, attempted in no other part of California except Butte County, is an assured success, according to the manager of the Hutchinson Lumber Company, which is testing the innovation east of Oroville, Cal. Operators of the electric engines, he asserts, are enthusastic in their praise. Not only do they simplify the work, but they speedily get ample power to where the logs are being handled.

Radio Vacuum Tube Rated at 100,000 Watts.—What is said to be the largest radio vacuum tube in the world has just been developed at the telephone laboratories of the Western Electric Company in New York. It is rated at 100,000 watts, or 200 times the power required for the usual broadcasting station of 100 miles range. The essential feature of the new tube is that the "plate" is a copper cylinder forming the outer wall of the tube, which makes it possible to cool the tube by water. Difficulty was found in making the instrument air-tight and in getting the wires for the filament and grid into the tube while keeping then insulated against 20,000 volts. W. G. Housekeeper, a Western Electric engineer, discovered a way to seal copper to glass, making an air-tight joint that will not crack at any ordinary working temperature. One of these tubes stands 3 ft. high and is 3⅛ in. in diameter at the bottom.

Electrical Power Gains in Tennessee.—According to the report of the Tennessee Public Service Bureau, there has been an extensive resumption of industrial activity in that state and the consumption of electrical energy has increased greatly. The survey of the board shows that the power load has made a 34.4 per cent gain in Nashville, a 47 per cent gain in Knoxville and a 33.6 per cent gain in Chattanooga over similar periods of 1921.

Electricity Making Progress in Poland. — Two large hydro-electric power plants are now under construction in Poland. One of them will produce 10,000,000 kw.-hr. a year, the other one 20,800,000 kw.-hr. At the present time the entire output of all the electric plants in the country is about 242,000 kw. and the energy generated about 370,000,000 kw.-hr. Electrification of the entire oil-well industry of the country is contemplated.

French Government Installs Radio Weather Service.—A nation-wide system of informing farmers of approaching weather conditions is being installed in France, according to a recent report to the United States Department of Agriculture. Thrice daily forecasts of the probable atmospheric changes and weather variations for the ensuing eighteen hours will be broadcast from the Eiffel Tower to agricultural districts. The service will serve communes within a radius of 300 miles from the tower.

To Improve Buffalo's Lighting System. — Plans to make Buffalo the "best lighted city in America" are being considered by the advertising group of the local Chamber of Commerce. First efforts along this line will be devoted to the downtown district. Every firm in and near Main Street will be asked to co-operate in making the city's principal thoroughfare a second "great white way." What will be particularly sought is attractive illumination, rather than glaring signs of an unartistic and perhaps offensive nature.

Utah Agricultural College Has Unusual Function.—The Attorney-General of Utah has just made a ruling on whether the board of trustees of the Utah Agricultural College has authority to prescribe the amount of electric power that the different Utah state institutions can have. The state power plant is installed at the Agricultural College, and it furnishes power and light to the state industrial school, the school for the deaf and blind, the University of Utah, including the state normal school, and the state prison. It also furnishes the state armory at Ogden and the Capitol from surplus electrical energy. The Attorney-General finds that the board of trustees may prescribe the amount of power that the different state institutions can have "if there is not sufficient power to satisfy the needs of all the institutions."

New York Police Department Adopts Radio.—A wireless broadcasting station of the latest type has been installed at Police Headquarters in New York City, and within a few months the police boats, police inspection district headquarters and stations will be equipped with receiving sets, so that they may obtain early information on stolen automobiles and crimes and criminals. The Police Department has received the permission of the Department of Commerce to operate on a special wave length of 400 m., a band not allocated to any one else, so that there will be no interference with the station.

Kewanee Votes for Municipal Plant.—The citizens of Kewanee, Ill., having voted recently in favor of a bond issue of $125,000 with which to begin the installation of a municipal electric light plant, the Consolidated Light & Power Company, a subsidiary of the American Gas Company, has offered to sell its entire property, including electric light and power, gas and heating plants, to the municipality. H. M. Smith, manager of the company, in a letter to the Mayor and Commissioners of Kewanee, stated that since acquiring these properties in 1906 the company has spent for additions and improvements approximately $575,000 and that for the last two years an adequate return has not been earned on the investment. "The people having apparently decided to go into the utility business," said Mr. Smith, "it would seem advisable for the city to occupy the field without competition." The company's franchise expires in about two years, and Mr. Smith stated that if an acceptable new franchise cannot be obtained from the city or a sale made to it, the plants will be closed.

Cooling Trout by Electricity.—West Tennessee is not the habitat of the mountain trout nor are trout streams included in the many natural attractions, but a crystal-clear brook flowing over a rocky bed, its course interspersed with falls and with the gamest of mountain trout inhabiting its stream, is to be the prize possession of a new estate under construction by Clarence Saunders at Memphis. The stream, if not the fish, is to be "done electrically." Although Mr. Saunders is transporting a complete stream from Colorado, bringing boulders, moss, ferns and the fish, he had to reckon on the natural temperature of Memphis, which is slightly higher than that to which the trout is accustomed in Colorado. To care for this he has arranged a duplicate electrical refrigerating scheme, one system to operate in case the other is interrupted, and thus will assure his trout that they will remain as cool as in their Colorado home. Engineers are at work too on an innovation for the bathing beach to be installed on an artificial lake. They are designing giant electrically operated agitators concealed beneath the surface, which are to create an artificial surf.

Associations and Societies

American Bankers' Association.—International finance is to be a main topic of discussion at the annual meeting of this association, to be held in New York City on Oct. 2 to Oct. 6. Reginald McKenna, former Chancellor of the British Exchequer, and Thomas W. Lamont are announced to speak.

Attractive Program for Springfield A.S.M.E. Meeting.—At the New England regional meeting of the American Society of Mechanical Engineers in Springfield, Mass., Sept. 25-27, F. C. Pratt, vice-president in charge of engineering, General Electric Company, Schenectady, N. Y., will deliver the opening address on "Engineering and the Engineer." A paper on "Multiple Source of Power for Reliable Industrial-Plant Operations" will be read by R. A. Packard, superintendent of power and shops for the Ludlow (Mass.) Manufacturing Associates. Among prominent engineering representatives expected at the meeting are Dean Dexter S. Kimball of Cornell University, president of the A.S.M.E.; Prof. L. P. Breckenridge of Yale and Dr. Ira N. Hollis of Worcester Polytechnic Institute.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Illuminating Engineering Society—Swampscott, Mass., Sept. 25-28. Samuel G. Hibben, 29 West 39th Street, New York (For program see issue of Aug. 5, page 292.)

American Institute of Mining and Metallurgical Engineers—San Francisco, Sept 25-28. F. F. Sharpless, 29 West 39th Street, New York.

N. E. L. A. Geographic Division — Great Lakes, French Lick Springs, Ind., Sept. 27-30. (For program see issue of Aug. 19, page 393.)

Indiana Electric Light Association—French Lick Springs, Ind., Sept. 28-30. Thomas Donohue, Lafayette, Ind.

Telephone Pioneers of America—Cleveland, Sept. 29-30.

American Welding Society, Chicago, Oct. 2-5.

American Electric Railway Association — Chicago, Oct. 2-6. J. W. Welsh, 8 West 40th Street, New York.

Empire State Gas and Electric Association —Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.

Electrical Supply Jobbers' Association, Atlantic Division — Philadelphia, Oct. 6. E. Donald Tolles, 165 Broadway, New York.

Arkansas Utilities Association—Hot Springs, Ark., Oct. 9 and 10. R. I. Brown, Little Rock Ry. & Electric Co., Little Rock.

Society of Motion Picture Engineers — Rochester, N. Y., Oct. 9-12.

Association of Edison Illuminating Companies—White Sulphur Springs, W. Va., Oct. 11-14. Preston S. Millar, 80th St. and East End Ave., New York.

National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St., New York.

Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 20-21. A. Bliss McCrum, Charleston, W. Va.

Electric Power Club—Asheville, N. C., Oct. 30. S. N. Clarkson, 506 Laclede Gas Bldg., St. Louis.

Ontario Association of Electrical Contractors and Dealers—Toronto, Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.

National Association of Railway and Utilities Commissioners—Detroit, Nov. 14. J. B. Walker, New York Transit Commission, New York.

Recent Court Decisions

Temporary Injunction Against Rate Order of Commission Upheld.—The Supreme Court of Kansas has found, in Kansas City Long Distance Telephone Company vs. Reed, that the District Court did not err in issuing a temporary injunction against a rate order made by the Public Utilities Commission, on evidence purporting to show that the rates prescribed were unjust and did not provide an adequate return on the property, and where the order was made without evidence which the company, at the request of the commission, had agreed to furnish, and without notice to the company that it would be made at that time in the absence of such evidence. (207 Pac. 763).*

Powers of Kansas Commission.—The Supreme Court of Kansas, in City of Winfield vs. Court of Industrial Relations, has found that during the time the Court of Industrial Relations was vested with the duties and functions of the Public Utilities Commission that court, and the commission prior to and subsequent to that interval, had power to set aside and change the rate for natural gas furnished to the inhabitants of the city of Winfield, notwithstanding the city's objection thereto, and notwithstanding the existence of a contract between that city and the party which supplied the natural gas, which contract had been made and promulgated by a city ordinance prior to the enactment of the public utilities law; and, whatever might be urged against the impairment of such contract by the other party thereto, the changes in the rates and service by order of the state tribunal did not, as against the city, violate the contract clause of the federal Constitution. (207 Pac. 813.)

Right of Property Owner to Obstruct Erection of Pole.—In Marx vs. Edison Electric Illuminating Company of Brooklyn the plaintiff, a woman, brought suit to recover damages for serious injuries alleged to have been inflicted upon her three years previous to the trial by workmen employed by the defendant company to erect an electric light pole in the street in front of her property. The plaintiff alleged that when she tried to obstruct the erection of the pole by placing her legs in the excavation that had been made the workmen assaulted her and finally jammed the pole down against her legs, fracturing a bone and permanently injuring her. In the trial court the judge directed a non suit. The New York Supreme Court, Appellate Division, has reversed this judgment on law and facts and ordered a new trial, on the ground that no permit to erect the pole was shown to the plaintiff on her demand and that any citizen has a right to object to unlawful interference with the public highway. (194 N. Y. S. 807.)

Finding that Overload of Electrical Energy Entered Building Does Not Raise Presumption of Negligence.—Declaring that a finding by a jury, in response to a special issue, that a fire in plaintiff's building was caused by an overload of electricity entering the building does not create a presumption of negligence on the part of the electric light company serving the building, the Court of Civil Appeals of Texas affirmed judgment for the defendant in Cecil & Company vs. Stamford Gas & Electric Company. In this case the jury answered several specific questions, one to the effect just given, another to the effect that the entrance of an overload of electricity was not due to the negligence of the defendant, a third to the effect that the fire was not caused by faulty wiring inside the building for which the company was not responsible, and a fourth to the effect that the Hamlin Light, Ice & Power Company (a codefendant) did not use the high degree of care which a person of the greatest prudence would have used. On appeal, plaintiff asserted that the second answer just quoted was contrary to the evidence. This contention the Court of Appeals did not accept. (242 S. W. 536.)

Maine Commission Over-ruled.—The Supreme Judicial Court of Maine has made rulings as follows *in re* the Caribou Water, Light & Power Company upon exceptions taken by the town of Caribou to an order of the Public Utilities Commission of the state: Where a contract was made between a public utility and a town setting certain rates in consideration of the town's surrendering claims which it had against the utility under a prior contract, an order of the commission changing the rates so established by contract was not unconstitutional as an impairment of the contract or as taking of property without due process of law; where rates established in a contract between a town and a public utility are not discriminatory within the definition of the statutes, the contract is valid until the commission shall determine that the rates are unjust and unreasonable, when they become unlawful; and where part of the consideration paid by a town to a public utility was a surrender of rights belonging to the town under a prior contract with the utility, the commission should take into consideration not only the annual payments but also the consideration paid at the inception of the contract, so as to arrive at the full sum paid for the service. In fixing rates to be paid by a town to a public utility an order of the commission that the town should repay the amount annually collected as taxes upon the property of the utility was an error, since the rates should be certain and definite and not subject to fluctuation from the acts of some body other than the commission. (117 At. 579.)

Commission Rulings

Individual as Against Collective Billing.—The Wisconsin Railroad Commission has held that a rule of the Beloit Water, Gas & Electric Company requiring each tenant of a building to obtain electric service through a separate meter is not unreasonable or discriminatory, irrespective of the practice of other companies. "Undoubtedly," the commission observes, "if the owner of a building is permitted to purchase the energy used by his tenants and to sell it to them at a price not controlled by the utility company, differences in rates may result between users of similar service in the same city."

Rate Readjustment for Libby (Mont.) Company.—After the filing of a complaint by the city of Libby against the electric rates of the Libby Water & Electric Company, the Montana Public Service Commission conducted an inquiry into the fair value of the company's property and the reasonableness of its rates and rules. The commission, finding that a deficit resulted from the operations of the company, entered an order increasing the rates which were less than cost of production, eliminated discrimination existing against residence consumers, and included a readiness-to-serve charge in the power schedules to reimburse the company for its standing investment for power consumers and to prevent saddling the cost thereof on patrons who are steady purchasers. The commission further required the company to keep its records and books in Libby, Mont., instead of in Wyoming.

Extraterritorial Service of Municipal Plant.—Complaint was made against the city of Manitowoc, Wis., for alleged refusal of service previously furnished outside the city limits. The Wisconsin Railroad Commission held that a municipal plant which has to a limited extent assumed the duties of a public utility in the surrounding rural and suburban district, but has not claimed to furnish, own or maintain any permanent distribution plant outside of the city limits, should not be required to reconstruct an electric line for service to persons outside the city after such service has been discontinued because of the tearing down of the line by the owner, who had allowed others to use it. The commission held also that this owner, who had accommodated his neighbor, without profit, had not been himself conducting a public utility and had therefore a right to discontinue at his own option the service he had been rendering. Another finding was that a charge outside the city limits 50 per cent more than the regular municipal rate was not excessive or discriminatory.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

H. H. Ganser Heads Pennsylvania Electrical Association

H. H. Ganser, who was recently elected president of the Pennsylvania Electrical Association, has been the manager of the Counties Gas & Electric Company, Norristown, Pa., since 1912, when the Norristown Electric Light & Power Company and the Gas Company of Montgomery County merged with thirteen other companies to form the present organization. Mr. Ganser was born in 1873 at Wilmington, Del., and followed newspaper work until 1899, when he allied himself with the Gas Company of Montgomery County as collector and meter reader. In 1901 he was advanced to the position of superintendent and one year later became manager of the Norristown Steam Heat Company. In 1904 he joined the Norristown Electric Light & Power Company as agent.

H. H. GANSER

Mr. Ganser is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the Engineers' Club of Philadelphia and the American Gas Association and a past-president of the Pennsylvania Gas Association.

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H. W. Dennis, construction engineer of the Southern California Edison Company, will be one of the speakers on hydro-electric development at the October convention of the American Society of Civil Engineers, to be held in San Francisco.

Ottomar Hamele, chief counsel of the United States Reclamation Bureau, is in the West inspecting irrigation projects. He will, among others, inspect the Strawberry Valley irrigation project and other reclamation projects in Utah.

George E. Lewis, executive manager of the Rocky Mountain Committee on Public Utility Information, and E. P. Bacon, manager of the Natrona Power Company at Casper, Wyo., visited the principal central stations in Wyoming during the summer in the interests of organization development and improved public relations.

E. E. F. Creighton, consulting engineer of the General Electric Company, recently visited the Pacific Coast. Mr. Creighton was formerly professor of electrical engineering at Stanford University. While in California he spent some time on his large ranch in the northern part of the state before going to Vancouver to attend the Pacific Coast convention of the American Institute of Electrical Engineers.

R. A. Hart, federal drainage engineer, has just returned from a two weeks' trip through Idaho and Montana, where he visited a number of proposed drainage projects with a view to making recommendations for starting them in the immediate future. Among those which he visited was one at Preston, Idaho, and another immediately west of the Yellowstone National Park in Montana.

F. T. M. Kissel of the electrical division of the Public Works Department, Wellington, New Zealand, has been visiting many Pacific Coast cities recently. He is on a year's tour of the world to investigate hydro-electric development and engineering as well as the uses to which hydro-electric energy is being put. Mr. Kissel attended the recent Pacific Coast convention of the A. I. E. E. at Vancouver and plans to come east through Canada and the United States and later sail for Europe.

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E. O. Shryock Made Light and Power Superintendent

E. O. Shryock, superintendent of transportation of the Columbus, Newark & Zanesville Traction Company, Zanesville, Ohio, has been selected to succeed B. S. Watters, who on Sept. 1 resigned his position as superintendent of the light and power department of the company. Mr. Shryock has a long service record in electrical utility work. In June, 1906, he was employed by the Meadville (Pa.) Traction Company, the Meadville & Cambridge Springs Street Railway and the People's Incandescent Light Company, which were jointly operated. In February, 1909, he was made superintendent of a new division then being operated under the name of the Meadville & Conneaut Lake Traction Company, holding this post until 1913, when these companies were consolidated under the name of the Northwestern Pennsylvania Railway and the Northwestern Electric Service Company. At this time he was made superintendent of transportation of the Meadville-Cambridge Springs Division, the Meadville Division and the Meadville and Conneaut Lake Division. Later the Erie Traction Company was consolidated with these companies, and Mr. Shryock was made superintendent of transportation and purchasing agent for the combined systems. In the following year he was promoted to be general superintendent, which position he held until 1920, when he resigned to become superintendent of railways of the Northwestern Ohio Railway & Power Company, with headquarters at Oak Harbor. This position he resigned in June, 1922, to become superintendent of transportation of the Columbus, Newark & Zanesville Traction Company at Zanesville.

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American Society for Steel Treating Elects President

Tillman D. Lynch of the Westinghouse Electric & Manufacturing Company has recently been elected president of the American Society for Steel Treating. Mr. Lynch was born in Harrison County, W. Va., in 1867 and was graduated in 1891 from the Virginia University with the degree of civil engineer. Upon graduation, Mr. Lynch joined the contracting and inspecting engineering firm of G. W. G. Ferris & Company of Pittsburgh, Chicago and New York, doing inspection work at mill, foundry, shop and field erection. During the period from 1895 to 1897 he had charge of the Chicago office of the firm. Mr. Lynch has been with the Westinghouse Electric & Manufacturing Company since 1899, holding various positions, among them being those of inspector of materials, engineer of tests, section engineer in charge of manufacturing processes and metallurgical engineer. He has written a number of technical papers for various societies and for the press.

T. D. LYNCH

M. L. Harned, formerly research engineer with the Union Gas & Electric Company, Cincinnati, is now engineer with Stewart & Company of that city.

A. M. Little, for twelve years president and executive head of the Mohawk Electrical Supply Company, Syracuse, N. Y., has recently been re-elected president of the organization.

Frank B. Tupper, vice-president of the Washington Coast Utilities Company, who was formerly in the Boston offices of the corporation, has been transferred to Seattle following the closing of the Boston offices.

H. J. Burgess has been engaged as electrical engineer by the H. E. Crook Company, Inc., contracting engineer, Baltimore. Mr. Burgess was formerly a member of the industrial power department of the Consolidated Gas, Electric Light & Power Company of Baltimore.

G. M. RoBards, formerly with the Apex Electric Manufacturing Company, with headquarters in Kansas City, has taken over the duties of new-business manager of the Alabama Power Company at Anniston, Ala. Mr. RoBards has had a wide experience in the commercial field.

Robert L. Eltringham, manager of the California Electrical Co-operative Campaign, recently visited Los Angeles and southern California, speaking to gatherings of electrical men and organizations on the California water and power bill. Mr. Eltringham has addressed about six thousand electrical men and reports that they are everywhere opposed to the proposed act.

Chester H. Rowell, prominent publicist and member of the California Railroad Commission, has announced his intention of resigning from the commission on Jan. 1, to spend a year or more in travel through the Orient. Commissioner Rowell was appointed in January, 1921, by Governor Stephens as successor to E. O. Edgerton, and his service has been marked by important contributions to the theory and practice of utility regulation.

E. L. Andrew, assistant manager of publicity for the Westinghouse Electric & Manufacturing Company, recently completed a tour of Western cities, during which he conferred with district sales promotion representatives and spoke before various electrical organizations. Mr. Andrew was born in the East, but went to Tacoma, Wash., while still at school. He was graduated from the University of Wisconsin with the degree of electrical engineer and then entered the Westinghouse apprentice course. After being in charge of the publicity department of the Cincinnati office for a short time. he returned to East Pittsburgh to become head of the merchandising section of the publicity department. Within a year he was intrusted with supervision of the national advertising of the company in popular magazines, newspapers and trade journals. He has initiated two comprehensive programs of cooperation between the Westinghouse company and jobbers and dealers.

C. E. Eveleth Is Assistant Manager Schenectady Works of G. E.

Charles E. Eveleth, executive engineer of the turbine department of the General Electric Company, has been appointed assistant manager of the Schenectady works of the company, the appointment dating from Sept. 1. Mr. Eveleth is a native of Toungoo, Burmah, India, where his father was a missionary, and was educated at the Worcester (Mass.) Polytechnic Institute, from which institution he was graduated in 1899 with the degree of bachelor of science in electrical engineering. In August of that year he joined the testing department of the company at the Schenectady works, of which he later became a foreman. From June, 1900, to May, 1903, he was in the switchboard department as research and experimental engineer.

C. E. EVELETH

In May, 1903, Mr. Eveleth joined the railway department as experimental and commercial engineer on submarine work, continuing in this field until the end of the war period. He joined the turbine engineering department in December, 1918, and in April, 1920, was appointed executive engineer in the Schenectady turbine department. In March of this year he was appointed to this same post in the Lynn turbine department. Mr. Eveleth became an associate member of the American Institute of Electrical Engineers in 1906.

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F. J. Gleiss has resigned his position as Oakland district engineer with the Great Western Power Company, San Francisco, and is now connected with the Western Sales & Engineering Company, Oakland, Cal.

Oscar E. Halderman, who has been manager of the Elwood plant of the Indiana General Service Company, supplying light and power to Elwood, Ind., has been transferred to Muncie, Ind., where he will become manager. He had been in charge of the Elwood plant for ten years. He will be succeeded by Homer Guant, who was assistant manager of the company's plant at Marion, Ind.

Edward J. Nally, president of the Radio Corporation of America, who recently sailed for Europe on the Homeric, will visit England, France, Germany, Holland, Italy, Norway, Poland and Sweden. Mr. Nally stated that his company has concluded contracts with the governments of Poland and Sweden for the building of high-power radio stations to be used for direct duplex radiotelegraph service between these countries and the United States, thus adding two additional radio circuits to the five already in successful operation between the United States and foreign countries.

Claude E. Reese, editor of the "Gas Engineering and Appliance Catalogue" and associate editor of the *Gas Age-Record*, has joined the stoker sales department of the Westinghouse Electric & Manufacturing Company at South Philadelphia. Mr. Reese, who is a graduate gas and electrical engineer, cadet engineer and combustion engineer, has been with H. L. Doherty & Company and assistant engineer of the Illinois Public Utility Commission. He will work with G. A. Sacchi, manager of the stoker sales department, and R. R. Davis, manager of the department of publicity at East Pittsburgh.

Sidney W. Bishop, executive manager of the Denver Electrical Co-operative League, after a year as director of the affairs of the organization, has been charged with the duty of supervising its extension into those parts of Colorado and the Intermountain region which can be successfully served through the electrical industry of Denver. Mr. Bishop is a native of that city and a graduate of the University of Colorado. After his graduation he worked on a Denver newspaper, later leaving this work to enter the beet-sugar industry. Mr. Bishop joined the Denver Electrical Co-operative Campaign immediately after its inception in July, 1921.

Obituary

Frank Adam, chairman of the board of the Frank Adam Electric Company, died recently in St. Louis. Mr. Adam was a pioneer electrical goods manufacturer in that city, founding in 1890 the company which bears his name and which is best known to the trade for its extensive manufacture of switches and switchboards.

Charles G. Armstrong, an engineer and the inventor of the Armstrong signal light used in elevators, was found dead recently in his home in Jersey City. Mr. Armstrong was chief engineer of the Department of Bridges in New York City in 1912 and consulting engineer on the Singer Building. He was born in Illinois and was graduated from the University of Illinois. He was a member of several national engineering societies. Mr. Armstrong was sixty-four years old.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic
Problems of the Producer and Distributor, with Market Reports, Trade
Activities, Foreign and Construction News

More Team Play on Electric Trucks

A Frank Statement of One Obstacle Now in the Way of Prosperous Vehicle Development—Need of Better Understanding Between Manufacturers and Central Stations

By James M. Eaton
General Manager Cowan Truck Company, Holyoke, Mass.

IN THE marketing of electrical machinery of various kinds in which more than one manufacturer is concerned a greater degree of team play would be beneficial to both users and sellers. I speak of team play as co-operation between branches of the electrical industry interested in the advancement of improved methods and the proper application of modern equipment. Taking the industrial electric truck and the tractor as examples, I am convinced that much would be gained if the manufacturers of motors, control equipment, batteries and trucks would endeavor to enter into closer relations with central station companies, and if the last named, on the other hand, would meet the manufacturing contingent on the ground of a better understanding of what this class of equipment can accomplish in service, what it actually has done and along what lines it can properly be applied.

J. M. EATON

Need for Data

The application of trucks and tractors to industrial-plant service is a task in sales engineering, but in the past there has been too little realization of this. These products of reputable factories are capable of giving intensive service under widely varying conditions, and because purchasers have relied so much upon overload capacity, insufficient care in truck and tractor selection has sometimes been exercised. One of the most important bases for a co-operative advance, therefore, is the securing and interchange of more performance data among interested branches of the industry. The representatives of accessory manufacturers and of truck builders are in positions to draw forth information of great value from the field in order to help users get more out of their equipment, as well as to share with the central-station power-sales engineer well-demonstrated service data which, if properly interpreted, would go a long way toward selling the prospective customer the idea of interior electric transportation.

The value of the battery-charging load to the central-station company has often been emphasized in connection with road trucks, but less has been said about it from the industrial truck and tractor viewpoint. No truck builder, battery or motor manufacturer worthy of the name wishes to see less attention paid to the development of the domestic appliance business by central stations, but when it is realized that the output of energy required to charge a single truck of the industrial type easily may equal that demanded by 600 washing machines in a year's service, and that the big advantage is that this load is handled during the off-peak period, with off-peak characteristics as allied advantages, the importance of taking the truck and tractor seriously becomes clear.

There is a vital need of a closer understanding between central-station power-sales engineers and the various manufacturing interests represented in truck and tractor production and sales. These utility men usually have an exceptionally good entrée into local industrial plants, and if co-operation becomes more effective, much good will result.

In too many companies supplying electricity over wide areas the power sales staff at present fails to show a really active interest in truck and tractor opportunities. The manufacturers and their representatives are not well acquainted with the utility men in many cases. The former have been busy calling upon mill purchasing agents, plant engineers and other factory executives, and the central-station people frequently do not realize the field of profitable service before them in the intelligent use of trucks and tractors by the local industrial plants, large railroad terminals and stations, warehouses, etc. The percentage of "tips" or opportunities to bid on truck and tractor installations arising from central-station information is almost negligible in many localities.

Lack of Contact

It is time for a closer understanding between these branches of the electrical industry. The names of central-station power-sales engineers must be put upon the mailing and calling lists of the truck and tractor, battery, controller and accessory manufacturers, in order that the utility men may be kept in touch with the latest developments in this important field. The utility sales staffs, on the other hand, owe it to their own organizations to take an active interest in industrial electric transportation. The opportunities are too great to justify a continuance of the present drifting and indifferent policy in a potential market of such rare promise.

To Reduce the Cost of Our Product

Some Definite Suggestions to Aid the Analysis of Departmental Expenses as Factors in Manufacturing Cost

By C. A. Porter
Treasurer Quigley Fuel Systems, Inc.,
New York, N. Y.

One of the most serious questions before American manufacturers today is "How may we reduce the cost of our product?"

In order that we may get business we must be able to meet local and foreign competition. We can accomplish this only by going about the reduction of costs in a sane, careful, considerate manner. We must study our business carefully, make an exhaustive analysis of our personnel and of our expenses, of our markets for raw and finished materials and of our labor and its attitude.

Let us analyze these costs into four main groups—material, direct labor, manufacturing expense, selling expense.

Right here the average manufacturer says: "Our business is different!" We wish you to understand that the principle underlying all manufacture is the same—the requirements of raw material to be manufactured into an article to sell. It should, of course, be sold at a profit if we wish to be successful and to continue in business, but this does not mean that we can hope to make a profit on every article where sales are low.

We must next analyze the various elements of our costs, step by step; this analysis going much further than mere accounting. In the analysis of materials we must determine the materials best suited to our purposes. In times of low production it may pay to change radically from the materials used in times of high production. We may buy the materials in a different state so as to add or to cut off operations. Our source may be wrong; our handling costs per unit may not be cheap enough; our methods of warehousing may be too costly; our percentages of waste may be too high, or our utilization of byproducts may not be highly developed.

Reducing Hand Operation

Direct labor must next be analyzed. We have many possibilities here, such as changing from hand to machine operations, combining and eliminating operations, changing our wage payment plans so that the unit cost per labor dollar will be reduced and still maintain a commensurate wage schedule.

Manufacturing expense, in which we will include administrative expenses, must next be analyzed. This is made up of fixed charges, or uncontrollable expenses, and controllable expenses. Fixed charges include fire insurance, capital-stock surplus tax, local-benefit taxes, building depreciation and machinery depreciation.

We may be carrying too much fire insurance; our rates may not be so low as we can get them; our fire hazards may be reduced and a new rate obtained. Our capital stock and surplus may not be correctly proportioned; our assessment for local benefits may be too high; our interest in local affairs may be only half-hearted; our building depreciation rates may be inconsistent; our equipment depreciation rates may be out of line.

Controllable Expenses

Under controllable expenses we have executive salaries, office clerical salaries, shop clerical salaries, supervision, building repairs, machine repairs, liability insurance, supplies, miscellaneous expenses, welfare charges and power costs.

Our executive salaries may be out of line per person, or perhaps there may be more executives than necessary. Our office clerical salaries may be too high because we may be getting reports which are useless or at least unused and perhaps unnecessary. Our shop clerks may not be busy. Our superintendents, works manager, foremen and assistants may be more numerous than they should be. Building repairs may be too extensive or spasmodic. Machines may be repaired when they should be replaced, or repairs made in a haphazard fashion so that the work must be done over in a short time. We may not be getting the correct classifications for our labor or may be insured in the wrong company. We may not have our supplies properly safeguarded, or they may be bought on the whim of some one who is unfamiliar with the most economical needs. Miscellaneous expenses may harbor too many avoidable items. Welfare charges may be made which are unnecessary to our business under the present conditions. Our power costs may be, in many instances, substantially reduced by substituting pulverized fuel in place of the more or less antiquated system of whole-fuel combustion. By using pulverized fuel a lower grade of coal can be used in many instances; little or no banking coal is required, and a saving of 10 per cent to 50 per cent may be made.

The more usual items under selling expenses to be examined are administrative charges, sales manager's office, salesmen's salaries, salesmen's traveling expenses, commissions, advertising, return of sales, statistical information, sales clerical work, collections, discounts, entertainment, donations, rents and telephone and telegraph.

Watch Sales Expense

Administrative charges may be too heavy owing to an over-developed organization. The sales manager's office may be acquiring useless information and following up poor "prospects." Salesmen's salaries may be paid in accordance with their volume of sales, rather than their net worth to the company. Traveling expenses may not be watched so carefully as they should be, and a proper schedule of allowable expenses may possibly not be made. Perhaps commissions are being paid that are excessive for the article sold and not properly charged in the cost of selling to show the error. Advertising is a much-debated subject, but we should all remember that trade papers and almost all other magazines are in business to sell space so that we should limit our efforts to the stronger papers in each field and not spread our "shot" too much with a "sawed-off shotgun."

Our salesmen may be making rash promises to increase their sales, so that our returns and allowances are higher than they should be. Our shipping clerks may be careless in shipments so that goods are damaged or mis-sent. We may be gathering too much statistical information that is of little or no value. Our sales clerical work might possibly be cut down by co-ordination or by changing to tabulating machines. Our collections may be too slow and our costs too high, owing to a poor credit investigation system. Our customers may be taking advantage of cash discounts on overdue payments.

Entertainment may be too large and lavish and charged to the company when it should be borne by the individual. Our donations may not be wisely given. Our rents may be higher than the class of business or the sales warrant. Our telephone and telegraph account may harbor many unnecessary or personal calls. Increased production, when plants are working below capacity, means lowered costs per unit, which is the big thing that we are striving for.

After having made a careful analysis build up a budget with all useless frills and ruffles cut from the garment—one that is in line, not with present or past production, but with a reasonable production, taking into account our own facilities, the foreign and domestic markets and our own organizations.

In order to get at *facts* along the lines of these suggestions, the executive in charge of the accounting work should take the organization chart of his company and from his intimate knowledge of inside conditions select those departments where in his opinion there is the greatest need of change or reform and study those departments.

The need for tact of the highest order cannot be too strongly emphasized. Unless the matter is handled diplomatically, too often the ends sought cannot be attained because a spirit of antagonism is immediately manifested.

Survey of Business Conditions

Switch Sales Improving

Heavy-duty switches are in increased demand, and the outlook for fall business is excellent, said C. B. Kendall of the Hart Manufacturing Company, Hartford, Conn., last week to a representative of the *Electrical World*. The company's orders from Sept. 1 to Sept. 14 exceeded the total business booked during August. Foreign trade is being well maintained and recent sales include substantial shipments to Canada, South America, England and Scandinavia. The company is operating fifty hours per week and has recently increased its productive forces.

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Competition Is Keen in Algerian Market

American firms exporting electrical goods to Algeria must conform to French style and tastes and in general should follow Continental standards, says Consul Kingston in a report to the Department of Commerce. Products from the United States enjoy a very good reputation, but firms entering the market should have a representative on the ground supplied with stock. As an alternative a Paris branch could send salesmen to call regularly on the trade in Algiers, Oran and other large cities.

The chief factor in the Algerian trade is minimum price consistent with good quality. Generous and well-placed advertising is a good investment but should be prepared by some one who is familiar not only with the French language but with French tastes and mentality.

Algeria, being almost exclusively an agricultural country, is obliged to import all its electrical material and equipment. The market is largely controlled by French manufacturers, some of whom maintain factory branches in Algeria supplied with stocks and include in their organization traveling salesmen besides agents in the interior of the colony. French factories also transact business through agents working on a commission basis, usually with an allowance for advertising. The small trade is handled through local firms, the manufacturer dealing directly only in the case of large consumers and wholesalers.

Before the war Germany provided keen competition in the Algerian market, according trade facilities which the French houses were not able to meet. England has a small share of the electrical goods business of Algeria, English firms usually working through a commission agent whom they supply with a small stock of goods on consignment to enable him to fill orders readily.

No other power has any share of importance in the electrical goods trade of the country, such American products as are sold having been imported from Paris.

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Italians Want American Radio

There is indication of a growing interest on the part of the Italians in American production of wireless apparatus, and inquiries are being received both for transmitting apparatus to be used in broadcasting and for radiotelephone receiving sets, according to the Department of Commerce.

Commerce Department Sells Goods Abroad by Radio

"Tipping off" American business men by radio as to foreign sales openings in order to get the jump on America's competitors for the world's markets is the Commerce Department's latest trade-promoting stunt. Inquiries for American goods coming into the Bureau of Foreign and Domestic Commerce from consuls, commercial attachés and other government representatives in foreign countries are now distributed to New England manufacturers and merchants through the air by the bureau's Boston office in collaboration with the WGI broadcasting station at Medford.

The service was tried out one night last week for the first time as an experiment. By first mail the next morning several letters were received from nearby firms. One of the leading New England manufacturers of artificial leather who happened to be "listening in" that night learned of two possible openings for his goods—one in Mexico and the other in Colombia. He was much pleased, commending the Department of Commerce for taking advantage of "this most valuable time saving device."

In the opinion of another New England merchant, the new "sell-it-by-air" service should appeal particularly to the out-of-town manufacturers and merchants who are not in daily contact with the offices maintained by the Commerce Department in Boston, New York, San Francisco, Chicago, New Orleans and other leading cities. "For example," says this executive, "there are many manufacturers interested in radio who wish to sell abroad but who are prevented from keeping in constant touch by frequent visits and telephone calls with the trade openings reported to the government agents. As the radio stations reach many outlying cities, it would seem that this service should be of especial value to more distantly situated business men within a wide radius."

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Prevailing Conditions Affecting Cost and Volume

Rubber Consumption.—According to a report by an investigating committee in England, the rubber-growing countries of the world have an estimated productive capacity in 1922 of 400,000 tons of crude rubber, while the year's consumption, it is estimated, will not exceed 300,000 tons.

Loading of Bituminous Coal.—Bituminous coal loadings on Tuesday, Sept. 12, totaled 30,786 cars, according to reports just received by the Association of Railway Executives from the railroads of the country. This was a decrease of 5,022 cars compared with the preceding day, but loadings on Monday are always heavier than on other days owing to the accumulation of empty cars over the week end.

Bank Clearings.—The margin of increase in bank clearings over the figures of a year ago narrowed appreciably for the week ended Sept. 16, an aggregate of $6,221,437,000 at twenty cities in the United States, as reported to *Dun's Review*, representing a gain of 11.8 per cent over the $5,564,865,879 of the corresponding period of 1921.

Failures.—Increases in the Southern and Pacific sections were slightly larger than declines in the other two sections of the United States, so that failures reported to R. G. Dun & Company for the week ended Sept. 16 totaled 333.

Export Rates Reduced. — Railroads west of the Mississippi River have reduced export rates on certain commodity shipments from Chicago, St. Louis, St. Paul, Minneapolis, Omaha, Kansas City, Denver and related points to San Francisco and Seattle, destined to points on the west coast of Central and South America.

Factory Employment Gains in New York.—Instead of the usual reduction in employment in August, figures compiled by the New York State Department of Labor show a gain of 2 per cent last month in the number of workers employed within the state compared with July.

Volume of Business. — Volume of business for the week ended Sept. 13 was $8,233,000,000, marking an increase of $827,000,000, or about 11 per cent, over the total of $7,406,000,000 reported for the preceding week.

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Decided Slump in Electrical Exports During July

A decided slump in the amount of electrical machinery and apparatus exported is shown by the July figures of the Bureau of Foreign and Domestic Commerce which have just been made public. The value of all exports during July was $4,350,128. This is nearly $2,000,000 under the June movement and is $1,000,000 less than the value of the exports in July of 1921. The detailed figures are given below.

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Metal Market Situation

Foreign Business Better than Domestic—Many Manufacturers Have Not Felt Coal Improvement

Foreign copper business is better than the domestic, and sales in both quarters have been better than for some weeks past. The price of 14 cents for electrolytic copper through the remainder of the year prevails, but no one seems to be disposed to quote into 1923 as yet. There is no apparent tendency to shade or raise prices at present, and there is no spread in quotations between the large and small producers.

Those who have been predicting an advance in copper prices have been somewhat disappointed by the recent developments. Their predictions were based on expectations that the settlement of the coal strike would result in an increased demand from consumers and thus bring about an advancing tendency. However, copper users are not yet rushing into the copper market for their future heavy requirements, because they have had no trouble in the past in placing orders, and it is believed they will continue to do business on a hand-to-mouth basis until such time as circumstances force them to change their tactics.

Many manufacturing consumers of copper have not yet felt the improvement in the coal situation because their receipts of fuel have not increased to any material extent. However, they have been increasing their operations, working on their surplus supply of fuel, as they feel that they can replenish their stocks when the coal movement becomes more general and these industries to which priority has been given have been taken care of.

Some copper sellers report an increased demand for casting copper for export and insist that the gain in foreign demand for this lower grade of the metal has been larger than for the electrolytic during the past week. China has been the leading buyer, and the quotation has been 13½ cents, free alongside ship, or equal approximately to 13¾ cents, delivered.

Approximately 100,000,000 lb. of copper will be utilized this year in the manufacture of automobiles in this country, according to a survey just completed by the Copper and Brass Research Association. This is 30,000,000 lb. more than in 1921 and about 750,000 lb. more than in 1920, in which latter year the automobile industry consumed 7.63 per cent of the total copper production.

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NEW YORK METAL MARKET PRICES

	Sept. 14, 1922 Cents per Pound	Sept. 21, 1922 Cents per Pound
Copper		
Prime Lake	14.00	14 00
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	5.75	5.75
Antimony	5.25	5.25
Nickel, ingot	36.00	36.00
Zinc, spot	6.50	6.50
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00–11 25	11.00–11.25
Brass, heavy	5 75– 6 25	5 75– 6 25
Brass, light	5 25– 5 50	5 25– 5 50
Lead, heavy	4 62½–4 75	4 62½–4.75
Zinc, old scrap	3.00– 3.37½	3 00– 3.37½

ELECTRICAL EXPORTS FOR JULY, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

	July, 1921 Value	July, 1922 Value
Electrical glassware, except for lighting	. .	$15,326
Electrical porcelain	. .	86,571
Carbons for electric lighting, electrodes and batteries	$29,317	99,286
Insulated wire and cable (iron and steel)	. .	16,296
Other manufactures of aluminum	116,126	79,901
Copper wire (bare)	66,823	130,184
Insulated copper wire and cable	496,928	145,186
Generators:	790,634	. .
Direct-current—		
Under 500 kw.	....	38,671
500 kw. and over	....	23,482
Alternating-current—		
Under 2,000 kw.	....	35,392
2,000 kw. and over	....	82,376
Accessories and parts of generators	....	251,709
Self-contained lighting outfits	....	52,571
Batteries	183,525	.
Primary—dry	....	70,440
Primary—wet	....	567
Storage	....	107,377
Transforming or converting apparatus:		
Power transformers	....	449,132
Other transformers	....	48,578
Rectifiers	....	5,843
Condensers, double-current and motor generators, dynamotors, synchronous and other converters	....	150,276
Transmission and distribution apparatus:		
Switchboards and panelboards, except telephone	....	274,906
Switches and circuit breakers	....	180,776
Fuses and fuse plugs	....	14,525
Watt-hour & other measuring meters	....	20,539
Volt, watt and ampere meters and other recording, indicating and testing apparatus	....	84,103
Lightning arresters, choke coils, reactors and other protective devices	....	23,988
Motors, starters and controllers:		
Motors, under 1 hp.	....	70,944
Stationary motors—		
1 to 200 hp	.	172,002
Over 200 hp.		$155,061
Railway motors	.	46,746
Electric locomotives	423,176	
Railway		......
Mining and industrial	.	8,802
Other motors	1,121,583	14,278
Rheostats, controllers and other starting and controlling equipment	61,755	39,346
Accessories and parts for motors	....	97,706
Electric appliances:		
Electric fans	37,566	51,463
Electric lamps—		
Arc	.. ....	1,316
Incandescent—		
Carbon-filament	10,802	5,629
Metal-filament	153,689	84,769
Other electric lamps	....	11,708
Flashlights	....	21,240
Searchlights and projectors	....	5,056
Motor-driven household devices	....	34,928
Domestic heating and cooking devices	54,262	36,116
Industrial electric furnaces and ovens	....	5,698
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	....	42,307
Signal and communication devices:		
Radio and wireless apparatus	....	385,861
Telegraph apparatus	....	9,979
Telephone apparatus, including switchboards	....	240,310
Police, fire and burglar alarm	....	708
Railway signals, switches and attachments	....	124,359
Bells, buzzers and annunciators	....	5,461
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	85,173	80,446
Insulating material	. ...	87,217
Metal conduit, outlet and switch boxes	. ..	27,202
Sockets, outlets and receptacles	...	34,070
Other wiring supplies and fixtures	79,327	89,738
Other electrical apparatus not elsewhere specified	1,716,498	444,404
Electrical machinery and apparatus (total)	$6,314,267	$4,350,128

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

ELECTRICAL business continues to show improvement, reports from all over the United States indicate. Central-station companies are preparing for the winter months, extending new lines and repairing the old. Poles and wire are moving better than for some time past. Lamp sales are beginning to pick up as a result of replacement buying by residential and industrial customers. Conduit stocks are lower in some sections of the United States, while in some Eastern cities sufficient material is to be found. Appliances are showing much activity. Prices generally are firm.

New York

Heater Sales Are Helped by Cooler Weather—Lamps Are Selling Best in Years

Sales of electrical materials and apparatus continue to show improvement. Stocks of conduit are more ample, recent orders of pipe having come from the mills to supply the heavy demand of fall construction. Central-station business is greater than last year, and much activity is being shown in preparation for the winter months. As a consequence of this poles and pole-line hardware are moving more actively. Lamps are reported selling better than for some years past.

Heaters.—Cooler weather has brought on brisk sales and the jobbers are easily supplying the market with styles of all kinds. Prices generally are firm.

Sockets.—Deliveries are satisfactory and stocks are meeting all requirements. Prices are firm. Sales are heavier than a year ago.

Meters.—An optimistic outlook prevails in the meter market, and sales are expected to continue strong for the rest of the year. Residential types are selling best.

Chicago

Wiring Prices Firm—Movement of Poles Improving—Better Demand for Radio Reported

A steady but firm electrical market was reported by jobbers this week. Prices on wiring materials are firm and stocks are ample on most lines except conduit. This material is still scarce, especially in the smaller sizes. Action on high-tension equipment still continues. Poles and cross-arms are gradually working out of the summer sluggishness. Radio demand is picking up and dealers feel that the winter business will be active.

Wire.—The market for rubber-covered No. 14 wire is firm, and in 5,000-ft. lots it costs between $6.20 and $6.35 per 1,000 ft. Jobbers report stocks in fair condition. No change in weatherproof or bare-wire demand.

Flexible Armored Conductor.—This material is available in the No. 14 two-wire, single-strip size for $48 per 1,000 ft. in 5,000-ft. lots. Action has been fair and stocks are normal.

Conduit.—Car scarcity is still keeping stocks of the smaller sizes of conduit down to low limits. The ½-in. black pipe is quoted at $55 and $57 per 1,000 ft. Demand is keen.

High-Tension Equipment. — Activity is still good. One manufacturer reports sales on seven 33,000-volt outdoor substations ranging from 200 kva. to 1,000 kva. to a Southwestern utility. Two 66,000-volt, 2,000-kva. substations were sent to a concern in the West.

Poles. — Movement is picking up after the summer let-up. Several ornamental street-lighting projects are calling for this equipment. Shipments from the coast are slow owing to a shortage of flat cars. Most dealers expect a good business this fall to prepare lines for the winter. Prices remain unchanged.

Cross-Arms.—This market follows the demand for poles and is steady both in price and demand.

Radio.—A slight improvement in the radio demand was noticed this week. Stocks are in good condition, and most jobbers think that the present start is indicative of an active winter's trade.

Cleveland

Heavy Stocks of Radio Reported—Refrigerating Machines Are Selling Better—Heaters Active

Electrical business continues in good volume, although nothing of great interest has occurred during the week except a slight acceleration in the sale of electric heaters and a general increase in the sale of appliances.

Radio Equipment.—Jobbers and retailers report a satisfactory week with a marked increase in the sale of parts. Heavy stocks are reported.

Refrigerating Machines. — Greater activity is reported with all indications that a fertile market is being developed. Several apartment houses under construction have ordered refrigerating equipment installed.

Heaters.—The cool weather has increased the sale of heaters appreciably. Stocks are good and prices are firm. An active fall season is expected.

Washers.—While demand has remained firm, there has been no evident increase in business over last week. Stocks and deliveries are good.

Ironers.—Sales in this line are showing good progress and stocks are ample.

Boston

Gradual Improvement Noted—Street Lighting Shows More Life—Non-employment Is Diminishing

Gradual improvement in trade is evident. Prices are firm, with tendencies to stiffen in rigid conduit. Wiring supplies are in chief demand in jobbing circles and apparatus sales are reported good among manufacturers. Deliveries have not yet got back to normal, although current needs in most lines are being met readily. Building operations continue healthy and retail trade is picking up in New England. Threatened coal shortage has led to improved sales of small or medium-sized generators for use in water-power plants, both central-station and industrial. Street lighting has shown more life, and a new installation in the Boston Back Bay district has attracted attention. Labor conditions in this district are quieter as regards strike troubles, and non-employment is diminishing.

Wire.—Rubber-covered wire is moving faster, and No. 14 sells at $6.25 per 1,000 ft. in Boston in 5,000-ft. lots. Weatherproof is dull this week, quotations being upon a 16.5-cent to 17-cent base. Little bare wire is moving.

Loom.—Sales have slowed up somewhat except for the "down East" demand. Prices have stiffened about 5 per cent recently. Stocks are ample.

Rigid Conduit.—Stocks are very much broken and shortages are reported in both large and small sizes. Quotations are tending higher. Deliveries are slow and the demand is active.

Flexible Armored Conductor. — A healthy demand is apparent on the basis of $44.20 per 1,000 ft. in 1,000-ft. lots for No. 14 single-strip. So far there is no serious shortage reported.

Motors.—Sales from week to week are somewhat spotty in small motors, but compared with last year's volume, 20 or 25 per cent better. In New England the motor business is reviving slowly but surely. Excellent deliveries are being made from the factories, and the second-hand supply from war plants has not upset conditions as much as was feared in some quarters.

Radiators.—The demand has leaped into brisk sales within a few days. The expectation is that factory stocks accumulated during the summer production period will soon be lowered to a point where deliveries will be decidedly lengthened. Prices are firm, and retail trade is beginning to improve.

Sockets.—Trade is good and deliveries are satisfactory. Prices are firm. Pulls in case lots net 32½ cents, keys 18½ cents and keyless 17 cents. Sales as a whole are much better than a year ago.

Porcelain.—Knobs and tubes are moving well, and so far deliveries are giving no serious trouble. Advance ordering, however, is playing a part in meeting current requirements.

Atlanta

Conduit Shortage Reported—Safety Switches Are Active—Good Stocks of Telephone Equipment

There has been no particular change in general conditions since last week. Jobbers report the volume of orders as very satisfactory, but on account of slow deliveries stocks are getting so low in some lines that it is difficult to fill the orders. A general shortage in conduit still exists in this section. Jobbers handling farm-lighting outfits report a quickened interest in this line, with satisfactory orders coming from North Carolina and the peach section of Georgia. An intensive advertising campaign will be launched in this line within the next few weeks which should boost sales considerably. Several large contracts have been let recently for the electrification of mechanically driven mills, and this will affect transformer and motor equipment lines.

Lamp Cord.—Temporary work is taking a satisfactory quantity of this article and jobbers have stocks on hand to meet all requirements. No recent price changes are to be noted.

Safety Switches. — Jobbers report good sales in this line with switches of from 30 amp. to 600 amp. 250-volt types, the best sellers. Satisfactory stocks are on hand.

Telephone Equipment. — The fall pick-up in this line has not yet materialized, but jobbers have good stocks on hand in anticipation of a brisker movement. No recent price changes are reported.

Electric Churns.—Only a fair movement is reported in this line, such sales as are reported being for the 32-volt type. Good stocks and steady prices seem to be the rule in the territory.

Outlet Boxes. — The demand for standard sizes is very good and jobbers have ample stocks on hand. Shipments are prompt but deliveries slow. No recent price changes reported.

Refrigerating Equipment. — Interest in this line is maintained, and dealers handling this equipment report satisfactory sales. Local advertising campaigns are on in Atlanta, and this will doubtless cause a brisker movement.

St. Louis

Demand for Residential Meters Steady —Holiday Business in Hollow Ware Has Begun

It is generally believed by jobbers that improved business will soon result from settlement of the rail strike and consequent improvement of morale. Local bankers, manufacturers and business men express relief that this major labor difficulty gives evidence of being concluded. With wheat harvest nearly completed, with a corn crop maturing that will be at least equal to the five-year average, with cotton picking now under way and its deterioration arrested by cooler temperatures, and with bumper fruit crops, purchasing power in this district will certainly be up to standard this fall and business in all lines is expected to be good.

Meters.—Demand of residential types is steady and, because of completion of extensive building programs over the entire territory, will probably continue good to the end of the year. Three-phase meters are much more active and demand should further increase because of extensive industrial construction.

Transformers.—There is a strong demand for large-sized power transformers, Kansas City and St. Louis being the principal fields. Sales of single-phase units for distribution are steady, but no large extensions by power companies are under way.

Hollow Ware.—Holiday ordering has begun on a small scale. Dealers' and jobbers' stocks have been conservatively maintained and indications are favorable to good buying.

Washing Machines.—Special efforts by jobbers have resulted in reasonably good sales which are growing in volume. Stocks are good.

Sewing Machines.—Improved demand and ample stocks are reported. Motors are dull.

San Francisco

Conduit Shortage Causing Serious Concern—Schedule Material Business Is Good

Store business is markedly better especially in smaller table appliances. Collections are slightly better.

Radio Material.—Movement is slow and still far below spring demand probably because of character of broadcasting. The present schedule is badly tangled. Dealers realize that future business depends upon improvement and standardization of broadcasting, and early action is expected.

Household Appliances. — Jobbers of standard lines are seeking new outlets for volume, recognizing the fact that electrical dealers and contractors are diverging more and more. House-to-house campaigns are not showing successful results. Business is apparently coming back to stores, therefore new favorable store outlets are being sought. Washer sales are very good, thus confirming the September prediction. Vacuum-cleaner sales are comparatively slow, but the greater volume of tools sold suggests encouraging future outlet. Other appliances, such as ironers, show little movement, though sewing-machine sales show an upper trend.

Conduit.—The situation is causing serious concern. The twin strikes, coal and rail, sharply cut into production which, coupled with record-breaking building in California, has produced a situation whose parallel existed only in summer of 1918. Only the largest sizes remain in stock. The settlement of the coal strike and the predicted early settlement of the rail strike come just in time to cause partial shipments that will tide over the worst and prevent absolute shutdown of electrical works because of pipe shortage. Eastern winter conditions, with a larger proportion of coal diverted from industries for heating, may cause a serious condition.

Schedule Material.—Volume for volume, present demand exceeds war-time demand, although higher war-time prices probably caused greater sales in dollars. Even that record may be shortly broken with constantly climbing building records. Demand is well distributed throughout a variety of devices as compared with the spasmodic and spotty war-time call.

Salt Lake City–Denver

Call for Radio Parts Especially Good—Air-Heater Stocks Are Reported Somewhat Low

Industry generally is resuming a settled trend and buying in most lines is showing a corresponding improvement. Virtually all of the railway strikers have returned to their jobs. Transportation is in better condition and perishable crops are moving satisfactorily. Millions of dollars representing Pacific Coast capital is seeking outlet in Intermountain development projects. The result is a growing optimism for future production and business. The demand for electrical merchandise shows slow but steady improvement.

Radio.—Jobbers' stocks are improving, owing to a let-up in consumer demand during summer. The market shows a better tone as summer merges into fall. The call for parts for amateur construction is especially good. Interest is said to be reviving all along the line.

Air Heaters. — Stocks are reported somewhat low. Several jobbers have cleaned up holdover stocks and placed good-sized orders. Reduction in price reaches as much as 20 per cent on some lines.

Portland–Seattle

Stocks Generally in Good Shape—Conduit Price Reduced About 5 per Cent

Business conditions continue good. Lumber production is normal, but new business continues about equal to production and back orders are very large. Car shortage is seriously hampering rail shipments. About 40 per cent of the total shipments from the Northwest are moving by water. The grain movement is in full swing and receipts are increasing daily.

Building construction continues to be active throughout the Northwest, and the value of such work started in this district during the first eight months of 1922 exceeds that for the same period of 1921 by 44 per cent, while the number of electrical permits issued maintains about the same ratio. The employment situation for this district remains about normal. Practically all lines of industries are active at the present.

Demand for harvest and fruit hands is large, a shortage of help is reported in some districts. The section of the new tariff bill putting a tariff on cedar logs but admitting cedar shingles duty free is causing considerable alarm among Northwest shingle mills.

Electrical jobbers and contractor-dealers report business to be very good, particularly in schedule material. The effect of the fall demand for lamps is beginning to be felt. Stocks in general are in very good shape, although shortages are reported in some sections in conduit and steel boxes. Prices are generally steady. A reduction in the price of conduit is reported for this week amounting to about five per cent.

Porcelain.—The demand for knobs, cleats and tubes is active and the price has remained steady for the past several months.

Insulators.—Glass insulators remain steady in price and the demand is fair.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Federal Wireless Contract Is Taken by New Concern

The contract of the Federal Wireless Company of California for erecting wireless stations in China, which has been the focus of international negotiations for some months, has been taken over by a new concern jointly owned by the Federal Company and the Radio Corporation of America, directors of the Federal company have just recently announced.

The new company will be known as the Federal Wireless Company of Delaware and is said to have the approval of the State Department. The announcement declared that the arrangement would insure the immediate construction of high-powered radio stations in China and a new American-controlled channel of communication with that country.

◆

Electric Power Club Is Now Established in Cleveland

The Electric Power Club has recently moved its headquarters from St. Louis to Cleveland, opening offices in the Kirby Building there. Cleveland was selected as the permanent headquarters of the club because it is the most central point for the majority of its members.

The club, which is an association of eighty-five representative manufacturers of electric power apparatus and control equipment, is organized for the standardization, improved production and increased distribution of electrical machinery and apparatus, succeeding the American Association of Electric Motor Manufacturers, which was organized in 1908.

The officers are: R. J. Russell, president; C. H. Roth, vice-president and secretary; J. K. Bass, treasurer, and S. N. Clarkson, executive secretary.

According to Executive Secretary Clarkson, the member companies manufacture more than 95 per cent of the electrical apparatus and machinery produced in this country and nearly one-third of the members are located in Ohio.

Included among the member companies are the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Robbins & Myers Company, the Electric Storage Battery Company, the Van Dorn Electric Tool Company, the Otis Elevator Company and the Ohio Electric & Controller Company.

◆

Buyer of Bankrupt Electrical Company Sues for Its Name

Suit has been started in the United States Circuit Court of Appeals at Cincinnati by the Theobald-Jansen Electric Company, Louisville, purchaser of the assets of the Harry I. Wood Electric Company, bankrupt corporation, at a referee's bankruptcy sale to establish whether it acquired with other assets the right to use the corporate name of the Harry I. Wood Electric Company.

After acquisition for $51,000 of the assets of the Wood company in the court of Judge George A. Brent, referee in bankruptcy, by the Theobald-Jansen Company, attorneys for Mr. Wood, who since has died but who then was the president and largest stockholder of the Harry I. Wood Company, brought this question of the sale of its corporate name before Judge Walter Evans, who nullified that part of the sale which included the corporate name. The case was then taken to the United States Court of Appeals at Cincinnati by the Theobald-Jansen company on a petition for review.

◆

Lynn Works of G. E. Company Are Being Enlarged

The General Electric Company, West Lynn, Mass., will shortly begin the construction of a four-story, 122-ft. x 57-ft., brick and concrete addition to building No. 63, for turbine and compressor work, at a cost of $200,000. The building will, it is said, be the last word in modern factory construction and will give the General Electric Company more than 75,000 sq.ft. of additional floor space.

National Electrical Credits Report on Delinquencies

The accompanying tabulation shows the number of delinquent accounts reported during July and August of this year, as compared with July and August, 1921, to the National Electrical Credit Association, headquarters in Chicago, by member manufacturers and jobbers, together with the total amounts and the average amounts of the delinquencies.

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
July, 1921	617	$80,681.69	$130 77
July, 1922	727	87,643.24	120 55
August, 1921	657	101,140 35	153 94
August, 1922	773	104,433.30	135 10
New York:			
July, 1921	341	67,907.00	199 00
July, 1922	395	54,704.00	139 00
August, 1921	370	62,758 00	169 00
August, 1922	578	79,764.00	138.00
Philadelphia:			
July, 1921	220	41,116.03	186.89
July, 1922	261	23,083.53	88 44
August, 1921	246	25,332.55	102.98
August, 1922	258	37,013.70	143 46
New England:			
July, 1921	80	10,194.64	127 43
July, 1922	55	6,779.59	123 46
August, 1921	62	11,929.57	192.41
August, 1922	63	9,491.30	150.65
Pacific Coast:			
July, 1921	19	3,511.55	184.61
July, 1922	13	1,280.71	98 51
August, 1921	17	3,271.30	196.54
August, 1922	21	3,450.23	154.77

It is to be noted that in the Central and New York divisions the increases in delinquencies are large, while in the New England and Pacific Coast divisions increases are small and in some cases there are decreases in the number of delinquencies.

◆

Westinghouse Company Receives French Railway Contract

An order covering the complete control equipment for 120 electric locomotives now under construction has been received by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., from the Paris-Orleans Railway of France as part of an electrification contract amounting to approximately $8,000,000.

The Paris-Orleans Railway, which is one of the largest systems in France, operating over 5,000 route miles of track, is electrifying 125 miles of its main line between Paris and Vierzon. This is the first of an extensive program laid out by the Paris-Orleans for the electrification of its lines.

After a careful and exhaustive study by the railway engineers of the various systems of control now on the market, they selected the Westinghouse electro-pneumatic control, which is now standard on most of the large railroads in America.

The complete order of control equipment will be manufactured in the United States, and shipment of this order will commence in January, 1923, and extend to December, 1924.

Announcement is made that the Westinghouse Electric & Manufacturing Company has become agent for the De Laval transformer-oil purifiers and dehydrators.

This make of apparatus, which operates on the centrifugal principal, is equally well adapted to the removal of sludge from lubricating oil and to the dehydration and purification of transformer and other insulating oils. Some of its distinctive features are that it is simple and effective in operation, reduces the expense of dehydration, is rugged in construction, and uses no filter medium of any kind, thus eliminating a source of delay and expense.

Elliott Company Opens Atlanta Office

The Elliott Company of Pittsburgh, with sales offices and factory at Jeannette, Pa., announces the opening of a new district sales office in Atlanta at 305 Haas-Howell Building. This move was felt necessary in order to take care of the company's increasing business in this territory and to serve more effectively the interests of customers and prospective customers in this district.

The Atlanta office makes the twelfth Elliott district sales office, all of which are located at strategic points and are manned by sales engineers especially trained for rendering service in connection with Elliott, Liberty and Lagonda products.

The new Atlanta office is in charge of H. A. Hoffmann, formerly with the Elliott Company in the Philadelphia office.

Jeannin Electric Company Moves to New Factory

The Jeannin Electric Company, Toledo, Ohio, has recently moved into its new factory, with 10,000 sq.ft. of floor space, situated near the Baltimore & Ohio and the Wheeling & Lake Erie Railroads, Toledo, Ohio. Much of the development of the company is in single-phase motor construction. The new plant is operating at 100 per cent capacity and additions are being planned to increase production.

Republic Electric Company's New Building Completed

The new home of the Republic Electric Company, Cleveland, pictured here, has just been completed. In addition to the Cleveland headquarters the company maintains a branch at Akron and many agencies throughout the state, which are now capitalized at $250,000.

Primarily, the object in designing the plan of the building was to reduce to a minimum the operations ordinarily required in moving out shipments, and to this end a most efficient warehouse arrangement was adopted.

The stock is arranged in such a manner that relative parts are neighbors and orders may be prepared for shipment in a comparatively short time. The stock is moved about on trucks, and upon reaching the shipping room "foreign" deliveries are distinguished from "locals" and are segregated for loading and shipping in an effort to lessen handling. Unassembled packing cases bearing the company's name and shipping instructions make it possible to construct cases of proper dimensions to incase shipments securely and without waste. A loading platform and a spacious freight elevator contribute largely to the greater efficiency of the shipping room.

NEW BUILDING OF REPUBLIC ELECTRIC COMPANY

The systematic arrangement of the stock also permits a rapid inventory, and departmental stock cards are revised constantly by the department head, thus evolving an immediate or current inventory as well. These cards constitute a report to the purchasing department, which through their inspection and bearing in mind the requirements of the sales charts may replenish depleted stocks and prevent any overstock or shortage.

A prominent feature of the building is the customers' display room, fitted up and set apart for the use of patrons who wish to demonstrate or exhibit the company's products to their own customers. Since the company has recently included radio supplies in its distribution, the display room is equipped with a complete radio section. The room is provided with an inside aërial and box aërials, and in addition there is an antenna on the roof.

A service department for the repair and inspection of appliances also occupies a large and well-fitted room.

Excellent ventilation and utilization of daylight have produced favorable working conditions, and rest and recreation rooms with shower baths have enabled the company to retain satisfied and productive employees.

The building is constructed of fireproof materials throughout. The executive and sales offices occupy the front part of the first floor, while the bookkeeping and credit departments are in the same position on the second floor.

The officers are: L. Griesser, president; A. C. Kinzel, vice-president, and H. W. Allen, secretary and treasurer.

Large Broadcasting Station at Louisville Helps Radio

The establishment of the large broadcasting station of the Louisville *Courier-Journal and Times* has increased interest for amateur sets in Louisville territory. Sales have jumped at a tremendous rate as a result.

The Electric Supply & Equipment Company, 103 Allyn Street, Hartford, Conn., has placed a contract for a new branch plant at Broadway and Church Streets, Albany. The structure will be four stories high, 42 ft. x 60 ft., of brick construction, and will cost $50,000.

The Alpha Electric Company, 151 West Thirtieth Street, New York, has leased the building at 396-402 Eleventh Avenue, Newark, N. J., totaling about 50,000 sq.ft., and will occupy the structure for a distributing warehouse and service building. The rental totals $300,000.

The Central Manufacturing Company, Inc., 2521-29 Montgomery Street. St. Louis, Mo., manufacturer of electrically operated washing machines, contemplates the rebuilding of the portion of its plant destroyed by fire, Aug. 29.

The Reynolds Electric Company, Chicago, manufacturer of fractional-horsepower motors, announces in a sales bulletin recently issued that it is now manufacturing 500 motors a day.

The Shaw Insulator Company announces its removal to a new building at 148 Coit Street, Irvington, N. J.

The Economy Fuse & Manufacturing Company, Chicago, announces that it has removed its Detroit sales office from the Majestic Building to the First National Bank Building.

The Mutual Electric & Machine Company, Detroit, announces the appointment of Joseph H. Rohs as sales manager of its apparatus division.

The Ward Leonard Electric Company, Mount Vernon, N. Y., announces the appointment of Willis D. Bishop of Montreal as sales representative in the Province of Quebec. Mr. Bishop has been closely identified with the design, application and sale of control apparatus and switchboards since 1904.

Foreign Trade Notes

UNDERGROUND RAILWAY FOR KOBE, JAPAN, PROPOSED — The first underground railway to be built in Japan may be in Kobe, the City Council having agreed to appropriate sufficient money to carry out the preliminary investigations. The proposed subway would extend from the eastern to the western boundaries of the city, about 5 miles. Extensions, according to the promoters, would be built as required.

INTEREST IN MOTOR-DRIVEN MACHINERY IN CHILE.—Interest in motor-driven machinery in Chile is constantly increasing, *Commerce Reports* states, owing to the intermittent fuel difficulties, which make electricity the most dependable form of power. The hydro-electric development which is under way near Santiago will emphasize this tendency. At present there is particular interest in catalogs of woodworking machinery, especially that equipped with electric motor drive. Both direct-current and alternating-current motors are used.

ELECTRIFICATION OF THE FRENCH RAILWAY SYSTEM.—The electrification of the entire French railway system has been decided upon, according to information recently given out by the French Minister of Public Works, *Commerce Reports* states, thereby reducing the running costs and doing away with the importation of foreign coal. Following an exhaustive inquiry, confirmed by the visit of a technical commission to the United States, the direct-current system of 1,500 volts has been adopted, and already various companies have begun work on the electrification of the more important sections. The three railway systems making the greatest progress are the Midi, the Paris-Orleans and the Paris-Lyons-Mediterranean. It is hoped to make the change within a few years on the Paris-Vierzon-Brive line, and also on the branches between Limoges, Montlucon, Gannat, Brive, Tulle and Cleremont-Ferran. This region is situated in the vicinity of the Dordogne River and its tributaries, on which, it is estimated, 400,000 kw. can be developed. The electrification of the Paris-Orleans and the Mediterranean railways will be rendered easy by the water power of the Rhone, the Alps and the central plateau. The electrification of 1,430 miles of its lines, or about 23 per cent, has been planned by this company. Within four years the line from Culoz to Modane will be electrified, as an experiment; later on stretches from Nice to Coni, Lyons to Marseilles and Ventimiglia, Lyons to Geneva, Lyons to Grenoble and the suburban lines about Paris will be operated by electricity.

New Apparatus and Publications

MOTOR DRIVE FOR ROLLING MILLS. —The English Electric Company, Ltd., Queen's House, Kingsway, London, W. C. 2, is distributing publication No. 372, which contains illustrations of various rolling-mill drives installed by the company.

ENGINEERING SERVICE. — Ophuls & Hill, Inc., 112 West Forty-second Street, New York City, mechanical, electrical and refrigerating engineers, is distributing a small booklet entitled "A $100,000-a-Year Supervising Engineer at Your Disposal," in which it describes its organization and methods of service.

RELAYS. — The General Electric Company, Schenectady, N. Y., is distributing bulletin No. 47,606, describing relays and their operation and general application.

HANDBOOK ON ELECTRIC EQUIPMENT.—The Electric Power Club, Kirby Building, Cleveland, has issued a new edition of its handbook covering substantially all the standardization in electric motors, generators, transformers, electric tools, mining and industrial locomotives, control equipment, switchboards and switching equipment manufactured in this country. It also contains definitions, symbols, general engineering recommendations and other information in connection with electric apparatus and control equipment.

PNEUMATIC COLLECTING AND CONVEYING SYSTEMS.—The B. F. Sturtevant Company, Hyde Park, Boston, has issued a seventy-two-page engineering bulletin on pneumatic collecting and conveying systems. It contains illustrations, diagrams and tables, how to find the size of fans, the suction, volume, r.p.m. and horsepower of any system, etc. Data are also given on dust collecting from grinding and polishing machines, coal breakers, etc., and the removal of fumes, gases, etc.

ASH DISCHARGE.—"The Rotary Ash Discharge" is the title of a booklet published by the American Engineering Company, Philadelphia, which covers its system of, ash treatment and discharge.

GALVANOMETERS.—Bulletin No. 250, issued by the Roller-Smith Company, 233 Broadway, New York City, describes and illustrates its types "LGD" and "KGD" portable direct-current galvanometers.

CENTRIFUGAL PUMPS.—The Pennsylvania Pump & Compressor Company, Easton, Pa., has issued bulletin No. 202, covering its line of double-suction, single-stage centrifugal pumps.

STEAM TRAPS.—The Yarnall-Waring Company, Chestnut Hill, Philadelphia, is distributing bulletin T-1701, describing the "Yarway" steam traps.

MINE APPARATUS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued catalog 6-M, entitled "Westinghouse Line Material for Mines." It also contains information regarding mine locomotives, safety switches, etc.

SERIES-MULTIPLE TRANSFORMER. —The Kuhlman Electric Company, Bay City, Mich., is distributing bulletin No. 113 describing the "Kuhlman" disconnecting type series-multiple transformer for street lighting.

CRANKLESS ENGINES.—The Crankless Engines (Aus.) Proprietary, Ltd., 9 Queen Street, Melbourne, Australia, is distributing a booklet entitled "The Handbook of the Crankless Engine," covering its reciprocating engines, pumps, etc.

RADIO APPARATUS. — The Pacent Electric Company, Inc., 150 Nassau Street, New York City, has recently placed on the market a new amplifying transformer ("Audioformer") and a new "Pacent" universal detector stand.

ELECTRIC FURNACES.—The Electric Furnace Company, Salem, Ohio, is distributing two leaflets describing and illustrating various types of the "Bailey" elec-enameling, annealing and heat-treating furnaces.

RADIO HORN. — The American Art Maché Company, 6,311 North Clark Street, Chicago, has recently placed on the market a die-cast wood radio horn, known as the "Madera."

ELECTRIC PERCOLATOR. — A new "Hold-Heet" electric percolator has been placed on the market by the Russell Electric Company, 340 West Huron Street, Chicago.

GATE VALVE.—Bulletin No. 8-G issued by the Schutte & Koerting Company, Philadelphia, covers the "Schutte" regrinding swing gate valve, designed for steam pressures up to 300 lb. per square inch and 750 deg. F.

ELECTRIC HOISTS.—The Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York City, describes the "Sprague" electric type WX hoists.

RADIO RECEIVING SET.—A new rectigon for charging batteries of radio receiving sets, known as "Radio-Type," is manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It is also suitable for charging three-cell filament batteries of three-cell and six-cell automobile starting and lighting batteries.

ELECTRIC BAKE OVEN.—A new automatic sectional-type electric bake oven has recently been perfected by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

New Incorporations

THE NEWBURG (MO.) LIGHT & POWER COMPANY has been incorporated by F. W. Shaw, B. F. Culbertson, E. J. Koch, A. E. Martin and J. H. Smith. The company is capitalized at $25,000 and proposes to supply electricity in Newburgh and adjacent territory.

THE NEW ORLEANS (LA.) PUBLIC SERVICE COMPANY has been incorporated with a capital stock of $5,000 for the purpose of distributing electricity and gas for lighting and power purposes. A. L. Kempster is general manager.

THE IMBODEN (ARK.) HYDRO-ELECTRIC POWER & MANUFACTURING COMPANY has been organized with a capital stock of $100,000. The officers are: W. R. Lane, president; L. F. Wheeless, vice-president; W. L. Bugg, treasurer, and G. G. Dent, secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

NORWAY, ME.—The Maine Power Company will install new equipment at its local hydro-electric power plant, including waterwheel, generator and auxiliary machinery. A portion of the main transmission line in the vicinity of Lewiston will be rebuilt.

WAVERLY, MASS.—A power house, 75 ft. x 78 ft., will be constructed at the local School for Feeble-Minded. C. H. Tenney & Company, Boston, Mass., are architects.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company plans the erection of a fuel-oil tank of 1,540,000 gal. capacity on Tallman Lane, near the Providence River, Providence, in the near future.

STAMFORD, CONN.—The Stamford Hall Company, Willow Street, is remodeling its power plant and installing new boilers at a cost of about $5,000.

Middle Atlantic States

TRENTON, N. J.—The Magnetic Pigment Company, Cass Street, will build a power house addition in connection with its proposed factory extension, estimated to cost $50,000.

RUNNEMEDE, N. J.—The Public Service Electric Company is extending its system to Runnemede.

READING, PA.—The Metropolitan Edison Company has arranged for a preferred stock issue, part of the proceeds to be used in connection with the acquisition of the properties and holdings of the York Haven Power & Water Company and the York Haven Electric Transmission Company, both of York Haven.

PHILADELPHIA, PA.—The Philadelphia Suburban Gas & Electric Company has issued bonds for $400,000, a portion of the proceeds to be used for extensions and improvements.

YORK, PA.—C. R. Gilbert, Superintendent of the Wrightsville Light & Power Company of Wrightsville, Pa., is now making preparation to extend the pole line and light wires to East Prospect Borough, a distance of 4 miles south.

CHESTER, PA.—The installation of a new lighting system on Edgmont Avenue is under consideration. Plans have been submitted by the Delaware County Electric Company.

LANCASTER, PA.—The American Telephone & Telegraph Company has applied to the Public Service Commission for permission to install a local underground conduit system.

MORRISVILLE, PA.—The light committee plans for the installation of a number of 600-cp. arc lamps.

MOUNTAIN TOP, PA. — The Pennsylvania Power & Light Company will extend its transmission lines here, making connection at Ashley, Pa. A local distributing system will be installed.

ROCKWOOD, PA. — The Youghiogheny Power & Electric Company has plans under way for the construction of a hydro-electric power plant on the Youghiogheny River, near Oakland, Md. Other plant units will be installed on the Muddy and Deep Creeks in the same district. Application has been made to the Maryland Public Service Commission.

TOPTON, PA.—The Topton Electric Light & Power Company is extending its transmission lines from the borough limits to Ringtown and Oreville.

BESSEMER, PA.—The Nashville Bridge Company, Nashville, Tenn., contemplates the construction of a power plant in connection with its proposed steel fabricating plant here. A site of 14 acres has been purchased.

BALTIMORE, MD.—The Bethlehem Steel Company, Bethlehem, Pa., will build a 10,000-kw. steam turbo-generator power plant at its local steel mills at Sparrows Point, in connection with plant extensions, to cost in excess of $3,000,000.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company has issued bonds for $5,000,000, a portion of the proceeds to be used for extensions and improvements.

HARRISONBURG, VA. — Contract has been let to Tucker & Laxton, Charlotte, N. C., for the construction of a municipal steam-operated electric power plant for auxiliary service, estimated to cost about $80,000. A list of equipment for installation is being arranged.

RICHMOND, VA.—Bids will be received by the Department of Utilities until Sept. 25 for the construction of a municipal power plant, with capacity of about 1,800 hp.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Oct 10 for 60,000 ft. of incandescent lamp cord and 40,000 ft. of lighting and power wire, for use at the Mare Island Navy Yard, Cal. (Schedule 150).

North Central States

MOUNT CLEMENS, MICH.—The Detroit Edison Company will soon commence the construction of a local substation to cost about $150,000.

ISLAND, KY.—The Douglas Coal Mining Company, 504 Fourth Street and First National Bank Building, Nashville, Tenn., will install motors, controllers and other electrical equipment at its properties here.

HAZARD, KY.—The Kentucky & West Virginia Power Company, a $6,000,000 corporation, has taken over the Daniel Light & Power Company, Whitesburg, Ky., and will install an enlarged new plant connecting directly with its big central plant at Lothair, Ky. The consideration was not made public.

HAZARD, KY.—The Kentucky & West Virginia Power Company will extend its transmission lines to Walkertown and Allais, beginning construction at once.

LOUISVILLE, KY.—The Louisville Gas & Electric Company will commence the immediate construction of a one-story cable house, 100 ft. x 100 ft., with extension, 20 ft. x 300 ft., estimated to cost about $1,000,000, including equipment.

PIKEVILLE, KY. — The Pike Light & Power Company has increased its capital from $50,000 to $200,000 and will make enlargements, it is announced.

MARTINS FERRY, OHIO. — Plans are being prepared for a municipal light and power plant in connection with waterworks improvements, estimated to cost about $450,000. G. L. Grogan is clerk.

BELLEVILLE, ILL. — The Southern Illinois Light & Power Company is securing the right-of-way for a transmission line between Belleville and New Athens. This company now serves 100 cities and towns in southwestern Illinois.

GRAND TOWER, ILL. — The Central Illinois Public Service Company will soon take bids for the construction of its proposed hydro-electric power plant on the Mississippi River here, estimated to cost close to $2,000,000. Sargent & Lundy, 72 West Adams Street, Chicago, are consulting engineers.

NORMAL, ILL.—Bids will be received by C. R. Miller, chairman Public Works and Buildings, Springfield, Ill., until Sept. 26 for the construction of a one-story power house at the State Soldiers and Orphans' Home here, 79 ft. x 90 ft. Edgar A. Martin, 410 South Wabash Avenue, Chicago, is architect.

PETERSBURG, ILL. — The Central Illinois Public Service Company has purchased the Abbott light and power plant at Petersburg for a reported consideration of $250,000. The Abbott plant supplied Petersburg, Ashland, Pleasant Plains, Tallula, Greenview, Athens, Middleton, New Holland, Easton, Mason City and San Jose, all towns in central Illinois. I. R. Abbott, who developed the property, will continue management of the plant. A transmission line will be built from Virginia, Ill., to Ashland, Ill., where it will connect with the transmission line of the Central Illinois Public Service Company from the hydro-electric plant at Keokuk, Iowa.

RUSSELLVILLE, ILL. — The Arkansas Light & Power Company will start work soon on the reconstruction of its power dam on the Illinois River near Russellville, Ill. Modern water turbines and generators for the development of 800 hp. of electricity will be installed.

EMMETT, IDAHO.—Work has started on the government diversion dam and power plant on Black Canyon. To secure electricity to operate the machinery a transmission line will be erected from the Emmett substation to the dam. The cost of the project is estimated at $1,500,000.

SIOUX CITY, IOWA.—A merger of the Sioux City Service Company with the Sioux City Gas & Electric Company has been approved at a special election. Extensions and improvements will be made in the consolidated system.

BRIGHAM CITY, UTAH.—A new electric feeder line is being erected from the new municipal electric plant at the mouth of Box Elder Canyon to Eighth West Street. The distribution system will be reconstructed in some parts of the city in the near future. It is proposed ultimately to rebuild the entire system.

LEVAN, UTAH.—The town of Levan has entered into a contract with the Big Springs Power Company, Fountain Green, for furnishing electricity for lamps and motors in Levan. Bonds to the amount of $16,000 have been voted to establish an electric service here.

ELKHART, IND.—The American Gas & Electric Company, New York, has acquired property of the Indiana & Michigan Electric Company. Extensions and improvements, it is understood, will be made.

EAU CLAIRE, WIS.—Contract has been awarded by the Dells Paper & Pulp Company to the C. R. Myers & Sons Company, Oshkosh, for a 1,000-hp. hydro-electric plant, to cost about $165,000.

MADISON, WIS.—The Wisconsin Light & Power Company has been granted permission by the Railroad Commission to issue $163,700 in bonds, the proceeds to be used for erection of a high-tension line from Fond du Lac, Beaver Dam and Dane.

HARTFORD, WIS.—The Utilities Department will erect a 20-ft. x 25-ft. brick and cement block addition to its present power plant, which when completed will be utilized in housing equipment.

KENOSHA, WIS.—A new lighting system will be installed by the Wisconsin Gas & Electric Company in Library Park, as well as the substitution of high-power lights and ornamental iron poles for the arc lights and wooden poles.

NEW LONDON, WIS. — Among many other improvements this fall will be the installation of an ornamental lighting system throughout the city.

CALEDONIA, MINN.—Contractors have already started on the construction of an auxiliary power plant for the Root River Power Company. The plant is to be erected by a Preston (Minn.) firm and will be a 50-ft. x 30-ft. cement-block structure located on land recently purchased for that purpose.

KANSAS CITY, MO.—The Kansas City Power & Light Company has issued bonds for $21,000,000, a portion of the proceeds to be used for extensions and improvements, including enlargements to the Northeast power plant to increase the capacity from 60,000 kw. to 90,000 kw.

HASTINGS, NEB. — Bids will soon be asked for extensions and improvements in the municipal power plant, estimated to cost about $20,000. The K. H. Gedney Company, Hastings, is architect.

OMAHA, NEB. — The Nebraska Power Company has issued bonds for $3,500,000 a portion of the proceeds to be used for extensions and improvements.

PITTSBURGH, KAN.—The Kansas City Southern Railroad Company, Kansas City, Mo., will build a power plant in connection with its proposed new car and locomotive shops here to cost about $1,500,000.

Southern States

DAVIDSON, N. C.—Bonds for $60,000 are being arranged for extensions and improvements in the electric lighting system and waterworks.

ELIZABETH CITY, N. C.—The Council has tentative plans under consideration for the construction of a new municipal electric plant in connection with proposed waterworks. Bonds for $750,000 will be arranged.

JACKSONVILLE, FLA. — The Kreiss Process Products Company, 205 Graham Building, recently organized, contemplates the installation of a power house in connection with its proposed local fertilizer manufacturing plant. William B. Taber is manager.

KNOXVILLE, TENN. — The Tennessee Power Company has been granted permission to issue bonds for $250,000 to defray in part the purchase of a transmission line to Maryville, about 16 miles.

FAYETTEVILLE, ARK. — The Spees Vinegar Company will build a new power house at its local factory. Headquarters are at Kansas City, Mo.

STEPHENS, ARK. — Preparations are being made by the Stephens Light & Power Company for the installation of a new electric light plant. L. B. Bracken is president

SEARCY, ARK.—The city will install an ornamental lighting system in the business district, totaling about 10 blocks. Service will be furnished by the Searcy Light & Water Company.

STEPHENS, ARK.—The Stephens Light & Power Company will soon take bids for the erection of a one-story power plant on the local site. Archer & Company, Kansas City, Mo., are engineers.

WALNUT RIDGE, ARK.—The Central Power & Light Company will make improvements in its local power plant and install new equipment.

BIRMINGHAM, ALA.—The installation of an ornamental lighting system on Fifth Avenue, to cost about $12,000, is under consideration by the Civitan Club. Y. Whitman is chairman.

MOBILE, ALA.—Bids will be received at the United States Engineer Office until Oct. 10 for a 100-ft. Diesel electric towboat, with equipment to include main engines, generators, exciters, switchboard, main motor, reduction gear, pumps, etc.

COLLINS, MISS.—A bond issue of $30,000, recently voted, has been sold, the proceeds to be used for the installation of a municipal electric system and improvements in the water plant.

NEW ORLEANS, LA. — The Citizens' Light & Power Company has plans in preparation for the erection of a one-story addition to its power plant on Carrollton Avenue, estimated to cost about $200,000, including machinery.

BLISS, OKLA. — Bonds have been approved for the installation of a municipal electric lighting system. Plans will be prepared at once.

MORRISON, OKLA. — A bond issue is being arranged for the installation of a municipal distributing system.

VINITA, OKLA.—Plans are being completed for the construction of a municipal hydro-electric plant on the Grand River, near Ketchum.

ABILENE, TEX.—The West Texas Utility Company, operated by the American Public Service Company, will make a number of extensions in its transmission system and will install distributing lines in towns throughout this district.

AMARILLO, TEX.—The Board of City Development has awarded a contract for installation of ornamental light standards and electric lights along two more blocks of the downtown streets.

CHILDRESS, TEX.—The Childress Electric Light & Ice Company, owned by the Central Texas Power Company, will be enlarged and made into a district generating plant, according to Frank Houston, district manager. It is planned to enlarge the Childress plant to supply energy for a number of the nearby towns, building high lines to the towns to be supplied. Improvements contemplated at Childress include a new building to take the place of the present wooden and sheet iron structure, the installation of new 75-hp. oil-burning boilers and direct-driven turbine generators. The improvements will cost in excess of $100,000. Work was started last week on the concrete foundation for the engine and generators.

DALLAS, TEX.—The Missouri, Kansas & Texas Railroad has preliminary plans in progress for the electrification of its lines between Dallas and Denton, Tex. Application has been made by John W. Everman, supervisor of public utilities, for approval.

DALLAS, TEX. — The Texas Power & Light Company is arranging a fund of $500,000, the proceeds to be used for extensions and improvements in different parts of the state.

MERCEDES, TEX.—Arrangements have been made by the Mercedes Light, Water & Power Company for extensive improvements, including a new power house, additional machinery and filtration plant.

HASKELL, TEX.—The West Texas Utilities Company, Abilene, contemplates extending its transmission lines to Haskell, Tuscola, Albany and vicinity.

KOSSE, TEX.—The Kosse Light & Power Company contemplates installing additional equipment in its plant.

CORSICANA, TEX.—The Corsicana Electric Light Company is making estimates of cost for an underground conduit system in the business district.

DALLAS, TEX. — The Dallas Power & Light Company has plans nearing completion for the installation of an ornamental lighting system on Pacific Avenue, including the installation of an underground conduit system for all overhead lines, estimated to cost $110,000.

KOSSE, TEX.—The Humphreys-Pure Oil Company will build a large electrically operated pumping plant at its new properties in this section. Headquarters are at Mexia, Tex.

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Pacific and Mountain States

ABERDEEN, WASH.—The Council plans for the installation of an ornamental lighting system on the principal streets.

PATEROS, WASH.—The Okanogan Valley Power Company plans for the immediate rebuilding of its local power plant, recently destroyed by fire.

OAKLAND, CAL. — Surveys are being made for the proposed ornamental lighting system on the shores of Lake Merrit. It is estimated that 325 lamp poles will be required.

PACIFIC GROVE, CAL.—The city trustees have approved plans for the installation of an ornamental lighting system on Lighthouse and Forest Avenues. H. D. Severance, city engineer, in charge.

LOS ANGELES, CAL.—Bids will be received by the Public Service Commission until Sept. 29 for a quantity of 35,000-volt cable. James P. Vroman is secretary. (Specification P-276).

SAN PEDRO, CAL.—Work has begun on the foundation on the new substation to be erected at Harbor Boulevard and Regan Street. Electricity will be supplied from Los Angeles at 33,000 volts. The cost is estimated at about $300,000.

DILLON, MONT.—The Montana Power Company has completed surveys for its proposed power line here. Equipment and cost are being estimated.

DENVER, COL.—Motor-driven machinery will play a large part in the $500,000 plant of the Myers Pulp & Paper Company now being constructed. The mill will produce board and container stock, wallboard and sheeting paper, and it will be a reclamation market for cast-off paper.

DENVER, COL.—Announcement has been made of the early construction of a ten-story office building as a memorial to the late Thomas M. Patterson, at a cost of $500,000, by Lovejoy & Erewen, local architects.

DENVER, COL.—Extensive additions to the ornamental street lighting of the city will be made in the letting of contracts for new units to be used on the Broadway extension and several of the streets in the lower part of the city, at a cost of about $100,000. The city engineer's office is working out the details.

ENGLEWOOD, COL.—The General Iron Works Company, representing the Consolidated Foundry & Iron Works interests of Colorado, has purchased 18 acres adjoining the Denver County line on which a plant costing $750,000 will be constructed early in the summer. T. B. Stearns of the Stearns-Rogers Manufacturing Company is directing the developments in the organization.

ARTESIA, N. M.—The Council has perfected plans for a municipal electric light and power plant.

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Canada

. ELKO, B. C.—The Wigwam Pulp & Paper Company will build a power plant in connection with its new local paper and pulp mill, estimated to cost in excess of $5,000,000.

VANCOUVER, B. C. — Bids have been called for by the Harbor Board for the supply and installation of a complete electrical equipment and cargo-lifting plant for the new $2,000,000 Ballantyne Pier. The equipment includes semi-portable electric cranes, electric freight elevators, electric escalators, electric capstans, tractors and trailers. A. D. Swan, harbor engineer of Montreal, is consulting engineer for the Harbor Board. It is roughtly estimated that the equipment will total in the neighborhood of $250,000. Bids will be received up to noon of Oct. 2.

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Mexico

PUEBLO, MEXICO—Surveys have been made for a large hydro-electric plant which is to be built on the Sequixquine River, State of Teaxcala, by William O. Jenkins, United States Consular Agent at Puebla. Mr. Jenkins has obtained a concession from the Mexican government for the proposed plant. It is stated that power transmission lines will be built to towns and industries in a wide scope of territory surrounding the new plant.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 29, 1922)

1,427,695. Switchboard Call-Signal Apparatus and Circuits; R. W. Morris, Roslyn, N. Y. App. filed March 15, 1919. Arranged to prevent several operators from answering same call.

1,427,718. Actuating Mechanism for Magnetos; P. Brown, Springfield, Mass. App. filed June 25, 1920. Reciprocatory make-and-break type for gas engines.

1,427,725. Switchboard Call Signal Apparatus and Circuits; L. W. Cooper, Brooklyn, N. Y. App. filed March 15, 1919. Facilitates answering of incoming calls.

(Issued Sept. 5, 1922)

15,444 (reissue). Engine Starter; F. E. Fisher, Detroit, Mich. App. filed April 2, 1917. Combined starting and lighting apparatus for automobiles.

1,427,779. Distributing Board for Electric House Installations; M. Breitner, Halle-on-the-Saale, Germany. App. filed Sept. 16, 1920. Meter and safety fuse board.

1,427,783. Air-Cooled Transformer; J. Burke, Erie, Pa. App. filed Nov. 6, 1919. Electric fan at top draws air through coils.

1,427,814. Electric Furnace; E. H. Horstkotte, Schenectady, N. Y. App. filed May 3, 1920. Resistance furnace with electrodes of cupped carbon disks.

1,427,816. Treatment of Zirconium Ores; Otis Hutchins, Niagara Falls, N. Y. App. filed Sept. 22, 1920. Producing pure zirconium by reducing ore in electric furnace.

1,427,832. Radio Telephony; F. S. McCullough, Cleveland, Ohio. App. filed July 7, 1919. Transmission system consisting of spark gap, electric arc and modulating circuit.

1,427,833. Radio Telegraphy; F. S. McCullough, Cleveland, Ohio. App. filed Aug. 2, 1919. System for determining direction of distant transmitting stations.

1,427,870. Hermetical Seal; W. L. Van Keuren, North Bergen, N. J. App. filed June 15, 1918. For miniature-lamp leading wires.

1,427,875. Means for Suspending Plates During Treatment by Electrolysis; R. M. Weeks, Narberth, Pa. App. filed Feb. 5, 1921. Process of electrical etching.

1,427,876. Apparatus for Electrical Etching; R. M. Weeks, Narberth, Pa. App. filed April 2, 1921.

1,427,877. Process and Apparatus for Electrical Etching; R. M. Weeks, Narberth, Pa. App. filed April 25, 1921.

1,427,883. Electric Lamp Lock; H. E. Williams, Washington, D. C. App. filed Oct. 17, 1918. To prevent the unwarranted removal of lamp.

1,427,908. Surgical Baker; L. Perlman, Philadelphia, Pa. App. filed Aug. 28, 1920. Heating device for treating the body.

1,427,911. Plastic Composition; L. T. Richardson, Milwaukee, Wis. App. filed Dec. 24, 1917. Insulating material composed of heat-treated pitch and asbestos.

1,427,919. Process for Electrically Manufacturing Compact Metallic Beryllium; A. Stock, Berlin-Dahlem, and H. Goldschmidt, Berlin, Germany. App. filed May 12, 1922. Beryllium produced by electrolyzing alkaline earth fluoride and beryllium compound.

1,427,923. Telephone-Call Circuits; J. G. Toomey, New York, N. Y. App. filed April 21, 1920. Pertains to call circuits between two exchanges.

1,427,953. Attaching Device; A. W. Harrison, Winthrop, Mass. App. filed June 6, 1918. Nail through knob for electrical work split to hold pieces together.

1,427,970. Secondary Battery; G. W. Pleis, Sr., and G. W. Pleis, Jr., Philadelphia, Pa. App. filed June 8, 1921. Formation of electrodes.

1,428,022. Advertising Device; C. Fleck, Cleveland, Ohio. App. filed Jan. 7, 1921. Motor intermittently drives apron to predetermined positions for display.

1,428,033. Recording Telegraph Machines; J. A. Hulit, Chicago, Ill. App. filed May 22, 1919. Means for connecting pen in recording telegraph machine.

1,428,049. Electrolytic Apparatus and Method of Depolarizing the Same; W. D. Nickum, Glendale, Cal. App. filed Feb. 8, 1919. Dissipates deterrent gas film formed by electrolysis of water.

1,428,050. Electrolytic Apparatus and Method of Depolarizing the Same; W. D. Nickum, Glendale, Cal. App. filed April 21, 1920. Maintains current of substantially uniform strength.

1,428,057. Production of Low-Carbon Ferroalloys; N. Petinot, New York, N.Y. App. filed Sept. 26, 1919. High carbon ferroalloys melted in acid-lined electric furnace.

1,428,061. Manufacture of Iron and Steel; T. Rouse, Stamford Hill, England. App. filed Nov. 23, 1920. Smelted in electric furnace.

1,428,062. Electric Distributor for Sealing Wax; H. Sanglier, Paris, France. App. filed Dec. 23, 1920. Electricaly heated pot with plunger to operate outlet.

1,428,071. Electric Heater; P. J. H. Bernard, Montreal, Quebec, Can. App. filed Dec. 9, 1920. Electric radiators for supplanting steam, water or hot-air heating systems.

1,428,083. Magneto; H. F. Geist, Hartsville, S. C. App. filed Oct. 30, 1920. Armature-wound type.

1,428,133. Current Collector for Railway Vehicles; R. Bienvenoe and J. Bienvenoe, Paris, France. App. filed April 15, 1920. Metal ring fastened to but insulated from car wheel collects current from flexible contact rail.

1,428,155. Means for Signaling Over Multiplex Transmission Channels; L. Espenschied, Hollis, and H. A. Affel, Brooklyn, N. Y. App. filed July 29, 1919. Provides means whereby ringing and other signals may be transmitted for each carrier channel.

1,428,156. Low-Frequency Amplifier; L. Espenschied, Hollis, N. Y. App. filed Sept. 26, 1919. Amplifies ocean-cable telegraph signals or vibrations emanating from propeller in submarine detection.

1,428,157. Electric Water Heater; A. Fisher, New York, N. Y. App. filed March 22, 1922. Instantaneous heater in which water is heated when faucet is opened.

1,428,178. Dehydrator; W. Meredith, Alameda, Cal. App. filed Oct. 28, 1920. Motor-operated electrode.

1,428,227. Electric Soldering Iron; J. T. Griffin, Oak Park; W. A. Timm, Berwyn, and A. E. Santschi, Cicero, Ill. App. filed Oct. 16, 1920. Self-supporting heating element within soldering head.

1,428,233. Electric Sadiron; J. A. Howard, Sr., West New Brighton, N. Y. App. filed June 4, 1920. Electrically heated rollers form bearing surface.

1,428,237. Call Bell on Signaling Device; S. Katz, Chicago, Ill. App. filed May 24, 1919. Bell hammer and buzzer may be actuated to give three different signals controlled from three circuits.

1,428,262. Method of Working Electric Resistance Welding Machines Operating with Continuous Current; E. Schroder, Berlin, Germany. App. filed Jan. 13, 1917. Gas-filled interrupters of turbine type interrupt currents without sparks.

1,428,277. Music-Roll Perforator and Printer; J. J. Davilla, New Orleans, La. App. filed June 13, 1921. Punching device electromagnetically actuated from keyboard of instrument.

1,428,305. Attachment for Telephone Transmitter; F. Sutherland, Chicago, Ill. App. filed Aug. 3, 1921. Device closes transmitter while receiving communications.

1,428,323. Compensating Device for Reaction Tubes; C. M. Colvin, Kansas City, Mo. App. filed June 6, 1921. For electrochemical apparatus manufacturing hydrocarbons.

1,428,342. Brush Mounting; J. D. Nies, St. Charles, Ill. App. filed April 27, 1921. Brush in insulated holder to prevent leakage of current.

1,428,349. Heating Device; M. J. Whelan, Clifton Heights, Pa. App. filed Feb. 17, 1922. Heating device for submersion in liquid to be heated.

1,428,374. Corrosion-Resistant Conduit Fitting; E. L. Huff, Natrona, Pa. App. filed Feb. 25, 1919. Consists of 90 per cent lead and 10 per cent antimony.

1,428,379. Pasteurizer; Y. Kokusho, Philadelphia, Pa. App. filed Oct. 14, 1920. Milk heated by current passing directly through it.

1,428,424. Electric Advertising Sign; O. Fehler, Berlin-Steglitz, Germany. App. filed Oct. 12, 1920. Lamp filament wound to form legend of sign.

1,428,489. Electric Engine; H. Mace, Sidewood, Saskatchewan, Can. App. filed Feb. 6, 1920. Reciprocating engine with armature placed in two electromagnets.

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The Fascination of the Unknown

AT THE bottom of every man's heart lies the desire to discover or explore. As long as humanity endures it will thrill to the tales of adventure and hardship in unknown regions. Columbus sighting land, Balboa staring at the Pacific from his Darien peak, Stanley threading the African jungle, Peary at the North Pole, are universal heroes. To such men themselves must come a sense of victory pure and unalloyed which no successful warrior or statesman ever felt. What the warrior or the statesman achieves today tomorrow may destroy, but the discoverer's triumphs are concrete and immutable.

The thing is as true of scientific as of geographical exploration. The poet has linked with the ecstasies of the discoverer of the Pacific those of the astronomer at the moment "when a new planet swims into his ken." The same recompense has come to the successful experimenters in every branch of knowledge—the men who have left others to pursue the obvious while they with inexhaustible patience and courage follow the lure of the unknown. Surely only the fascination associated with the work of research holds such men to their tasks, for their material recompense is out of all relation to their educational training and their mental ability.

TO MEN engaged in materialistic occupations is sometimes permitted a fugitive glimpse of these hidden mysteries of science—a glimpse usually made possible by the work of a research engineer who has replaced speculative philosophy by experimental delving. To each of us, indeed, in some degree there comes at times the overwhelming satisfaction that is associated with a creation or a discovery; thus we comprehend why some men devote their lives to research without thought of material gain.

In no branch of science has research established a greater monument than in electricity. That mysterious force possesses inherent elements of interest to those with the capacity for analysis or vision because it is so all-pervading yet physically so intangible. Few are capable of grasping the work of Faraday, Maxwell or Kelvin except through its adaptation to engineering mechanisms, yet all render these men unstinted honor.

HAD we the proper perspective to recognize them, there are equally worthy living investigators who are seeking the unknown, and often finding it, in the secluded research laboratories of great manufacturing establishments and in the quiet halls of our institutions of learning. To these men too frequently we render no homage, but rather dismiss them and their work as theoretical or impracticable and even scoff at their results because they have no apparent application to utilitarian purposes. It would be much more fitting to concede to these explorers of the unknown their place as leaders in the profession who are doing the work that really makes for an advance in our art. Let us encourage and honor those who build for future generations.

Frank D. Newbury

Designer of alternating-current machinery and an authority on machine temperature limits.

THOUGH practically all electric machinery in general use today is the result of the work of many minds and represents in a very true sense the best thought of the entire industry, there is a group of men who are the acknowledged leaders in electrical machine design and who are chiefly responsible for the rapid progress that is characteristic of American electrical manufacturing. Among these is Frank D. Newbury, manager of the power engineering department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. Mr. Newbury has devoted his entire professional life to the design and construction of alternating-current machinery. He took the apprenticeship course of the Westinghouse Electric & Manufacturing Company in 1901, immediately after his graduation from Cornell University, and when he had completed this training he entered the alternating-current generator section of the Westinghouse company's engineering department. Here he steadily advanced until finally he was placed in charge of the power engineering department.

Among the important developments that have been carried out under Mr. Newbury's supervision are the development of the present Westinghouse standard lines of belted and engine-type generators, the designing of self-starting synchronous motors, self-starting synchronous converters and high-speed 60-cycle synchronous converters, and the construction of single units of great capacity.

He has carried out a number of careful researches with the object of improving the performance of alternating-current rotating machinery. The increase in the efficiency of large machines to the almost theoretical limits of 97 per cent for turbine-driven generators and more than 98 per cent for waterwheel generators is to a great extent due to Mr. Newbury's investigations. He has also paid special attention to the subject of the internal heating of these machines and has decreased to a marked extent the possibility of damage due to hot spots. His papers on temperature distribution within generators form a valuable addition to engineering literature and his researches along these lines have led to important discoveries.

Mr. Newbury has been a manager of the American Institute of Electrical Engineers since 1918 and has been active in the committee work of the Institute. He is a member of the standards committee and chairman of the rotating machinery sub-committee of the standards committee. He is also a member of the power station and electric machinery committees of the Institute.

The accurate, analytical mind of Mr. Newbury has always been at the service of the electrical industry, and a host of friends evidence the respect and affection with which he is regarded. He has always been interested in the education of engineers and is well known as a lecturer in several engineering schools. His services as a lecturer are also in demand by sections of the American Institute of Electrical Engineers. The influence of Mr. Newbury in shaping the developments in electrical machinery has been directed toward obtaining improved performance and has been based on scientific knowledge and investigation.

Editorial Comment

Electrical World, September 30, 1922

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Number 14

The Congressional Session Just Ended

THE present session of Congress having ended, it is well to recall what has been accomplished. So far as the electrical industry is concerned, definite legislation has been for the most part lacking, and when one contemplates the laws that were piled one on the other, this is not a subject of lament; rather, we should be thankful. The less we have of laws the better off we shall be. The noxious Bacharach bill, opposed by commissions, and damned by the legal profession, never got beyond the judiciary committee. For this relief electric light and power companies and all public utilities should return thanks. Manufacturing interests center chiefly in the new tariff, and manufacturers are welcome to whatever comfort they can derive from it.

Muscle Shoals as an issue has been clarified, thanks to the initiative, sanity and courage of Representative Charles C. Kearns of the Sixth Ohio District and Senator Norris of Nebraska. Without discourtesy or ungraciousness to the members of the Senate committee on agriculture who followed Representative Kearns with much more bitter denunciation of the attempt to grab Muscle Shoals, it is only fair to record the fact that it was he who first told the country in a big public manner the real truth about Muscle Shoals and the offer of Henry Ford. A lot of water has gone over a great many dams since the false cry "Cut the farmer's fertilizer bill in half" was coined by certain organizations and put in circulation among women's clubs, boy scouts, posts of the American Legion, organizations of ministers of colored churches in the South, real-estate speculators and just plain politicians seeking the farmer vote. For some time now the tumult and the shouting of the misinformed have died away, and the captains and the kings of propaganda seem to have departed from Washington, apparently unable to endure the blinding glare of the truth.

Aside from the recent legislation affecting the coal industry, no other outstanding measures of particular concern to public utilities were considered by Congress during the last session. This is a matter for congratulation all around.

The Value that Springs from Words of Appreciation

"YOU have a loyal organization and one that is efficient, but it is starving for a word of appreciation," was the report that a delegate to the Detroit meeting of the National Safety Council told of giving to an executive whose organization he had been called upon to examine. As in many another case of the same kind, the assertion was a real shock to the executive, who had prided himself on his organization and behind the mask of indifference had hidden a real appreciation of his men. With all the talk of right public relations, there is yet a large body of men in official position who fail to realize that the biggest single asset they have is the group of employees under their direction. All the justice and squareness that an executive can exercise in dealing with these employees is likely to be unseen unless sympathy and a ready word of appreciation go with the day's work.

In this must be included courtesy in contact with the employees in the every-day routine and an attitude that will encourage men to come with their difficulties to the "boss" for a free discussion and will lead them to take an interest in the business itself because they know that their interest is keenly appreciated. Courtesy and appreciation on the part of the executive will be reflected in the dealings the organization has with the public, because these two factors are the ones that take the rough edge off unpleasant experiences in the day's work and create contented and happy men who are proud of their work. Only such men can meet and deal properly with the public.

The Larger Problems of Electric Power Supply

ONE of the very noteworthy papers before the Association of Iron and Steel Electrical Engineers was that by Dr. Steinmetz on industrial power supply and its relation to public power supply. The subject is a big one, and Dr. Steinmetz handled it in a large and stimulating way. His fundamental conception of the situation is that power production has become a separate industry and that it is more economical, speaking broadly, to obtain power from this specialized source than to produce it for the individual use of an industrial plant. Few engineers will be disposed to differ from these conclusions, since unquestionably the supply of electric power is a highly specialized industry capable of being conducted on so vast a scale as to permit extraordinary economies in operation. Granted this condition in electrical power supply, the inference is strongly against substantial competition from any individual source. As Dr. Steinmetz very plainly points out, one of the fundamentals of the situation is that the power-producing industry can benefit from diversity factor to an extent that is rarely possible in any single branch of industry.

Electrical power is one of the very few important commodities that cannot be stored under any conditions practicable on a large scale. It has to be made as used, and therefore the load factor of the system, which is determined very largely by the diversity factor, is all-important to economy; yet conditions may arise in which the balance quivers or turns in the opposite direction, and the analysis of these is an important economic matter. In exceptional industries a very high load factor is possible—higher perhaps than can be attained by a specialized power-producing plant even with the help of its diversity factor—for as a rule diversity factor is attained only at the expense of a far-flung distribution and consequently at a relatively high cost. The diversity which could conceivably be obtained within a single city block reacts much more favorably on the cost of generation than if it had to be obtained over a twenty-mile radius. It may happen then that an independent plant operating as part of some specific industry will win out in the matter of load factor, including diversity. If such should be the case, then the relative cost of operating locally and obtaining energy from a public supply becomes somewhat dubious. If the individual industrial plant be a large one, the cost of generating power may drop below the cost of buying it at the end of a transmission line.

No one can say exactly what is the variation of cost with size of plant. The facts differ in different localities and under different circumstances, but the curve expressing the variation of cost with size does grow asymptotic, and when a value is reached which is close enough to that asymptotic value to leave insufficient room for transmission cost, then the scale turns to the favor of the smaller plant on the spot. Similarly, where there is by-product power unusable for commercial purposes it may be turned to power production at very great advantage. Such cases are the exception rather than the rule, however, and Dr. Steinmetz examines with keen analysis the mutual relations which may exist between a power system and an industry with available by-product energy. In such cases co-operation may be established to great advantage, power being supplied to the industry when its by-product power is small and in part turned back to the power supply when the by-product is plentiful.

The case closely resembles one which is not infrequent in hydro-electric practice where a transmission system takes on an industrial steam plant not as customer but as ally, turning over to it power when available at high water and receiving from it in return needed aid when the water runs low. It often requires very fine figuring to see exactly what the equities in the matter of price are in these intricate cases. It has usually proved possible, however, to strike a balance which seems to be and is advantageous to both parties as against treading their separate paths. Such may undoubtedly be the case in dealing with by-product power. The principles, indeed, are quite the same as in case of a network served both by steam and by electric plants of various sizes operating under diverse conditions. It requires the wisdom of the serpent to plan the systematic operation of the several units in such a way as to secure maximum economy. In actual fact the schedule of operation with respect to load and water conditions may vary greatly from one system to another. In fact, we have published recently examples showing utterly diverse general schemes of operation, each, however, meeting its own economic requirements. In the long run the relations between the big industrial power consumer and the public system which serves him has to be based, as Dr. Steinmetz intimates, on man-to-man equity. It is not in the long run a safe expedient to charge what the traffic will bear, even when camouflaged, as Dr. Steinmetz hints, into "based on the value of the service to the user." The "square deal" has been the foundation of success in the production and distribution of electric power, and the greater the structure of interlocked industries and super-power systems the more necessary will be this foundation stone.

Why Not Eliminate Unnecessary Equipment?

THE means provided to facilitate maintenance are often viewed in too exact a light by both the designer and the operator. The article in this issue describing a substation of the Richland Public Service company of Mansfield, Ohio, is an illustration of what can be done if preconceived ideas are not too tenaciously held. It is probable that the tendency of nearly every designer in the case of a substation as important as this one would be toward the installation of duplicate oil switches. As a matter of fact, the cost of the duplicate equipment under the operating conditions that prevail is not justified, and air-break switches installed as transfer and by-pass switches do the trick just as well and with less investment cost.

The installation is an excellent illustration of the way in which design should be carried out. The first and fundamental question in the installation of any equipment is its worth from the viewpoint of the service to be given. This cannot always be valued in terms of dollars, but it can be valued in terms of the danger of interruptions to service and the probability of their occurrence with resulting damage. In the particular design described the cost of the duplicate oil-switch equipment that might be theoretically desirable was too high for any benefit that could be derived. None the less it was seen that future conditions might force its use, and therefore a place for its installation was provided at virtually no increased expense. The equipment throughout shows the same careful estimate of present and future needs. This is the sort of consideration that every plant unit should have.

Salesmanship and Engineering

A GOOD many recent discussions on the merchandising of almost everything from spark plugs to illumination bring out in bold relief the relations of salesman to engineer. Every branch of the electrical art has gone through a succession of curiously interrelated phases—the invention of a new device; its development, usually at the skilled hands of engineers associated with manufacturers; its standardization, when these engineers are told to keep hands off and let well enough alone; its exploitation; the call for improvements, which rings louder and louder from customer and independent engineer until something has to be done—and then the same cycle over again. Some of the most accomplished engineers have also the instincts of the skillful salesman, but the combination is a scarce one. The engineer certainly gets in the salesman's way a great many times and is hence unpopular. Yet even in these days the consumer has some rights which must be seriously considered, and the engineer is about the only person who is disposed to enforce these against all comers.

In fact, however, the salesman and the engineer ought to be much better friends than they are, and in branches of the business where the engineering skill back of the salesman is high there is relatively little collision and often fairly efficient co-operation. One of the most striking of recent tendencies is toward the provision of engineering facilities without ostensible charge by manufacturers. Sometimes these facilities are uncommonly good, at times even better than could be obtained elsewhere, but as the turn of the wheel goes on toward standardization and pure salesmanship the manufacturer's engineer often finds himself cornered, and even morally incarcerated, lest he interfere with the beautiful symmetry of the sales department.

The relation of the consumer to those who make, design, sell and advise may perhaps be best expressed as follows: If you were going to buy an expensive used motor car, would you take the word of the garage man as to its actual condition or, with some thousands of dollars at stake, would you take along an expert mechanic having no association with this particular branch of the motor-car business and get his judgment as to whether the machine was in thoroughly good condition or not?

Right here is the function of the engineer. He may not know the chassis as well as the man who built it, or the virtues of the car in general as well as a man who is trying to sell it, but he can tell the customer whether, mechanically speaking, he is getting his money's worth.

More Knowledge Needed of Security Selling

EVERY thinking central-station man today realizes that the selling of junior securities to customers is more than a method of raising money, important as that is. It is the key to a door that opens wide the way to greater popularity and prosperity. It is a new source of capital, a new defense against the politician who attacks the corporation that appears to have few friends. But with all this accepted in principle, the question comes: How can the stock be sold year after year to help provide five dollars to finance each additional dollar of new business taken on?

The idea of selling stock to customers of the company through the co-operative work of employees is naturally appealing. Each organization to which it is properly presented responds enthusiastically, and the campaigns which they make are almost universally successful when the methods employed are in any way well organized. There have been some failures, but that is understandable, inevitable.

But the industry needs to know—what *are* the right methods under varying conditions? Why have the profitable and creditable campaigns worked out so well? And what are the definite mistakes that have brought disappointment to other companies? There is too meager a recorded knowledge of both the things to do and the things not to do in selling utility stock to the community served. Too little is really certain about this new and complex problem, but it should be possible to develop much information in useful form.

This is an appeal to central-station companies that have sold stock to their customers and those that are engaged in such campaigns at the present time to give more thought to the careful recording and reporting of their experience. For instance, what is best—if there is any best and if not what is good — in sales plans and campaign methods?—in methods and results of publicity?—in hiring, schooling, compensating and handling salesmen?—in methods of dealing with banks? —in maintenance of market and resale?—in methods of accounting and collecting? What should be the cost of selling securities under varying conditions? What are the possibilities for saturation in selling to customers?

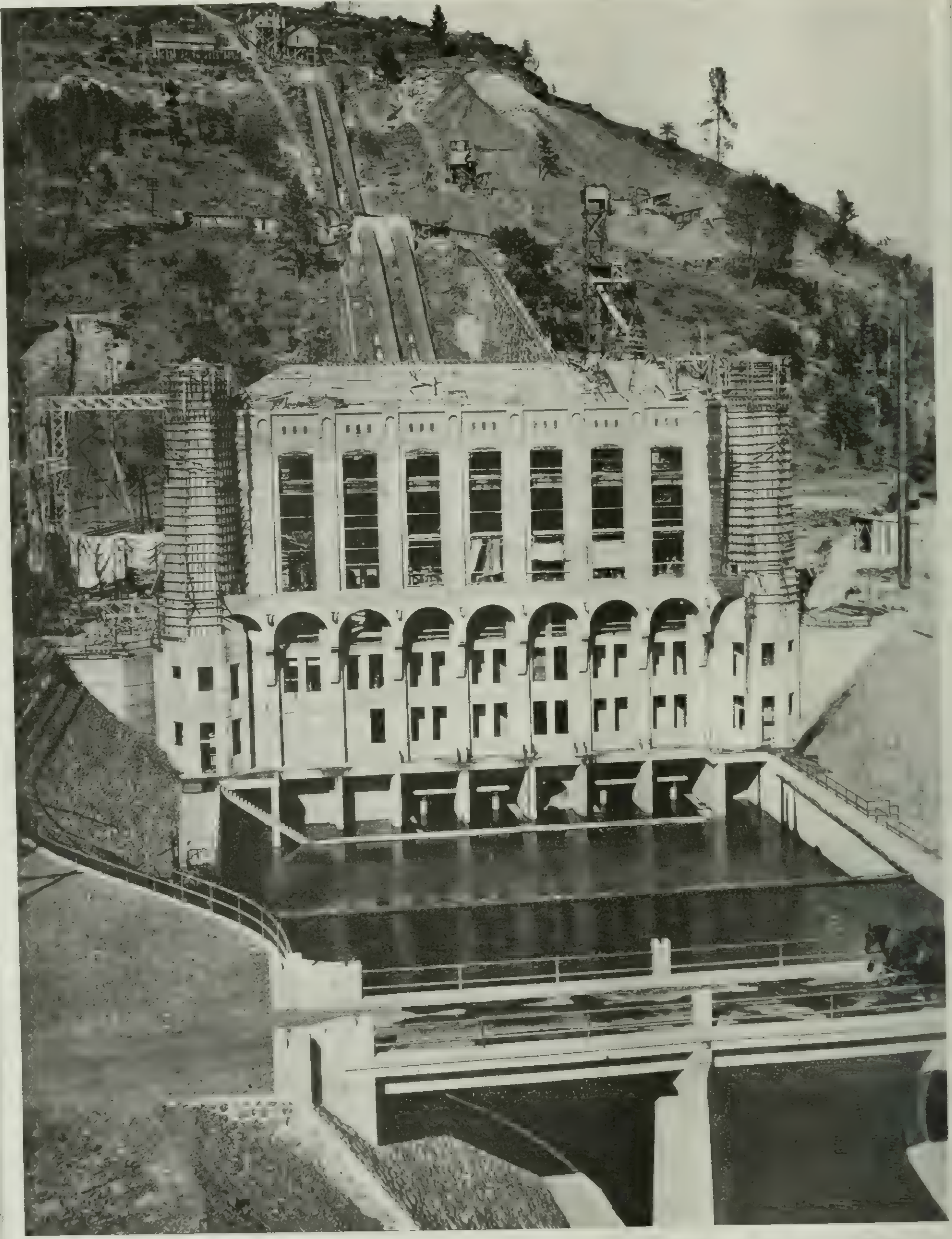
Comprehensive Electrical Projects in Russia

A DISCUSSION by Dr. Steinmetz of the official propositions for extensive electrical development in Russia is naturally a matter of interest. That Russia, in addition to other huge sources of potential wealth, has great stores of fuel and immense hydro-electric resources may be taken for granted. The summation of these which Dr. Steinmetz considers in some detail was made at the instance of the putative Russian government within the last two years, a fact which detracts from its weight as a technical document. Yet it doubtless correctly describes much that exists in the way of resources and possible projects for present or future execution. The most interesting feature to the world's engineers will be the stress which is laid on the great resources in coal and iron of southern Russia, resources so great as to permit, when suitably developed, even of the exportation of anthracite to add to the world's supply. Virtually all the useful varieties of coal are represented in this region, and the facilities for steel making from the adjacent iron mines are exceptionally good. There are of record in southern Russia a very considerable group of steel mills, demanding altogether about 30,000 kw., and perhaps double this capacity is required for coal mines. What the actual output of these mines and mills is at the present time is an entirely different question, as is the prospect of stable and efficient operation under the existing Russian organization.

In the Caucasian district there seems to be a better chance for the resumption of normal industrial activities than in most other Russian territory. Here water-power plants can be made available, and in the oil fields there are good possibilities for the exploitation of surplus fuel oil in certain regions. At Baku it may be long before the production reaches the point where oil can be spared for fuel. All up and down the Volga district, where there is great lumber supply, both timber scrap and hydraulic resources can be to a certain extent utilized. Even the somewhat rosy report of the commission leaves considerable doubt, however, concerning the likelihood of rapid rehabilitation. There are stated to be very great resources of peat in Russia, particularly in the delta of the Volga. The project of a regional power plant with peat fuel is an interesting one. Attempts to utilize peat for fuel have usually led to economic disaster, but what might be possible under the labor conditions in Russia, at least temporarily, remains to be seen. Finally in north Russia and the Urals there is ample opportunity for hydro-electric plants adequate for power supply.

The total cost of the improvements sketched out runs to nearly $600,000,000, and the statement that the possibility of carrying out this program within the next decade will depend on the assistance which can be enlisted from America is probably strictly true. We have grave doubts, however, whether this or any other material amount of American capital can be coaxed into Russia until both its ideals and its practice of government are radically changed. That there is a vast country of unexploited resources goes without saying. What its population now numbers heaven only knows—doubtless many millions less than a few years ago. All of this has a direct bearing on the possibilities of such rehabilitation as would justify American capital in taking a chance. At present the situation looks to us more like poker than investment.

Third Step in Development of Pit River Reaches Completion



ON SEPTEMBER 30 the 70,000-kw. Pit River No. 1 power house of the Pacific Gas & Electric Company was formally placed upon the power lines of California. This is the third unit of seven in a development on the Pit River which will eventually bring in 600,000 hp. It is unique among hydro-electric power developments of the West in that the source of water supply is so constant month in and month out that no water storage is necessary. Power is generated at 11,000 volts and is stepped up to 110,000 volts temporarily. Later it is proposed to raise this voltage to 175,000 volts and by the first of the year to 220,000 volts. Interesting among the features of this installation are the vertical turbine units (the second largest of their kind in the world), the long stretch of transmission line which extends almost due north and south for a distance of 250 miles, the world's record voltage of 220 kv., and the size of the great substation at Vaca, which ranks as the largest terminal substation yet constructed.

Great as is this triumph of engineering, its economic value to the section of the nation it serves is of far more value.

Air-Break Switches Reduce Maintenance

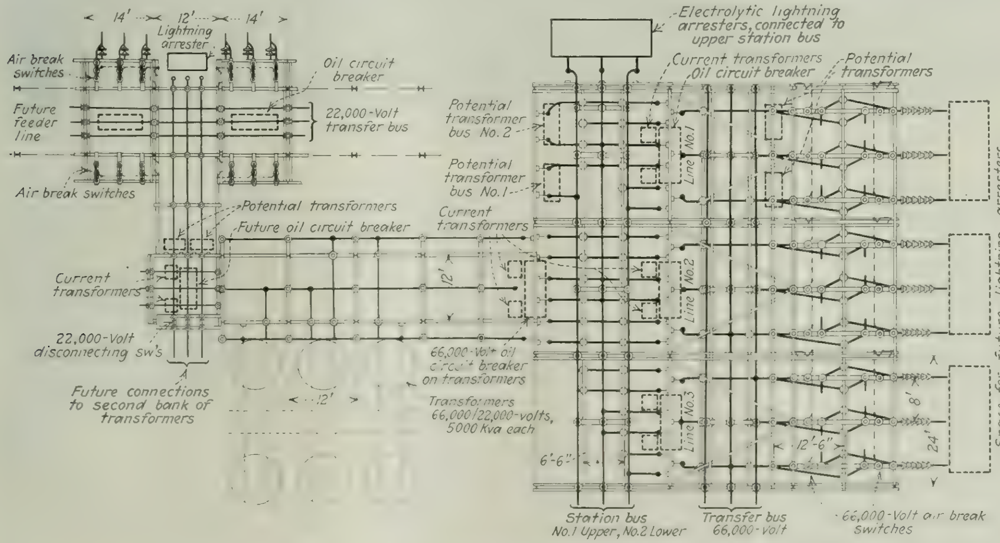
Richland Public Service Company Avoids Duplicate Oil Switches and Uses the Air-Break Type—Provisions in Outdoor Substation for Future Additions at No Present Investment Cost

By **H. E. HOADLEY**
Chief Engineer Richland Public Service Company

TO DETERMINE how far the designer can go in laying out a large substation for an important interconnection point in providing facilities for switching and protection of apparatus without running into an unnecessary expense has always proved a puzzling question. The Richland Public Service Company, in facing the problem of how a substation at Mansfield, Ohio, was to take care of the transformation of energy from the transmission voltage of 60 kv. to the prevailing distribution voltage of 22 kv. that prevails in the greater part of the Mansfield district, selected the outdoor type. Although most of the 60-kv. transmission lines come from the plants of the company, one line now represents an interconnection with a foreign company, and it is expected that future developments will call for more foreign lines, representing other interconnections.

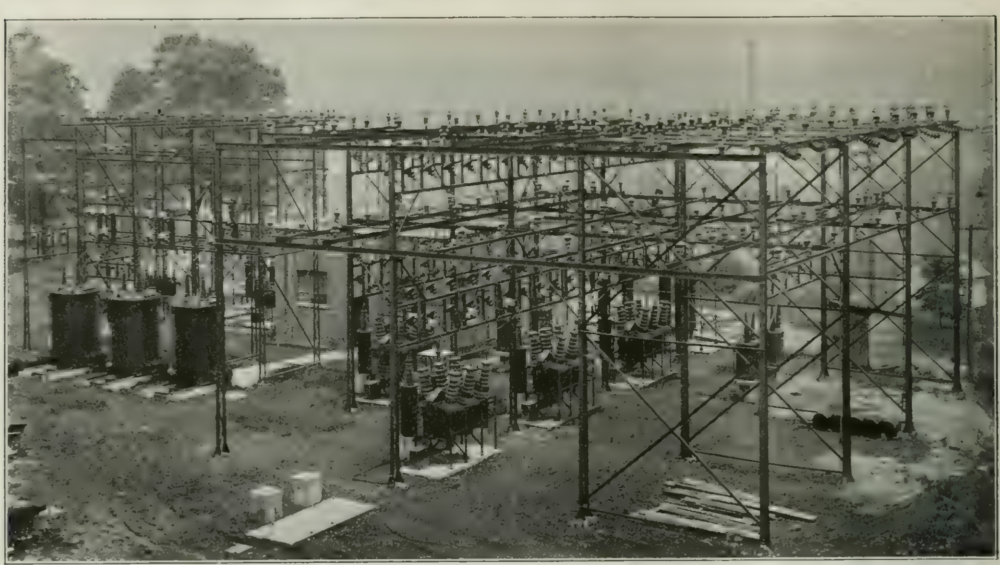
Consideration of the type of station revealed the probable cost of an indoor type of station at approximately double the cost of an outdoor type to provide the same facilities. The cost of the outdoor equipment was not only attractive, but offered opportunity to make extensions for future demands much more readily than the indoor type. These considerations influenced the choice of the outdoor type of construction, with a small house to protect the switchboard and the operating force.

The present installation comprises three 5,000-kva., single-phase transformers between the 66-kv. incoming lines and the 22-kv. outgoing lines, all of which are three-phase. Space is provided at the present time for three incoming and two outgoing lines. By reference to the plan it will be seen that the steel structures are so arranged that additions can be made without any disturbance of the existing installation, except such shutdowns as may be necessary to connect the old and new lines. The existing structure is a unit in itself, and it has not been necessary to spend money to provide for future developments except to provide land space to meet any demand that can be reasonably expected.


14'
12'
14'
Lightning arrester
Air break switches
Oil circuit breaker
Future feeder line
22,000-Volt transfer bus
Air break switches
Potential transformers
Future oil circuit breaker
Current transformers
22,000-Volt disconnecting sw's
Future connections to second bank of transformers
12'
12'
Electrolytic lightning arresters, connected to upper station bus
Current transformers
Oil circuit breaker
Potential transformers
Potential transformer bus No. 2
Potential transformer bus No. 1
Current transformers
66,000-Volt oil circuit breaker on transformers
Transformers 66,000/22,000-volts, 5000 Kva each
6'-6"
Line No. 1
Line No. 2
Line No. 3
12'-6"
24'-8"
Space for future lightning arresters
Station bus No. 1 Upper, No. 2 Lower
Transfer bus 66,000-volt
66,000-Volt air break switches

OUTDOOR SUBSTATION DESIGNED TO TAKE CARE OF PRESENT LOAD WITH SPACE PROVIDED TO MAKE EXTENSIONS AS NEEDED

The incoming 66-kv. bus structure is arranged so that, if necessary, duplicate oil switches for the high-tension lines can be provided, but the expenditure for such equipment was not warranted by the present demands and the arrangement shown in the wiring diagram was employed to avoid the use of duplicate oil switches and at the same time give full opportunity for inspection and maintenance of the oil switches installed. Normally the station is operated with an oil switch in each line, but in emergencies any incoming 66-kv. line can be thrown onto any other line through the transfer bus by manipulation of the air-break switches. This means the placing of two lines on one oil switch. but as such use will be for maintenance



A SIMPLE STEEL STRUCTURE PROVIDES MAXIMUM OPPORTUNITIES FOR MAINTENANCE AT ABOUT HALF THE COST OF AN OUTDOOR STATION

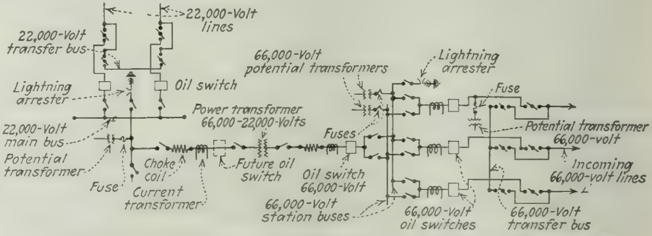
purposes during the light-load hours of the day, except in cases of extreme emergency such as those due to sudden failure of an oil switch, there is no reason why difficulties should arise from the arrangement. A double 66-kv. station bus is provided for maintenance purposes, and the incoming lines can be switched from one to the other by air-break switches. In all of these operations the 66-kv. circuits will be synchronized through the oil switches, and the air-break will be used for transfer purposes without being called on to break load.

At the present time, as there is only one transformer bank, an air-break switch has been used between the transformers and the main 22-kv. bus. With the addition of another transformer bank a 22-kv. switch will be used for the protection of each bank. The outgoing circuit switches are ample protection for the present. Each outgoing 22-kv. circuit is equipped with an outdoor oil switch, transfer bus and air-break switch similar to the 66-kv. lines.

In the selection of lightning arresters it was not believed necessary to provide arresters for each individual line. However, space is provided for their installation if future operation proves it advisable. Electrolytic arresters were therefore arranged as shown on each of the main operating buses. Choke coils are provided on each side of the transformer bank. Each arrester is supplied with a disconnecting switch between it and the bus so that the equipment can be cut if necessary. A bypass protective device consisting of two gaps in multiple, one a vacuum gap, the other a knurled air gap, with a resistance in series with both gaps, is mounted across the primary terminals of each 66-kv. current transformer.

The steel structure is simplified as far as possible. Built-up members, particularly large latticed girders, are avoided as far as possible with the result that a compact structure having ample clearance is obtained. The supports are expanded metal poles, and the other members are largely of channel and I-section.

The switch house is a one-story brick building with a concrete roof and contains panels for the control of the lines and the transformer bank. It is divided into three rooms, storeroom, washroom and operating room. The operating room contains the load dispatcher's desk, telephone and main switchboard. A panel is provided for each feeder and transformer bank, and a mimic bus extending the length of the board shows completely the switching and bus arrangement. Each oil switch is controlled from the panel by a nickel-iron-alkaline battery. All control wires enter the building in iron conduits in a concrete trench which extends the full length of the board in the rear. The control wires end on terminals mounted on a hard-wood strip at the base of the panel supports, where they are tagged and connect to panel wiring. Each feeder is protected by overload induction relays, and each of the two parallel lines at 66 kv. from the company's generating station 12 miles (19 km.) away is equipped with reverse-power relays.



AIR-BREAK SWITCHES MAKE IT POSSIBLE TO CUT OUT THE OIL SWITCHES FOR MAINTENANCE PURPOSES

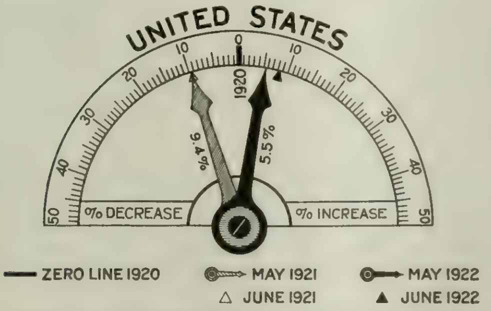
Business Trend from Energy Consumed

Electrical Energy Generated by Public Utility Companies Has an Important Bearing on the Study of General Business Conditions — Practical Applications Showing Its Value for This Purpose

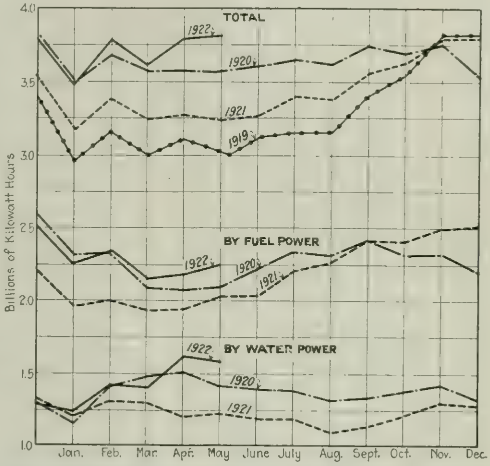
By **THEODORE DWIGHT**
Society for Electrical Development, Inc.

JUST as adequate electric power determines the industrial growth and prosperity of many cities and towns, so also does the prosperity of the electric light and power companies act as a guide to the study of business conditions, for electricity is utilized from coast to coast and the extent of this use is a gage of activity. Its employment is, indeed, a more reliable index than are the conditions in specific industries or the large financial movements more generally studied and analyzed. For instance, studies of existing conditions and of prospects for business as customarily made—the market for iron and steel, the volume and value of crops, the securities market, the borrowing rate for money, the bank clearings, etc.—are often merely local in their scope.

Three factors must be carefully considered in the application of electrical energy statistics to the study of general business conditions: (1) The electric light and power industry has made vast strides both in number of customers and in energy production during the past two years; (2) from certain states a certain amount of energy is exported, and (3) the government figures of energy generated include the output of electric railway generating plants as well as of light and power plants. These factors should be taken into account in the study of general business conditions based upon energy consumption, although the last two factors influence individual states rather than the sections into which the country has been arbitrarily divided.



A DECIDED UPWARD TREND SHOWN IN THE COUNTRY AS A WHOLE



CHARACTERISTICS OF MONTHLY ELECTRICAL ENERGY OUTPUT FOR PUBLIC UTILITIES, AS COLLECTED BY THE UNITED STATES GEOLOGICAL SURVEY

In the accompanying chart the ten divisions are arranged so far as practicable in groups representing similar industries or natural resources. The figures for June—indicated by the small triangles, white for 1921, black for 1922—show the strong "comeback" due to the improved market for textiles in certain states and groups. With a knowledge of dominating products in these groups, a study of the tabulated facts and figures will give an explanation of existing or portending conditions.

Take the states of Utah and Montana—both largely dependent on mining and stock-raising. In Utah mining is largely of low-grade copper ore and lead. Montana produces much copper from higher-grade ores and also mines silver, gold and zinc. Montana has "come back" more quickly than Utah because of its higher grade of copper and its electrolytic refining. Utah's stock-raising has been affected by the low price of wool and the advanced freight rates, making the marketing of products difficult.

Hydro-electric power has been the great developer of California and the other Pacific Coast States, and this has more than offset the effect of the general business depression in 1921. The same explanation applies to other states which possess cheap power. Attention might also be drawn to the improvement in states with large agricultural interests. This is shown in Divisions 7 and 8 of the chart. The improvement in the iron and steel industry is clearly shown by the improved conditions in Pennsylvania, Minnesota, Michigan and Alabama. Oil and agriculture have helped to better conditions in Oklahoma and Texas, and mining has been a factor in Arizona, Nevada and Michigan, the latter state being helped also by general increased building, which has improved the market for lumber.

Combining these divisions and considering the United States as a whole, an excellent picture is presented.

Electrical Energy Generated in Public Utility Plants by Water and Fuel Power During May, 1920, 1921 and 1922

States and Sections	Population	Assessed Valuation State (Thousands)	Electrical Energy Generated in Public Utility Plants of State and Section (Thousands of Kilowatt-Hours) May, 1920 By Water Power	May, 1920 By Fuel Power	May, 1920 Total Energy Generated	May, 1921 By Water Power	May, 1921 By Fuel Power	May, 1921 Total Energy Generated	May, 1921 Per Ct. Gain Over May, 1920	May, 1922 By Water Power	May, 1922 By Fuel Power	May, 1922 Total Energy Generated	May, 1922 Per Ct. Gain Over May 1920	Leading Resources and Industries
United States:	105,273,049		1,524,682	2,054,965	3,579,647	1,322,438	1,919,415	3,241,853	—9 40	1,626,711	2,149,910	3,776,621	5 50	....
Division 1	7,400,909		132,250	164,490	296,740	102,209	146,694	248,903	16 10	122,994	156,818	279,812	—5 70	Waterpower, textiles, manufacturing, shoes, paper, commerce
Division 2	22,261,144		312,686	659,210	911,896	218,918	649,031	867,949	—10 70	323,558	719,519	1,043,077	7 30	Manufacturing, agriculture, iron and steel, mining, textiles, commerce
Division 3	7,862,182		19,552	158,191	177,743	24,658	160,571	185,229	4 20	29,836	180,404	210,240	18 30	Agriculture, manufacturing, tobacco, commerce, mining
Division 4	8,107,149		153,311	31,426	184,737	123,116	23,532	146,648	20 60	152,015	26,525	178,540	—8 77	Agriculture, tobacco, textiles, sugar, waterpower, cotton
Division 5	10,027,390		82,180	51,598	133,778	62,630	51,559	114,189	14 60	70,561	52,661	123,222	—7 70	Lumber, cotton, tobacco, mining, manufacturing, steel
Division 6	22,247,531		87,046	703,055	790,101	89,326	620,167	709,493	10 20	95,004	738,231	833,235	5 45	Agriculture, mining, manufacturing, slaughtering, steel
Division 7	11,772,261		157,113	124,643	281,756	156,622	120,516	277,138	1 98	177,643	140,436	318,079	12 70	Agriculture, livestock, manufacturing, lumber, packing
Division 8	7,386,023		11,047	71,454	82,501	7,520	80,628	88,148	6 72	11,453	86,682	98,135	18 95	Agriculture, livestock, lumber, oil, mining
Division 9	2,641,589		184,110	20,567	204,677	116,862	17,284	134,146	35 00	161,289	19,483	180,772	11 65	Mining, stockraising, agriculture, waterpower, smelting
Division 10	5,566,871		385,387	70,331	455,718	420,577	49,433	470,010	3 13	482,358	29,151	511,509	10 90	Waterpower, agriculture, lumber, mining, manufacturing
Division 1:														
Maine	768,014	$637,403	29,459	420	29,879	26,763	206	26,969	—9 75	31,083	66	31,149	4 25	Water power, lumber, paper, shipbuilding, textiles
New Hampshire	443,083	511,457	20,321	5,632	25,953	15,665	1,882	17,547	32 40	20,321	2,124	22,445	13 50	Water power, agriculture, quarrying, manufacturing, shoes, textiles
Vermont	352,428	260,894	20,829	76	20,905	8,703	3	8,706	58 30	9,896	0	9,896	52 60	Tobacco, textiles, shoes, manufacturing
Massachusetts	3,852,356	7,276,334	42,670	100,762	143,432	34,815	92,005	126,830	11 50	41,522	98,632	140,154	2.28	Tobacco, textiles, shoes, shipbuilding, manufacturing
Rhode Island	604,397		933	20,024	20,957	882	19,155	20,037	4 40	840	19,927	20,767	0 95	Textiles, manufacturing, metals
Connecticut	1,380,631	1,464,602	18,038	37,576	55,614	15,381	33,443	48,424	12 20	19,332	36,069	55,401	3 82	Water power, tobacco, agriculture, manufacturing, copper, machinery
Division 2:														
New York	10,385,227	14,850,980	250,404	289,925	540,329	166,480	302,502	468,982	13 20	264,597	334,232	598,829	10 80	Water power, agriculture, mining, manufacturing, commerce
New Jersey	3,155,900	3,254,964	221	85,556	85,777	208	72,177	72,385	15 60	208	84,488	84,696	—1 26	Iron and zinc, agriculture, quarrying, manufacturing, textiles
Pennsylvania	8,720,017	9,391,039	62,061	283,729	345,790	52,230	274,352	326,582	—5 52	58,753	300,799	359,552	3 98	Mining, steel, agriculture, manufacturing, textiles
Division 3:														
Maryland	1,449,661	1,555,226	183	15,294	15,477	378	12,991	13,369	13 60	289	16,563	16,852	8 90	Agriculture, canning, shipbuilding, manufacturing, commerce
Virginia	2,309,187		16,978	23,715	40,693	21,708	22,650	44,358	9 00	26,252	27,030	53,032	30 90	Tobacco, agriculture, lumber, shipping, manufacturing
Delaware	223,003		0	5,735	5,735	0	5,394	5,394	5 90	0	6,754	6,754	17 80	Grain, fruit, manufacturing
West Virginia	1,463,701	1,579,594	2,391	91,646	94,037	2,562	97,289	99,851	6 17	3,287	103,830	107,117	13 90	Water power, mining, natural gas, agriculture
Kentucky	2,416,630		0	21,801	21,801	10	22,247	22,257	2 10	8	26,227	26,235	20 30	Tobacco, agriculture, manufacturing, flour mills
Division 4:														
Georgia	2,895,832	1,346,883	39,606	8,744	48,350	38,678	6,444	45,122	6 70	46,983	5,928	52,911	9.45	Lumber, tobacco, turpentine, fertilizer, cotton, sugar, grain
North Carolina	2,559,123	2,579,076	59,674	9,016	68,690	24,282	3,149	27,431	60 00	31,981	4,415	36,396	47 00	Water power, grain, textiles, sugar, tobacco
South Carolina	1,683,724	448,223	53,097	4,202	57,299	59,428	3,341	62,769	9 56	72,520	3,637	76,157	32 90	Water power, agriculture, cotton, tobacco, grain, textiles
Florida	968,470		934	9,464	10,398	728	10,598	11,326	8 90	531	12,545	13,076	25 50	Agriculture, lumber, turpentine, phosphates, fruits
Division 5:														
Tennessee	2,337,885	1,649,524	41,132	10,758	51,890	33,851	9,792	43,643	15 90	25,817	11,711	37,528	27 60	Mining, agriculture, lumber, manufacturing
Alabama	2,348,174	952,602	40,941	8,541	49,482	28,719	8,614	37,333	—24 60	44,610	6,877	51,487	4 05	Water power, mining, steel, manufacturing
Mississippi	1,790,618	765,198	0	5,770	5,770	0	4,912	4,912	—12 10	0	4,624	4,624	19 20	Tobacco, grain, cotton, lumber
Arkansas	1,752,204		107	8,426	8,533	60	8,997	9,057	6 50	134	9,311	9,445	10.80	Agriculture, rice, cotton, grain
Louisiana	1,798,509	1,698,564	0	18,103	18,103	0	19,244	19,244	6 34	0	20,138	20,138	11 20	Sulphur, cotton, lumber, sugar, shipping, tobacco
Division 6:														
Michigan	3,668,412	5,320,000	59,937	112,452	172,389	60,560	94,465	155,025	10 60	65,914	112,879	178,793	3 70	Mining, agriculture, lumber, autos, shipping
Ohio	5,759,394	10,672,277	2,890	246,969	249,859	2,868	195,820	198,688	20 50	3,817	240,387	244,204	12 28	Mining, agriculture, manufacturing
Indiana	2,930,390		3,465	67,325	70,790	4,636	65,767	70,403	0 50	6,507	76,765	83,272	7 60	Agriculture, manufacturing
Illinois	6,485,280	8,403,631	15,202	226,835	242,037	15,663	211,109	226,772	6 30	15,853	246,174	262,027	18 25	Mining, agriculture, slaughtering, steel, manufacturing
Missouri	3,404,055	4,920,926	5,552	49,474	55,026	5,599	53,006	58,605	6 48	2,913	62,026	64,939	8 00	Mining, agriculture, cotton, tobacco, slaughtering
Division 7:														
Minnesota	2,387,125	2,084,287	38,676	8,220	46,896	43,484	11,046	54,530	16 25	46,829	11,673	58,502	24 80	Mining, agriculture, lumber, manufacturing
Iowa	2,404,021		59,291	25,505	84,796	54,363	27,677	82,040	4 36	63,097	29,541	92,638	7 95	Agriculture, livestock, packing, manufacturing
Wisconsin	2,632,067		54,306	36,933	91,239	53,434	29,791	83,225	8 75	62,243	40,762	103,005	12 86	Wheat, flour mills, lumber, shipyards, manufacturing
North Dakota	646,872	1,377,916	0	1,855	1,855	0	2,023	2,023	9 50	0	2,061	2,061	11 00	Agriculture, livestock, wheat
South Dakota	636,547	2,064,602	1,412	2,377	3,789	1,589	2,298	3,887	2 50	1,648	2,614	4,262	12 45	Mining, livestock, wheat, milling, dairying
Nebraska	1,296,372		987	19,032	20,019	1,477	19,254	20,731	3 55	1,476	21,480	22,956	14 60	Livestock, lumber, wheat, packing
Kansas	1,769,257		2,441	30,721	33,162	2,275	28,427	30,702	—7 40	2,350	32,305	34,655	7.50	Live stock, grain, packing, manufacturing
Division 8:														
Oklahoma	2,028,283		143	17,276	17,419	265	15,773	16,038	7 93	166	19,663	19,829	13 80	Oil, agriculture, lumber
Texas	4,663,228	3,370,470	310	48,094	48,404	372	59,944	60,316	24 60	379	62,880	63,259	30.60	Oil, lumber, livestock, cotton, grain, tobacco, sugar
New Mexico	360,350	363,722	82	1,162	1,244	73	1,211	1,284	3 22	56	1,345	1,401	12 60	Agriculture, cattle
Arizona	334,162		10,512	4,922	15,434	6,810	3,700	10,510	-31 80	10,852	2,794	13,646	18 95	Cattle, mining, agriculture
Division 9:														
Montana	548,889		95,245	506	95,751	42,270	587	42,857	54 00	81,488	571	82,059	14 00	Water power, mining, smelting
Wyoming	194,402	438,150	179	3,746	3,925	140	2,722	2,862	27 00	117	2,753	2,870	27 00	Stockraising, agriculture
Colorado	939,629	1,578,814	15,428	16,111	31,539	15,762	3,548	29,310	—7 03	15,641	15,949	31,590	1 60	Water power, mining, agriculture, stockraising
Utah	449,396	688,000	13,955	6	13,961	7,754	0	7,754	44 30	4,493	35	4,528	67 50	Mining, smelting, agriculture, livestock
Nevada	77,407		2,646	73	2,719	3,081	25	3,106	14 20	3,310	32	3,342	22 90	Mining
Idaho	431,866	506,603	56,657	125	56,782	47,855	402	48,257	15 0	56,240	143	56,383	7 05	Water power, mining, agriculture, sheep raising
Division 10:														
Washington	1,356,621	1,177,239	94,819	2,348	97,167	88,536	2,177	90,713	6 65	101,595	1,968	103,563	6 57	Water power, grain, stock raising, fisheries, flourmilling, shipbuilding
Oregon	783,389	1,020,804	32,042	7,026	39,068	33,314	3,449	36,763	8 45	32,951	5,224	38,175	2 28	Water power, lumber, agriculture
California	3,426,861	4,929,480	258,526	60,957	319,483	298,727	43,807	342,534	7 20	347,812	21,959	369,771	15 80	Water power, lumber, agriculture, mining, manufacturing

Taking conditions as of May for the three years, the index of reference being as before the situation in 1920, the conditions in May, 1921, when the output of the nation's electric light and power companies was 9.4 per cent below that of the corresponding period of the index year, indicates a material drop in business activities. By May, 1922, however, the index of business is shown swinging over to the other side of the scale, registering a betterment over 1920 output of 5.5 per cent.

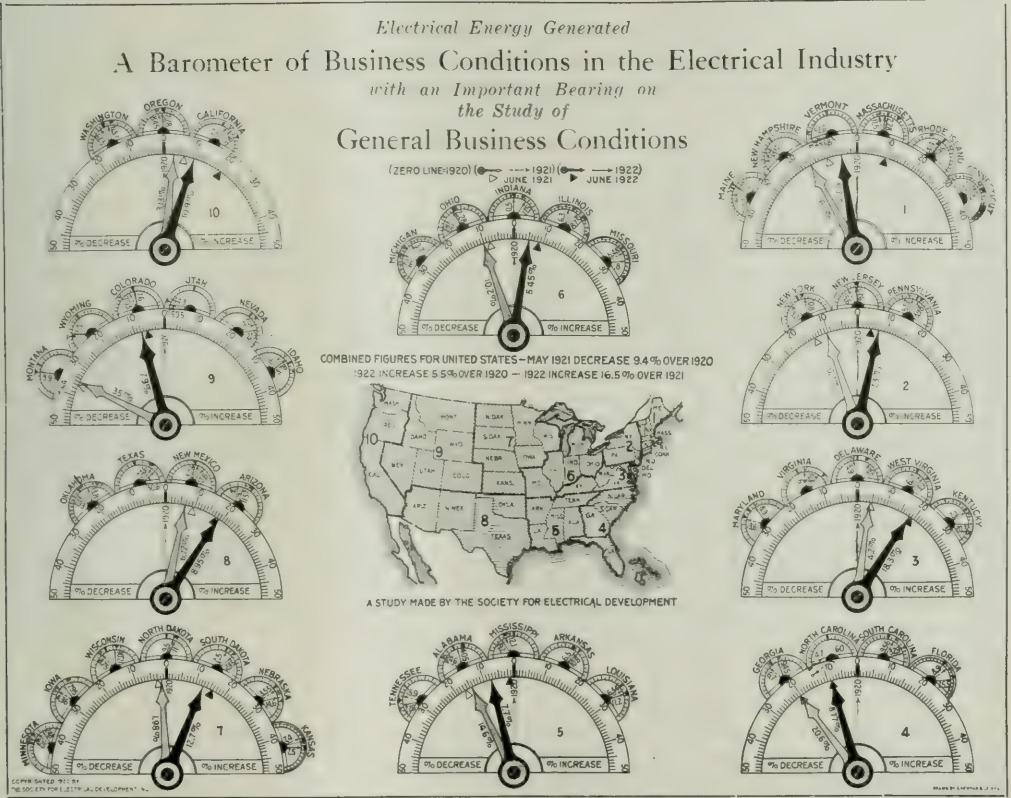
The June conditions show even a more gratifying trend, for the electrical output in June, 1921, was 9.2 per cent below that for June, 1920—a slight improvement over the situation in the corresponding months of May, indicating that a slow but positive improvement had commenced even in 1920. By June, 1922, the betterment is seen to have become quite marked, for not only is the betterment for the months of May equaled, but the index points to a gain of 8.2 per cent above the 1920 balance.

During the latter part of 1921 the output of the central stations rose slowly and steadily as conditions commenced to improve until at the commencement of the current year it was within 1 per cent of the banner year of 1920. This gain was almost entirely due to increased domestic business on the part of the central stations, and therefore it was not so promptly felt in betterment of business as a corresponding increase in industrial demand would have been. Since the first of the year, however, there has been a steady resumption of industrial activity, the latest available records showing that, following a drop of about 0.5 per cent in January, the increase in central-station output is 10 per cent higher than for the corresponding period of 1920.

WHILE ELECTRICAL OUTPUT IS MAINTAINED DEPRESSION CANNOT RETURN

Just as surely as the 10 per cent drop during 1921 indicated depression, the 10 per cent increase indicates prosperity. The most sensitive of gages has registered, and depression cannot return before there is a decided slowing down of the central-station generation, a process which would take considerable time.

The accompanying diagram showing central-station output in the United States by months for the years 1919, 1920, 1921 and 1922, emphasizing the deductions made above and the comparison of the amounts produced by water power and fuel, brings out clearly the fact that there was a big drop in 1921 in the consumption of electric energy produced by water power, which is used largely for industrial power, but a distinctly rising market for energy produced by fuel. The addition of a million (or 12.5 per cent) to the number of domestic consumers during the year, with an increased use for electrical appliances in the homes, explains in large part the quick rise in the latter half of the year.


Electrical Energy Generated

A Barometer of Business Conditions in the Electrical Industry

with an Important Bearing on the Study of

General Business Conditions

(ZERO LINE=1920) (●—→ 1921) (●—→ 1922) ▷ JUNE 1921 ▶ JUNE 1922

COMBINED FIGURES FOR UNITED STATES—MAY 1921 DECREASE 9.4% OVER 1920 1922 INCREASE 5.5% OVER 1920 — 1922 INCREASE 16.5% OVER 1921

A STUDY MADE BY THE SOCIETY FOR ELECTRICAL DEVELOPMENT

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Relative Merits of Mine Locomotives*

Larger-Capacity Straight-Battery Type Might Show Rate 2 Cents a Ton Lower than Combination — Reel Type Fits Heavy, Combination Fits Medium, and Straight-Battery Fits Low Grades

WIDELY differing experiences have been reported by mining and electrical engineers discussing the merits of different kinds of gathering locomotives. This variance is attributed to the fact that much of the equipment has been misapplied and the individuals responsible have refused to acknowledge their mistakes. With the hope of correcting any wrong impressions which have thus arisen, some facts will be brought out here that should make it possible to assign the straight storage-battery, the combination and the conductor-reel gathering locomotives each to its most economical field of application. The statements and data are based on extremely accurate cost records kept by the Logan (W. Va.) Mining Company since March 1, 1920. In the comparisons made, nineteen gathering locomotives are considered. Nine are combination machines equipped with eighty-eight-cell lead batteries, all thirteen-plate except one, which is fifteen-plate; seven are of the straight forty-eight-cell storage-battery type, two being seventeen-plate, three nineteen-plate and two twenty-one-plate; three locomotives are conductor cable-reel type. The coal beds are generally considered level but have numerous dips ranging up to 4 per cent.

The largest item of cost is for the wages of motormen and brakemen. The average wage these operatives received during the period under consideration was $5.59 per eight-hour day, the mines working 404.5 eight-hour shifts during this time. The next important item is the power-demand charge, which in this locality is based on the highest integrated five-minute peak that occurs during a month. This charge is $1.80 per kilowatt per month, and to it the regular charge for energy must be added. By the use of straight storage-battery locomotives this demand charge is at a minimum, hence the straight-battery machine is taken for a base.

Allocation of Demand Charges

Accordingly the cable-reel-locomotives must be charged with a demand equal to the capacity of their motors, which is 30 kw., as they all draw their power from the trolley and do it during the day shift, when the maximum load is on. The motor capacity of the combination locomotives is 20 kw. Apparently they should be charged with 20 kw. of demand, but as they operate from the trolley only 20 per cent of the time they rarely ever all draw their maximum capacity from the system at the same time. Consequently they are charged with 75 per cent of their capacity, which is 15 kw. per locomotive per month.

Reel and combination locomotives are charged with increased copper, trolley hangers, bonds and labor for bonding butt entries, but these charges are spread over the total tonnage of a 1,000-ft. x 300-ft. panel in a 5-ft. seam with 80 per cent recovery. The maintenance cost of the wire and bonding is not considered, as it will just about offset the value of this material when the entry or panel is worked out. But there is another charge of like nature. It is well known that if cable-reel or combination gathering locomotives are being used more substation capacity and more copper in the whole transmission system are required because a greater percentage of the total power consumption is being used in a shorter period than would be the case where straight storage-battery machines were being employed. Hence these two charges must be made against these two types of locomotives. They are divided between them in about the same proportion as the demand charge, but they are based on the total tonnage of an average-size lease or mine.

Another claim or charge must be made against the cable-reel gathering locomotive; this is the loss caused by power failure or interruption. When there is such failure the whole mine comes to a dead stop almost instantly, so far as the moving or transportation of coal to the tipple is concerned. Still, a major portion of the operating expenses continue.

The power company's record in this locality from a time standpoint shows 98 per cent supply. This means that during 2 per cent of the time no power is available at the mines. This is a pretty fair degree of service. But it also means that on an average during 28.8 minutes out of every twenty-four hours no power is available. It is reasonable furthermore to believe that 75 per cent of this failure will come during the eight-hour working shift, because this is the period of heaviest load. This being the case, the period when power is lacking averages 21.6 minutes during each working shift, or is equivalent to 4.5 per cent of the working time.

Assuming the average cost of production as being about $1.75 per ton, allowing for the fact that power failure would not be particularly injurious when coal is not being produced and allowing for contingencies, the charge entered against the reel-type gatherer is 1.75 cents per ton.

A battery locomotive could not continue its work over any protracted period of time should the power not be restored, because the mine cars would all be filled and because the mine could not continue to operate without ventilation, but the records show that the average duration of these failures is fifteen to twenty minutes. It is obvious that with storage-battery locomotives these short interruptions are scarcely felt, as the main-haulage locomotives and tipples almost always have a surplus of capacity sufficient to overcome these short delays, provided that the loaders at the working face are kept going.

Another consideration in connection with power failure, not convertible to figures but nevertheless pronounced in its effect on cost, is the fact that miners are difficult to hold in a mine when they fail to receive cars promptly, consequently a power failure of thirty minutes in the afternoon often leaves a mine badly crippled for the remainder of the shift. To those who closely watch the daily cost statements of a mine the effects of such happenings are often noticeable to the extent of 25 cents or 30 cents per ton.

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*Abstract of report of committee on the relative merits of storage-battery, combination and conductor-cable-reel gathering locomotives, presented Sept. 20 at the meeting of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers, by C. E. Rogers, chairman.

The data given in Table I show that the straight-storage-battery locomotives have an advantage of 0.07 cents per ton over the combination machines. Although this is correct, if we stop here we shall not do justice to the straight-battery locomotive; therefore Table II, showing the comparative capacity of the two, is presented.

TABLE I—RELATIVE MERITS OF COMBINATION, STRAIGHT BATTERY AND CONDUCTOR-CABLE-REEL LOCOMOTIVES

TONNAGE DATA

Locomotives	Total Tons	Tons per Locomotive	Tons per Locomotive per Eight-Hour-Day
Nine combination	735,543	70,615.9	174.6
Seven straight-battery	355,852	50,836.0	125 7
Three conductor-cable-reel	150,307	50,102.3	123 9
Total	1,241,702	60,089.6	148 6

Percentage	
Combination	100.00
Straight-battery	71.99
Cable-reel	70.96

COST DATA ON NINE COMBINATION LOCOMOTIVES

		Cost per Ton, Cents
Total repair cost	$13,431.49	2.11
Total battery depreciation	19,774.50	3.11
Increased power demand, 15 kw. x $1.80 x 9 x 27	6,565.00	1.03
Increased cost of wire and of bonding butt entries	1,334.64	0.21
Increased substation capacity	254.22	0.04
Increased main feeders and main-line bonding	63.55	0.01
Operating cost, 404.5 days at $5.59 x 2 x 9	40,700.79	6.40
Total	$82,124.19	12.91

COST DATA ON SEVEN STRAIGHT-STORAGE-BATTERY LOCOMOTIVES

Total repair cost	$3,657.75	1.03
Total battery depreciation	10,385.10	2 92
Operating costs 404.5 days at $5.59 x 2 x 7	31,656.17	8.89
Total	$45,699.02	12.84

COST DATA ON THREE CONDUCTOR-CABLE-REEL LOCOMOTIVES

Total repair cost	$3,394.78	2.26
Increased power demand, 30 kw. at $1.80 x 3 x 27	4,381.29	2.91
Increased cost of wire and of bonding butt entries	1,608.28	1.07
Increased cost of main feeders and main-line bonding	90.18	0.06
Increased substation capacity	270.55	0.18
Cost arising from power interruptions	2,630.37	1.75
Operating cost, 404.5 days at $5.59 x 2 x 3	13,566.93	9.03
Totals	$25,942.38	17.26

AGGREGATE COST DATA ON NINETEEN LOCOMOTIVES

Total tons 1,141,702; Total cost $153,765.59; Average cost per ton 13.47c.

ADVANTAGES

Battery over combination, 0.07c. per ton, saving on above tonnage	$799.19
Battery over reel type, 4.42 cents per ton, saving on above tonnage	50,463.23
Combination over reel type, 4.35 cents per ton, saving on above tonnage	49,664.04

From this it may be seen that the combination machine drawing 20 per cent of its power from the trolley has a battery equivalent of 44.23 kw.-hr., which gives it an advantage of 35 per cent in capacity over the straight-battery locomotive. The table of percentage shows that the combination has led the straight-battery machine by only 28 per cent in tonnage, notwithstanding its 35 per cent advantage in capacity.

This difference in tonnage cannot be traced to anything but a difference in capacity resulting from the fact that the mileage rating of both types of locomotives under consideration is the same when operating from the batteries, but the combination has 42 per cent advantage in speed over the straight-battery machine while operating from the trolley, provided that 250-volt pressure is maintained on the section from which cars are being gathered. This latter condition is possible but not practical, consequently we drop this apparent advantage and assume that the straight-battery machine equipped with the same capacity as the combination locomotive will gather the same tonnage under the conditions being considered. This would require about a twenty-seven-plate instead of a nineteen-plate battery, which is approximately a 50 per cent increase.

TABLE II—CAPACITY OF COMBINATION AND STORAGE-BATTERY LOCOMOTIVES

	Cells	Plates	Total Positive Plates	Kw.-Hr. Capacity, Six Hours
Combination	88	13	528	35 38
Straight battery	48	19	432	28.94

If we go back to the data in Table I referring to the seven straight-battery locomotives and increase the battery depreciation 50 per cent and the repair cost and tonnage 28 per cent, based on the combination tonnage, while the operating cost remains the same, it will give the results set forth in Table III, showing what the cost and tonnage figures would have been on these locomotives had they been equipped with this additional capacity.

Had the data already given in this paper been procurable at the time the above equipment was purchased Table IV could have been prepared.

TABLE III—TOTAL TONS INCREASED BY 38.9 PER CENT, OR FROM 355,852 TO 494,278

		Cost Per Ton, Cents
Total repair cost increased by 38.9 per cent, or from $3,657.75 to	$5,080.54	1.03
Total battery depreciation increased by 50 per cent or from 10,385.10 to	15,577.65	3.15
Operating cost remaining the same	31,656.17	6.40
Total	$52,314.36	10.58

By comparing the repair cost alone of the three types of locomotives the combination will seem a little high, as it has no cable cost or reel maintenance. This is due to a rather delicate equipment, originally installed in eight of these locomotives. This equipment was taken out about eight months ago and replaced with a later and more rugged type, which has already lowered the maintenance from 2.51 cents per ton to 2.11 cents over the whole time period of twenty-seven months.

Figured on the last eight months alone maintenance cost is down to 1.42 cents per ton. This is the only pronounced advantage that the cable-reel locomotive has had over the combination machine in this comparison. Had the combination had this latter equipment in the beginning, the difference would have been 0.69 cent per ton more in its favor. Having been in service for many years, the design of cable-reel locomotives has reached a comparatively high state of perfection. This has been greatly in their favor in all cases where they have been called on to compete with storage-battery locomotives.

The cost of motor cable is used as a common argument by battery-locomotive "boosters" as an item sufficient just about to offset battery depreciation. This we do not believe can be verified except possibly in a few extreme cases. The average life of a cable on the locomotives for which results have just been given is eight

TABLE IV—RELATIVE MERITS OF STORAGE-BATTERY, COMBINATION AND CONDUCTOR-CABLE-REEL GATHERING LOCOMOTIVES

Advantage of straight-battery locomotives:	
Over combination, 2.33 cents per ton; saving on total tonnage	$26,601.66
Over reel type, 6.68 cents per ton; saving on total tonnage	76,265.69

months. Worked out in cost per ton it stands at about 0.3 cent, compared to battery depreciation of 2.92 cents and 3.11 cents per ton.

The straight storage-battery locomotive has a clear advantage over both the other types in maintenance cost, and it is not likely that either of them will ever be able to compete with it in this particular. Its entire electrical circuit is insulated from the ground. There is thus no difference in potential between the motor windings and the frame, and for this reason the tendency to ground is eliminated.

Moreover, as the straight-storage-battery locomotive has its whole source of power on its back and is not subject to transmission troubles or losses, the electrical equipment is designed for a much lower voltage than the combination or reel type. This, in addition to the double insulating feature, almost entirely eliminates electrical trouble. Records show that the number of such troubles with this kind of locomotive compared with that of the other types is about in the ratio of one to twelve.

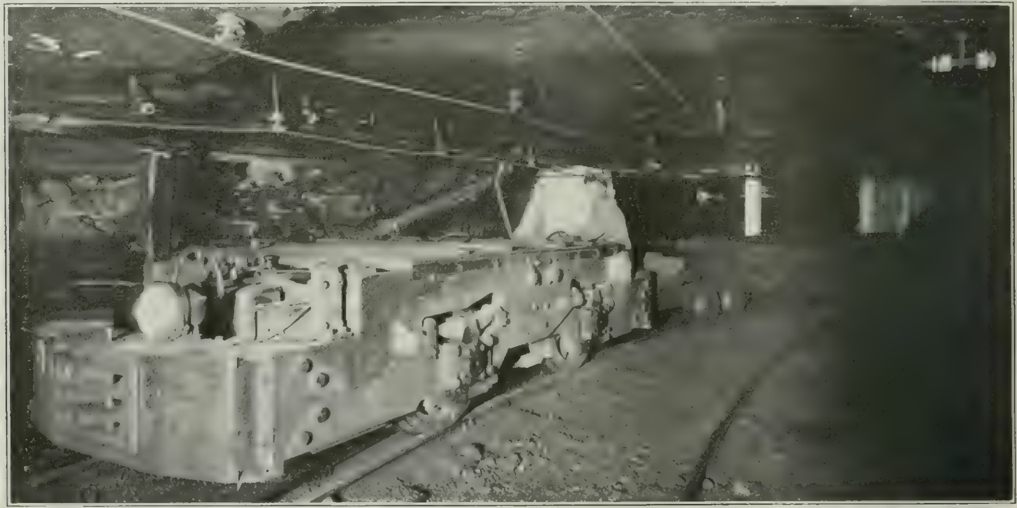
This brings in another important point of merit for which for want of more definite data this locomotive receives no credit in the tabulation. What does it mean to have a locomotive in the middle of the shift come hauling in another that is incapacitated from a burnout?

It means that one locomotive is taken from its work for at least fifteen or twenty minutes while the cost on that section goes right on. The other machine is out probably for the rest of the day; the miners on its section go home; the day is finished with 50 or 100 tons of coal short, yet with no curtailment of the day's expense. These are the things that really count when it comes to considering the relative merits of various types of equipment.

The lower voltage of the straight-storage-battery machine gives it another advantage over the combination type from the battery point of view. The first cost of the battery is less per kilowatt-hour of capacity because of the smaller number and the larger size of the cells. This reduced number of cells and lower voltage reduce the battery maintenance cost, there being fewer cells to keep up and less tendency for grounds and leakage due to lower voltage and a completely insulated battery circuit. From this company's records this consideration seems to have netted 12½ per cent longer life on this battery. Of course, this is all worked into the data given, and it also is noticeable to the extent of 0.19 cent per ton on the battery depreciation, notwithstanding the fact that the combination locomotives did 20 per cent of their work from the trolley.

Another misfortune that to some extent has held down the tonnage of the straight-battery machine is that it did not have sufficient battery capacity even to get a chance in competing with the combination locomotive for the larger producing territories.

It seems that the greatest disadvantage of the reel type of locomotive lies in its inability to compete with the battery machine in tonnage under average gathering conditions. This is due to a number of considerations, chief among which are power interruptions or failures from various causes, cable and reel troubles, inconveniences of changing from trolley to cable, and vice versa.



THE MINE LOCOMOTIVE HAS MADE POSSIBLE A GREAT REDUCTION IN THE PRODUCTION COST OF COAL

In considering efficiency from a power standpoint it is generally thought that the cable-reel locomotive is more efficient than the battery. We do not believe there is much difference in the controllers of the two types of machine as the loss in a battery usually just about equals the line drop sustained in the other type. But from the controller to the rails sufficient reason exists to believe that the battery considerably leads the other type. In the first place, the reel type almost always has a higher mileage rating, which tends to give quicker acceleration but which at the same time results in considerably more slippage, thereby consuming energy uselessly.

Under the same conditions the reel type must necessarily operate with more resistance in the circuit than the battery machine. Another argument in the same direction is that in almost every case where the operator is changed from a reel-type to a battery locomotive, he "kills" the battery on much less tonnage than the old operator who has learned to save through a realization that his supply of energy is limited. There is no question that a battery teaches economy in this respect. If an accurate test were made the storage-battery locomotive would probably show about 40 per cent more efficiency than the cable-reel type.

The place for the cable-reel type is down over the hill, that for the combination just over the brink a little, and that for the straight battery on top of the hill. If they will stay in their respective places, there should be no trouble or argument, but if the battery goes down over the mountain it can expect to be run out by the cable-reel locomotive, or if the cable-reel persists in coming up or staying on the level, it will be put out of business by the battery machine. In like manner the combination must not go too far over the hill or try to cover too much of the top. This designates an economical place for each of the types of gathering locomotives, and it is doubtful whether there is a single large mine in the country that should not have just such a mixture of equipment.

An example of the effect on the cost of production of such record keeping over a period of twenty-seven months divided into three periods of twelve, eight and seven months is presented in Table V. Had it not been for the record keeping, the cost would have continued somewhere near that of the first year, and if so the total outlay on the above tonnage would have been $81,624.26 instead of $55,791.27. This shows a net saving of $25,832.99, or approximately $1,000 per month.

TABLE V—HOW MAINTENANCE AND BATTERY DEPRECIATION COSTS DECLINED AFTER KEEPING COST RECORDS

	Tons Moved	Cost	Cost per Ton Cents
First twelve months	505,300	$29,435.33	5.83
Next eight months	476,810	17,610.06	3.69
Next seven months	417,963	8,745.88	2.09
Twenty seven months.	1,400,073	$55,791.27	3.98

Ground Relays Improve Protection

Isolation of Accidentally Grounded Sections by Accurate Switch Operation Can Be Effected in Nearly Every Case by Use of Proper Combination of Protective Relays

By **L. A. TERVEN**

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THE increasing use of three-phase transmission lines with the neutral grounded through a resistance or dead-grounded has accentuated the development of so-called ground relays. The function of these relays is to trip the proper circuit breakers or give certain alarm signals in case of a fault to ground on a line or within some piece of apparatus. The most desirable protection is given when the switches nearest the fault are tripped quickly. Ground relays are usually operated in conjunction with other relays used for overload and short-circuit protection, and meters are frequently inserted in the same secondary circuits. The tendency is to overload the instrument transformers, and each application should be carefully considered from this standpoint.

The induction type of relay is commonly considered preferable for ground relays on account of the accurate time setting possible. Selectivity of relays is usually accomplished through timing, the breakers nearest the source of power being the last ones to go out in case of a line fault. However, relays of other types can often be employed to advantage, other types commonly used being the bellows, the thermal and the straight instantaneous. In the examples given in this article relay adjustment for time is necessary for the proper operation of a number of the schemes.

The simplest kind of protection against the accidental grounding of a feeder is shown in Fig. 1. Any ground current flowing results in an unbalance between the three current transformers, the exact ground-current equivalent appearing in the ground relay and causing it to operate. If ground relays are used at a point between the feeder and the source of power, their time setting must be longer than that of the ground relay protecting the feeder so that the latter shall get an opportunity to clear before a large portion of the system is affected.

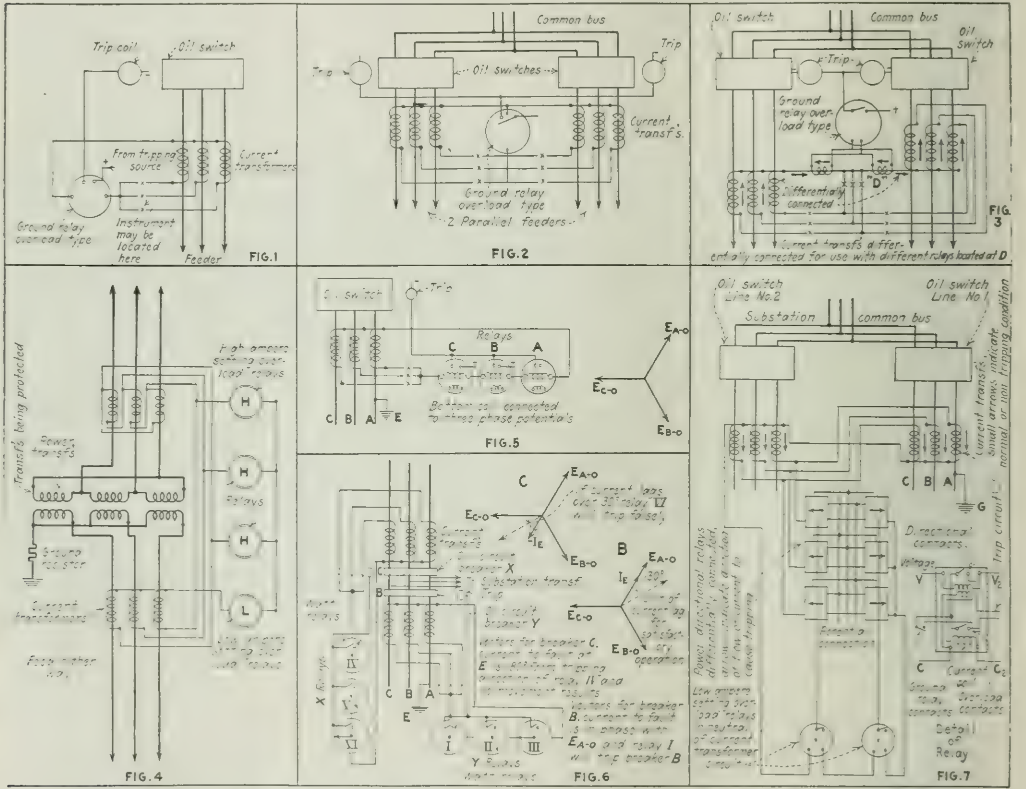
A scheme for tripping the circuit breakers feeding a bus in case of a fault to ground in the bus is shown in Fig. 2. All of the ground current is carried through the ground relay. Operation of the relay trips out all breakers feeding power into the bus. In case the current transformers on the lines are differentially connected as indicated in Fig. 3, it is necessary to install 5/5-amp. current transformers in order to sum up the total ground current, this being used for bus ground protection.

Where the grounding resistor of the neutral of the system has a high ohmic value, the current resulting to ground in case of a fault may be so limited in value that relays designed for overloads or short circuits will not operate. In Fig. 4 a scheme is shown where the ground current only flows through the relay marked L, and hence this relay may be of a very low current setting. The advantage of the connections illustrated is that switching surges appear as three-phase currents in the relays marked H and do not disturb relay L. Similarly, different characteristics of current transformers on the high and the low side of the power transformer will not cause tripping currents in the relay system throughout the range of operation of the power transformer. This is because the currents are balanced and do not flow in the ground relay, while the H relays are set high against this very contingency.

In many cases the use of directional relays is preferred to those operating on amount of current only.

Such relays respond both to amount and direction of the ground current. An example of this type of protection is given in Fig. 5, where three relays are employed to trip one switch. The middle coils of the relays are connected in series and carry the ground current. The bottom coils are connected to a three-phase potential source, one phase per relay as illustrated in the vectors. A fault current to ground on wire *A*, for example, would appear in all of the relays simultaneously and in phase. However, only relay *A* would operate, because it is the only one where the voltage and current are in phase. This idea is extended in Fig. 6, showing both sides of a substation, where a tap for the station feeders is placed between the switches. A fault to ground in wire *A* should only trip the breaker between it and the substation bus. However, ground current may be flowing from the source of power above the substation and, appearing in the *X* relays, will tend to trip two of these with a torque amounting to 50 per cent of the torque developed in relay III. This comes from the fact that the current and voltage are out of phase by 60 deg., the cosine of the angle being 0.5. In relay III the current and voltage are in phase and the torque is 100 per cent. The lower breaker, *Y*, should trip first because of time selectivity, its relay having twice the torque of the relays tending to trip the upper breaker. These operations are on the basis of unity power factor of the ground current. In case the ground current should lag more than 30 deg. the wrong relays will operate. At 30 deg. lag the torque in either set of relays is 86.6 per cent. If the ground resistor has a high ohmic value and the lines protected have a low reactance, it is possible that the power factor of the ground current cannot fall below 86.6 per cent in case of accidental ground. On such systems the directional ground relays of Fig. 6 may be used successfully.

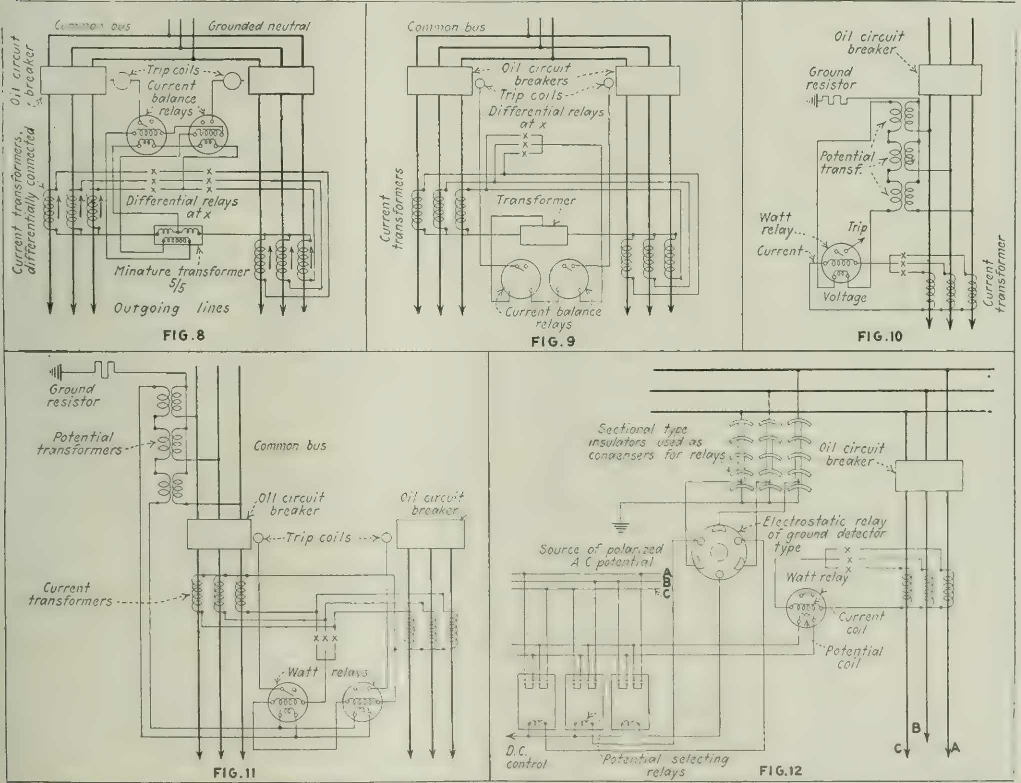
For the receiving end of parallel transmission lines the ground relays of Fig. 7 can be used satisfactorily. The overload relays are cross-connected and are set to operate upon excess power flowing from the bus. Because of the cross-section of the relays the directional elements corresponding to one line will most likely be closed. The relays receive the difference between the secondary currents of the two lines, and some slight unbalance must always be present due to inequalities in resistance and reactance of the lines. If a ground occurs on the bus, the ground current in each line will be approximately the same and will circulate through the current transformers without passing through any of the relays. Should a ground occur at the point marked *G*, a ground current will be drawn from the



OVERLOAD RELAYS OFTEN MUST BE SUPPLEMENTED WITH DIRECTIONAL RELAYS TO OBTAIN SELECTIVE GROUND PROTECTION

Fig. 1—Time-element overload relay for protecting single outgoing feeders. Fig. 2—Overload-type relay for bus ground protection. Fig. 3—Overload-type relay with differential connection of current transformer for bus protection. Fig. 4—With a resistance ground, switching surges do not affect ground relay L. Fig. 5—Three relays are used in series to trip. Fig. 6—Directional relay scheme for substation application. Fig. 7—Receiving ends of transmission lines protected by directional relays.

source and will pass through the receiving stations as shown. The direction of the ground current will be "in" on line 2 and "out" on line 1. The directions of flow being reversed, the ground current will appear in double quantity in the relay system, causing the ground relays to operate. When the contacts of the ground relays close, the current setting of the directional relays is removed so that outgoing power will trip its breaker. Ordinarily the only outgoing power is represented by the ground current in line 1 as indicated, but because of inequalities in line characteristics it may be that line 2 carries slightly less current normally than line 1 does. Were such the case, a ground fault at *G* would cause a reversal on phase *A*, but would leave phases *B* and *C* set for operation of line 2. This difficulty may be overcome by having ground relays function to change the overload setting of the directional relays, instead of omitting it altogether. Unfortunately the inherent design of commercial relays renders this object difficult of accomplishment.



NETWORK AND MULTIPLE FEED SYSTEMS REQUIRE SPECIAL TREATMENT TO OBTAIN GROUND PROTECTION

Figs. 8 and 9—Current-balance scheme for use on the sending end of single and parallel transmission lines. Fig. 10—Current-balance directional relays are required to protect the receiving end or intermediate stations on multiple-fed transmission system. Fig. 11—Special-type directional relays are used to secure protection on parallel transmission lines. Fig. 12—An electrostatic method for obtaining proper phase and potential on directional relays. A direct-current trip circuit is used.

Directional-Balance Relays

Current directional, or current-balance, relays may also be used for ground protection. In Fig. 8 the line relays are connected for single-line operation, while in Fig. 9 they are cross-connected for parallel-line operation. In either case the ground relays respond satisfactorily to outgoing ground current only. They are not suitable for receiving-end operation because when the ground current flows in on one line and out on the other the current-balance relays operate as though the ground current were in or out simultaneously on both lines. In other words, some polarizing force must be present in order to render such ground relays directional. This force is commonly obtained from potential between phases or between phase wires and ground.

To obtain the proper phase of potential to impress on ground relays is no easy matter. The methods so far known require auxiliary equipment, which is expensive and which may add to the complications of the system of relays. But directional ground relays are often worth the price, as they are the only kind which will operate at intermediate stations of a long transmission system fed from more than over one point and which has more than one permanent ground resistor connected to the line at remote points, at one time. In such cases the load current may flow in one direction and the ground current in another. In fact, it is impossible to foresee the direction of the ground current, its amount or its relative phase with respect to the load current. Hence ground directional relays must receive, besides the ground current, a potential approximately in phase, or 180 deg. out of phase, with the ground current. If the current and voltage are in phase, the relay will operate after its time limit is reached; if the current and voltage are 180 deg. out of phase (approximately), the ground relay contacts will go against the stops in the reverse position from normal tripping direction.

In Fig. 10 the approximate phase of the ground current is obtained from three potential transformers, star-connected on the primary side and delta-connected on the secondary side. The neutral of the potential transformers is grounded through a resistor, and the ground relay is inserted in series in the delta. When a ground occurs on a line wire the effect is to upset the balance of the voltages to neutral in the potential transformers. The potential across the relay, normally zero, now rises to about three times the voltage corresponding to the voltage ratio of the potential transformers, and its phase is that of the grounded line wire to ground. This method of ground relay protection can be used on lines which have no grounded neutral.

The connections for the same relay when used for parallel lines, cross-connected, are shown in Fig. 11. Two separate relays are used instead of one three-contact differential relay because of the greater time selectivity which occurs on account of the greater arc of movement of the swinging contact arm of the relay. There are instances where no live line is available for energizing the potential transformer. With modern multiple transmission-line installations, using duplicate buses, it is difficult to obtain satisfactory potential connections without throw-over switches. In this case the switches would be on the high-potential side, and thus would necessarily be cumbersome and expensive.

An electrostatic means of obtaining proper phase potential for ground relays is shown in Fig. 12. The connections are similar to those of an electrostatic voltmeter. A ground on a phase wire destroys the attraction on that wire in the ground detector and permits the other two phases to pull the central disk over, causing it to close contacts opposite to the grounded phase. The contacts thus closed permit direct current to flow through potential selecting relays which impress the proper potential upon the ground relays.

French Engineering Society Opposes Legal Control of the Profession

A SPECIAL meeting of the Société des Ingénieurs Civils de France was held recently in Paris to express the views of the society upon a proposed law making it a legal offense for any one to assume the title of professional engineer except on compliance with regulations of the Council of State passed on the advice of properly constituted professional groups. The report of the committee of the society which had considered the project was adopted by a large majority. It disapproved the proposed law, as well as a suggested amendment that membership in the society should be held equivalent to a diploma and confer the right to the title of engineer. The committee came, instead, to the following conclusions, which are condensed from the report in *Le Génié Civil:*

1. That "engineer" or "civil engineer" is not a title, but the simple indication of a profession to which any person having sufficient technical knowledge is able to belong, his particular branch being properly indicated by the word "construction," "mechanician," "electrician," etc., following the word "engineer."
2. That a properly qualified person not a technical-school graduate should not be hampered by law in following his chosen work.
3. That engineers with diplomas are able easily to defend themselves against usurpation of the titles conferred by their colleges.
4. That a restrictive law would tend to prevent practical men from attaining posts to which entitled.
5. That it would be difficult for the society to accord to some of its members a special dignity of which many eminent engineers would be deprived.
6. That if, notwithstanding the foregoing considerations, it should be thought useful to protect titles conferred by colleges, the committee was not opposed to an addition to the penal code covering this matter.

Pulp and Paper Industry of Canada Highly Electrified

THE application of electricity in the pulp and paper manufacturing industry of Canada is very clearly brought out in the interpretation of a survey recently completed by the *Electrical News*, Toronto. In any industry the relative necessity of obtaining peak and adequate power may be gaged by the amount required per dollar of product. With the possible exception of certain electrochemical and metallurgical processes, the requirements for pulp and paper are among the highest. The importance of cheap power may be judged from the fact that it takes practically 100 hp. to make a ton of paper per day. Average figures in connection with a large Canadian mill show that mechanical pulp requires 73 hp. per ton of daily output, of which 67 hp. is for grinding alone; sulphate pulp requires 8.7 hp. per ton of daily output, and in other large mills as high as 20 hp. to 30 hp. is needed, while the production of newsprint from pulp consumed 12 hp. for the same unit output. Continued operation of mills in this industry, usually twenty-four hours per day, permits a very advantageous use of the necessary power.

The water-power installation for the operation of pulp and paper mills in Canada aggregates 476,503 hp., while the additional hydro-electric energy purchased for this industry is 160,577 hp., giving a total of 637,080 hp. The use of steam as a source of power in this industry is very limited, being in 1920 reported as 62,400 hp. Electric drive is an important consideration. Of the total water-power installation for the various mills, 178,911 hp. is converted into electrical energy before it is used to operate the pulp and paper machinery.

A rapid inspection of the data in the various tables presented shows that the Province of Quebec is slightly ahead of Ontario in the pulp and paper industry. British Columbia ranks next, followed by New Brunswick and Nova Scotia, while this industry has yet to be introduced into the prairie provinces. Quebec has fifty-four mills, requiring a total of 312,867 hp. either installed or purchased. Ontario has forty-one mills, while the installed or purchased power aggregates 242,746 hp. British Columbia has only five mills operated by water power, but they are all of fair size and require a total installation of 48,000 hp. New Brunswick has three mills operated by water power, with a total installation of 14,668 hp., and Nova Scotia reports ten mills operated by water power, with a total of 17,999 hp.

The Soviet Plan to Electrify Russia

Twenty Regional Steam Plants and Ten Hydro-Electric Plants Form the Basis of Electrification—These Plants Require American Capital to Bring Them to Fruition

By DR. CHARLES P. STEINMETZ

IN THE early part of 1920 the Council of People's Economy was instructed by the legislative branch of the Russian government, the All-Russian Executive Committee, to work out a plan of electrification. For this purpose a special committee was created, the "State Committee of Electrification of Russia," with Prof. G. Krizizhanovsky as chairman.

The following instructions given by the central executive committee are of interest in showing an understanding of the economic importance of electrification which is usually not found among statesmen:

"It is recognized that electrification is of prime importance in the development of the natural resources. The concentration of the generation of power in large plants located at the sources of energy makes it possible to transmit and distribute in the most efficient way over the whole country by means of a network of electric lines for industrial, transportation and other uses. It will be especially useful in supplying light and cheap power to the farmers for the various needs of everyday life and so bringing to the rural population the superior advantages of urban districts. It will also improve the facilities existing in the country for other home industries besides agriculture."

More than 180 engineers participated in working out the electrification plan, and the report of the committee was issued recently in the form of a book of 655 pages. This report says:

"The purpose of every economic activity is the obtaining of maximum results with the least effort, in other words, the obtaining of maximum efficiency. There are three ways in which the efficiency may be increased: (1) By doing, through increase of effort, more work in a unit of time; (2) by mechanization, that is, by substituting mechanical power for the muscular strength of men and animals; (3) by rationalization of the work, that is, by proper organization and management and following a well-laid-out plan of production. It can be easily shown that electrification works in all three ways."

The report gives a review of the status of the Russian industries, and the electrical industry in particular, up to the war, and a statement of the effect of the war as far as it is pertinent. It says that a total of 3,000,000 hp. in prime movers was installed in Russia in 1916. Of this 1,800,000 hp. to 2,000,000 hp. was used for driving electric machinery. The aggregate capacity of public electric plants amounted to 450,000 hp. to 500,000 hp.; that of private electric plants to 1,350,000 hp. to 1,500,000 hp.

It is interesting to note that Russia had a considerable electrical industry before the war, so that in 1913 more than half the electrical machinery used in Russia was built in that country. These electrical industries were, however, largely owned and operated by foreigners, and in 1920 the output of the electric factories in Russia was very low. Despite this their equipment, including tools, was, it is said, perfectly intact and ready for the resumption of large-scale operations.

Of the importations, 86.6 per cent came from Germany, 6 per cent from England and 1.8 per cent from the United States. This figure does not fairly represent America's participation in the electrical industry of Russia. While little was imported into Russia from America, a considerable amount of American electrical apparatus was built by the large branch factories operated in Russia by America's great electrical corporations. This is shown by the 311,540 kw. in generators and motors and 96,313 kw. in transformers, out of a total value of seven million dollars, manufactured in Russia in 1913.

Basic Problem of Russian Electrification

The basic problem considered in planning the electrification of Russia was to utilize in a most complete and perfect way the available resources of production and of labor.

In order to work up a rational plan of the country's economic life, the country was subdivided in economic self-contained units—regions—and the plan for electrification of each region was prepared with the assistance of local organizations familiar with the local conditions. Eight such districts are considered, as shown on the accompanying map.

The present transportation crisis in Russia is well known and should be only briefly mentioned here, before taking up for consideration how much electrification can improve it and thus pave the way to wide co-operation of the various economic centers of the country.

Russia possesses several widely used river systems which do not require much capital to make them real factors in the cheap transportation of goods from the place of their production to the centers of consumption. However, some of the most important industrial centers (as, for instance, Moscow) are situated on water divides, just as some of the most important coal and metal mines are situated in mountainous regions remote from large rivers.

These centers quite naturally became surrounded by railroads, but the latter were always laid as independent trunk lines with the purpose to move goods along the shortest route (in mileage), without any regard to the advantage of moving the freight in some other possible way which at times would have been more beneficial to the country at large.

Southern District Has Coal

The southern district has the high-grade coal mines of Russia, in the Donetz region. Electrification of the trunk lines connecting the Donetz coal mines with the Moscow industrial district will decidedly increase their capacity. This is the reason why the electrification of these lines is considered as one of the most urgent needs in order to increase the output of coal in the Donetz district.

There are about seventy power plants in the southern district each of 1,000 hp. or over. Their aggregate capacity is over 200,000 kw. The majority of the coal-mine plants and some of the steel-mill stations are in three industrial centers—Hughsovo-Makeevsky, Almazno-Marievsky and Central. Their total capacity is estimated as 87,200 kw., as shown in Table II. When these plants are interconnected the load factor will be improved, which will permit a higher degree of electrification and will increase the output of the mines as compared with pre-war time.

The stations mentioned are situated in the coking-coal districts. From the broader point of view the coking coal should be preserved and the use of anthracite stimulated. It is advisable, therefore, to install an additional temporary anthracite plant, with an ultimate capacity of 100,000 kw., in the district of Shtervoka. This power plant will serve as a nucleus to a larger regional plant erected for supplying power to the anthracite mines and to fill other needs of that district.

The anthracite resources of the Donetz district are so vast that part of the output can be exported. The port of Mariupol will be used as an export base, and the trunk line connecting this port with the mines will be the first to be electrified. The countries bordering on the Mediterranean are in dire need of mineral fuel, and thus there is a good market for the coal.

TABLE I—SOUTHERN RUSSIAN RESOURCES FOR STEEL MAKING

Map No.	Industrial Centers	Number of Power Plants Coal Mining	Number of Power Plants Steel Mills	Total Capacity in 1,000 Kw. Coal Mining	Total Capacity in 1,000 Kw. Steel Mills	Load Factor, Per Cent Coal Mining	Load Factor, Per Cent Steel Mills
31	Hughsovo-Makeevsky......	10	12	36	15.5	34.7	35.5
32	Almazno-Marievsky.......	6	2	14.5	6.5	30.5	20.5
33	Central..................	4	1	7.2	7.5	26.4	45.8
	Total................	20	15	57.7	29.5		

Care should be taken, however, to increase the efficiency of mining labor. As compared with pre-war times, efficiency is now reduced owing to underfeeding, to the loss of qualified labor and to obsolete equipment or lack of implements. The electrification of the mines will remove the last two causes, and a comprehensive program for supplying food will be introduced.

The general tendency will be to develop the steam plants into very large producers of power, with a range of action up to a radius of 200 km. Simultaneously with the Shtervoka plant, another one will be erected at Lisichansk, with an initial capacity of 80,000 kw. The immediate purpose of this station will be to supply power to the district where the long-flame coals are mined and also to the Bachmut district, rich in salt mines and various mineral resources. The same plant will supply power for the electrified railroads (part of the net of Donetz railroads and the section of the trunk line adjoining Lisichansk). The Shtervoka plant will use anthracite scrap as fuel, whereas the Lisichansk station will work on coals containing much ash and not suited for transportation.

Anticipating the tremendous increase of electric power demand in a district where coking-coal mines are close to high-grade iron ores (Krivoy Rog and Nikopol veins), plans are made for a hydro-electric plant on the River Dnieper, at the city of Alexandrovsk. By concentrating the river fall in one spot a very large amount of power will become available, and at the same time that part of the River Dnieper which is known for its cascades will be made navigable.

The initial capacity of the contemplated hydro-electric plant will be 200,000 kw. The hydraulic part of this installation will have to be built to the full extent at the start, which will require considerable time both for preparing the details of design and for actual erection. The ultimate capacity of the Alexandrovsk hydro-electric plant will reach 820,000 hp.

Due consideration should be given to plant 34, in the Ekaterinslav district, and to the 40,000-kw. plant (No. 4) to be built in Grishino. The Grishino coal district has grown rapidly in late years, and its power plant should soon increase its initial capacity. The eastern anthracite region will be taken care of by a 60,000-kw. plant at Belaia Kalitva (No. 5). The plant (No. 35) now existing at the Grushevka mines will be extended. The power stations in Rostov will be consolidated and enlarged.

CAUCASIAN DISTRICT WILL RECOVER RAPIDLY

Because of its favorable situation and density of population there is every reason to believe that Kuban province will be the first to regain its normal life and to make further progress. The River Belaya may be utilized and may give, as estimated, 70,000 kw.

A small steam plant (No. 6), rated at 20,000 kw., will be installed in the lower Kuban valley. It will be used in the first years of electrification and will serve as the nucleus of the huge steam hydro-electric system planned for this district.

The water-power plant (No. 7) in the upper Kuban valley, rated at 40,000 kw., will take care of that country, rich in copper, zinc, lead, iron, nickel and chromium and also in coal. Among the other riches of this land the mineral water springs which have made it famous for summer resorts should be mentioned.

The water power plant (No. 8) on River Terek, rated at 40,000 kw., is close to the Republic of Georgia. Power will be supplied to Tiflis, the capital of Georgia, and to surrounding district. On that side of the boundary line zinc, lead, copper and iron ores are found in abundance.

The Vladikavkaz Railroad, which already has considerable traffic, will soon reach a stage where its electrification will become profitable. Energy will be derived from the two water-power plants just mentioned.

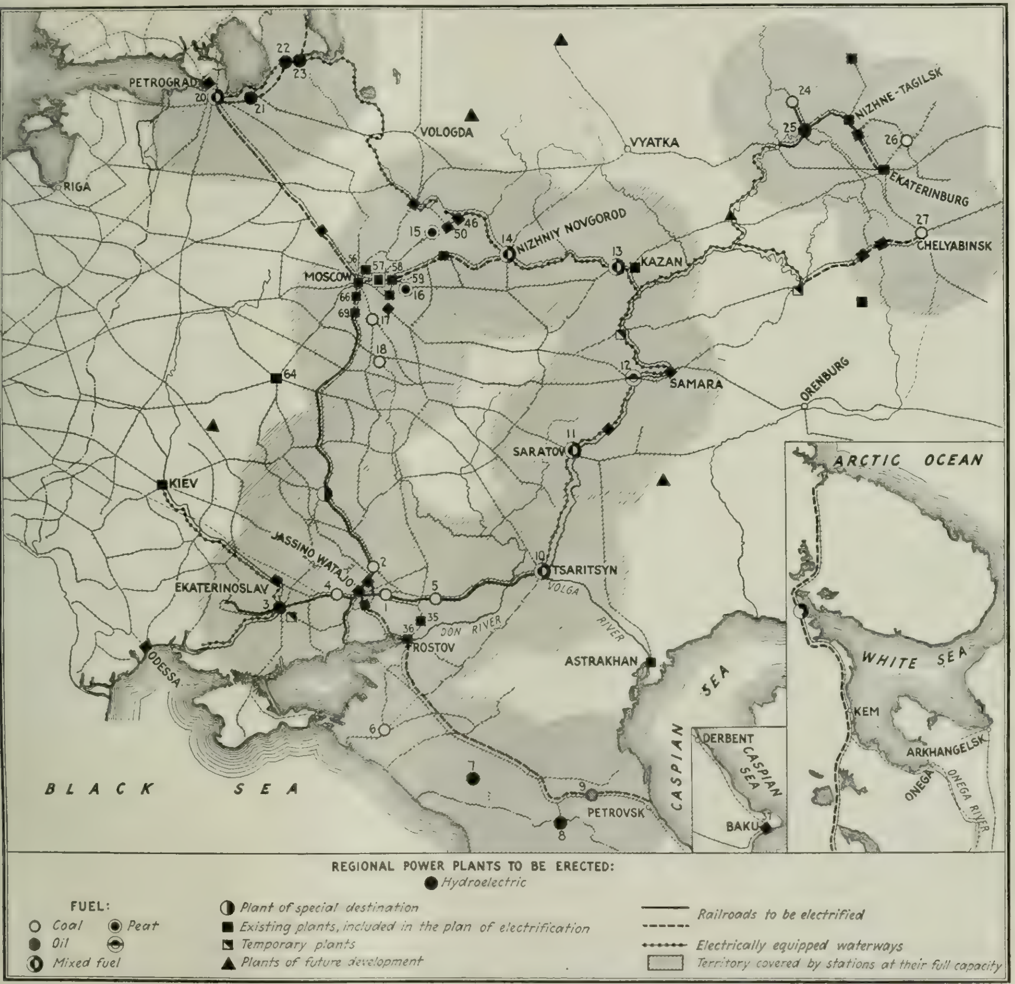
An oil-burning plant of 20,000 kw. (No. 9) will be built in the Grozny oil fields. The need of this plant is most urgent, because electric power will mean a greatly expedited rehabilitation of the oil wells. The oil-burning plant at Grozny and the water-power plant on the River Terek may be operated as one unit, thus making better use of the equipment.

The plants at Baku (No. 37) will be enlarged to 80,000 kw. It should be noted that, owing to the condition of the oil fields, an oil shortage must be expected for several years. The available oil should be used rather for making lubricants and similar products than for fuel. The district where fuel oil has been most extensively used is the Volga valley. Another sort of fuel should be substituted for it.

VOLGA DISTRICT RICH IN TIMBER

The anthracite of the eastern Donetz region will be brought to Tsaritsine on the Volga over an electrified line. On its return trip this railroad will carry timber for the mines. The timber is sent on rafts down the Volga River from northeastern parts of Russia. Thus the freight rates will be low and the cost of anthracite in Tsaritsine will be close to its cost at the mines because of the short haulage.

The great quantity of timber scrap from the sawmills at Tsaritsine can be used as fuel for the regional power plant together with the coal carried thither over the electrified railroad. This fact will greatly reduce the cost of power generation, and in turn this cheap power will further stimulate the growth of industries, and even before the war Tsaritsine was a growing industrial center as well as the most important shipping point on the lower Volga. Beyond Tsaritsine water transportation must be changed to rail. It is therefore of prime importance to (a) provide unloading facilities at this point, (b) equip the sawmills adequately in order to get the received timber into the shape most suitable for railroad transportation, and (c) build docks and warehouses to take care of the proper co-ordination of the seasonal character of river transportation with all-year operation of railroads.



THE PROPOSED SUPERPOWER SYSTEM FOR RUSSIA UTILIZES ALL POSSIBLE FUEL AND WATER POWER RESOURCES

The further development of the Volga system as a means of transportation will have a decided effect on the exploitation of natural resources of the northeast, particularly of the Ural region.

It is planned to build a large steel plant at Ufa, on the River Balaya, using water transportation for bringing coke and anthracite from the Donetz district and, in turn, to ship the Ural iron ores down the river to Tsaritsine, where large steel plants are already in existence. The Tsaritsine power plant will be of about 40,000 kw. capacity and will burn timber scrap for fuel. It is also feasible to utilize the blast-furnace gases of the steel plants.

The next points to the north of Tsaritsine where regional power plants will be erected are Saratov (No. 11) and Kashpur (No. 12). Timber scrap will be used as fuel as will low-grade coal obtained near Kashpur. The plants, which will be about 250 km. apart, will be interconnected and will work as one operating unit.

The main task of these plants will be to supply power for agricultural purposes. Attention should be paid to the salient features of this region which call for its electrification:

1. Periodical droughts, causing crop failures on otherwise fertile lands.

2. The short duration of spring. This necessitates the concentration within a short period of time of the enormous amount of work necessary for the cultivation of fields.

3. At present the peasants split their land in three parts, of which two are cultivated each year, while the third recuperates. In most cases only one kind of crop is planted. It will be necessary to introduce more variety in the plantations and to encourage deeper plowing. Moreover, the animal stock is greatly depleted and mechanical power should be made use of.

This is last year's famine region.

PEAT FUEL IN CENTRAL DISTRICT

An urgent need for electric power exists in Nijny-Novgorod, which always was a very important industrial center and grew even more so during the war, when many factories were moved there from western Russia.

Vast resources of peat fuel are found in the deltas formed by the Rivers Oka and Volga. The marshes near the city of Balahia alone contain more than 30,000 acres of good peat. These marshes are near the Volga, where a regional power plant could be built. The work of developing peat will be combined with the drainage of marshes and making them available for cultivation.

TABLE II FIRST PART OF RUSSIAN PROGRAM OF ELECTRIFICATION

	Districts							
	Northern	Central Industrial	Southern	Volga	Ural	Caucasus	Siberia and Turkestan	Total
Number of steam plants	1	6	4	4	3	1	1	20
Number of hyrdo plants	3	......	1	......	1	3	2	10
Rated capacity of steam plants, kw.	30,000	280,000	280,000	100,000	140,000	20,000	40,000	890,000
Rated capacity of hydro plants, kw.	130,000	......	200,000		25,000	100,000	80,000	535,000
Installed capacity of steam plants, kw.	40,000	360,000	330,000	120,000	180,000	30,000	50,000	1,110,000
Installed capacity of hydro plants, kw.	155,000	....	230,000		30,000	125,000	100,000	640,000

The most urgent problem of the Moscow district is that of bringing in raw materials, especially fuel. To relieve the critical situation it is planned to electrify the coal region around Moscow by means of power transmission from the Kashira* and Epiphan power plants to Moscow and to electrify the trunk line from Moscow to the Donetz district to provide cheap transportation of coal.

There exists at Bogorodsk, near Moscow, a regional peat-power plant feeding Moscow in conjunction with the Moscow plants (Nos. 57 and 58). The industrial power plants of Bogorodsk district are connected to the same system (No. 59). The Bolshovskia plant (No. 56) acts as a nucleus of another regional station in the district of Mitishti. All the above plants are using peat as fuel, burning wood in emergencies. Only the plants of Moscow are built for oil burning.

To stimulate the peat production a 5,000-kw. plant is built on the Shatursky peat marshes. Eventually it will be developed into a regional plant interconnected with the Bogorodsk system.

The existing plants in the Ivanovo-Voznesnsk and Kineshno-Vichugsk districts (Nos. 46 and 50) will be consolidated. The aggregate capacity is about 20,000 kw. In some of these plants steam is also used for manufacturing processes, so that the power generation is inexpensive.

A few similar plants around Podolsk and Serpuhov (Nos. 66 and 69) will be included in the system of the 60,000-kw. Kashira plant. The Epiphan plant, also of 60,000 kw. capacity, will be in the center of a coal-mining district where iron ore is also found in considerable quantities.

The coal mines around Moscow do not produce coking coals, and these will be brought from Donetz. The return cars will carry the ore to the south, supplementing the output of the Krivoy Rog iron mines. The existing steam plants around Briansk (No. 64) will be consolidated. A 40,000-kw. station will be built at Belgorod (No. 19) to supply power for the adjoining section of the electrified trunk line.

NORTHERN DISTRICT TO BE FIRST TREATED

In the northern district of Russia the power supply of Petrograd will first be taken care of in order to revive the industrial life of this section and of the port of Petrograd. The largest items of the port's business in former days were the exportation of timber, which in 1913 came to 104,000,000 poods, or 1,872,000 short tons, and the importation of coal, which in the same year totaled 191,000,000 poods, or 3,430,000 short tons. The imported coal was used for the industrial and power plants of Petrograd.

The lumber is brought to Petrograd over the Rivers Svir and Volhov, which abound in cataracts. The building of water-power plants on these rivers will at the same time improve the navigation. Hydro-electric plants on the Svir and Volhov will first be built (Nos. 21, 22, 23).† The Volhov plant (initial capacity 30,000 kw.) will incidentally connect Petrograd with navigable rivers 2,000 km. in length. The development on the Svir will radically improve the capacity of the existing Mariensky waterway system. The rating of the Svir plant will be 100,000 kw.

The seven plants in Petrograd to be consolidated will have a combined capacity of 112,000 kw. (Altogether there were in that city more than 200 plants, of which forty-four were of 500 kw. or more.) The construction of a regional power plant in the Petrograd country was started before the war (No. 20). It will be completed and the plant capacity brought to 30,000 kw.

The Petrograd steam plants will be interconnected with the water-power plants. The steam plants will use peat and timber scrap as fuel. The total fuel consumption will not be great, because the basic load will be carried by the hydro-electric stations.

The installations on the River Svir will supply power not only to Petrograd but also for the district along the southern part of the Murmansk Railroad. The country traversed by this line is noted for its abundant water systems, which are thus tapped by the railroad, and also for its riches in timber and minerals. Plant 23 on the Svir will furnish power to the canal zone of the Maricnsky system. The latter will be reconditioned to take care of bulk traffic from Volga and Kama to Petrograd.

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*The Kashira plant was opened a few weeks ago, supplying power to Moscow over a 110,000-volt transmission line.

†The Volhov plant is now under construction, the electrical and turbine equipment having been ordered in Sweden.

ELECTRIFICATION IN URAL DISTRICT

The Ural mountain ridges, separating Europe from Asia and the adjoining country, were quite recently connected with European Russia only by the River Kama and by two narrow-gage railroad lines. The latter were used mainly for the Siberian traffic. The construction of the Volga-Bogolminskaia and of the Kazan-Ekaterinenburg Railroad, with bridges at Simbirsk and at Sviajsk, makes the situation better, but there still is an imperative need of improvement of navigation on the River Kama (up to the city of Perm) and the River Belaia (up to the city of Ufa). At these points the waterways are tapped by the trans-Ural railways, the capacity of which will be raised by electrification.

In the first place the line from Perm to Nijnytagil and the branch to the Lunievskie coal mines should be electrified. The power will be supplied from the Kizel plant, now under construction. This plant, built for coal-mine use, will be converted into a regional plant of 40,000 kw. (No. 24). A 25,000-kw. hydro-electric plant will be built on the river Chusovaya (No. 25).

The plants just mentioned will be interconnected and will together cover a territory containing the most important Ural coal mines and steel plants.

The Ural district has no coking coals, and their place is taken by charcoal, the available supply of which is limited by reforestation restrictions. For this reason the use of charcoal should be restricted to purely metallurgical processes, whereas for other purposes mineral coal should be used as fuel.

A 40,000-kw. plant will be erected at the Egorshinsky anthracite mines. Another 60,000-kw. plant will be built at Cheliabinsk, near the rich brown coal mines (Nos. 26 and 27).

WEST SIBERIA AND TURKESTAN REQUIRE CAPITAL

The Ural is so rich in high-grade iron ore that it is very essential to connect the district with coal-mine regions and to develop blast-furnace operations to a higher degree.

The connection of the southern Ural region with the Donetz district has been dealt with above. Another plan is to connect the Ural region with the Kuznetsky coal district in western Siberia. The enormous riches of the latter country in coal of the highest grade and its general natural wealth require systematic development.

The northern part of Turkestan, adjoining Siberia, presents similar conditions. A 40,000-kw. hydro-electric station will be built shortly in the Fergan district.

Table II gives an approximate idea of the first part of the electrification of Russia, comprising a total of twenty regional steam plants and ten regional hydraulic plants, with a total capacity of 1,750,000 kw. The estimated cost of this part of the program is $425,000,000 for electrical plants and $145,000,000 for electrification of railways, a total of $570,000,000. Whether it will be possible to carry out this program in the estimated time of ten years will depend on the assistance which can be enlisted from America.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Brightness Units and Their Measurements

To the Editors of the Electrical World:

Within the last year there has been an increasing interest in the practical application of brightness tests in the selection of lighting units for office and school illumination. In the past lighting units have been selected almost entirely upon their relative merits of efficiency, appearance and ease of maintenance. Recently, however, it has been observed that the brightness of the lighting unit as related to glare has been of first importance. Secondary to these factors are efficiency, appearance, ease of maintenance, distribution and the psychological factor, the appearance of the lighted room.

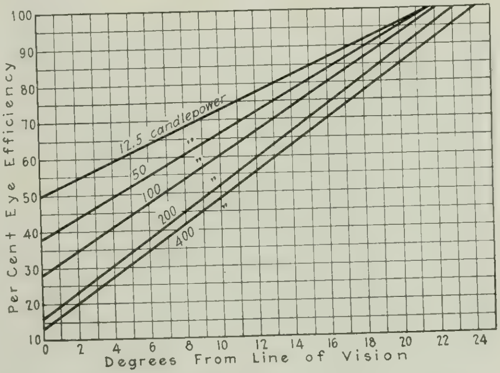

FIG. 1—RELATION BETWEEN GLARE AND VISUAL ANGLE

Brightness as a function of glare applies only in the visual angle, and its effect is greatest at the highest angle. This relation is most admirably shown in the results of tests by Arthur J. Sweet. A graphical representation of the relation between glare and visual angle is shown in Fig. 1.[*] It is to be noted that the importance of brightness as related to glare applies only to brightness of lighting units between the angles of approximately 66 deg. and 90 deg. from the vertical and that high brightness values at angles near 90 deg. from the vertical have a greater glare effect than brightness at smaller angles. Thus a lighting unit having a brightness of 10,000 millilamberts at an angle of 45 deg. from the vertical would be less dangerous from the glare standpoint than a unit having a brightness of 5,000 millilamberts at 75 deg. from the vertical.

Brightness Units.—The most popular unit of brightness and one which is widely used today is the candlepower per square inch. However, the most practical unit, which is advocated by the Illuminating Engineering Society, is the lambert or millilambert.

Brightness[†] in terms of the luminous intensity *I*

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[*] See report of the committee on nomenclature and standards of the Illuminating Engineering Society.

[†] See "The Influence of Illumination Conditions Upon Eye Strain," an address delivered before the Detroit-Ann Arbor Section of the American Institute of Electrical Engineers by Arthur J. Sweet, April, 1912.

(candlepower) per unit of projected area of the surface (candlepower brightness) corresponds to the defining equation $b_I = dI/dS \cos \theta$, where θ is the angle between the normal to the surface and the line of sight. The unit of brightness so defined is candlepower per square inch.

Brightness in terms of the flux, F, proceeding from a unit area of the surface, on the assumption that the surface is a perfect diffuser—i.e., it obeys the cosine law of emission or reflection (lumen brightness)—corresponds to the defining equation (perfect diffusion assumed) $b_F = dF/dS$. In this system the lambert, L, is the unit of brightness. It is the brightness of a perfectly diffusing surface emitting or reflecting 1 lumen per square centimeter. For most purposes the millilambert, 0.001 lambert, is the preferable practical unit.

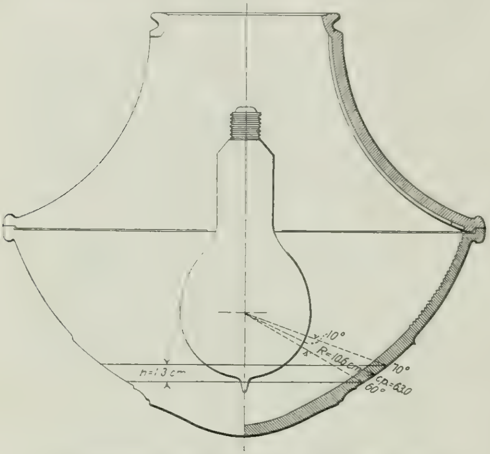

FIG. 2—SECTIONAL DRAWING OF LIGHTING UNIT AIDS IN COMPUTING AVERAGE BRIGHTNESS

When deriving units of flux (lumen) and illumination (foot-candles) we are accustomed to thinking of a point source. We immediately get into trouble, however, with this assumption when thinking of brightness (candlepower per square inch or millilamberts), because a point source would have infinite brightness inasmuch as the expressions $dS \cos \theta$ and dS in the equations become zero. Let us, therefore, consider a uniform spherical source of finite size and use distances so far away from this spherical source that the source is essentially a point.

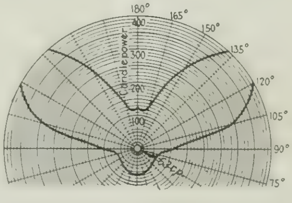

FIG. 3—LIGHT DISTRIBUTION OF GLOBE SHOWN IN FIG. 2

Consider a spherical source of unit radius (1 cm.) emitting unit candlepower uniformly in all directions. The total output from the source will be 4π lumens. The superficial area of the source is 4π sq.cm., and, hence the output is equal to 1 lumen per square centimeter and by definition has a brightness of 1 lambert. At any appreciable distance from the source the projected area of the source viewed from this distance is equal to π, and hence the apparent candlepower per unit of projected area is $1/\pi$ candlepower per square centimeter. Expressed in terms of candlepower per square inch, the brightness would be $1/\pi \times 6.45 = 2.054$ candles per square inch.

In like manner the following equivalents may be obtained:

1 candle per square inch is equivalent to 487 millilamberts.

1 lumen, emitted, per square foot is equivalent to 1.076 millilamberts.

1 lambert = 0.3183 candle per square centimeter and is equivalent to 2.054 candles per square inch.

Practical Measurement of Brightness.—It is very desirable when selecting lighting equipment and paints for interior decoration to be able to measure their brightness. This is most readily done by using a brightness illuminometer. The instrument can be aimed at the surface whose brightness is to be measured and readings made on the direct-reading foot-candle scale. Since a foot-candle is equivalent to 1 lumen per square foot and a lambert is equivalent to 1 lumen per square centimeter, the reading on the foot-candle scale is readily converted into millilamberts by multiplying by the conversion factor 1.076.

Computed Brightness.—The average brightness in the various 10-deg. zones for a lighting unit can be computed to a close degree of approximation by using the photometric distribution curve and a sectional drawing of the lighting unit. For example, Fig. 2 shows a section of an inclosing globe and Fig. 3 shows a photometric curve of this globe. It is desired to compute the average brightness of the zone contained between the angles of 60 deg. and 70 deg.

The candlepower at the mid-zone position (65 deg.) is taken from the photometric curve as 63.0 cp. The lumens contained in the zone 60 deg.-70 deg. are found by multiplying the mid-zone candlepower by 0.9920, the solid angle content of the zone 60 deg.-70 deg.

$$\text{Lumens 60 deg.-70 deg.} = 63.0 \times 0.9920 = 62.5$$

The area of the surface of the zone 60 deg.-70 deg. is found from the sectional drawing by applying the formula $A = 2\pi rh$, where r is the distance from the light center to the outer surface of the globe at the 65-deg. angle and h is the height of the zone. Both r and h should be measured in antimeters.

$$A = 2\pi\ 10.6 \times 1.3 = 86.5 \text{ sq.cm.}$$

From the definition of the millilambert, the average brightness of the 60-70-deg. zone is then $62.5 \div 86.5 \times 1{,}000 = 723$ millilamberts, or $723 \div 487 = 1.5$ candles per square inch.

DAVIS H. TUCK,
Electrical Engineer.

Holophane Glass Company,
New York.

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As Told in the Bloomington "Pantagraph"

To the Editors of the Electrical World:

The following is quoted from the Bloomington *Pantagraph*:

"During the summer of 1881 I attended some bicycle races at the old fair grounds at Bloomington on July 2, and Bloomington was to celebrate its fiftieth anniversay with a big celebration and fireworks on the Fourth of July of that year.

"The feature that attracted the most attention was four little electric lights on the dome of the court house. The square was roped off, and we stood and gazed at those little bulbs and wondered if they would ever be of any commercial value."

CHARLES MCMURPHY,
City Engineer.

Farmer City, Ill.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Steel Towers Erected by Unit Method

Eliminates Straining and Bending of Members When Structures Are Up-ended Complete—Construction Details Outlined

A SYSTEM of building up steel transmission towers in the vertical position, known as the unit method, has been evolved by the Southern Power Company of Charlotte, N. C. This system does away with many of the disadvantages of the usual method where the tower is assembled in the horizontal position and then up-ended. In this latter method the anchors were set in the ground by means of steel or wooden templets. The holes were then back-filled and the anchors were tamped securely into place. The tower was assembled on the ground in a horizontal position, alongside the anchors, and was then up-ended into position by means of a gin pole and suitable rigging.

This method of erecting towers made it necessary to have two teams of horses, a wagon for hauling, a heavy gin pole, five sets of blocks, a suitable timber or "bucking board" against which to up-end the tower, and timbers for temporary struts around the base of the tower. Complete private rights-of-way for transmission lines are so expensive that except for congested districts they are seldom acquired. The towers are therefore usually located on private property, mostly farms, and suitable easements are obtained from the property owners permitting the location of each structure. If there were any crops in the fields when the towers were erected, there was considerable damage done by the assembling of the tower and the teams and rigging used in erection. This involved expense of settling claims and often aroused ill will.

This company, therefore, evolved the unit method, in which many of the difficulties involved in the former method were overcome. The towers were designed and fabricated by the Riter-Conley Company to suit this system of erection. The splices and connections were located and simplified so that they were easy to connect while working up on the tower.

Each construction gang for constructing these towers consisted of a foreman, two erection crews of eight men each, one anchor-setting crew of three men, and sufficient men to dig and back-fill the holes for the anchors, the number depending upon the character of the soil encountered.

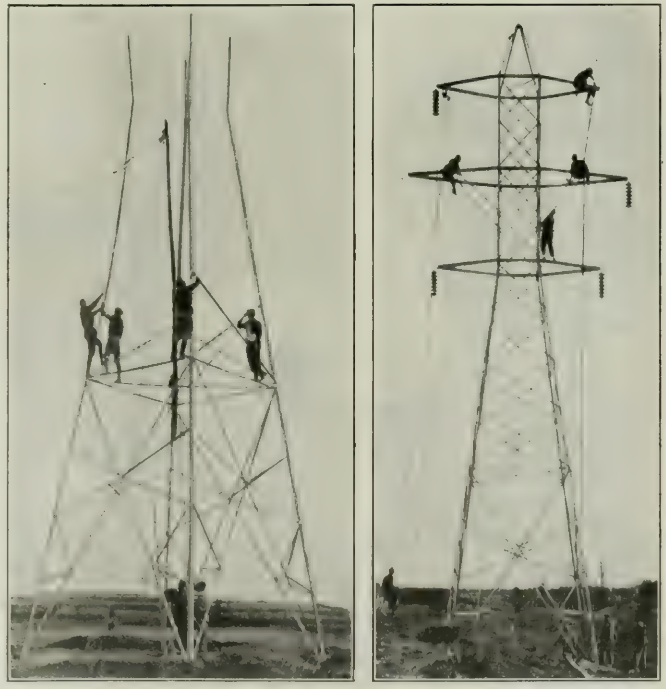

FIG. 1—ERECTING STEEL TRANSMISSION TOWERS BY UNIT METHOD ELIMINATES DAMAGE TO PRIVATE PROPERTY

One skilled and two unskilled laborers placed the anchors. Templets were furnished, made up mostly of tower members, but it was found that anchors could be placed without the use of templets, and they were therefore seldom used. The surveying party placed one stake at the center location for each tower and one at each side in the direction of the line, as shown in Fig. 2A. By means of two measurements made from these stakes the anchor stubs were put in position. A tape line was suspended as a plumb line from the top corner of the stub angle down to a definite point on the grillage to obtain the proper batter for the stub angle. When the anchor was thus placed in position both for site and for batter, it was held in place by thrusting some light tower members into the earth on each side of the stub angle, as shown in Fig. 2B. A short piece of tower diagonal was bolted to the stub angle to assist in placing the anchors. This increased the length of the stub angle a sufficient height above ground where it could be easily handled, and the extended stub was also used for leveling purposes. One of the main post angles of the tower was used as a leveling board and was laid across the tops of two extended stub angles. A spirit level placed on top of the post angle indicated when the anchors were at the same elevation. This operation was repeated until all four anchors were at the same elevation.

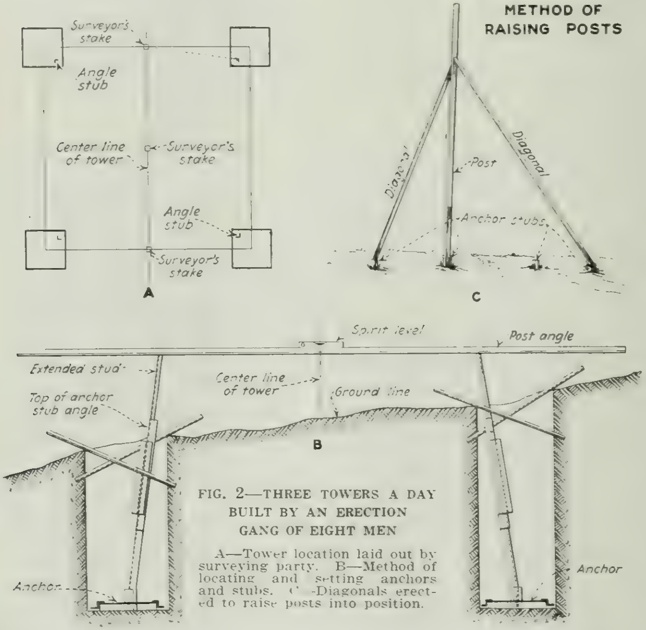

FIG. 2—THREE TOWERS A DAY BUILT BY AN ERECTION GANG OF EIGHT MEN

A—Tower location laid out by surveying party. B—Method of locating and setting anchors and stubs. C—Diagonals erected to raise posts into position.

Each erection crew had four ground men and four men who could work above ground. The former now proceeded to erect the tower. Two long diagonals were connected to one of the bottom section post angles, and by means of these diagonals the post was raised and held in place, as shown in Fig. 2C. All four posts with their diagonals were similarly erected. The secondary bracing of this bottom section was then placed, followed by the horizontal struts and horizontal diagonal bracing.

The erection of all intermediate diagonals and bracing was facilitated by having holes for ladder bolts in all four post angles of the tower. Temporary ladder bolts were used on all four posts during erection, but when completed, only one post carried a ladder. When the bottom section of the tower was completely erected, the anchors were automatically adjusted to their correct positions, and the holes were then back-filled and tamped by the digging crew. The erection crew was now augmented to eight men, one man worked on each corner of the tower, and four remained on the ground.

A light pole was lashed to one of the corner posts of the tower, as shown in Fig. 1, left. One ground man served as a "dead man" for a guy line attached to the top of the pole. Another served on a "tag line" attached to the piece to be raised. The two remaining ground men attached and hoisted the various members by means of a single block and line connected to the top of the pole. All four second-story posts were raised into position without changing the location of the pole.

The diagonal web members were built into place piece by piece as the men ascended the tower. The top post sections were light enough to be raised into place without the aid of the pole, which was never moved from its initial position.

The four leg angles composing the ground wire mast and the ground wire clamp were bolted to the cap plate on the ground. This section was then raised into position complete. The cross-arms were erected and the same gang of men hung the insulator strings. This is shown on the right of Fig. 1.

When the tower was completely assembled and the insulators hung, the four men who worked up on the tower started at the top and worked down, tightening every bolt. The four ground men proceeded to erect the first-story section of the next tower, as noted above. After some experience one erection crew of eight men has erected as many as three towers per day.

Exceedingly accurate shop work is an absolute requisite for this method of erection, because it would not be advantageous to have the men stop in their work of erection to ream and pin holes while working above the ground.

There are many advantages in this erection plan. There is complete elimination of the straining and bending of members which so often happens when the towers are upended complete. In this unit method of erection every member of the tower is inserted into its correct position and is not subjected to any extra erection strains.

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Operating Experiences with Boiler-Room Equipment

SEVERAL engineers have expressed the desire for information regarding the operating experience of the boiler-room equipment at the Colfax station of the Duquesne Light Company in addition to that given with the performance figures in the *Electrical World* for Aug. 12, page 329. Some of the more important features that have been giving trouble and have been remedied are mentioned in the following paragraphs:

The brick lining of the ash hoppers is standing up very well after eighteen months of operation, no repairs having as yet been required. In ash handling two laborers are required, and part time of a dinky locomotive and operator is charged against ash removal, as well as part of that of the locomotive-crane operator.

Slagging on the boiler tubes is slight and has never been sufficient to cause trouble. No serious trouble with piping or valves has been experienced. Evaporators have in general given satisfactory service, although some trouble was experienced due in part to improper design of some features and in part to lack of experience with the particular water being evaporated. The thermal efficiency of the evaporators is practically 100 per cent, and with the modifications now being made it is thought they will give no trouble. No condenser leakage has as yet been detected.

It has been found that dissolved oxygen in the feed water tends to pit the boiler drums, this pitting taking place during banked periods, there being virtually none when the boiler is active. To decrease the quantity of dissolved oxygen all parts of the feed cycle are effectually sealed against air, the feed temperatures being maintained at 205 deg. or higher to drive out the entrained air. Further experiments are being carried on to determine whether a lower feed temperature with higher vacuum in the barometric condenser will improve this condition.

Each boiler is equipped with eighteen soot-blower elements, nine on each side. Trouble was experienced from warping of the elements apparently due to insufficient drainage. The drip system was altered so as to carry this water off more positively, and this sort of trouble was eliminated. Future installations will be modified so that no valves will be required on the individual soot blower leads, thus permitting easy draining of accumulated water and requiring but a single master valve on each side of the boiler. Soot blowers are operated three times a day with the dampers opened wide.

The superheaters are placed over the tube banks between the first and second pass. Considerable trouble has been experienced because of insufficient superheat. The normal superheat should be 180 deg. with boilers operating at 200 per cent of rating, but 145 deg. has seldom been exceeded.

Boilers to be installed this summer will have the superheaters above the sixth row of tubes, and with this arrangement no trouble from deficient superheat is anticipated.

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Power Engineer.
Dwight P. Robinson & Company, Inc.,
New York, N. Y.

Experience with Radio Leads to Extended Use

IN THE new developments of the Big Creek hydro-electric project of the Southern California Edison Company the problem of communication during the winter months at altitudes of 4,000 ft. to 10,000 ft. over a large area presented itself and has been met in a satisfactory manner thus far by means of three radio stations. These stations have been so successful that it is planned to extend the service by installing additional stations as new camps are opened.

Because of the snow and sleet storms which are prevalent it was thought that wire communication would not give reliable service unless an exceptionally strong pole line were constructed and the right-of-way cleared of trees for sufficient width to prevent falling timber from striking the line. As the country traversed is all within the National Forest and heavily timbered, this would mean a considerable expense. Therefore radio communication in place of wire communication was decided upon. There are now three combined radio-telegraph and radio-telephone stations in operation. The headquarters station, at Cascada, Cal., at an elevation of 5,000 ft., is in a canyon approximately 2,000 ft. deep with abrupt walls on three sides. The second station is at 7,000 ft. elevation and about 6 miles, in an air line, northeast of Cascada, at the head of Huntington Lake. The third is about 7 miles, in an air line, northeast of the second station, but is only 300 ft. higher. There is a mountain pass 2,300 ft. high between them.

The stations began operations in December, 1920, and during the month of January, 1921, 25,000 words were handled. Business steadily increased to such an extent that during the month of August, 1921, 125,000 words were handled. With a small diminution during the winter months business has continued approximately constant to August, 1922. In addition to regular messages, a news service was instituted which was greatly appreciated by the men in isolated camps. A telegraph operator in the main office sends baseball scores and interesting headlines from the morning paper to Cascada over a wire-telegraph circuit. This news is posted on a bulletin board at Cascada and relayed by radio so that the men at radio stations Nos. 2 and 3 get the news days ahead of the arrival of the dogsleds which carry the papers and mail during the winter.

Owing to the location of the stations, the topography of the country and the fact that little was known regarding communication in mountainous territory, it was necessary to do considerable experimenting before satisfactory results were obtained. Portable radio-telephone sets which had given satisfactory service in the vicinity of Los Angeles were first

LEFT—RADIO STATION NO. 2 IS 7,000 FT. ABOVE SEA LEVEL AND SEPARATED FROM NO. 3 BY A MOUNTAIN PASS. RIGHT—ROUGH COUNTRY AND SNOWSTORMS HAVE PRACTICALLY PRECLUDED WIRE COMMUNICATION taken into this territory. Tests were made which showed that to communicate a certain distance it was necessary to use about twenty-five times more power than was needed near Los Angeles. The transmitters now installed use vacuum tubes of the three-electrode type made by the DeForest Company and called "oscillion tubes." One tube is used in a set.

Manual control is used to transfer the antenna from the transmitting to the receiving equipment; that is, a double-throw switch must be placed in one position to talk or telegraph and in the other to hear incoming signals or speech. This, together with the fact that the radio is, of necessity, a four-wire circuit, two for outgoing and two for incoming, precludes its connection to the ordinary two-wire telephone circuit or instrument, except by the use of special equipment, the cost of which does not seem warranted.

RADIO TELEGRAPH MORE SATISFACTORY THAN TELEPHONE

Use of the radio telephone, therefore, requires that persons wishing to talk shall go to the radio station. This takes up the operator's and party's time to such an extent that the telegraph is found far more satisfactory and is used almost exclusively. The continuous wave is used in preference to the buzzer-modulated wave.

At Cascada the transmitter obtains its filament current from the 110-volt alternating-current lighting supply and plate current from a 1,500-volt direct-current generator belt driven by a 2-hp., three-phase induction motor. As this station receives power over a few hundred feet of 6,600-volt line from Big Creek No. 1 hydro-electric plant, no emergency source of power has been provided. The power plants at radio stations 2 and 3 consist of a 220-volt, three-phase motor, coupled to a 32-volt direct-current generator and belted to a 1,500-volt direct-current generator from the coupling. Under normal operation the 32-volt direct-current generator produces current for the filament of the vacuum tube and the 1,500-volt generator supplies the plate. If the three-phase motor is off, owing to a failure of the 30,000-volt transmission line, the 32-volt generator then operates as a motor from storage batteries, thus driving the 1,500-volt generator. The filaments are also supplied from the batteries in this case.

Each antenna consists of five No. 8 B. & S. gage copper wires spaced 4 ft. apart. At Cascada is an inverted L-type antenna, 140 ft. high at the free end, 90 ft. at the station end and 120 ft. long. At radio station No. 2 is a T-type antenna 140 ft. high and 175 ft. long. At radio station No. 3 is a T-type antenna 90 ft. high and 180 ft. long. The current in each of these antennas is about 2.4 amp. at 540 m., which is the normal operating wave length. These stations have been heard clearly at night in San Francisco, Santa Barbara and Los Angeles.

Each receiving set consists of an audion-detector panel, honeycomb-coil tuner and a two-stage amplifier, but the second step of amplification is seldom used for inter-camp work. The wave length of the receiving tuner is from 180 m. to 25,000 m.

Some very good results on long-distance reception have been obtained. Following are the important stations that are heard consistently, together with the international call letters by which they are known: All stations on the west coast of North America as well as the United States Navy station NPM at Pearl Harbor, Hawaiian Islands, and NPM at Cavite, Philippine Islands; also the Mexican government station XDA in Mexico City. On the East coast all of the long-wave stations as well as NAW in Cuba and NBA in the Canal Zone are heard. The only European stations that the operators have made note of hearing are POZ at Nauen, Germany; LCM in Norway, and LAF, the new Lafayette station near Bordeaux, France.

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Executive Engineer.
Southern California Edison Company,
Los Angeles, Cal.

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Meter Tests to Be Provided by Illinois Commission

IN AN amendment to the rule covering meter-test requirements the Illinois Commerce Commission proposes to test service meters for public utilities having not more than 250. Fees are to be charged and requirements are made in addition by which the utilities will pay for time and material used for repairs and furnish transportation if the meters to be tested are in rural districts. The scale of fees is as shown in the accompanying table.

Where instrument transformers are used the rated capacity of the meter is considered to be that of the complete metering installation and is determined by taking into consideration the ratio of the instrument transformers.

It is not intended that this rule shall apply to the testing of meters measuring energy for resale, nor in the case of electric railway or other electric utilities which may sell large amounts of energy through a relatively small number of meters to municipalities, power customers or other public utilities.

(a)	For single-phase watt-hour meters operating on circuits of 650 volts or less and having not to exceed 25 amp. rated capacity	$0.60
(b)	For each additional 50 amp. or fraction thereof	0.10
(c)	For direct-current watt-hour meters operating on circuits of 650 volts or less and having not to exceed 25 amp. rated capacity	0.75
(d)	For each additional 50 amp. or fraction thereof	0.15
(e)	For single-phase meters operating on circuits of more than 650 volts and for polyphase meters, with or without instrument transformers, having not to exceed 25 kva. rated capacity	1.25
(f)	For each additional 25 kva. of rated capacity	0.25
(g)	For each demand meter	0.75
(h)	A minimum charge of $10 will be made for any single series of such tests in each municipality, which shall be considered to include the rural territory adjacent thereto.	

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

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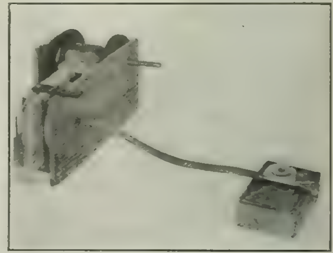
Wire-Measuring Drum

CONVENIENCE in winding coils for time switches and other apparatus used by the Hartford (Conn.) Electric Light Company is served by the home-made idler drum illustrated herewith. Wire is unreeled from the spool shown at the rear of the right-angled standard carrying the spool and drum. The drum is 12 in. in circumference, and its turns are recorded by a revolution counter which thus gives a direct reading of the number of feet of wire wound from the coil at the rear upon a second coil at the left, not shown.



TACHOMETER RECORDS FEET OF WIRE WOUND ON COIL

E. Y. RICE,
Chief of Laboratory Staff.
Hartford Electric Light Company,
Hartford, Conn.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

More Business Through Better Lighting*

Improvements in Customers' Lighting Installations Offer Many Opportunities for Increasing Revenue at Small Cost

By G. Bertram Regar
Illuminating Engineer Philadelphia Electric Company

THE possibilities of the lighting business, in its superior usefulness to the customer, as a load builder to the central station and from a commercial aspect to the entire electrical industry are greater than those of any other form of electrical service.

Today the income from lighting for the central stations of the country in general represents 59 per cent of the total revenue. Furthermore, lighting equipment represents 66 per cent of the jobber's sales and 68 per cent of the dealer's sales. Notwithstanding this, very little real concentration on the part of the industry as a whole to reach the saturation point of this class of business has been made.

Lighting has three basic principles:

First—Utilization. Successful business methods demand that the lighting be good, and good lighting is efficient, because the predominating factors have been treated in a scientific way.

Second—The physiological effect. With the recognized advantages, both from the commercial and the industrial standpoints, of a higher intensity of illumination careful consideration must be given the subject of proper direction, diffusion and color of lighting.

Third—Psychological effect. We have been educated to the comforts and refinements of our present-day lives, and the artistic effect of lighting, therefore, plays a prominent part. It may be either pleasing or distasteful.

It must, however, be borne in mind that the relationship of each of these principles to the others varies according to the class of the installation, that is, whether home, store or factory. Some actual instances of the results of improved lighting are interesting as they demonstrate the possibilities of a "drive" for better illumination.

In the bathroom, kitchen, pantry and laundry the utilitarian consideration is predominant, with a mixture of the physiological element. In the bedrooms and study the necessity for a more artistic effect is felt, while in the dining and living rooms the decorative or psychological effect is first. In the majority of our homes there is the constant aim to add to their attractiveness.

Residence Lighting

The following interesting case presented itself through a request for better lighting:

The residence was of the usual type, situated in the suburbs. The kitchen contained a pendent fixture with a 60-watt lamp, which was replaced with a semi-indirect fixture containing a 100-watt "gas-filled" lamp and objectionable shadows were eliminated. The sun room contained a four-light cluster with 25-watt lamps. This fixture was replaced by a semi-indirect one containing a 150-watt lamp with a silk shade, harmonizing with the draperies and giving a perfectly diffused light over the room, permitting study and reading in any part of it. A portable floor lamp was added for its decorative value, with the result that its attractiveness created a desire to leave a 25-watt lamp burning in it when the room was not in use. The living room contained a semi-indirect and shower fixture with a wattage of 160. This fixture was replaced by one of a semi-indirect type, with a silk shade, containing a 200-watt lamp. A floor, a table and two mantle portables with amber-tinted lamps were added to the room. These are now in constant use, the center fixture being employed only when general lighting is desired. The total kilowatt-hour consumption for the year 1919 prior to the change was 272. After the change, in 1920, it was 326, and in 1921 it was 337, an increase of approximately 23 per cent.

There are thousands of antiquated fixtures in use today and thousands of instances of an absence of convenience outlets, handicapping the use of electric appliances—all due to lack of knowledge or of proper appreciation of their value.

Store Lighting

The value of good illumination is not generally realized, because people feel it unconsciously. They avoid a store that is harshly or inadequately illuminated. In a well-lighted shop they stay longer and shop with more pleasure, owing to the restful feeling of comfort, and they speak well of such a store.

An example of a change in store lighting is interesting as it shows the possibilities of increased revenue. A retail millinery establishment was operating a private plant and using emergency central-station service only for window lighting and store cleaning at night. Cluster and bracket fixtures were in use, and the whole aspect was glaring and unsightly.

The lighting service department of the Philadelphia Electric Company offered to prepare plans for a new installation and the advantages of central-station service were pointed out. The company's proposition was accepted, and the results were so pleasing to the owners that additional work has been done in the nature of showcase lighting and the conversion of steam hydraulic elevator service and a steam carrier system to electric service. The sales arguments of efficient lighting brought to the central-station company an increased income of $2,713 the first year, without additional investment and with little increase in the demand. It also brought a construction job at $5,200 to the contractor.

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*From a paper presented at the Pennsylvania Electric Association convention at Bedford Springs, Pa., Sept. 6 to 9.

It has been only in the last three or four years that lighting has in the minds of factory executives been taken out of the janitor service class and placed with automatic machinery and labor-saving devices, where it belongs. Manufacturers are beginning to realize that it is a substantial aid to production.

An investigation conducted in the General Electric Company's Schenectady shops showed that increasing the illumination from 3.8 foot-candles to 11.4 foot-candles in a section devoted to semi-automatic buffing increased the production 8.5 per cent. The increased cost of lighting amounted to 0.4 per cent of the increased value of production. A steel-machine shop in Chicago by increasing the illumination from 3 foot-candles to 11.7 foot-candles showed an increase in production of 10 per cent with an increase of the lighting cost of 1.2 per cent of the pay roll. Here is a large and profitable field for the sale of better illumination.

An analysis of good lighting shows it to be a great creative force for the entire industry. There is, however, a necessity for, first, generally speaking, a higher plane of ethics in the industry; second, the realization by the public and the industry of the benefits of good illumination, thereby creating a demand for it, and, third, ability on the part of those concerned to furnish the means to this end.

ORGANIZED WORK

Lighting service departments should be organized in every central station, even though they consist of only one man, and their services should be constantly offered to the customers for the purpose of planning new installations and correcting or improving existing ones.

An intensive campaign for better lighting should be inaugurated. It should be done locally by central stations, which should advertise the advantages of good lighting and offer their services in planning lighting. House-wiring and fixture campaigns should be inaugurated, the installations to be made by contractors and perhaps financed by the central stations. In other words, every possible means to create a universal demand for better lighting should be adopted and all concerned should give their active support to that end. Improving a customer's lighting is a real service and offers a fertile field for increased business.

Line Crews Demonstrate Resuscitation

SIX line crews of the Dallas (Tex.) Power & Light Company showed several thousand persons at the company's annual picnic how they do their work. Among the interesting events for the entertainment of the public were a rescue test and an overhead-line construction test.

DEMONSTRATING RESUSCITATION FROM ELECTRIC SHOCK

The realism in the rescue contest was such as to give a thrill even to a crowd that knew it was only a demonstration. Six men acted as if they had been shocked into insensibility at the tops of the poles and in each case a crew made a demonstration of rescue and resuscitation for a prize given by the company. A crew made up of D. E. Therrel, Carl Maringo, Jack Baker, Earl Messerole and Charles Mounier won the contest in the record time of thirty-five seconds. The exhibition showed men working on neighboring poles clambering down, lowering the injured man to the ground, removing his belt and beginning resuscitation.

Another event, a test of speed, displayed the same six crews establishing connections, affixing cross-arms and transformer and lighting a house adjacent to the pole. This contest was won by a crew composed of Estes Wood, J. C. Copeland, N. O. Lang, George Winborn and Charles O'Brien. The time was ten minutes and thirteen seconds, thought to be the best for a serviceable permanent connection of this kind.

CONTEST IN ESTABLISHING CONNECTION

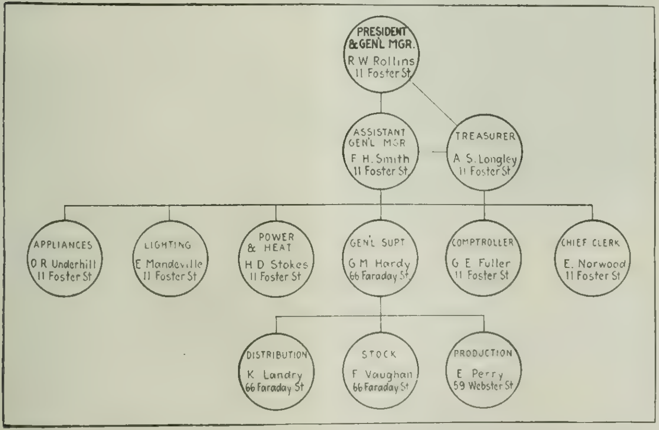
Boston Edison's Activities Filmed for the People

CARRYING forward the good-will and courtesy work which has been emphasized on its system so vigorously during the past few years, the Edison Electric Illuminating Company of Boston has just completed a motion-picture film of its service activities which will be shown during the coming fall and winter to many thousands of residents of its territory with the object of making clearer the meaning of the company's immensely varied activities.

The film was prepared under the immediate direction of Leavitt L. Edgar, assistant general superintendent, and J. J. Caddigan, assistant to the general superintendent, and it shows in animated fashion the fundamentals of mining, transporting, storing and burning coal for electrical generation at the company's main plant in South Boston, the handling of turbo-generating and electrical equipment, work of construction and maintenance forces, activities of engineering and sales employees, trouble-hunting methods, welfare work and many other doings associated with the supply of energy over the 650 square miles served by the system. All those shown in the film are employees, and the use of electricity in the home is liberally featured. It is believed that this motion picture of the company's activities will arouse even greater interest than the lantern-slide talks upon this subject which were given throughout the territory last winter by employees.

Organization Diagrams Aid Visitors

TO AID visitors quickly to locate officials of the company, organization diagrams are displayed by the Worcester (Mass.) Electric Light Company at certain office entrances at various points on the system. One shows the location of the principal officials of the company and the other shows in detail the department heads and departmental subdivisions at the local office. The diagrams are particularly valuable in enabling a stranger to determine at a glance whether the person he should see is at that office or elsewhere.



GENERAL ORGANIZATION DIAGRAM POSTED AT ALL OFFICES

Interesting Local Bankers in Utility Securities

IN CARRYING out its policy of selling securities to the public the Iowa Railway & Light Company of Cedar Rapids, Iowa, has made a special effort to enlist the interest and support of the bankers in its territory. To this end L. F. Wiegand of the company's investment department has prepared a message addressed particularly to banking officials. This message shows the relation of the banker to the pubic utility company and stresses the importance of co-operation between the banks and the utility for the upbuilding of the community. Among other things it says:

"A commercial bank is a real public utility and its fundamental functions are to accumulate and guard the surplus cash of the community through the receipt of deposits and to furnish necessary funds for its upbuilding by way of commercial loans. The greatest measure of a banker's success is the part he plays in developing the community, the magnitude of his deposits and increasing surpluses.

"Every banker is fully aware of the fact that money is leaving his community daily for speculation in wildcat schemes and that it is to his own credit and the advantage of his bank to encourage the investor to invest at home. Statistics show that wherever utility companies have conducted the sale of their securities to customers savings accounts have increased because the people were taught thrift and America's vital need today is thrift.

"Public utilities in growing communities demand an annual supply of new capital for new extensions, additions and improvements. New capital is demanded constant in ever-increasing amounts, because, first, a public utility is a growing business requiring continually additions to its plants and property; second, these expenditures are for permanent improvement and are all spent in the community and for the benefit of that community.

"What better service can the banker render to his community than to encourage the people of that community to invest their money at home in their own public utility instead of pouring hundreds of millions of dollars each year in 'blue sky' schemes in which great losses of both principal and interest result?

"The strength of a bank depends on the financial soundness of its community, and it seems reasonable that the more local investors can be induced to place their savings in the development of essential industries at home the greater will be the financial stability of the community."

What Other Companies Are Doing

Providence, R. I.—To avoid the interruption in employees' service records which arises in case of a temporary lay-off or other authorized unprotracted absence from the organization, the Narragansett Electric Lighting Company has established a new ruling which retains the seniority rights of any employee who is laid off or granted a leave of absence for a period not to exceed three months.

Salem, Mass.—From Jan. 1 to Sept. 15 the Salem Electric Lighting Company connected up 154 old houses previously unwired, compared with 113 for the same period in 1921 and 125 for the corresponding 1920 period. These installations are being made through circularization and letter methods, supplemented by personal solicitation. The householder can obtain wiring on terms as low as $5 down and two years to complete payments.

Dallas, Tex.—*Texas Utility News*, a monthly magazine published by the advertising department of the Texas Power & Light Company at Dallas, with Beeman Fisher of that department as editor, recently devoted one entire issue to the electric range. In the magazine of fifty-six pages there were a hundred or more letters from users of electric ranges in cities and towns served by the company, and not one but praised the electric range for its economy of operation, convenience, cleanliness and efficiency. In publishing the letters photographic reproductions were used in most cases and many photographs of kitchens equipped with electric ranges were shown.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Utilization of Waste Heat.—A group of papers dealing with the application and performance of waste-heat boilers and the utilization of waste heat from blast and open-hearth furnaces and cement kilns.—*Mechanical Engineering*, August, 1922.

Suggestions for the Use of Small Water Powers.—R. BESSELMANN.—The article describes two methods of economical use of small water powers. Both methods represent isolated direct-current plants with a storage battery. In one case the storage battery augments the generator during peak-load periods; in the other case an auxiliary (crude-oil) engine, which drives a second generator, is used together with a battery to cover the highest demand. Wattmeter relays attend automatically to the proper division of the existing load between the main generator, the auxiliary dynamo and the battery.—*Elektrische Kraftbetriebe und Bahnen*, Aug. 10, 1922.

Power Plant of First National Bank of Jersey City.—This article describes a typical small power plant for a modern office building, which, having been completed only a few months ago, affords a good example of a plant of this type. The equipment includes three 3,085-sq. ft. water-tube boilers, hand-fired, operating at 150 lb. pressure, and three direct-current generators (total capacity 500 kw.) directly connected to uniflow steam engines. Auxiliaries are both steam-driven and motor-driven and are automatically controlled.—*Power*, Aug. 29, 1922.

Hazards in Hydro-Electric Plants.—ALEX. E. BAUHAN.—The author describes some of the hydraulic and mechanical hazards present in the operation of a low-head hydro-electric plant and outlines corresponding precautions that the power company can take which should be effective if supplemented by thoughtful conduct on the part of the employee.—*General Electric Review*, September, 1922.

Generation, Control and Switching

Commercial Measurement of Power Factor and Volt-Amperes. — R. C. FRYER.—Several methods for the direct and indirect measurement of power factor and volt-amperes are described. Perhaps the most interesting of these is the Sperti-Blecksmith meter, illustrated in Fig. 1. This meter shows directly kilowatt-hours, kilowatt demand (block interval), volt-ampere demand (block interval), reactive volt-ampere hours, reactive volt-ampere demand (block interval) and average power factor (vectorial) for any given length of time. The accuracy in the measurement of the various factors mentioned is comparable to that of the present standard watt-hour meter. The two right-hand elements shown measure kilowatt-hours while the two left-hand elements measure reactive volt-ampere-hours. The former are connected to a register train which indicates the total kilowatt-hours and are also connected through reducing gears to the movable arm *A* shown in Fig. 2. The two left-hand elements are likewise connected through gears to arm *B*. This arm is caused to move in a constant direction toward the right, the movement being proportional to the reactive volt-ampere-hours. Arm *A* is likewise caused to move toward the left a distance proportional to the kilowatt-hours. These arms are connected through arms *C* and *D* to an indicating stylus *E*. As arms *A* and *B* move, point *E* travels from its zero position a distance proportional to the square root of the sum of the squares of the reactive kilovolt-ampere-hours and the kilowatt-hours respectively. This causes point *E* to travel from its zero position to a point on the kilovolt-ampere-hour scale which is a definite distance from the zero point corresponding to the given kilovolt-ampere value. Point *E* is attached by means of a flexible lead to the circular disk *F*, which is retracted by the light spring *G* and which also carries the indicating pointer *H*. When point *E* moves over the resting plate *J*, the values in kilovolt-ampere-hours may be read directly from the position of the pointer on scale *K*.—*Electric Journal*, July, 1922.

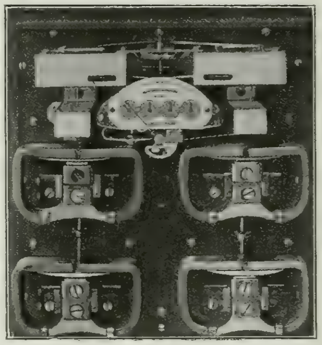


FIG. 1—SPERTI-BLECKSMITH KILOWATT-HOUR AND BLOCK-INTERVAL KVA.-HOUR DEMAND METER

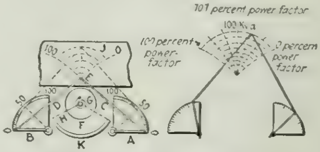


FIG. 2—SCHEMATIC ARRANGEMENT OF INDICATING MECHANISM

Design of a Bifilar Non-Reactive Resistance Coil.—H. NUKIYAMA and Y. SHOJI.—This coil usually gives a condensive reactance at high frequency and the object of the paper is to observe the frequency error at audio-frequency range. The impedance characteristic resembles that of an electric cable, and from this experimental fact a cable theory of a bifilar non-reactive coil is deduced. A practical example of the design of a 100,000-ohm coil, giving a phase angle less than 5 deg. at a frequency of 5,000 cycles, is given.—*Journal of Institute of Electrical Engineers of Japan*, August, 1922.

Transmission, Substations and Distribution

Economical Ways of Transmitting Power Underground.—The importance of keeping a trolley system separate from the power circuit, protection against electric fires and a description of an automatic substation are the features of the report of the committee on underground transmission and distribution presented at the convention of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers at Huntington, W. Va., on Sept. 19. Mine owners have come to realize the importance of keeping the trolley system separate from other power circuits in order that accidents on the haulage road which may tear down the trolley wire shall not interfere with the supply of power for cutting machines, pumps, booster fans and other apparatus. The method of running trolleys and overhanging feeder wires along haulage ways demands careful consideration, and the present practice in this regard is outlined. Figures show that the cost of alternating current is less than that of direct current for operating fans, pumps, coal loaders, etc. A detailed description is given of the self-acting regulatory devices in the automatic mine substation at Van Lear, Ky. Diagrams show connections, and the action of automatic devices is described in detail.—*Coal Age*, Sept. 14 and 21, 1922.

Units, Measurements and Instruments

Acceleration Indicator for Hoists.—G. KEINATH.—This paper describes a transportable apparatus for the accurate measurement and registration of the acceleration of mine hoists and elevators. The instrument consists of a fixed weight attached to one end of a double-arm lever, which is counterbalanced by a calibrated and adjustable spring. To prevent undue oscillating of the lever, a dashpot makes the arrangement dead-beat (aperiodic). To produce an easily readable rectangular co-ordinate curve upon the registering sheet, the circular motion of the pointer is straightened out by means of a lemniscate lever arrangement. Several curves are reproduced, showing how this instrument can be used to supervise the operation of a mine-hoist regulator and to detect faulty guides or unskilled operation of mine hoists. It is shown how it may also be used to determine the condition of railway tracks and bonds by measuring the shocks of the car.—*Siemens Zeitschrift*, July. 1922.

Temperature Measurement in Turbo-Generators.—R. T. PIERCE.—Several means of measuring the temperature of turbo-generators are described, among which are resistance-coil temperature indicators in which the coil is one arm of a Wheatstone bridge, embedded thermocouples with a potentiometer, direct-reading thermocouples and a method that combines the Wheatstone bridge and the direct-reading thermocouple.—*Electric Journal*, August. 1922.

Illumination

History of the Tantalum Lamp.—L. FISCHER.—A very accurate account from personal observations and notes is given of the history of the development of the tantalum lamp, the first successful metallic-filament lamp in use. — *Elektrotechnische Zeitschrift*, Aug. 24, 1922.

Better Electric Lighting in the Home.—G. R. LAWALL.—A practical guide for lighting the home, replete with sketches illustrating the use of various types of lighting fixtures to obtain desirable effects in different rooms. The first part of the publication applies to the newly planned home or to a house in which the wiring has had proper consideration and where sufficient outlets properly placed have been provided. The second part considers houses that have been wired for a decade or more in which considerable rewiring would be necessary to provide a modern standard of illumination. Schemes are given for modifying at a very small expense the existing fixtures in such houses to obtain better lighting.—*Bulletin No.* 47, *Engineering Department, National Lamp Works of General Electric Company.*

Motors and Control

Starting Squirrel-Cage Induction Motors.—R. ELSASSER.—The paper advocates the use of induction motors with a cage armature in connection with a centrifugally operated mechanical clutch between the motor shaft and the driven machine. Such a motor, if started with a star-delta switch, will prevent an excessive current rush at its start and may be used for full-load start of the driven machine. The clutch has the further advantage of acting as a load-limiting device on the motor, as it will open if the motor speed falls below a set limit. A number of oscillograms are reproduced which show the starting characteristics of a 5½-kw. motor under various conditions.—*Siemens Zeitschrift*, July, 1922.

Power Service on Machine Tools.—ROBERT HARRIS.—The author describes the motor and control methods adopted by William R. Thropp & Sons Company, Trenton, N. J., in applying motor drive to machine tools. Definite examples show how new operating conditions in a large shop can be met by revamping the power service. —*Industrial Engineer*, Aug. 1922.

Heat Applications and Material Handling

Variable-Voltage Installation at the Missouri School of Mines.—T. M. BAINS.—A description is given of the new equipment for controlling power conditions in electrothermic work. The equipment allows full capacity with voltages from 18.5 to 506, and down to zero at lower capacities.—*Engineering and Mining Journal-Press*, Aug. 5, 1922.

Resistance Material.—A. G. KUMMER.—A mixture of quartz and carbon is fired at temperatures between 2,000 and 3,000 deg. C., resulting in a metal carbide which can be formed into rods or tubes. The temperature-resistance coefficient of such a rod is negative up to 600 deg. C., then becomes positive up to 1,000 deg. C. and changes finally again into negative. The material can be used as a heating resistance up to 1,700 deg. C. At the ends, where the rod clamps into clips, the material is metallized to insure a good heat-resisting contract. Owing to its remarkably low expansion coefficient it is possible to pour water on a glowing rod without its cracking, or the rod can be brought to incandescence under water. These rods are being used on a number of air heaters, ranges and commercial ovens.—*Bulletin of the Association Suisse des Electriciens*, July, 1922.

Electrophysics, Electrochemistry and Batteries

Relative Value of Cast Grids and Grids of Steel Plate for Use as Resistors in Mine Locomotives.—According to the report made on this subject at the Huntington convention of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers, Sept. 19, it has been found that cast grids do not warp so much as plate grids, rust less, are more rigid and require fewer tie rods. Summing up the relative merits of cast-iron, cast-alloy and punched-metal grids, the report states that the cast-iron grids will, for stationary apparatus, be cheapest from the standpoint of first cost, maintenance and consistent electrical characteristics. For portable equipment the cast-alloy grids, with a slightly higher first cost, have approximately the same electrical characteristics as cast-iron grids, but the alloy gives an added toughness. Punched-metal grids at a considerably greater first cost give a practically unbreakable resistor element, but in obtaining this quality some of the better electrical characteristics are sacrificed, such as low-temperature coefficient of resistance, thermal capacity and ease in making repairs.—*Coal Age*, Sept. 14, 1922.

Traction

Freight Operation on Electric Railways as a Paying Proposition.—Two papers, one by L. T. Hixson and the other by R. S. Drew, analyzing the various methods by which the cost of hauling passengers and freight on electric railways can be apportioned.—*Electric Railway Journal*, Sept. 9, 1922.

Limiting Temperatures of Railway Motors.—G. E. LÜKE.—The author discusses the insulation life of railway motors as influenced by temperatures, the relation of motor load to internal temperatures and the method of measuring these temperatures. Insulations for railway motor windings are divided from the temperature standpoint into two classes. The first is composed of specially treated or impregnated cotton, linen, paper and similar materials and is found in light-traction railway motors. This insulation deteriorates in strength with age, even at room temperatures, and its deterioration is greatly accelerated by high temperatures within the motor. The other class is composed of mica, asbestos and other materials capable of resisting high temperatures, which are used chiefly on heavy-traction motors, especially those having strap-wound armature coils.—*Electric Railway Journal*, Aug. 19, 1922.

Telegraphy, Telephony, Radio and Signals

New Loud-Speaking Telephone.—A loud-speaking telephone is described so designed that the speaker has no need to speak into a small mouthpiece or to place a receiver at his ear. The incoming voice is carried 30 ft. from the instrument and at that distance the reply can be given in an ordinary tone.—*Bulletin of the Department of Overseas Trade*, August, 1922.

Operation of Fire-Alarm Systems.—J. ELMER HOUSLEY.—The principles of operation of fire-alarm systems for factories are explained, and the author describes how existing installations can be renovated to meet changed conditions. — *Industrial Engineer*, August, 1922.

Radio Communication.—W. R. G. BAKER.—The operation of the ordinary wire-line telephone is briefly sketched to make clear, by analogy, the later explanation of the radio telephone. It is shown that the two systems have four primary units in common—some sort of energy conductor between stations, some form of energy capable of being modulated to conform with sound waves, a transmitter and a receiver. Since the type of radio equipment discussed utilizes primarily the vacuum tube, a section of the article is devoted to a description of the principles and characteristics of this device. The rest of the article shows how the transmitter modulates the radio-frequency carrier wave that it broadcasts, how the receiver by rectification of the otherwise inaudible incoming wave reproduces the sound wave and how amplification is accomplished.—*General Electric Review*, September, 1922.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

Debate Uniform Accounts

Agreement on Regulation Under Water-Power Act Sought by Utility Men and Federal Officials

MANY representatives of public utilities and public service commissions are now engaged at Washington in a two weeks' discussion with O. C. Merrill, executive secretary of the Federal Power Commission, in the hope of agreement on regulations to bring about a uniform system of accounting under the water-power act. It seems virtually certain, the Washington correspondent of the *Electrical World* reports, that such an agreement will be reached, despite the difficulties attendant upon any effort to provide a system which will be acceptable to electric utilities in Eastern cities and at the same time meet the requirements of hydro-electric development in the West.

One of the difficult problems with which the conference is dealing is that of the classification of fixed capital, particularly as it pertains to land and structures. There is strong sentiment from the West in favor of classifying fixed capital according to its functions rather than to its characteristics. This classification has a direct bearing on the manner of handling operating expenses.

The inclusion in the water-power act of the 1914 classification of the Interstate Commerce Commission for the regulation of fixed-capital accounts was criticised by H. M. Edwards, representing the National Electric Light Association, who favored the system of the National Association of Railway and Utilities Commissioners. Mr. Merrill explained that this classification was put in the act in order to provide a basis for recapture of properties. Nothing would be more unfortunate, he said, than to allow differences between the jurisdictions of the state and federal bodies.

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Conrad E. Spens Is Made Coal Distributor

President Harding has, on the recommendation of Secretary Hoover, appointed Conrad E. Spens, vice-president of the Chicago, Burlington & Quincy Railroad Company, to be the Federal Fuel Distributor under the act passed just before the adjournment of Congress. One of the first acts of the new distributor was to telegraph the state governors to emphasize the fact that the principal control over price must be exercised by the state authorities and that federal control can be applied only to coal which moves between states.

At a conference of leading bituminous coal operators held in New York it was resolved to urge upon the Fuel Distributor and the railroad executives the imperative necessity of speeding up transportation. An exhaustive survey of the situation was said to show that in many of the soft-coal-producing fields the supply of cars is sufficient to keep the mines going only two or three days a week, while in some fields there has been an even smaller supply. The Association of Railway Executives, however, announce a new high mark for the period since April 1 in the number of cars loaded with coal during the week ended Sept. 23. The total for the week was 212,110 cars, an excess over the preceding week of 16,968 cars. On the basis of this loading coal production during that week approximated 11,500,000 tons, of which about 9,750,000 tons was bituminous.

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Northern Wisconsin Utilities Are Merged

The merger of seven northern Wisconsin utility companies into the Wisconsin Public Service Corporation is announced by Clement C. Smith of Milwaukee, president of the Wisconsin Securities Company, which will hold a controlling interest in the new company. The Wisconsin Public Service Corporation will have a capital stock of $5,000,000, half common and half preferred, and will take over the operation of the Wisconsin Public Service Company, supplying Green Bay and its suburbs with electric, gas and transportation services; the Sheboygan Gas Light Company, the Menominee & Marinette Light & Traction Company, the Calumet Service Company, operating at Chilton and Brillion; the Manitowoc & Northern Traction Company, operating an interurban line between Manitowoc and Two Rivers; the Peninsular Service Company, furnishing electric service to Kewaunee, Algoma and Sturgeon Bay, and the Oshkosh Gas Light Company.

The new company will operate in Winnebago, Manitowoc, Oconto, Brown, Kewaunee, Outagamie, Door and Marinette Counties and will control two large hydro-electric plants at High Falls on the Peshtigo River and Grand Rapids on the Menominee River. An additional hydro-electric plant is now under construction at Johnson's Falls on the Peshtigo River, and a fourth water power will soon be developed at Seymour Rapids, also on the Peshtigo.

Indiana Utilities Have Faith

Confidence in the Industry's Future Is Voiced at Annual Meeting of State Association

INDIANA utilities have not yet found it necessary to ask for increases in rates as a result of the coal and railway strikes, President E. M. Walker of the Indiana Electric Light Association asserted in his annual address at the convention held at French Lick Springs on Wednesday of this week in conjunction with the convention of the Great Lakes Geographic Division of the National Electric Light Association, which continued for the rest of the week. President Walker said that this avoidance of requests for increased rates was a measure of the faith of the men in the business as to its future.

The report of the meter committee showed an increase in the attendance at the meter school at Purdue University this year of 25 per cent over that of last year and a demand on the part of those in attendance for a greater discussion of the practical phases of meter operation and maintenance. A course of from five days to a week, in April, was favored.

D. B. Shourds discussed the by-product electric station, showing the possibilities of the production of gas for fuel, the sale of the by-products and the use of the coke as a commercial fuel. He said that coal from Indiana, Illinois and Kentucky mines could not be used to produce a good grade of coke by the ordinary high-temperature processes, but could be utilized by the low-temperature process to produce coke of a grade comparable to that now produced from the higher grades of bituminous coals at high temperatures.

Asserting that in dealing with the public the utilities are touching the most sensitive nerve of the individual, his pocketbook, Charles A. Bookwalter of Indianapolis likened the methods employed by some utilities in bringing their problems to the public's notice to the actions of a driver who speeds his motor-car engine to its highest rate and then abruptly throws in the clutch. He advocated a careful, consistent and frank setting forth of conditions for the information of the public. The time to do this, he asserted, is before rate issues are raised and passions inflamed.

The officers of the association for the coming year are: President, Harry Reid, Indianapolis; vice-president, Frank Haas; secretary and treasurer, Thomas Donohue, Lafayette.

Record Units for Brooklyn Edison Company

Company Begins Work on 400,000-Kw. Steam Station with Largest Single-Cylinder Turbines Ever Built—Cost Will Be About $80 a Kilowatt

THE Brooklyn Edison Company has begun the construction of a 400,000-kw. steam-turbine station, the initial installation in which will call for an expenditure of $8,000,000. Orders have already been placed for two 62,500-kva. turbo-generator sets, eight 1,695-hp. boilers and as many stokers. A plot of two blocks on Hudson Avenue adjoining the Brooklyn Navy Yard and facing the East River is being made ready for the power-house structure, the completion of the first section of which is scheduled for November, 1923.

The steam turbines will be the largest single-cylinder machines thus far built. One will be built by the Westinghouse Electric & Manufacturing Company and the other by the General Electric Company. Each will be wound for 13,800-volt, three-phase, 60-cycle current. Notwithstanding the size of the turbines, it is expected that by the time the final installation is made advances in the art of steam-turbine design may call for the substitution of still larger units. Each turbo-generator set will cover a space 95 ft. long. Orders for the switching equipment have not yet been placed.

Babcock & Wilcox water-tube boilers have been ordered, as have six Westinghouse and two Combustion Engineering stokers. The condensing equipment will be supplied by the Westinghouse Electric & Manufacturing Company.

M. S. Sloan, president of the Brooklyn Edison Company, in commenting on the growth of the Brooklyn system said that load will be available for the new Hudson Avenue station as soon as it is completed. Additions have been made to the Gold Street and Bay Ridge stations of the company, but the demands for service are such that additional energy will have to be procured elsewhere while the Hudson Avenue station is being built. Accordingly heavier interconnections have been completed between the systems of the Brooklyn Edison Company and the New York Edison Company, by means of which large blocks of power can be obtained from the new Hell Gate station of the United Electric Light & Power Company.

The Hudson Avenue station of the Brooklyn Edison Company is being designed by the company's own engineers, with Thomas Murray as consultant. It will cost complete approximately $80 a kilowatt.

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German Trust Organized

A new German trust rivaling the Stinnes Rhein-Elbe-Siemens-Schuckert-Union concern has just been organized with Otto Wolff as the head. The capitalization of the new trust is 684,000,000 marks, and besides coal, iron and shipping groups it contains electrical concerns. Among these is the Dessauer Gas Corporation which controls thirteen gas and electric properties. It also controls the Theydt Electro-Technical Manufacturing Company, which in turn is allied with the Sachsenwerke electrical system of Saxony.

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Pit River No. 1 Is Ready

New Plant of the Pacific Gas & Electric Company to Be Put in Service Today

CALIFORNIA electrical men are to celebrate today the putting into service of the Pacific Gas & Electric Company's Pit River plant No. 1, east of Mount Shasta, in the northern part of the state, and two hundred representative engineers and business men have made the three-day 500-mile journey into the mountainous country where the plant has been built in order to be present, as guests of the company, at its inauguration.

The completion of Pit River plant No. 1 marks a new record of achievement in electric generation on the Pacific Coast. Not only does it surpass with its 92,000 hp. in total installed equipment the present record west of the Rockies, but it is connected with a line 202 miles in length that is designed for 220,000-volt long-distance transmission of hydro-electric energy. The new installation marks also the appearance of probably the largest 60-cycle hydro-electric generators thus far designed, generators of 35,000 kva. rating. It can boast besides of single-phase, 220,000-volt transformers, equaling in capacity those of the Southern California Edison Company.

Nearly all the large manufacturers of hydro-electric machinery and line material have contributed to the equipment of this plant, an illustration of which, with more details, appears on page 702.

GROUND BEING CLEARED NEAR NAVY YARD FOR 400,000-KW. STATION OF BROOKLYN EDISON COMPANY

Bay State Commission Bars Tidal-Power Securities

A decision forbidding the sale of securities by the Universal Tide Power Company, the Damiano Tide Water Power Company and the Paesano Hydraulic Power Company has been handed down by the Massachusetts Department of Public Utilities, following an inquiry lasting several months into the financial and engineering situation involved in these concerns' efforts to raise capital at Boston and elsewhere. The commission heard the parties at length, called upon Prof. H. K. Barrows of the Massachusetts Institute of Technology for an expert study of the claims presented, and came to the conclusion that the equipment at present available is purely experimental and that the claims set forth by the promoters, while they may not have been intentionally dishonest, appear to be misrepresentations due at any rate to gross negligence and not made in good faith in regard to future prospects.

The commission feels that the sale of these securities is fraudulent or would result in fraud, and therefore denies their entrance into the Massachusetts market under the sale of securities law. John A. Knowlton, Domenico Damiano and Vincenzo Paesano, all of Boston, are presidents of the above companies in the order named.

Technical Section Men Confer

Distinct evidence of progress in bringing the members of the National Electric Light Association closer together in technical matters was visible at the group meeting of the Technical Section held at Milwaukee last week. Nearly two hundred men, representing every section of the country, were present. The meetings of the eight committees were held from Monday to Thursday inclusive, and, except for inspection trips to the Lakeside powdered-fuel plant of the Milwaukee Electric Railway & Light Company and to automatic substations, the four days and part of the evenings were spent in intensive work.

On Tuesday night most of those in attendance were present at a meeting at which Chairman R. F. Schuchardt outlined the purpose of the section. This, he said, was to develop its members and bring the largest possible number of technical men among the member companies into close touch with each other and the problems of the industry, which may begin as local problems but rapidly grow into national ones. The desired result, Mr. Schuchardt indicated, cannot be attained so long as the active work is confined to national committees, because at the best only a few men can be included in such activities. He outlined the geographic organization and pointed out that through it and the state committees all problems which are national in their scope can be quickly brought to the attention of the national committees. Through the combined efforts of the state, divisional and national committees these problems can be adequately handled, and the information developed can be promptly and effectively passed back through the interlocking memberships of the various committees. The speaker dwelt on the need of increasing the membership of the geographic technical divisions by bringing in every technical and operating man who can be interested.

Reading and Harrisburg Utilities in Conflict

The action of the Metropolitan Edison Company of Reading, Pa., in seeking to have the Pennsylvania Public Service Commission approve the acquisition by it of control of the York Haven Water & Power Company and the York Haven Transmission Company has met with opposition from the Harrisburg Light & Power Company, the Borough of Middletown and certain York manufacturing companies.

Lucian H. Tyng, vice-president of the Metropolitan company, denies that it seeks control of the York Haven plant so that it can raise the rates for hydroelectric energy. He says his company plans to increase the capacity of the plant from 15,000 kw. to 25,000 kw. and that an expenditure of $1,000,000 will provide for developing the plant to its highest degree.

The solicitor of Middletown Borough, where there is a municipal plant supplied from York Haven, threatens to carry the fight against the amalgamation to the Supreme Court of the state.

New Alabama Power Line Will Cost $1,000,000

The 110,000-volt, 90-mile transmission line to be erected by the Alabama Power Company from Mitchell Dam to Opelika and Lanett, the construction of which it is officially announced will begin at once, will, it is understood, cost approximately $1,000,000. In addition, a 44,000-volt line will be built from Lafayette to Opelika, connecting there with the existing high-tension lines and giving Opelika a second source of electric power. The new line to Lanett will give increased service to seven other towns and probably lead to the establishment of new large industrial plants. Lanett itself has more than ten large cotton mills in operation.

Radio and Wire-Line Service Linked Together

Announcement was made last week by Edward J. Nally, president of the Radio Corporation of America, that an agreement had been signed between his company and the Postal Telegraph-Cable Company whereby every office of the Postal company in the United States becomes an agency of the Radio Corporation for the acceptance of radiograms for transmission across the Atlantic Ocean and for the delivery of radiograms received from overseas for points in the United States.

Utility Referendum in Indiana

A referendum to ascertain the sentiment of the business men of Indiana regarding regulation of public utilities is under way among members of the Indiana Bankers' Association, the Indiana Utility Association and one other organization. Approximately four thousand business and industrial leaders in the state will be asked to express their opinion before Oct. 18. In view of recent attacks made on the Indiana Public Service Commission and the threatened attempt to abolish it at the next session of the Legislature the referendum is of particular significance at this time. The questionnaire sent out asks four questions—first, whether utilities should be regulated at all; second, whether utilities extending beyond municipal limits should be regulated by state commissions; third, whether in the case of companies operating in one jurisdiction the state or the city should control; fourth, whether a state commission should be made strictly non-political.

Champions of Ford Project Keep Up Fight

Advocates of acceptance of the Henry Ford offer for the Muscle Shoals project caucused before Congress adjourned and laid tentative plans to renew their effort when the two houses reconvene.

Leader Mondell is quoted as having assured the Ford advocates that personally he saw no objection to having the Ford offer brought on the floor of the House early in the next session.

In the last week of the recent session of Congress the Ford advocates abandoned their tactics of obstructing other legislation in an effort to have the Muscle Shoals bills called up because it was realized that nothing could be accomplished in the short time left.

Hearings also will be asked immediately by Representative Hull on his resolution to refer the whole question of disposition of the Muscle Shoals properties to the Secretary of War with power to act.

Federal Power Board Seeks to Dismiss New York's Suit

A motion for the dismissal of the petition filed by the State of New York in the United States Supreme Court seeking to bring suit for an injunction against the Federal Power Commission to restrain the latter from issuing preliminary permits and licenses within that state has been filed by Solicitor-General James M. Beck. It is expected that the federal government's motion will be heard by the Supreme Court during the first month of its fall session, and that if dismissal be denied, Attorney-General Charles D. Newton of New York State will apply for an advanced hearing of the petition. Without an advanced hearing the case would not be reached for nearly two years.

Illuminating Engineers Meet at Swampscott

Residence and School Lighting, Luminaire Design and Cost of Daylight Among the Topics—Attractive Displays on the Shore and in the Hotel Grounds

THE annual convention of the Illuminating Engineering Society, held this week at Swampscott, Mass., was most successful both from the viewpoint of attendance and with regard to the information that it has made available to the society's members. More than 300 members and guests were registered on Thursday night, the fourth day of the convention. The program was particularly attractive, not only because of the subjects included, but also because of the way in which they were grouped. Excellent entertainment was provided, and special lighting effects were a feature of the convention. Of the papers and reports submitted, those on residence and school lighting, a code of luminaire design and cost of daylight were especially interesting.

ADDRESSES AND REPORTS

Elihu Thomson, who presented the address of welcome, recalled early methods of illumination and traced development down to the present time, saying that tungsten filament cannot be considered the last word in lamp development.

The ideals and characteristics of the society were emphasized by George S. Crampton, who in his presidential address said that they deserve the unstinted support of all members. The report of the general secretary, C. L. Law, followed.

F. E. Cady, in his progress report, which has almost come to be an institution, referred particularly to the increasing use of neon lamps, colored-light traffic signals, higher-power lamps, attention to street lighting, higher sign intensities and unique church lighting.

Clayton H. Sharp, in his report on nomenclature and standards, pointed out that provision has been made by the American Engineering Standards Committee for a sectional committee to take up current revision. In discussion of these standards it was particularly emphasized by M. Luckiesh and Louis Bell that light should be defined on a physical-sensation basis.

Popular lectures and suggestion of subjects for research have been the chief activities of the committee on education, said Prof. F. C. Caldwell, who pointed out the individual duty of members in this work.

Clayton H. Sharp, the chairman of the committee on motor-vehicle lighting, declared that the principal change in rules has been the increase of headlamp intensities. Color traffic signals have also received much attention. Tail-lamp specifications will be considered in the near future.

Two excellent papers on the status of residence lighting and the field for development were presented by M. Luckiesh and N. D. Macdonald. In commenting on these reports E. D. Tillson of Chicago urged strong support of portable lamps as the best method of improving residence lighting. R. S. Hale pointed out that the reason for the low number of convenience outlets is the narrow interpretation put on the National Electrical Code. Education of the inspectors and a concerted effort to have the code definitely remove any ambiguities will help immensely. Dr. Bell prophesied that the most abominable lighting ever experienced would result if gas-filled lamps are not used with caution in residences, Dr. Luckiesh adding that careful consideration of shades would be imperative.

It was announced by S. G. Hibben, chairman of the committee on a residence-lighting bulletin, that the committee planned to prepare a booklet which would appeal particularly to the householder.

O. Hogue outlined the plans of the National Electric Lighting Association for a "more and better business" movement which will be continuous.

Specifications for luminaires were the feature of the report of the committee co-operating with fixture manufacturers, M. Luckiesh chairman. Dr. Luckiesh and P. S. Millar urged that criticisms and suggestions be sent in.

The Monday morning session was closed by an illustrated talk by J. W. Gosling on "How to Tell Period Styles in Fixtures."

LIGHTING THE SCHOOLHOUSE

At the afternoon session on Tuesday the importance of better schoolhouse lighting, more intensive window illumination and a better selection of equipment in restaurant lighting was brought out. Prof. H. B. Dates, Cleveland, read a paper describing the equipment of a local school which served as a model for similar installations elsewhere. Tests showed 5 foot-candles to be the minimum desirable. Non-symmetrical fixture layouts and dust-proof unventilated globes were favored in the discussion.

Show window lighting was exhaustively discussed in the papers by Ward Harrison and H. T. Spaulding and W. Sturrock and J. M. Shute. The value of spotlighting and curved glass in correcting external reflection was brought out, and the greater drawing power of intensive lighting supplemented by color effects was emphasized.

J. L. Stair, in a paper upon "The Lighting of Public Eating Places," emphasized the varied equipment available for this class of service and the successful efforts of modern designers to avoid glare in dining rooms.

A paper on the hygienic effects of proper artificial lighting in food industries by W. H. Rademacher drew forth discussion on other applications of lighting to this industry, the stimulation of interest which investigations create, and the importance of dust-proof fixtures with large radiating surface in grain elevators.

John W. Lieb presented a paper giving the results of tests of tungsten lamps upon alternating and direct current, under the auspices of the Association of Edison Illuminating Companies. These tests showed differences in life or efficiency of little commercial importance, although in general the lumens of 100-watt gas-filled lamps at three-quarters total life was 3 to 5 per cent lower on direct current. In the case of vacuum lamps the watts are about 1 per cent higher and in gas-filled lamps about 1 per cent lower when run upon direct current.

Steps toward the establishment of a museum of lighting appliances were forecast in a vote authorizing the council to consider this project.

Twenty-five stores have pooled their lighting problems for the investigation of the industrial hygiene department of the Harvard Medical School, said Dr. A. B. Emmons, 2d, of Boston, in a paper on "Office Lighting from the Viewpoint of Hygiene."

The fallacy that daylight costs nothing was well riddled by M. Luckiesh and L. L. Holladay, Cleveland, in a paper upon "The Cost of Daylight." Comprehensive figures were presented showing that in many cases the cost of artificial illumination is lower than of providing for daylight through extra building construction, and in any case it is seldom enough higher than daylight costs to preclude a more liberal attitude toward investment in equipment for artificial lighting.

The demands of the motion-picture industry upon the electrical engineer were outlined in a paper by F. S. Mills on lighting for motion-picture studios.

On Wednesday evening a most interesting symposium reviewing the past fifteen years' development in illumination was contributed to by authors of papers at the first I. E. S. convention, namely Messrs. Sharp, Millar, Marks, Bell, Ryan, Hale, Blood, Morrison and Walker.

The papers presented on the last day of the convention, Thursday, were chiefly on photometric subjects.

SPECTACULAR LIGHTING PLEASES

On Tuesday evening the hotel and adjacent shore were brilliantly illuminated by searchlights, floodlights and a 100,000-cp. incandescent lamp, combined with special float and transparency effects in plain and colored rays. Through the courtesy of the United States Navy Department the destroyer F. Fred Talbot was anchored off shore and illuminated in outline. Ornamental posts illuminated with the emblem of the I. E. S. were a feature of the hotel grounds. Many thousands of motorists and pedestrians attended the display, which was arranged by engineers of the Lynn works of the General Electric Company, with the co-operation of the United States Army.

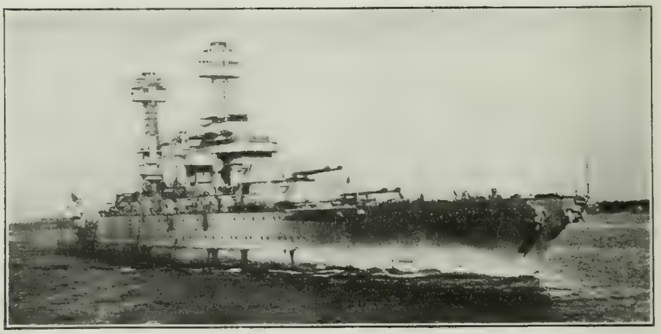
High Praise for Ship Drive

Commander of Battleship Maryland Finds It Far Superior to Other Drives in Storm

SAILING from Rio de Janeiro, Brazil, on Sept. 13, with Secretary of State Hughes, who represented the United States at the opening of the Brazilian centenary celebration, on board, the United States battleship Maryland dropped anchor in the Hudson River last Saturday after a record trip of 4,760 miles up the Atlantic Coast. In the course of her voyage the Maryland ran at full speed through a severe gale, the wind reaching 75 miles an hour and heavy seas pouring over the vessel's decks. Her ability to perform this feat was attributed by Admiral Hilary P. Jones and Capt. David Foote Sellers to the electric drive with which she is equipped.

"I did not realize until this trip how superior the electric drive is to anything else," said Admiral Jones.

"It is the most efficient driving force on any war ship, in economy, power, ease of handling. I have been amazed by the performance."



UNITED STATES BATTLESHIP MARYLAND, ELECTRICALLY DRIVEN

Captain Sellers, commander of the ship, said that the time from Rio to the Ambrose Light was four hours under the previous record.

"The storm proved the value of the electric drive," said Captain Sellers. "That is automatically regulated, so that no matter what seas we plow into the speed of the ship is maintained. During the storm we sometimes brought up against seas as if they were brick walls, but the Maryland went right through them. We only lost eight-tenths of a knot at any time during the worst of the blow.

"The engineer officer told me that at one time when we ran up against seas that checked our way there was 8,000 more horsepower generated to bring the speed up to the normal 18 knots and keep it there. The automatic governor takes care of that, and all that is necessary is to set the motors at the desired number of revolutions, and they keep that speed. There is no racing, either, when the screw lifts from the water.

"The ship picks up like a subway express. When we left the anchorage at Rio we set the motors full speed ahead and she started off like a racehorse. We passed a Japanese ship 800 yards from our anchorage, and we were then going eighteen knots. She is the best ship in the world."

The Maryland, which has a displacement of 32,000 tons and is 624 ft. in length, was completed in 1920 and was the fourth capital ship of the United States Navy to install electric drive. Her electrical equipment was manufactured by the General Electric Company. It consists of two turbo-generator units rated at 11,000 kw. each, one control board, four 7,000-hp. propeller motors of the induction type and six 300-kw. exciter sets.

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New Insull Company to Care for Small Security Buyer

The investment departments of the Commonwealth Edison Company, the Public Service Company of Northern Illinois and the Middle West Utilities Company are being superseded by a new investment banking corporation under the name of the Utilities Securities Company, with rooms on the ground floor of the Edison Building at 72 West Adams Street, Chicago.

The new organization is the outgrowth of the success of the customer-ownership policy that has been followed by the Insull companies in the past few years. This business has grown in volume until the organization of a separate company to handle it has become a necessity. In discussing the new organization Fred H. Scheel, the vice-president and general manager, pointed out that the success of customer ownership has built up a list of 56,000 stockholders and approximately half that number of bondholders. He spoke of the difficulties in the way of expense that have prevented the investment banking houses from catering to the needs of the small investor and indicated that the object of the new organization is to do so. John F. Gilchrist, vice-president of the Commonwealth Edison Company, is the president of the Utilities Securities Company.

Insull's Thirty Years' Work

Commonwealth Edison Company Honors His Long Connection with Chicago Electric Service

A DINNER commemorating the thirtieth anniversary of his connection with the Commonwealth Edison Company and its predecessor, the Chicago Edison Company, was given President Samuel Insull by the company officials at the University Club, Chicago, the night of Sept. 20. It was not only an anniversary celebration but a "welcome home" to Mr. Insull, who had spent ten weeks vacation in Europe. There were 170 persons present, including executives, heads of departments and older employees of the company.

The toastmaster was Louis A. Ferguson, vice-president in charge of construction and operation, whose employment dates back to 1888. John F. Gilchrist, vice-president, who came to the company in 1887, summarized Mr. Insull's achievements.

Mr. Insull, in responding, presented a vivid picture of the rise of the company. He told how he came to adopt the Wright demand system of rate charging as a result of a visit to Brighton, England, and how he adopted steam turbines for the Fisk Street station, which was the first all-turbine generating station in the world.

Mr. Insull predicted a further wonderful development of the central-station utility in Chicago in the next thirty years. Within twenty years he felt that the capitalization of the company would amount to $300,000,000 instead of half the sum, as at present. He declared that the foundation of his company was the close personal relations existing among the officers and employees.

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A. M. E. S. Schedule Meetings

The Associated Manufacturers of Electrical Supplies have issued a proposed schedule for the meetings to be held in New York City during the week commencing Oct. 16 as follows:

Monday, Oct. 16—Association rooms: General standards committee, 1:30 p.m. Old Colony Club: Radio Apparatus Section, 10 a.m.

Tuesday, Oct. 17—Association rooms: Heating Appliance Section, 10 a.m.; Snap-Switch Section, 10 a.m.; Laminated Conduit Products Section, 2 p.m.; Lamp Receptacle and Socket Section, 2 p.m.; Attachment Plug Section, 4 p.m. Old Colony Club: Radio Apparatus Section (all day), 10 a.m.; Industrial Lighting Section, 10 a.m.

Wednesday, Oct. 18—Association rooms: Fuse Section, 10 a.m.; Air Circuit-Breaker Section, 10 a.m.; Knife and Inclosed Switch Section, 2 p.m.; Molded or Formed Insulation Section, 2 p.m. Old Colony Club: Outlet Box Section, 10 a.m.; Rigid Conduit Section, 10 a.m.; Armored Cable and Flexible Conduit Section, 2 p.m.; Non-metallic Conduit Section, 3 p.m.; Metal Molding Section, 4 p.m.

Thursday, Oct. 19—Association rooms: Signaling Apparatus Section, 10 a.m.; Panelboard and Switchboard Section, 10 a.m.

Friday, Oct. 20—Association rooms: Meeting of board of governors, 2:30 p.m.

There will be a special meeting of the chairmen and secretaries of all sections with the president of the association on Monday at 7:45 p.m. at the association rooms.

Mining Engineers for Automatic Substations

Huntington Meeting Records Them Also as Favoring Electric Welding, All-Rubber Insulation and Steel Grids—Storage-Battery Locomotives Best for Work on Level

AT THE meeting of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers in Huntington, W. Va., on Sept. 19 to 22, a number of topics of interest covering electrical applications in the coal industry were discussed, including methods of distribution, relative merits of locomotives, automatic substations and hoists and the insulation needed on underground cables.

C. E. Von Sothen of the General Electric Company read an illustrated paper by M. A. Whiting on automatic substations and hoists, and C. J. Fuetter described in detail an automatic substation installation.

J. H. Edwards, in discussing the papers, said that four years ago his company had investigated automatic stations but got no encouragement from the manufacturers, while today there are about fifty installations in the mining industry. He was firmly convinced of the advantages of automatic control even to push-button starters on shop induction motors. George E. Suiter said that his company had operated a 100-hp. automatic hoist successfully for five or six years. C. J. Fuetter asserted that he would not use any substations that were not automatic because the automatic stations were cheaper, safer and more reliable.

In a discussion on bonding, opinion based on the experience of all present was to the effect that the electrically welded bond was best. H. E. Carlton said that a gang of three men was able to get 75 to 125 welded bonds per shift. It was conceded that a motor-generator welding outfit was the best to use in order to insure the positive condition on the rail necessary to a good welding operation, particularly on old rails.

RELATIVE MERITS OF LOCOMOTIVES

C. E. Rogers, in discussing the relative advantages of storage battery, combination and cable-reel locomotives in mine service, said that the storage-battery locomotive was best on the level, the combination on a combination grade and level, and the cable reel on steep grades. Thus each had its field.

J. H. Edwards said that the depth of vein affected the opinion of some engineers on the relative merits of the locomotives. It was also maintained that automatic charging methods should be used to reduce costs on battery locomotives. H. E. Carlton said his experience indicated a constant expense for maintenance on a 600-volt installation for cutting-machine service used independently of trolley-type locomotives, and he thought that lessened maintenance cost should be credited to them.

On Thursday F. M. Reigher read a paper on the comparative merits of cable insulation, his conclusion being that the all-rubber-covered type would give the best service, although its cost is great and the existing reels are not designed to the best advantage for using it. He stated that braided cable of the best quality gave six to eight months' service while the all-rubber-covered type lasted a year or longer. He particularly accented the fact that cable-reel design had not kept pace with locomotive design and said no satisfactory reel was yet on the market.

Robert Lee said his company had used rubber-covered cable for seven or eight years with great success. H. E. Carlton reported use of rubber-covered cable for the last few months, as did C. E. Rogers. N. A. Johnson said that his company was using it, but found difficulty in adapting it to the reels. J. H. Edwards asserted that the mining men of his company thought the all-rubber-covered cable gave better service.

A. F. Phelps held that it was reasonable to expect two or three times the life with all-rubber insulation that is obtained with braided insulation. H. M. McFarland pointed out that the length of life depended on five factors, the size of the conductor, the working voltage, the size and method of operating reels, the type of stranding and insulation, and the experience of the operator in handling cable. He emphasized the necessity for using large enough cables to withstand heating due to overloads and the importance of proper stranding to secure the necessary flexibility. F. M. Reigher said his experience indicated about 12 mills per ton of coal as the cost of using all-rubber cables.

STEEL GRIDS FAVORED

Roscoe Woltz gave a paper on the relative merits of cast-iron and alloy-steel-plate grids for mine service. He listed many advantages of the steel grid and pointed out the disadvantages of the cast-iron grid. F. M. Reigher said the steel grids were best and that he had one that had been in use eight or ten years. J. H. Edwards said steel grids should be furnished by the locomotive manufacturers and the operators should not be compelled to rebuild locomotives after purchase. A. F. Phelps stated that the locomotive manufacturers would supply steel grids if specified by the purchaser.

George Suiter stated he had equipped eighteen out of thirty mine locomotives with steel grids with good results and expected to equip all the mining machines with steel grids. They were easy to repair and cheaper in the long run.

R. Dawson Hall read a paper by W. C. Shunk on how engineers could increase their usefulness. The paper pointed out many important things the engineer could do in the way of getting accurate cost records, reducing maintenance expense and decreasing mining costs.

On Friday M. W. Crenshaw gave a lecture on the wireless telephone and R. R. Webster presented a paper on insulating oils, which was well received. The following officers were elected: President, Roscoe Woltz; vice-president, R. R. Webster; secretary and treasurer, Herbert Smith. The executive committee will comprise; J. H. Edwards, F. M. Reigher, G. Suiter, J. J. Fluck and Henry Maxwell.

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Electrochemists Hear Papers on Industrial Heating

A successful meeting of the American Electrochemical Society was held last week at the Windsor Hotel, Montreal. At the opening session on Thursday industrial heating was exhaustively discussed. Dr. C. P. Steinmetz contributed a paper on the underlying principles of the problem, and among other papers presented were the following: "Electric Heat—Its Generation, Propagation and Application to Industrial Processes," by E. F. Collins; "Principles of High-Temperature Furnace Design," by E. J. Smalley; "Advantages of Industrial Electric Heating," by Wirt S. Scott; "Some Electrical Properties of Alloys at High Temperatures," by M. A. Hunter and A. Jones; "Resistivities of Some Granular Resistor Carbons," by C. E. Williams, and "Heat Insulating Materials for Electric Heating Apparatus," by J. C. Woodson.

On Friday the program included "Methods of Economically Handling Materials in Electric Furnaces," by Frank W. Brooke; "The Development of Industrial Electric Heating for Low-Temperature Enameling," by Wirt S. Scott; "Treatment of Ceramics," by E. T. Smalley; "Electric Annealing of Malleable Iron," by C. B. Gibson; "Electric Steam Generators and Their Application," by P. S. Gregory; "A New Type of Induction Furnace," by J. Murray Weed; and "A Simple Electric Crucible Furnace for Melting Aluminum," by A. Glynne Lobley.

Among Saturday's papers was one on "The Relation Between Current, Voltage and the Length of Carbon Arcs," by A. E. R. Westman.

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Water Power to Be Main Topic of A. S. C. E. Convention

A discussion of water-power problems will be the main feature of the technical sessions at the fall meeting of the American Society of Civil Engineers, which will be held at the Palace Hotel in San Francisco, beginning on Wednesday, Oct. 4. The papers to be presented on that day include one on the development of the Colorado River by Arthur P. Davis of the United States Reclamation Service, one on the new development at Niagara Falls by Frederick A. Gaby, chief engineer of the Ontario Hydro-electric Power Commission; one on the present tendency of water-power development in New York State by John P. Hogan, consulting engineer, New York, and one on the operation of the federal water-power act by Oscar C. Merrill, secretary Federal Power Commission.

On Thursday, Oct. 5, these papers will be presented: "Water-Power Potentialities of the Pacific Coast," by Frederick H. Fowler, United States Forest Service, San Francisco; "Hydro-Electric Developments on the Pacific Coast," by John D. Galloway, Consulting Engineer, San Francisco; "High-Voltage Power Commission," by F. W. Peek, Jr., General Electric Company, Pittsfield, Mass.; "High-Voltage Phenomena Encountered in Power Transmission," by Prof. Harris J. Ryan, Stanford University; "Growth of the Use of Electric Power in Southern California and Probabilities of Its Future Growth with Reference to Sources of Hydraulic Power," by Harry W. Dennis and H. A. Barre, Southern California Edison Company, and "Hydro-Electric Power Development as Related to Electrification of Railroads," by Charles F. Loweth, chief engineer Chicago, Milwaukee & St. Paul Railway.

On the evening of Friday, Oct. 6, there will be an informal dinner, when Charles D. Marx, professor of civil engineering at Stanford University, will talk on the social and economic aspects of hydro-electric power.

Brief News Notes

Work on Wilson Dam.—The congressional appropriations for continuing the construction of Wilson Dam at Muscle Shoals have led to a resumption of work on an extensive scale, and it is expected that 2,400 men will soon be employed on the project, although new men are being added only as their services can be utilized to the best advantage.

Muscle Shoals Helps Care for Shortage of Steam-Generated Power.—The Alabama Power Company has been furnishing electrical energy for Georgia and the Carolinas through a tie-in at Gorgas from Nitrate Plant No. 2, Muscle Shoals. The plant at Muscle Shoals is reported as running full force in order to care for a shortage of power in those states due to the fuel situation.

Algerian Water-Power Potentialities.—Arrangements are being perfected to utilize the water of the "Plains of Cheliff" in Algeria for irrigation and water power. The amount of water which is estimated to be available is about a billion cubic meters in dry years and as high as twenty billions in years when the rainfall is heavy, says the electrical division of the Department of Commerce.

Power Survey of Green River.—A survey made to formulate a report on the power and reservoir possibilities of the Green River has recently been completed by a party which traveled 400 miles between Green River, Wyo., and Green River, Utah, in three especially constructed boats, spending several weeks on the trip. The party, which included H. L. Stoner of the Utah Power & Light Company, was in charge of R. R. Wooley, hydraulic engineer of the United States Geological Survey. Work on topographic maps of the river and reports will be begun at once.

Electrical Show to Be Held in Pittsburgh.—An electrical show will be held in Motor Square Garden, Pittsburgh, beginning Nov. 4 and continuing for one week. The show, which will be the first held in that city in several years, will be sponsored by the Electric League of Pittsburgh. Paul D. Lockard of the Duquesne Light Company has been appointed general manager of the show. One hundred and sixty exhibitors will have exhibits, and elaborate electric lighting and decorations will be provided to make the setting an attractive one for those who attend. The exhibit booths will be placed on the first and second floors.

Official Figures on French Water Power.—Replying to written questions from members of the Chamber of Deputies, the Minister of Public Works of France recently put the existing installed capacity of hydro-electric developments in that country at 2,100,000 hp., divided as follows: For lighting, serving small motors and heating, 650,000 hp.; for industrial, electrometallurgical and electrochemical plants, 1,300,000 hp.; for agricultural and other purposes, 150,000 hp. Besides this, he estimated that within two years an additional 300,000 hp. will be installed in power houses now under construction. Concerning the electrification of steam railroads he said that, although only 74 miles have been electrified since 1918, before the expiration of five years 930 miles will be added. The program adopted calls for the electrification of more than 5,500 miles within fifteen or twenty years.

Rural Service in Wisconsin.—Construction of a 66,000-volt high-tension transmission line extending 75 miles from Dane, Wis., through Columbus and Beaver Dam to Fond du Lac and connecting with the hydro-electric plant of the Wisconsin Power, Light & Heat Company on the Wisconsin River at Prairie du Sac, nears completion, 55 miles of poles having already been erected between Dane and Fond du Lac. It is expected that all wires will be strung by Nov. 1. The company is also preparing to furnish farmers with light and power service by placing on its poles a service wire in addition to the main cable. Power cannot be taken from the high-tension wire in the country, but will be supplied farmers living along the power line from these service wires strung out from the cities or villages. The cost of installing transformers outside of cities or villages would be prohibitive, company officials declare.

Building a Dam by Electricity.—In order to use electric power in operating dredges and other equipment in the construction of the big dam and irrigation project of the Wichita Valley Irrigation District a transmission line has just been built from the plant of the Wichita Falls (Tex.) Electric Company to the site of the dam, 41 miles, at a cost of $90,000. The dam for the main reservoir is being constructed throughout by motor-driven pumping equipment mounted on a huge barge. Motor-driven centrifugal lamps suck up the mixture of mud and water and throw it into place on the dam through a string of 40-in. piping which is floated between the barge and the dam on small skiffs, these skiffs and the main barge being in the main lake. The barge equipment requires 2,100 hp., the main motor driving the centrifugal slush-pumping unit is rated at 1,600 hp., and the operation of auxiliary barge equipment takes 500 hp.

Associations and Societies

Arkansas Utilities Association.—To avoid conflict with other conventions, the date for the meeting of the Arkansas Utilities Association at Hot Springs, Ark., has been changed from Oct. 9-10 to Nov. 7-9.

New Orleans Electric League Promotes Good Will.—The New Orleans Electric League recently gave a "central-station night," designed to promote good will and get the electrical story before the citizens. It took the form of a dinner and entertainment, interspersed with talks by electrical men, including Frank G. Frost, W. E. Clement, W. J. Aicklen, Jr., and F. J. Schwab.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

American Welding Society, Chicago, Oct. 2-5.
American Electric Railway Association — Chicago, Oct. 2-6. J. W. Welsh, 8 West 40th Street, New York.
Empire State Gas and Electric Association —Lake Placid, Oct. 5-6. C. H. B. Chapin, Grand Central Terminal Bldg., New York.
American Society of Civil Engineers—San Francisco, Oct. 4-8.
Electrical Supply Jobbers' Association, Atlantic Division — Philadelphia, Oct. 6. E. Donald Tolles, 165 Broadway, New York.
Society of Motion Picture Engineers — Rochester, N. Y., Oct. 9-12.
Association of Edison Illuminating Companies—White Sulphur Springs, W. Va., Oct. 11-14. Preston S. Millar, 80th St. and East End Ave., New York.
National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St., New York.
Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 20-21. A. Bliss McCrum, Charleston, W. Va.
Electric Power Club—Asheville, N. C., Oct. 30-Nov. 2. S. N. Clarkson, Kirby Bldg., Cleveland, Ohio.
Arkansas Utilities Association—Hot Springs, Ark., Nov. 7 and 9. R. P. Brown, Little Rock Ry. & Electric Co., Little Rock.
Ontario Association of Electrical Contractors and Dealers—Toronto, Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.
National Association of Railway and Utilities Commissioners—Detroit, Nov. 14-1 J. B. Walker, New York Transit Commission, New York.

Recent Court Decisions

Contract Entered Into Prior to Commission Law Is Not Exempt from Order of Commission.—In Clute vs. Nassau & Suffolk Lighting Company the New York Supreme Court has held that a gas company's contract with a private individual, fixing the price of gas to be furnished him, entered into prior to the grant by the state to the Public Service Commission of the power to fix rates, did not make a commission order fixing rates for the company inapplicable to such individual, the contract having been entered into with knowledge of the power of the state to regulate rates. (195 N. Y. S. 84.)*

Supreme Court of Florida Reverses Judgment Awarding $18,000 for Death of Husband.—A jury in Davis vs. Southern Utilities Company awarded $18,000 to a widow for the death of her husband while in the employ of the company named. Finding that the evidence as to reasonable damages, based on loss of support, earning capacity of the husband and so forth, was fragmentary and lacking in material particulars, and declaring that the determination of the amount of damages is by no means to be left to the uncontrolled discretion of the jury, the Supreme Court of Florida reversed the judgment and ordered a new trial. (92 So. 683.)

Damages Granted for Backwater from Power Company's Embankment.—An action was brought by one Peerenboon against the Wisconsin Traction, Light, Heat & Power Company for damages to his land caused by the backing up of water due to an insufficient opening to carry a stream through defendant's railway embankment. The company held that there was no negligence as the physical facts showed the railway structure to have been erected so as to take care of every contingency, but the Supreme Court of Wisconsin took issue with the statements of the company's engineers and affirmed the finding of the trial court for the plaintiff. (189 N. W. 267.)

Utilities Do Not Surrender Proprietary or Contractual Rights by Accepting Extension of Charter.—A suit brought by the city of Portsmouth against the Portsmouth Gas Company and decided in favor of the defendant was appealed to the Supreme Court of Appeals of Virginia and judgment affirmed. The city claimed that the charter of the company had lapsed. The court held that the amendment of a charter by extending it for a further period did not make a break in the corporate existence of the company and that a resolution of a municipal council granting to a company exclusive privileges for fifteen years did not expressly or by implication limit the right to use the streets to that space of time. Where, on the contrary, the company continued for more than sixty years to use the streets it had the municipality's consent to their use for an indefinite period. In construing grants of the right to the use of the streets reasonable and just protection will, the court said, be extended to public utility corporations, whose investments are necessarily based upon calculations of future growth and development. (112 S. E. 792.)

Concrete Instruction on Contributory Negligence Must Be Given to Jury if Necessary to Present Defense.—In remanding for new trial the case of Morris vs. Kentucky Public Service Company the Court of Appeals of Kentucky declared that it was an error for the trial court to refuse to give the jury a concrete instruction on the issue of contributory negligence. The case concerned the fatal injury from electric shock of a lineman in the company's employ. It was not denied that he had neglected to wear rubber gloves, contrary to the orders of his employer, but it was asserted that the injury had not been received through his hand and was due to the company's negligence in not properly insulating its lines. In proof of this it was asserted that another lineman who wore, like the victim, only leather gloves had cut the wire to release the latter without receiving any injury. The Court of Appeals held that the jury should have been instructed to the following effect: "You will find for the plaintiff unless you believe from the evidence that the transmission of the current through decedent's hand was the proximate cause of his death." (242 S. W. 599.)

Voluntary Payment Does Not, as a Matter of Law, Defeat Recovery of Overcharges.—The Supreme Judicial Court of Massachusetts has found, in City of Boston vs. Edison Electric Illuminating Company of Boston, that under the statutes a dissatisfied customer of a public utility is limited to the means of redress provided through the Department of Public Utilities and cannot sue to recover alleged overcharges in excess of reasonable rates. When legislation covers the entire field the provisions of the common law in conflict therewith are no longer in force. Under the statutes the Department of Public Utilities may be petitioned for an inquiry into prices by the Mayor on complaint of one customer. The Supreme Court further found that where a city suing to recover alleged overcharges for electricity alleged that it was dependent on the furnishing of electric light and power by defendant, and unable properly to perform its municipal and corporate functions if the obtainment of such electric light and power from defendant was interrupted, the doctrine of voluntary payment presented no defense as a matter of law, as it could be found that the circumstances created a necessity of payment as the only means of immediate relief. (136 N. E. 113.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Extensions by Overloaded Utilities.—A petition brought by customers of the Batesville Electric Light & Power Company to compel it to furnish additional power service has been dismissed by the Indiana Public Service Commission upon a showing that there was another source of power available and that the plant of the utility was overloaded. "An order," observed the commission, "which would necessitate enlargement of the capacity of respondent's plant would possibly entail an expenditure so great that it might be reflected in the rates which respondent would be entitled to receive and thus work a hardship upon the great body of consumers in Batesville and its vicinity."

Overbuilding of Plant.—In ordering the Adirondack Power & Light Corporation to reduce its gas rates in the city of Oneida the New York Public Service Commission made some observations on the unnecessarily large plant of the company, in part as follows: "A real issue in this case is: Was it a wise and prudent investment for this company to build such a plant in view of existing conditions and future probabilities? The consuming public in Oneida evidently had cause to demand better service than the old coal-gas plant could furnish. The company claimed that the present plant represents a sincere effort on its part to remedy the situation formerly existing. . . . It seems well settled that a utility which is overbuilt should be permitted to charge such rates as will produce sufficient revenue to meet its operating expenses, create a proper depreciation reserve and leave a fair return upon such part of the investment as is necessary to serve the territory in which it operates. . . . It probably is more economical to construct a large plant in entirety than to add from time to time as business increases. A plant constructed as an entirety is usually more efficient, certainly more harmonious in structure and undoubtedly more economical in operation. It is also the duty of public utilities to take account of the probable increased demand due to growth in population; and some latitude must be allowed for prudent overbuilding of plant, lest the necessary capital be kept away from utility investment. But in the instant case the company admits that its plant is four times greater than present needs require. . . . If this company were allowed a full return and in order to get it could charge whatever rate is necessary, it might thereby become relieved of the necessity of prudent and economical management and be enabled to pass the burden of its mistakes or misjudgment on to the consumers. This should not be."

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Luncheon for Dr. Giolitti

Dr. Federico Giolitti, Italian metallurgist, was the guest of honor at a luncheon at the Bankers' Club, New York City, last Tuesday, where he was met by members of the iron and steel committee of the American Institute of Mining and Metallurgical Engineers. Dr. Giolitti, who is revisiting America, was managing director during the war of the great Ansaido works at Genoa. He is a son of the Prime Minister of Italy. Dr. Giolitti's visit to America is regarded as of more than ordinary importance by American engineers who are entering into a plan of international co-operation with the engineers of Italy. This plan was furthered during the recent visit to Italy of John W. Lieb, vice-president of the New York Edison Company, who made the trip as the emissary of the American engineering profession.

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Frank S. Clark, associated with the Stone & Webster Engineering Corporation, Boston, has been elected chairman of the Boston Section of the American Society of Mechanical Engineers. He succeeds Alfred S. Kellogg.

W. H. Richardson, manager of the Brattleboro (Vt.) office of the Twin State Gas & Electric Company, was elected a member of the executive committee of the New England Division of the National Electric Light Association at the recent New London meeting.

James Orr has been appointed assistant superintendent of power for the Hartford (Conn.) Electric Light Company, with headquarters at Hartford. For the past fifteen years Mr. Orr has been in the employ of Stone & Webster, Inc., as a power-plant expert, the last five years having been spent as an engineer in the betterment division.

E. M. Knight, who for the past several years has been resident engineer in Parkersburg, W. Va., of the Monongahela Power & Railway Company, has been promoted and will have headquarters at Fairmont, W. Va., as assistant to the chief engineer of the system. Mr. Knight will be succeeded by Howard Carr of Fairmont.

Dr. Otto Feuerlein, to whose work is attributed the tantalum lamp that led up to the tungsten filament, recently arrived in this country and will visit a number of American lamp plants. Dr. Feuerlein is connected with the Osram Company, Berlin. He has not been in the United States since 1913, but is well acquainted with a number of the leaders in the American lamp industry.

A. H. Anderson recently returned from Haiti, where he acted as electrical engineer with the Haitian American Sugar Company and assistant superintendent of the Port au Prince Electric Light Company. Prior to his work in Haiti he spent about five years in South America, two years on the west coast with the Chile Copper Company, and the rest of that time with the Armour interests as electrical engineer in charge of construction, in the building of packing plants, eighteen months being devoted to work in Patagonia.

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R. B. Gerhardt President of A. I. and S. E. E.

R. B. Gerhardt, the new president of the Association of Iron and Steel Electrical Engineers, has been associated with the Bethlehem Steel Company as electrical superintendent of the plant at Sparrows Point, Md., in charge of design, construction and operation, since 1913. Mr. Gerhardt was born in Martinsburg, W. Va., Aug. 2, 1884, and at the age of sixteen was employed as an electrician by the Pennsylvania Steel Company, Steelton, Pa. He entered Pennsylvania State College, but at the end of his sophomore year transferred to Cornell University, from which he was graduated in 1907 with the degree of M. E. He then returned to the Pennsylvania Steel Company as electrical construction foreman at the Steelton and Lebanon plants. For four years previous to his connection with the Bethlehem Steel Company Mr. Gerhardt was electrical and mechanical engineer on development, construction and operation of iron-mining property for the Spanish-American Iron Company, Felton, Cuba. Mr. Gerhardt has been active in the affairs of the A. I. E. E. and of the A. I. and S. E. E. for the past two years.

R. B. GERHARDT

Committee Chairmen of Northwest Power Association

President Brockett of the Northwest Electric Light and Power Association has named the following as chairmen of the four principal committees of the association:

George F. Nevins, secretary and treasurer Pacific Power & Light Company, Portland, chairman executive committee Accounting Section; Lewis A. Lewis, sales manager Washington Water Power Company, Spokane, chairman executive committee Commercial Section; George L. Myers, assistant to the president Pacific Power & Light Company, chairman executive committee Public Relations Section; R. M. Boykin, vice-president and general manager North Coast Power Company, Portland, chairman executive committee Technical Section.

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Don Stearns of Humbolt, Iowa, was recently elected second vice-president of the Iowa Section of the N. E. L. A.

Dr. Arthur E. Kennelly, professor of electrical engineering at Harvard University and the Massachusetts Institute of Technology, who has been in France as exchange professor in engineering and applied science during the past year, returned Saturday, Sept. 23. While in France Dr. Kennelly was honored by the French government with the cross of the Legion of Honor.

S. Glen Vinson, vice-president and general manager of the Ideal Electric & Manufacturing Company of Mansfield, Ohio, has just returned from a very extensive trip through the Orient, where he made a careful survey of business conditions. Mr. Vinson visited all the prominent cities in the Hawaiian Islands, Japan, China and India and returned by way of the Suez Canal, visiting Egypt, Italy, Switzerland, France and England.

S. E. Doane and **M. D. Cooper** of the engineering department of the National Lamp Works of the General Electric Company embarked for Europe on the *Olympic*, Sept. 23. They will visit England, France, Austria, Germany, Holland, Switzerland, Norway, Sweden and Italy to investigate the problems and progress of the lighting industry in those countries. The offices of the International General Electric Company at Paris will be their headquarters. They plan to return to this country at Christmas time.

Arthur W. Ambrose has been selected to succeed E. A. Holbrook as assistant director of the United States Bureau of Mines. Mr. Ambrose has been in the service of the bureau since 1917, during which time he has risen through the various grades from petroleum technologist to chief of the petroleum division of the bureau. His technical education was obtained at Stanford University, where he obtained his mining engineer's degree. Prior to his connection with the Bureau of Mines he was in the service of the Dutch Shell and other petroleum companies.

Radio Corporation Elects David Sarnoff Vice-President

David Sarnoff was elected vice-president and general manager of the Radio Corporation of America at a recent meeting of the board of directors. Mr. Sarnoff, who is only thirty-two years old, has been associated with radio activities for more than sixteen years and with the Radio Corporation of America since its organization. An early exponent of the broadcasting idea, Mr. Sarnoff ranks as one of the foremost workers in the radio industry.

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R. F. Gooding, formerly chief engineer of Winthrop College, Rock Hill, S. C., is now associated as electrical engineer with Charles B. Hawley & Company, Washington, D. C., consulting engineers on water-power development.

B. L. Conley has resigned as instructor in electrical engineering at the Case School of Applied Science, Cleveland, and is now electrical engineer of the Hoover Suction Sweeper Company, North Canton, Ohio.

R. Philip Hart, who recently resigned his position as head of the standardization laboratory of the Hartford (Conn.) Electric Light Company, has been made manager of the Cazenovia (N. Y.) Electric Company.

Henry H. Plum, formerly connected with the electrical division of the United States Reclamation Service in Denver, Col., has been transferred to the Minidoka Project, Idaho, as assistant in charge of the power system.

J. P. Hickey, chief accountant of the Australian General Electric Company of Sydney, recently passed through San Francisco en route to the Schenectady plant of the parent company. It was Mr. Hickey's first visit to the Pacific Coast.

P. H. Falter, the new vice-president and treasurer of the Electric Furnace Construction Company, Philadelphia, is a graduate of the engineering department of the University of Michigan and until recently was vice-president and general manager of the Canadian Electro Products Company, Quebec. Prior to his connection with that organization he was general manager of the Baltimore Electric Alloys Company and for thirteen years with the Aluminum Company of America. Mr. Falter was also general manager of the Shawinigan Electro Metals Company, Montreal, and has had considerable experience on hydro-electric power-plant work.

Herman K. Ansingh has been selected as the Canadian representative of Ferguson, Pailin, Ltd., of Manchester, England, manufacturers of switchboards and switching equipment, who are opening an office and warehouse in Canada. In entering the Canadian field the British firm has intrusted its interests to an engineer of wide experience on both continents, for Mr. Ansingh was formerly chief switchboard and switching-equipment design engineer of the British Westinghouse Company and until recently has been switchboard and equipment-design engineer for the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. He is a member of the American Institute of Electrical Engineers and an associate of the (British) Institution of Electrical Engineers.

J. Louis Daeuble, for many years engaged in the electrical supply business, has become vice-president and treasurer of the Wood-Reinecke Electric Company, the firm organized by the late Harry I. Wood immediately preceding his death. Mr. Daeuble was manager of the Harry I. Wood Electric Company for ten years. During the past three years he has conducted an electrical business of his own under the name of the Electrical Sales Company.

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R. S. Mitten Appointed Branch Manager

R. S. Mitten, formerly sales manager of the Electric Appliance Company, Chicago, has been appointed branch manager for the Black & Decker Manufacturing Company in Chicago. In his new office Mr. Mitten is succeeding W. C. Allen, who has been selected to be sales supervisor for the Black & Decker Company. The territory which is to be in Mr. Mitten's charge consists of the States of Illinois, Iowa, Wisconsin, Minnesota and North Dakota, the eastern half of Missouri, including St. Louis, a small corner of Indiana, taking in South Bend, and the western end of Michigan.

R. S. MITTEN

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M. G. Linn, Des Moines, Iowa, was recently elected secretary-treasurer of the Iowa Section of the N. E. L. A.

H. M. Hicks, formerly local manager at Leeds of the Alabama Power Company, has been promoted to be district manager of the Ashland district.

William L. Higgins, for the past five years connected with the sales department of the Stuart-Howland Company, Boston, and prior to that for eleven years with the Belcher & Loomis Hardware Company, Providence, has become connected with the Providence office of the Western Electric Company, Inc.

C. W. Horn Will Take Charge of Westinghouse Radio Operation

C. W. Horn, manager of the radio division service department, Westinghouse Electric & Manufacturing Company, has been appointed as superintendent of radio operations of the Westinghouse company. Mr. Horn succeeds L. R. Krumm, who left the service of the Westinghouse company to become manager of the radio department of the Erner-Hopkins Electric Company, Columbus, Ohio. In his new position Mr. Horn will have charge of all radio operations of the Westinghouse company, including the company's four radio broadcasting stations, at East Pittsburgh, Pa., Newark, N. J., Chicago, and Springfield, Mass. Mr. Horn has been interested in radio for the past thirteen years and knows every phase of radio development. His work in this field has taken him to South America, Central America and the West Indies. For the present Mr. Horn will continue as manager of the radio division service department.

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W. H. Cogswell, formerly with the Miller-Owen Electric Company, Pittsburgh, has become associated with H. F. Randolph, consulting electrical engineer, Oliver Building, Pittsburgh.

H. Owesen, formerly mechanical engineer of the Apollo Steel Company, has become assistant chief engineer of the Youngstown Sheet & Tube Company.

George Roome Smith, formerly associated with the safety-switch section of the Krantz Manufacturing Company of the Westinghouse Electric & Manufacturing Company, Brooklyn, N. Y., has recently severed his connection with that department. The department will hereafter be known as the safety switch section of the Westinghouse Electric Products Company and is being transferred to Mansfield, Ohio, where W. G. Balph will be manager.

Obituary

Albert F. Dow, for many years president of the Fall River (Mass.) Electric Light Company, died Sept. 20 at Fall River. Mr. Dow retired from active business in February, 1922.

Jasper N. Keller, former president of the New England Telephone & Telegraph Company and a close associate of the late Theodore N. Vail in the upbuilding of the Bell system, died Sept. 22 at Surry, N. H. Mr. Kellar was born at Burlington, Iowa, in 1846. His career embodied varied experiences in mining, railroad work and telegraphy in the pioneer days of the Far West. He entered the telephone field in 1880 at Ogden, Utah, and four years later went to Boston, where he soon became general manager and then chief executive of the New England company.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic
Problems of the Producer and Distributor, with Market Reports, Trade
Activities, Foreign and Construction News

A Review of the Jobber's Rôle—Part I

The Many Important Functions Which Are Filled by Him Serve Materially to Lessen the Burdens Imposed on Both the Manufacturer and the Dealer

THE following comments on the service which is rendered by the stocks of the electrical supply jobbers concentrated at centers of population throughout the country have been contributed from various sources and have been gathered together under appropriate general heads, but without any attempt to knit them into a narrative. They are presented rather as the opinions of many men on the practical usefulness of this service element in the machinery of distribution.

Economy in Investment

A well-equipped jobber can make delivery from one local stock at minimum expense in time and money of many small items used in electrical work in the building trades and in connection with the maintenance and operation of the country's manufacturing and various commercial activities. Literally, thousands of small items in the electrical supply line are unnecessary requirements of various classes of electrical work. While individually these items are of minor importance, they would qualify collectively as an uneconomic and unbearable stock-carrying burden for the installer or user should he attempt to have a working quantity of a representative number of them on hand in his own stock at all times.

Electrical supply jobbers' stocks serve as an effective influence in reducing investments in miscellaneous stocks of electrical materials carried regularly by the various public service corporations, dealers and contractors. Should the jobbers' stocks be withdrawn, they would each find immediate necessity for investing additional millions of dollars in stocks of supplies beyond what is now available in jobbers' stocks subject to the call of any and all local users, and on this extra investment the public must pay.

Were it not for the concentrated stocks in the hands of the jobbers, the central stations and contractor-dealers would necessarily have to increase their investment in merchandise materially in order to have the necessary materials on hand to do their jobs promptly and efficiently. This would make impossible the quick turnover of the contractor's investment and materially increase his cost of doing business.

The investment in jobbers' stocks is undoubtedly much less than would be the investments in goods in transit and increased customers' stocks due to purchases direct from manufacturers. This elimination of investment in customers' stocks results in a great saving in interest, warehousing, accounting, trucking, handling, depreciation, obsolescence and breakage, and because of all this the public is bound to benefit.

Great savings are made by purchasers of electrical materials owing to the lack of delay in obtaining materials, prompt adjustment of claims and prompt billing, and dealers and contractors gain the opportunity of turning over their stocks more quickly and are enabled to conduct their business on less invested capital.

We all know that proper merchandising means the carrying of stock for which there is a demand and on which a reasonable profit can be obtained at a minimum investment expense and on which the necessary turnovers during the year can be obtained.

Purchasing Service

The full-fledged electrical supply jobber functions economically as purchasing specialist for the common bulk items used in electrical construction of all classes. He also functions economically on warehousing operations and in the delivery of starting quantities and finishing quantities, as well as supplying shortages necessitated through changes in construction programs or unexpected modification of building or other construction plans.

If it were not for the jobber, the consumer would either be obliged to buy his material direct from an infinite number of manufacturing plants, at higher prices, because of his small potential purchasing possibilities to each individual manufacturer, and with a longer delivery period, or he would have to buy from a similar number of local stocks, if the manufacturers attempted to maintain their own local stocks, at a still further increased cost by reason of the expensive distributing expenses of the manufacturers.

The jobber protects the consumer from poorly designed and manufactured products and from irresponsible manufacturers.

Delivery Service

An electrical supply jobber in preparing to serve a more general demand from a recognized distributing center can and does justify carrying a working quantity of these numerous items in his stock, and can deliver them promptly in accordance with the requirements of the job as it progresses and at lowest costs to all concerned.

It would be impossible to carry on the operations in the electrical industry in all its present proportion without these concentrated stocks. The success of all large operations, whether military or industrial, is dependent upon the reliable supply base from which materials and other essentials for carrying on the work can be obtained.

Bearing in mind that even the simplest electrical installation requires a great variety of such products produced from nearly as many different sources, the importance of the electrical supply jobber's economic necessity becomes increasingly apparent when the electrical industry as a whole is considered.

Emergency service from jobbers' stocks is an ever-ready aid in restoring operations of public service corporations whose properties and service are seriously crippled, as they frequently are in time of fire, flood, storm or disaster of any character. Jobbers' stocks also make it possible to meet various serious emergencies that often befall important industries in the larger centers.

SALES SERVICE

A jobbers' selling organization can thoroughly and economically cover a territory in which very few, if any, manufacturers can operate because of the limited business available in any one line.

The jobber is or should be equipped to render practical engineering assistance to the trade through the collection and dissemination of data on electrical construction material requirements and their proper and economic uses. This same assistance rendered direct to the trade by manufacturers' representatives would be much more expensive to all concerned.

There are or should be trained salesmen in a position to serve the customer on any one of four or five thousand items and to counsel and advise him in an efficient manner on price, quality, application and service. Elimination of the jobber's salesmen would require twenty-five or thirty salesmen, each representing his respective line. This would add more to the selling cost than the direct-from-factory service warrants.

Behind the trained salesmen stand the experts specializing on specific lines, whose services are available to dealers, contractors and industrial plants in their engineering and sales problems.

The jobber should have creative salesmen who will constantly increase the number of users of electrical merchandise by advocating wiring of old houses, convenience outlets, appliances, better lighting, etc. While it is true that the manufacturer can and does to some extent advertise to inform the public regarding his own particular material, it is the jobber and the jobber's representative that carry the word-of-mouth information direct to the trade regarding the latest and best electric development.

The jobber, because of his location and the nature of his business, obtains the confidence of the consumer, a confidence it would be impossible for the manufacturer to gain.

It would be physically impossible for the retailer to carry in stock a complete line of commodities so as to be in a position to care adequately for the requirements of the consuming public. Inasmuch as the manufacturer is usually interested in but one class of product, it has been demonstrated that an intermediate step is necessary to carry economically the many and miscellaneous lines and thus relieve the retailer of the burden of an excessive variety of stocks.

The jobber needs successful dealers to complete his lines of distribution and must make the dealer successful in all the lines he handles. He must see that the dealer is running his business economically and that he is allowed enough margin in the lines he handles to enable him to live.

The jobbers are of benefit to the consumers in that the profits made by the jobbers are retained in the community providing those profits.

Why Not Develop a True Electric Range?

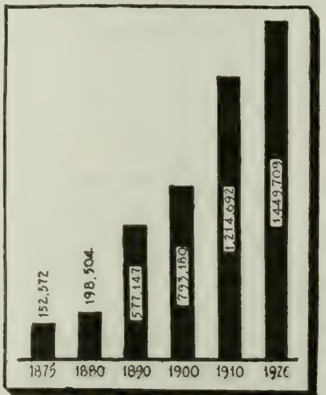
Universal Electric Cooking Can Be Brought Materially Closer by the Simplification and Cheapening Inherently Possible, if Traditions of Coal, Gas and Oil Are Shaken Off

BY A MANUFACTURER

WITH dealers aggressively demonstrating and displaying electric ranges, central-station companies making vigorous efforts to connect more of them to their lines and well-equipped and forward-looking manufacturers devoting their facilities to producing them, it seems time, not in spite of all this, but because of it, to point out that we still have no *electric* ranges, but simply an array of *electrified* ranges.

I have been inspecting some recently—nickel and white enamel, automatic control, fireless cookers, multiple-heat switching, individual fuses, removable elements, convenience outlets—impressively clean, impressively convenient, impressively economical. But what struck me most impressively is the fact that, stripped of their strictly electrical equipment, they are, in construction, design and general conception, directly adapted from ranges of other sorts.

Growth of Wire Mileage in the United States



Magazine of Wall Street

Since 1875 there has been a tremendous growth of wire mileage in the United States, as shown by the above chart. Much of this growth has been due directly to the great increase in the use of electric energy.

Take as an example a range of well-known make in the "quality" class, turned out by an organization which produces nothing else. The model I inspected had three hot plates, an oven, a fireless cooker and a broiler, was handsomely finished, equipped with all recent control and other refinements, and sold for a little more than $200. Yet with its elements out, its switches off and its wiring removed any mechanic of average skill and ingenuity, and without expending too much time, could convert this range (with the possible exception of the fireless cooker) into a gas or kerosene burner, and possibly into even a coal burner, because its general construction and basic design are the same as these other types.

I realize, of course, that certain similarities are inevitable; that, for one thing, it would be difficult to sell women a range that broke too sharply from conventional appearance, and that certain common parts, like the top, are necessary regardless of the heat source. But with all the possibilities thrown open by electric heat it scarcely seems necessary to follow previous types so slavishly, particularly when this following has made itself a severe handicap to the electric range.

Take the single item of weight, for instance. The wiring and heating and control equipment of the range just referred to weigh perhaps 50 lb. The oven, cooker and broiler, with the structure necessary to support all with a load of utensils, weigh perhaps another 100 lb., making a permissible total of 150 lb. But this range, installed, weighs 350 lb., 200 lb. of excess material, represented not in surplus strength or durability, but in plates, housing and braces put on solely to give the illusion of coal or gas. The nameplate is even a panel embossed like an ash door, and one finds himself all but looking for the smoke pipe.

It is as if the electric locomotive carried a dummy boiler, the tungsten lamp were equipped with a chimney or mantel, and the electric motor with cylinders and crank shaft.

To be sure every development is certain to carry over some excess baggage from the thing it supersedes. The first automobiles were simply motorized carriages, the first railway trains steam-drawn stagecoaches, and the first steamboats engine-driven sailing craft. But the electric range, it seems, is now old enough and has gone far enough to become something of itself.

Electric cooking is finding gradually widening use. Its obvious cleanliness and convenience have aways recommended it powerfully, and with rates reduced to a point where the operating cost compares very favorably with that of fuel-fired equipment, it is not too much to expect that in the future electric cooking will be universal. But what postpones this time to something beyond the near future is the fact that electric equipment is considerably and admittedly higher in first cost than the fuel-fired type, and in this lies the real significance of present electric construction practice.

With the possibilities for simplicity and flexibility of construction thrown open by ease of control and intensive localization of heat, electric equipment should be, unit for unit, cheaper than all other types, once it breaks away from the traditions of coal, gas and oil and strikes out on a new path of design.

This would require boldness. Any innovation, and particuarly one that involves introductory selling, as this well might, requires that. But the reward not only to the manufacturer but to the entire industry seems worth the risk, for any one can see what universal or even "near-universal" electric cooking will mean to the manufacturer, jobber, contractor-dealer and central station.

Who will take the plunge?

Survey of Business Conditions

Reliable Radio Manufacturers Reduced Prices Sensibly

A leading manufacturer of radio appliances in Philadelphia states that current sales cannot compare with sales of six months ago, when the great interest in such apparatus was at its height, and that the tremendous amount of orders which were placed at that time was to a large extent either canceled or arrangements for gradual deliveries were made between the manufacturers and the jobbers.

"Deliveries can be made without undue delay, and we do not expect business to be such as to demand undue lengths of time to make shipments." he says.

"Prices have gone down compared with six months ago on most items, but not to nearly such an extent as would appear from quotations which are made from certain so-called manufacturers. The better class of manufacturers have made certain reductions, but in a systematic and sensible way. We do not anticipate any change in the near future.

"We think the outlet for the next six months is good because the cold season is conceded to be the best time for the sale of radio material.

"Paradoxical as it may seem, the tremendous setback which we had here in the past few months was most helpful to the reliable manufacturers, since the "fly-by-nights" could not stand the strain and a good many went out of the business as fast as they came in. This situation, of course, accounts also for some ridiculously low figures which are reported for certain items in the radio line—these items being mostly bankruptcy stocks or material from people who want to raise the cash to close up."

Says Small Wiring-Box Sales Have Increased Materially

Current sales of small wiring boxes for armored conductors have increased very materially over those of six months ago, according to one manufacturer in New York City. He says that this condition is due to the heavy construction of the last summer. It is known among manufacturing circles that producers have been unable to meet the demand on account of the deliveries of raw material which have been made by some foundries, but that the outlook is improving every day. This manufacturer states:

"There have been no changes in prices; in fact we feel that prices are about stabilized, at least for the next six months, and our opinion is that business will greatly improve in the spring, but with a slackening from now until early in March."

High-Class Construction Helping Refrigerators and Heaters

Reports to the housing division of the Department of Commerce indicate a slow swing in the construction of new buildings from the New York-New Jersey district to the Middle West with the center in Chicago. Throughout the country generally reports indicate a continuation of the tendency to erect dwellings and apartment houses of the higher class. This situation, it is pointed out, is particularly satisfying to manufacturers of refrigerators, electric heaters and high-grade appliances of all kinds.

The rate of construction contracts has been high since March, according to the reports, and present activities probably will carry the building industry through well into cold weather. There is no indication thus far, according to the housing division, of the effect of increasing prices of construction upon future contracts.

Chile Promises Good Market for American Radio

Chile is sending inquiries to the Department of Commerce relative to the development of the radio industry in this country. Several manufacturers in New York City are in receipt of letters from business men in the South American country asking about standard material and its price. It seems probable that before long serious consideration will be given to the exploitation in Chile of this new development, according to Commercial Attaché Charles A. McQueen at Santiago.

Legislation is now contemplated in Chile, he says, based on the laws of the United States. Although it does not provide specifically for the establishment of broadcasting stations by private enterprise, it is possible that this service will be available through the leasing of government-owned stations during times of peace.

Record-Breaking Heater Sales Are Reported

Within the past few weeks the demand for electric heaters has risen by leaps and bounds under the stimulus of the domestic fuel situation, and the outlook for the year's business is record-breaking, according to R. P. Ingalls, sales manager Simplex Electric Heating Company, Cambridge, Mass.

To a representative of the *Electrical World* Mr. Ingalls said last week that the company is running on full time and that accumulated stocks of heaters manufactured earlier in the season against the present demand are being rapidly diminished. In fact, rationing of heaters delivered for resale has become necessary. The supply of raw material for present needs is satisfactory.

The demand is well distributed over the country north of Washington, D. C., and St. Louis. Sales so far this season are easily treble those of a year ago.

The Metal Market

Domestic Copper Demand Active—Refuse to Pay Attention to War Talk

Demand for domestic copper is active, and inquiry in the market at the present time is close to 10,000,000 lb. Most of this is from the wire companies, although a good proportion is from brass works. Domestic buying, however, is in moderate volume as consumers are still trying to find interests willing to sell under 14 cents.

Metal interests refuse to pay much attention to Near East war talk. A long touch with the Near East makes them realize that money accomplishes more in diplomatic circles in that area than probably any other place in the world. Therefore they expect an early settlement. Armies are more expensive to support than Near East diplomatists.

As was expected, the current week brought a further extension of the improvement in the iron and steel industry. With a lessening of the drawbacks arising from the coal mining and railroad labor troubles, production of pig iron and steel is recovering, and many of the blast furnaces that had suspended operations because of deficiency of fuel supply have started up once more.

The gain has been general, all districts making more favorable reports, and steel mills are now running, as a whole, at about a 65 per cent rate. An encouraging feature has appeared in the placing of important rail orders, and the leading interest, although recently announcing an advance of $3, effective Oct. 1, is at present booking contracts for the first half of 1923 at $40 per ton. While declines have occurred in certain grades of pig iron, the main price trend continues upward, and quotations in most instances are appreciably above the levels of a year ago.

NEW YORK METAL MARKET PRICES

	Sept. 21, 1922 Cents per Pound	Sept. 28, 1922 Cents per Pound
Copper		
Prime Lake.......	14.00	14.00
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price.............	5.75	5.75
Antimony ...	5.25	5.25
Nickel, ingot ..	36.00	36.00
Zinc, spot	6.50	6.50
Tin, Straits.	32.20	32.20
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

Heavy copper and wire ..	11.00–11.25	11.00–11.25
Brass, heavy ..	5.75–6.25	5.75–6.25
Brass, light	5.25–5.50	5.25–5.50
Lead, heavy... .	4.62½–4.75	4.62½–4.75
Zinc, old scrap....	3.00–3.37½	3.00–3.37½

Cuban Electrical Market Situation

Present Conditions Have Good and Bad Features— People There Are Fast Spenders—Best Chances Are for Those with Native Connections

BY RUSSELL RAYMOND VOORHEES

WHAT are the chances of increasing the sale of American-made electrical goods in Cuba? The question can be easily answered by saying that the chances of increasing the sale of American-made electrical goods in Cuba are at this writing both good and bad. That seems strange, to say the least, but a little thought on the subject will show that such an answer comes nearer the truth than anything else could.

In the first place the sale of electrical goods or anything else in any country is dependent to a great extent on the amount of wealth that that country produces. To this can be added, of course, the wealth that the tourist leaves in the country. From this viewpoint Cuba is not a very good market for electrical goods at this time because her chief source of wealth, sugar, is more or less upset both as to price and as to demand. Her other big crop, tobacco, is showing an improvement, but at the same time it is not what it should be. An insight into the situation can be obtained from the fact that the men who cut the sugarcane in the field now get only 40 cents a day in comparison with $2 a day a year or so back. From this it can be seen that the wealth that Cuba is producing is not enough to make it a very good customer for electrical goods. Economic conditions in Cuba are still very much upset, although they are better today than they were a year ago or even six months ago. But at that conditions in Cuba are far from normal.

TOURIST MONEY IS HELPING

The tourist is visiting Cuba and spending money, to be sure, but no country the size of Cuba can develop itself on the tourist business alone. The money that the tourist is spending is helping the situation to some extent, but that is about all that can be said for it.

And so it is not hard to see why Cuba is not just now much of a market for American-made electrical goods; but while the present situation is not very encouraging as far as increased business is concerned, it is not hard to see a brighter future for increased sales there.

The population of Cuba is about 3,000,000. Outside of Havana and Santiago there are few if any cities that amount to a great deal. There are places with 25,000 to 50,000 population, but a Cuban city of even 50,000 population appears to be far smaller than an American city of the same size. It can truly be said that the mass of the Cuban population live outside of the two largest cities, and even outside of the smaller cities, and are of the peon class. For the most part they are poor. Their hotels or huts do not contain even the rudiments of comforts such as the poorer classes in the States know. These peons, who today because of poverty have practically no wants, can be made to be the great purchasing power of Cuba, and it is to them that I look when I say that the future possibilities for business in Cuba are good. The better class, of course, will have its wants, too, but no one has yet been able to deny that a large middle class able to buy is the best class of trade for any business to have.

One doesn't find electricity in the smaller towns and in the rural districts, but that will come in time. The reason it is not there now is that there is no need for it. But just as soon as the purchasing power of the average Cuban rises to a level where electric service is within his reach the question of electricity in the rural sections will be solved without much delay.

Cuba is bound to progress, and as she progresses she will become a better and better customer for American-made electrical goods. The peon will not be satisfied with his hovel and former life, and improvements will be the order of the day. It is hard to imagine a people improving their situation without making use of electricity. Some one will get this business when that time arrives. It might as well be the American manufacturer as anyone else. It is safe to say that this class of trade represents fully half of the total population of the island.

The other portion of the population, the more prosperous class, have homes that are wired for electricity and they know something of the advantages that come from its use in the home. But even among this class there are opportunities existing today to increase the sale of electrical goods. These people have the money with which to buy these things, and while they may not be buying just at the moment because of the unsettled economic conditions, they possess a potential buying power that is well worth paying heed to.

LIKES TO SPEND MONEY

The one thing that is a happy feature of the entire situation is that the Cuban is a spender. Money goes about as fast as it comes with him, regardless of how fast or slow it comes. He spends because he likes to spend, which is a good thing for business.

From this it can be seen that there are real opportunities in Cuba to increase the sale of American-made electrical goods. Among the better class it should be possible to sell almost any sort of electrical appliance right now, and in the future as conditions improve and as the condition of the peon becomes better and better it should be possible to interest him in electrical appliances to lighten the work in the home and to make comforts more complete. It is just a question of waiting until Cuba produces wealth enough to put these things within reach of the mass of her population.

Right here it might not be amiss to say that the Cuban likes display, and since this is the case he should make an excellent customer for electrical appliances of various sorts, because they add a certain amount of display to any home.

It should be borne in mind that Cuba is in very close touch with Europe. A French steamship lines touches the island and German boats are beginning to come. All over Cuba it is possible to see goods which have been imported from Germany and France and the American manufacturer should remember this when he approaches the island for business. He will find some competition from these sources, but should not have much trouble in meeting it and even in beating it.

Cuba for Cubans

But in the selling of electrical goods or, in fact, anything in Cuba there is a trick. Cuba is a country that appears to be run for the benefit of Cubans. "Cuba for Cubans" appears to be their motto, and so American electrical goods manufacturers should take the hint and seek some connection that is Cuban. I have been told that unless a part of every business enterprise is Cuban it will not be allowed to exist, and while this statement is probably overdrawn, it does appear that a business enterprise that is not partly Cuban has a much harder road to travel than one that is partly Cuban. There seems to be little if any dislike for American goods; it is just a question of wanting a Cuban to be "in on the deal" and to "get his." It would be well while conditions are none too good to look into this phase of the situation and so to be ready with the proper organization when the Cuban is ready and able to buy.

Shipments to Cuba are a very easy matter. Goods can be loaded on freight cars at the factory in America and run to Key West, Fla., where the cars without unloading are run onto special boats that take them to Havana. At Havana they are run to their destination, making it possible to ship direct from the factory in America to the destination in Cuba without unloading. Railroad facilities in Cuba are most satisfactory and prompt service is given.

In conclusion, it is safe to say that American-made electrical goods can gain a wider market in Cuba, if not today, then tomorrow. The great mass of the population will some day seek some of the things that have heretofore been denied to them, and the wider use of electricity is then a certainty. This demand will be tremendous when it develops. Added to this is the possibility of increasing the sale of electrical merchandise to the better class now or in the very near future. Will American manufacturers share in the revival of business when it comes?

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

DEMAND in the electrical market continues to grow better as fall and winter articles commence to sell in a more active way than for some years past, reports from all over the United States indicate. Central-station companies report increases in business.

Appliance sales are taking on renewed activity, flatirons and toasters leading. Heaters, owing to the coal strike, are selling in large quantities and stocks are reported sufficient for approximately two months' supply. Business in radio apparatus has shown much improvement during the last few weeks.

New York

Business Increasing—Residential Meters Selling Best—Small Motor Sales Spotty

Business in the electrical industry continues to increase. Greater interest is being shown in sales of hollow ware, some jobbers reporting unusual demand for this time of the year for flatirons and toasters. An active business in heaters of all descriptions is on in earnest. Reports from central stations say that business is much heavier than a year ago. Conduit stocks are in much better condition.

Meters.—Residential types continue to sell best. A heavy demand is expected to continue for the rest of the year.

Radio Equipment.—Much improvement is reported. Sales during the last few weeks have been heavier than for some time past. Stocks are very heavy.

Motors.—Sales are spotty in the small-motor business and compared with the volume in 1921 are approximately 20 per cent better.

Electric Heaters.—Sales continue to increase and stocks are only fair.

Chicago

Entire Trade Is Moving Upward—Schedule Material Advances—Safety Switches Steady

With the final settlement of both the railway and coal strikes, the electrical trade has started again on its upward swing toward better business. Jobbers are still troubled with slow shipments, but this situation is gradually righting itself.

Stocks of most material are in fair condition, with the sole exception of conduit, which is still at a premium. Building construction is still creating an active demand for wiring material. Schedule material, including push switches, advanced 10 per cent. High-tension manufacturers are continuing to be active. Inquiries on open-air heaters have started, and from present indications the winter's trade will be good.

Conduit.—Demand is still active, but stocks have improved but slightly. The ½-in. black pipe sells for $55 per 1,000 ft. in lots of 5,000 ft.

Wire.— Most all jobbers report good sales on rubber-covered wire. No. 14 is available in lots of 5,000 ft. for $6.30 per 1,000 ft. Stocks are normal. Call for bare and weatherproof wire has been steady. Prices are firm.

Safety Switches.—The call for the 30-amp. switch follows the activity of home building. Stocks are in good condition.

Air Heaters.—Dealers are reporting an increasing amount of inquiries relative to heaters. Stocks are in good condition, and jobbers feel that the winter business will be good.

Fuses.—There is a steady call for this material, which is absorbed mostly in the new building. Stocks are in good condition.

Schedule Material.—A 10 per cent increase on push switches, key and keyless sockets was announced during the week.

Boston

Loom Prices Show Tendency to Stiffen—Rigid-Conduit Delivery Situation Greatly Improved

With the coal and rail strikes behind, business is hitting a faster stride. The demand for electrical material is unusually well distributed. Deliveries are better in smaller sizes of rigid conduit, but electric heaters are being offered on a four weeks' basis. Prices are firm and tend to stiffen in loom, weatherproof wire and steel products. General business in New England is improving, and little fear of industrial adversity resulting from a shortage in bituminous coal is expressed.

Jobbers' stocks are well maintained in most lines, but the demand for rubber-covered wire is so active that no great surplus is being accumulated. Building operations continue on a large scale, residential structures being in marked demand in suburban territory. Telephone and traction earnings are excellent and central-station outputs are increasing rapidly.

Wire.—Rubber-covered No. 14 was quoted Monday at $6.25 per 1,000 ft. in 5,000-ft. lots. Weatherproof base is about 17 cents. One large factory is now running three nights per week to catch up on rubber-covered orders.

Loom.—Prices show a tendency to stiffen. Deliveries are good and the demand moderate. In 1,000-ft. to 5,000-ft. lots, $\frac{7}{32}$-in. loom sells at $16.75 per 1,000 ft. and ¼-in. at $19.50. Stocks are satisfactory.

Tape.—A fair demand is resulting from the increased amount of interior electrical construction lately observed. Prices vary widely according to quality, representative quotations on ¾-in. black tape of excellent grade being 50 to 60 cents per pound in 100-lb. lots.

Heaters.—Jobbers' stocks have been cut to the quick and in some cases cleaned out by the sudden demand, notwithstanding the efforts of the factories to anticipate it. Vigorous retail sales efforts are reaping their reward.

Rigid Conduit.—Smaller sizes have have now come to hand in sufficient quantity to greatly improve the delivery situation, but larger sizes are still hard to obtain. Prices are steady, the 500-5,000-lb. lot quotation Monday on 1-in. black being $108.21 per 1,000 ft., galvanized being $118.41.

Radio Apparatus.—A rising demand is a feature of the market, although this has not yet equaled the volume of last year at this time. Jobbers anticipate an excellent fall and winter trade, however.

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Atlanta

Jobbers Report Very Satisfactory Volume of Electric Heater Sales—Industrial Motors Slow

"Georgia is on the road back to a healthy financial condition," according to the statement of F. R. Bennett of the State Department of Banking. His statement shows a reduction in loans and discounts of $35,391,000 over a year and a reduction in overdrafts of $133,674 over the same period. This will give a good picture of financial conditions throughout the state, with prospects for conditions to be bettered as soon as cotton crop now in the course of picking is marketed. The three largest railway shops in Atlanta have settled their difficulties with the striking shopmen and old employees returned to work on Sept. 20, thus settling practically the only labor difficulty in this city at the present time. Rail shipments continue very slow. Difficulty is experienced in obtaining fuel for industrial requirements and prices are high. Work on the eight-hundred-thousand-dollar viaduct in Atlanta was started this week, and the schools proposed under the recent bond issue amounting to $4,000,000 are also under way, assuring building activities in Atlanta for the next twenty-four months.

Electric Ranges.—Despite continued high prices, jobbers report a very satisfactory volume of sales, with local stocks in satisfactory shape. Shipments from factory are fairly good, but receipts are poor.

Industrial Motors.—The movement in this line continues slow, though there are good prospects for reawakened activity as soon as negotiations with a number of the larger textile mills are complete. Stocks are in good condition with factory shipments satisfactory and deliveries slow.

Oil Switches.—Only a fair volume of this specialty is being taken, most of the sales being for the outdoor type. This line will be likely to respond to the purchase by industrial plants within the next sixty days.

Lighting Fixtures.—A brisk movement in this line is reported by all dealers in both the residential and commercial types, the commercial leading the field at this time, and the prospects are for a continued demand for some time to come.

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St. Louis

Conditions Better than Six Months Ago—Jobbers' Sales Holding Own—Wire Steady

"Conditions in the St. Louis territory may be described as principally fair and better than six months ago," says a special report just issued by the Liberty Central Trust Company, based on a questionnaire sent to 250 banks in southern Illinois, Missouri, Arkansas, Oklahoma and Texas. "The farmer's financial prospects are not yet entirely satisfactory. Opinion is divided evenly on the question of profit. In Arkansas and Texas most correspondents believe that the farmer will do better than break even. To a less degree this is true in Missouri, and in Oklahoma and Illinois the majority assert that in 1922 the farmer will get but meager returns." The oil business is reported fair, building generally active, livestock industry fair to good, and retail trade fair.

Local jobbers report that trade is holding its own but not showing the continued increase anticipated. The recent strikes created an unfavorable mental attitude, but one prominent jobber states that business confidence is bettering, and he anticipates more activity this fall. The higher prices are expecteed to be of aid to the jobbers, and with the higher resulting profits they hope to offset the losses preceding June so as to break even on the year's business. Larger stocks are maintained as the general level of electrical prices rises.

Loom.—Good stocks are on hand to meet an active demand, and prices are increasing. The principal demand is for new residential construction, and some decreases may be expected later this year. The price of $\frac{7}{32}$-in. is $15.75 per 1,000 ft. and ¼-in. is $18.40, both in 1,000-ft. lots.

Wire.—Sales continue in the same relative volume. Stocks of rubber-covered, with the exception of No. 14, are low. Prices are tending upward. No. 14 rubber-covered sells for about $6.50 per 1,000-ft. in 5,000-ft. lots, while weatherproof in sizes from No. 4/0 to No. 8 inclusive have increased from $17 to $17.50 and $18 per 100 lb. in lots of 500 lb. and larger.

Cleveland

Radio Sales Surpass All Expectations—Heaters Are Active—Refrigerating Machine Sales Decline

With the advent of fall comes renewed activity in the sale of appliances. Small portable heaters are moving well and a brisk season is predicted. Several dealers are operating booths at the "Palace of Progress" exposition and have stimulated interest in washers and cleaners.

Radio Equipment.—Sales of the past week have surpassed all expectations as it was not generally expected that the fall season would commence so early. Demand, however, while heavier than usual, does not absorb the supply, since production has been increased to permit a reserve stock with which to handle the "hold" orders.

Heaters.—The cold snap has been considered responsible for the sudden demand for the small portable type. Dealers are well stocked but are replenishing the supply to meet an expected increase in demand which they believe will be caused by the fuel shortage this winter.

Washers.—Although a few dealers report normal consumption, sales in the aggregate have decreased and have seemingly affected ironers, which have also shown a decline.

Refrigerating Machines.—The diversion of the attention of consumers to heating devices has caused a sharp decline in refrigerating sales. Jobbers are preparing estimates, however, for contractors engaged in apartment-house construction.

Motors.—As if in compensation for the stagnation of other products, jobbers report a fair activity in motor sales although confined to the smaller type. Supply and deliveries of stocks are fair.

Lamps.—An increase of more than 25 per cent in lamp sales is reported. The supply is sufficient, however, to meet the demand and leave a satisfactory margin.

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Salt Lake City

Collections Show Steady Improvement—Lamp-Cord Stocks in Excellent Shape — Wire Steady

That manufacturers and financial concerns are operating on a better profit basis is indicated in current dividend reports. Many firms that suspended dividends during the worst period of depression have lately resumed payments. A speculative tendency in investments has reduced many excellent local bond and stock offerings to a condition of minimum demand. Collections show a quite steady improvement.

Weather conditions are ideal for harvesting. There has been no let-up in building activity. Rough labor is in good demand, while there is a considerable oversupply of clerical help. Salt Lake City will be the Mecca of electrical men for two weeks, beginning Oct. 2. The big electrical exposition, held under the auspices of the Rocky Mountain Electrical Co-operative League will, it is said, present a million-dollar display of electrical products, with factories in every part of the country amply represented.

Lamp Cord.—Jobbers' stocks are in excellent shape. Prices have advanced.

Wire.—In steady demand, though not ordered in large quantities. Mine activity is creating a better market. Prices show a stiffening tendency.

Rigid Conduit.—Slight price increases in the past month. Demand is good.

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Portland-Seattle

Improvement in Business Seen — Demand for Washers Active — Fan Stocks Well Cleaned Up

Water-borne commerce of the ports of the Northwest is very encouraging, and present indications are that the total volume for the year 1922 will far exceed any other year's business. The lumber cut is above normal at the present time, and the demands are so great that practically every mill is making an endeavor to cut as much as possible in the few weeks remaining before winter conditions interfere with logging operations. Bank deposits also show a very material increase over a year ago. This section of the country is faced with a serious shortage of cement, which is seriously interfering with construction work at the present time. Grain shipments continue to increase. Electrical jobbers report business to be exceptionally good. Almost all lines of material are in demand, but particularly along the line of construction material. Manufacturers report much the same condition, stating that while business will not equal some past records, it is very good and far better than it was during the first quarter of this year. Central stations and the lumber industry seem to be creating the principal demands. The railroads were buying actively before the strike, but since that time orders have been somewhat curtailed. General reports indicate that the strike is not seriously affecting transportation in this section as transcontinental shipments have been coming through in very good time. Jobbers report that local railway transportation conditions are improving. Prices usually are very stable and stocks are in good shape, some few lines being a little short. Central-station generation for the past week is reported to be the greatest in the history of Portland and exceeds that of a year ago by approximately 20 per cent.

Washers.—The demand for washers and ranges is very active throughout the Northwest.

Appliances.—There is a strong demand for practically all lines of household appliances. Fan stocks have been very well cleaned up. The demand for room heaters is increasing rapidly.

San Francisco

Heating Devices in Brisk Demand—Steady Demand for Private Telephones—Wire Improving

Building construction continues at a fast pace, employing every available man. Easier credit conditions, particularly in the inland districts where the bulk of the crops are now being marketed, and the practical elimination of non-employment, providing better retail markets, will reflect themselves in better business through all successive sources of distribution. The increasing industrial importance of San Francisco and the Bay region is emphasized and augmented by the location of a new General Electric Company factory near Elmhurst, the first unit of a large plant, and by surveys made by active new-business departments of power companies which have now an increasing power surplus.

Ranges.—Electric ranges are moving well, especially in Alameda and Contra Costa Counties. One large power company is apparently specializing on apartment houses and on one make, though not exclusively. Another company is purchasing four or five makes in carload lots and making fairly rapid turnovers.

Household Appliances.—Country fairs and fall industrial shows are being well covered and are now recognized battle grounds for publicity. Slightly revised models are causing a slight upward trend of prices with fairly staple trade prices to provide greater profits for dealers. Electrical homes are being revived in the Bay region, their original starting point.

Telephones.—There is steady though rather negligible demand for rural telephones on private lines. Interphones, however, are selling well. One firm reporting an average of one apartment house per day since early in the year. Such apartments average eight to ten sets and total about $500 per job.

Special Wires.—Special rubber cables for a variety of industrial purposes are proving a fruitful field.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Anaconda Company Asked to Give Bid on Largest Inquiry

The largest copper-wire inquiry ever received in this country came from Japan last week, according to an official of the Anaconda Copper Company.

"We received an inquiry from Japan," the official said, "for 2,500,000 lb. of copper strand for the Tokio Electric Company. This is the largest foreign inquiry for copper wire ever received in this country. The contract has not yet been awarded, but it is unlikely that an American firm will obtain the order because Japanese buyers must pay a 30 per cent ad valorem import duty on copper."

Approximately 12,000 miners, smelter men and other employees of copper mining companies in Montana have received an increase of 50 cents a day in wages, according to the official quoted. Miners will receive $4.75 a day.

◆

Kerr Turbine Company Holds Sales Convention

The annual sales convention of the Kerr Turbine Company, manufacturer of steam turbines and gears, was held at the plant, Wellsville, N. Y., on Sept. 11 to 13. Business sessions were interspersed with pleasure trips through the adjoining country and also with entertainment at the Sagamore Camp of Paul B. Hanks, president of the company.

General renewed activity in business was reported from all sections, from the Atlantic to the Pacific Coast and from Texas to Canada. An inspection of the plant was also made, particular interest being shown in the test department.

◆

Ohio Brass Ships Twenty-five Cars of Porcelain Insulators

The large amount of new transmission-line construction being undertaken in the Northwest this year is indicated by the fact that one insulator manufacturer, the Ohio Brass Company, has already shipped into that district a total of twenty-five cars of porcelain insulators of all types, principally high-tension pin and suspension units.

◆

Brown Instrument Company Opens Two New Sales Offices

The Brown Instrument Company, Philadelphia, announces the opening of its New England branch sales office at 185 Devonshire Street, Boston. George Goodman is in charge. The company also announces the opening of its Southern district branch sales office in the Brown-Marx Building, Birmingham, Ala., in charge of Charles L. Saunders.

◆

Rome Wire Company Opens Boston Sales Office

The Rome Wire Company, with plants in Rome, N. Y., and Buffalo, N. Y., has recently opened a Boston sales office in the Little Building, Boston. This office will be in charge of C. G. Miller, who has previously represented the company in the territory mentioned.

Westinghouse Receives Large Order for Power Equipment

The large increase in the demand for electric light and power in the territory surrounding Pittsburgh has made necessary additions in equipment by the West Penn Power Company. Several large orders have been placed recently, the latest, amounting to approximately $400,000, being for transmission apparatus, to be supplied by the Westinghouse Electric & Manufacturing Company.

This order includes nineteen transformers and fifty-three oil circuit breakers. The transformers are all oil-immersed, self-cooled, single-phase, 60-cycle outdoor type. Of these, four are rated at 10,000 kva., 132,000/25,000 volts; seven at 2,000 kva., 25,000/7,500-2,500 volts; four at 5,000 kva., 132,000/-25,000 volts, and four at 500 kva., 25,000/7,500-2,500 volts.

The oil circuit breakers are for outdoor use and are three-phase, electrically operated. Three are type G-2, 132,000 volts, 400 amp.; two are type 0-21, 25,000 volts, 1,200 amp., and forty-eight are type 0-21, 25,000 volts, 600 amp.

◆

Dealers Complain of Narrow Margins of Profits

Members of the Pennsylvania State Association of Electrical Contractors and Dealers have notified the Electrical Supply Jobbers' Association that the present differential is not great enough to enable the contractors and dealers to make a reasonable profit. The association also went on record to work for legislation that will require the licensing of contractors.

In the discussion of profits on appliances speakers said some houses at present are selling at a profit of 5 per cent, or at a price less than the general run of dealers can purchase the goods. The speakers made it plain that it was not their desire to attempt to curb price cutting, but they were of the opinion that the manufacturers' price lists should be high enough so that with a substantial discount the dealers could make a reasonable profit on a sale.

◆

Company to Make Radio Parts Is Organized in Connecticut

The Cheshire Manufacturing Company, West Cheshire, Conn., has been organized and will take over a plant in West Cheshire, adjoining the Connecticut Brass Works, to manufacture various electrical novelties, radio parts and devices. The concern is headed by F. Cranston Thomas, president of the Natural Dyewoods, Inc., and George A. E. Jones of the United States Electrical Company, New London, Conn.

The new company has received an order from a large radio corporation for 1,000,000 pocket radio boxes and for 40,000 cabinets, similar to those used for phonographs, in which the radio company will install receiving sets that make unnecessary the use of outdoor or indoor antennas.

About $50,000 will be expended in improvements and several hundred workers will be employed.

◆

Mack Batteries in Northwest Selling Actively

A branch factory is now being established in Portland, Ore., by the Mack Battery Company of Los Angeles, Cal. LaFaver & Jordan, distributors of the Mack dry battery in that city, announce that sales are climbing rapidly, 1,500 batteries of all sizes having been sold in Oregon and Washington during the first ten weeks of operation. The new plant will reduce freight rates and insure better deliveries.

◆

The Tiffany Electric Company, 131 Howell Street, Jersey City, N. J., manufacturer of electrical specialties, has filed plans for the erection of a one-story building at its plant.

The Indiana Battery Service Company, 1,007 North Meridian Street, Indianapolis, has acquired property at 1,136 North Meridian Street, 80 ft. x 320 ft., as a site for the erection of a new one-story plant, plans for which are now being prepared.

General Electric Company business at its Schenectady plant continues upward, officials of that company state. Though the company has given out no figures lately regarding the number on the payroll, the total is believed to be within approximately 3,000 of the normal figure, around 18,000 persons.

The Post-Glover Company, Cincinnati, manufacturer of panelboards, switchboards and accessories, celebrated its thirtieth anniversary on Sept. 12.

The Hoover Suction Sweeper Company, North Canton, Ohio, is issuing pictures of Christmas electric cleaner displays in preparation for holiday business.

The Power Specialty Company, 111 Broadway, New York City, announces the appointment of Pell W. Foster, Jr., as New England district sales manager, with offices at 50 Congress Street, Boston. Mr. Foster was formerly in the New York sales office.

The Henderson Electric Company, North Adams, Mass., is planning to move to larger quarters in the Richmond Hotel Annex.

The U. S. Electro Galvanizing Company, with main office and factory at 32 Brockton Street, Brooklyn, N. Y., announces its change of name to the U. S. Galvanizing & Plating Equipment Corporation.

The Coleman Electric Company, Allentown, Pa., has opened an electrical department in the Bush & Bull Department Store, Bethlehem, Pa., with a full line of Gainaday washers and appliances.

The Standard Variometer Company, City Point, Va., recently organized, has arranged for the operation of a plant in that city for the manufacture of radio equipment and parts and kindred electrical specialties.

The Electrical Appliance Manufacturing Company, Waterbury, Conn., has filed a certificate with the Secretary of State of Connecticut increasing its capital stock from $10,000 to $100,000. The issue will be used to increase production.

The Walker Vehicle Company, electric trucks, Chicago, announces that it expects to open a Buffalo branch sales office in the near future. According to C. A. Street, sales manager, the company has been operating its large new factory full time for many months and is now planning to operate a night force owing to increasing sales.

The Burdick Cabinet Company, Milton, Wis., manufacturer of cabinets, radio cases, talking-machine panels, etc., has engaged the Federal Engineering Company, Milwaukee, to design a brick and steel manufacturing addition, 80 ft. x 160 ft., two stories and basement, estimated to cost $50,000.

The Wabash Electric Company, Clinton, Ind., has plans under consideration for extensions and improvements in its plant and system to cost approximately $50,000.

The Electric Storage Battery Company, Philadelphia, has obtained a permit for construction of a factory building and assembly plant at Rochester, N. Y., to cost approximately $60,000.

The Northeast Electric Company, Rochester, N. Y., manufacturer of electrical equipment, announces that it will erect a two-story addition to its plant, 50 ft. x 90 ft., to cost $35,000.

The Standard Electric Works, Montgomery, Ala., recently organized, has arranged for the establishment of a plant at 17 Bibb Street for the rebuilding and repair of electric motors and other electrical equipment.

The Universal Burner Company, manufacturer of liquid-fuel burning equipment, Logansport, Ind., recently incorporated under the laws of Indiana at $25,000, all common stock, expects to build all its equipment with the exception of large air compressors and steam pumps, which it will purchase on the market. It will also purchase motors for use in connection with small units and motor-driven oil pumps.

The Atkinson Armature Works, Pittsburgh, Kan., announce that they have awarded a contract to the Helman Rogers Construction Company, Pittsburgh, for the erection of a one-story basement addition to their electrical equipment plant.

Ophuls, Hill & McCreery, Inc., consulting engineers, 112 West Forty-second Street, New York City, announce that the firm name has been changed to Ophuls & Hill, Inc. The firm has issued a bulletin describing its five years in business. Officials state that $10,000,000 worth of work has been built under the supervision of the company during that time.

The Alp Manufacturing Company, Newark, N. J., announces that it has changed its name to the Continental Electric Company, Inc.

Foreign Trade Notes

CONCESSION GRANTED FOR ELECTRIC RAILWAY IN LIMA, PERU.—The Peruvian government, according to Assistant Trade Commissioner Turner, Lima, has authorized the presentation of plans for the construction of an electric railway. The new line will start at the Avenida Industria, Lima, and will connect with the present system at either Bellavista or Callao. A concession has already been granted for the construction of an electric car line from Lima to La Punta via Magdelena.

SECOND POWER STATION PROPOSED FOR LAKE COLERIDGE, NEW ZEALAND.—Plans have been completed, according to the *Electrician,* for a second power station at Lake Coleridge. A complete duplication of the present headworks, including intake and tunnel, are included in the supplementary scheme. The present station has a generating capacity of 12,000 kw. Representations are to be made to the government to proceed with the work with as little delay as possible.

EXTENSION TO ELECTRIC POWER AND TRAMWAY SYSTEM IN SAO LUIZ DO MARANHAO, BRAZIL.—Proposals are solicited until Nov. 27, the *Electrician* reports, in connection with the scheme of the municipality to grant a concession for a period of thirty years for the extension of an electric light, power and traction system. The town has a population of about 53,000.

PROPOSED EXTENSIONS TO TELEPHONE AND TELEGRAPH SYSTEMS IN AUSTRALIA. — The Australian House of Representatives on Aug. 31, according to the *Electrician*, passed a bill authorizing the raising of a loan for £17,000,000, of which £3,000,000 will be used for postal, telephone and telegraph extensions.

PROPOSED ELECTRICAL DEVELOPMENT FOR POLAND.—A scheme of works which are considered to be of an urgent nature is reported to have been prepared by the Union of Polish Electrical Undertakings, according to the *Electrical Review.* Among other things, the project, which it is hoped to carry out with the aid of foreign capitalists, provides for the construction of a central power station at Boryslaw, together with electric railways in this oil region.

Foreign Trade Opportunities

ELECTRIC LIGHTING SYSTEM PROPOSED FOR BANKSTOWN, AUSTRALIA. —The Town Council of Bankstown, New South Wales, Australia, the *Eleatrican* states, has approved a plan to borrow £30,000 for the installation of an electric lighting system.

THE ADELAIDE ELECTRIC SUPPLY COMPANY, Grenfell Street, Adelaide, Australia, according to the *Electrician*, will receive tenders until Dec. 5 for 300 electric motors.

MUNICIPAL ELECTRIC SYSTEM PROPOSED FOR BATHURST, AUSTRALIA.—The City Council of Bathurst, New South Wales, Australia, the *Electrician* reports, has decided to appropriate £40,000 for the installation of an electric system for the city.

THE VICTORIAN ELECTRICITY COMMISSION, 22 William Street, Melbourne, Australia, the *Electrican* states, will receive tenders until Jan. 23, 1923, for a back-pressure steam turbo-generator set, including a 1,500-kw. alternator.

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Catalogs and full information are desired in the Philippines (No. 3,580) regarding radio apparatus.

Equipment is desired for a radio transmitting station, rated at 1 kw. in the antennas and with cathode lamps, in Czechoslovakia (No. 3,603). Quotations are also desired on 0.5 kw. or 0.25 kw. in the antennas.

Telephone cables and equipment are desired in connection with remodeling a central station in Bulgaria (No. 3,631).

A party in Canada (No. 3,635) desires to purchase electric floor scrapers.

An agency is desired in New Zealand (No. 3,641) for high-voltage insulators (110,000 volts).

Electrical goods, machinery, boiler fittings, etc., are desired in India (No. 3,644).

Information is desired on electric plants, machinery, tractors, hardware, etc., which may be required by the government or general merchants in South Africa (No. 3,673).

An agency is desired in Italy (No. 3,690) for electrical apparatus, electric clocks, fire gages, etc.; purchase desired

Information is desired in Czechoslovakia (No. 3,692) on electric vacuum cleaners, carpet sweepers, etc.

A party in Spain (No. 3,703) desires to purchase electric ventilators, storage batteries, lanterns, etc.

Representation is desired by an importing firm in Egypt (No. 3,709) of manufacturers of telephone equipment, electric generators, internal-combustion power plants, low-pressure waterwheels, electric lighting equipment, etc.

New Apparatus and Publications

FIXTURES.—An accessory line of "Red Spot" hangers and brackets for commercial lighting has been announced by the F. W. Wakefield Brass Company, Vermilion, Ohio. These units supplement the regular "Red Spot" line and are intended for lighting of hallways, rest rooms, closets, etc. They include a ceiling-type fixture, one of the suspension type and one pendant, all of the same standard construction as regular "Red Spot" hangers.

HOME LIGHTING. — Julius Andrae & Sons, Milwaukee, have issued a pocket catalog of home lighting to the retail trade.

BEARING METALS.—The A. W. Cadman Manufacturing Company, Pittsburgh, has issued Engineering Bulletin M-2, giving information on bearings and bearing metals.

ELECTRICAL COMMUNICATION.—The Western Electric Company, New York City, is issuing for the first time a magazine published by the International Western Electric Company and intended for distribution in foreign lands. The purpose of this publication is to give a clearer picture of electrical communication to foreign government officials interested in telephone and telegraph work and to others.

CABLE SPANS. — The English Electric Company, Ltd., London, England, has issued publication 368, describing cable spans.

VARIABLE-SPEED TRANSMISSIONS. —The Fairbanks Company, New York City, has recently issued bulletins describing the ball-bearing, self-oiling and standard designs of variable-speed transmissions.

CABLE END BELLS. — The Electrical Engineers' Equipment Company, Chicago, has issued publication bulletin 110, covering cable end bells.

ELECTRIC VEHICLES. — The Walker Vehicle Company, Chicago, has issued a folder describing the Walker "Pay-out-of-the-Savings" plan in the purchase of electric trucks.

DRIERS.—The B. F. Sturtevant Company, Hyde Park, Boston, has issued bulletin 299 on unit driers. This drier consists of a motor-driven fan, the air from which passes over heater coils and then is discharged into a cabinet.

MOTORS.—Bulletin No. 29, issued by the Century Electric Company, St. Louis, describes its type R. S. single-phase motor.

REFLECTORS. — The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, is distributing circulars describing its new X-ray Curtis adapter, No. 3,000, and its new convex luminaire, No. 5,000. The Curtis adapter converts an ordinary floor lamp into an indirect-lighting fixture.

New Incorporations

THE HOME MUTUAL LIGHT COMPANY, Harrisonburg, Va., has been incorporated with a capital stock of $10,000. Dr. Ashby Turner is president.

THE CAP ROCK LIGHT & POWER COMPANY, Crosbyton, Tex., has been organized by S. A. Guy, J. C. Orr and E. H. Wheat. The company is capitalized at $40,000 and proposes to construct and operate an electric lighting plant in Crosbyton.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

NORWAY, ME. — The Central Maine Power Company, Augusta, is planning to install additional machinery at its local plant, including waterwheel, generator and auxiliary power equipment.

INDIAN ORCHARD, MASS.—The Indian Orchard Company will soon begin work on a one-story power house at its cotton mill, to cost about $80,000.

SPRINGFIELD, MASS. — The Indian Orchard Company has awarded a contract for the erection of a boiler house at its plant, to cost about $75,000.

WAVERLY, MASS. — Plans have been completed for the erection of a one-story power house, 75 ft. x 78 ft., at the School for Feeble-Minded.

Middle Atlantic States

NEW YORK, N. Y.—The Fleishman Company, 701 Washington Street, will install an electric substation at its yeast plant on 158th Street, to cost about $20,000.

TONAWANDA, N. Y.—The Town Council has awarded a contract to the Tonawanda Power Company for the installation of a special lighting system on several streets, comprising 100 lighting units.

VISCHER FERRY, N. Y.—The Department of Public Works, Albany, has completed plans for the construction of a hydro-electric power plant on the State Barge Canal at Vischer Ferry. Bids will be called at once.

KEARNY, N. J.—The Ford Motor Company, Lincoln Highway, will build a power house at its local assembling plant, to cost about $100,000.

STOCKTON, N. J.—The Eureka Power Company, Trenton, has applied to the Delaware Township Committee for permission to erect transmission lines from Stockton to Rosemont and Sergeantsville and on various other roads in the township.

TRENTON, N. J.—The city has authorized the Public Service Company to install additional lamps on South Warren Street.

HARRISBURG, PA. — An underground police and fire-alarm system will be installed in the Reservoir Park section.

JERSEY SHORE, PA.—The New York Central Railroad Company, New York, plans to double the capacity of the power house at its local shops. The cost is estimated at $100,000.

PHILADELPHIA, PA.—The Kensington Hygeia Ice Company, Trenton Avenue, will build a one-story addition to its power house.

PHILADELPHIA, PA. — Power equipment, ovens, conveying machinery and other mechanical equipment will be installed in a baking plant for the Great Atlantic & Pacific Tea Company, Philadelphia, to cost about $80,000, for which a general contract has been awarded to the Turner Construction Company. Headquarters of the company are at 150 Bay Street, Jersey City, N. J.

WILLIAMSPORT, PA. — An ornamental lighting system will be installed on West Fourth Street, from Pine to Hepburn Street.

WOMELSDORF, PA.—Merger plans are being perfected between the Womelsdorf Electric Company and the Berkshire Electric Company, under the latter name. The Womelsdorf company has acquired the local system.

SEAFORD, DEL.—The Kent County Electric Light Company has been acquired by the Eastern Shore Electric Light Company. The new owner will make extensions and improvements in the local system.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company will build a three-story plant at 501-31 Madison Street, to cost about $113,000.

BRUNSWICK, MD.—The Potomac Public Service Company has contracted with the Baltimore & Ohio Railroad Company for power supply for its local shops.

CAMBRIDGE, MD.—Plans are being arranged for the installation of an ornamental lighting system in the business district. The Chamber of Commerce is interested.

BLACKSBURG, VA.—The Virginia Polytechnic Institute has plans under way for the construction of a power house to cost about $50,000. Wiley & Wiley, People's Bank Building, Lynchburg, Va., are engineers.

SUFFOLK, VA.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system in the business district.

WASHINGTON, D. C.—The Corby Baking Company, Georgia Avenue, N. W., will build a one-story power plant addition in connection with extensions at its local plant.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Oct. 12, for mechanical and electrical equipment for Canal Zone service, including fans, motor, cable, wire, ammeter, voltmeter, flexible non-metallic conduit, steel conduit, automatic arc controls, vacuum tubes and miscellaneous electrical supplies. (Circular 1496.)

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, Munitions Building, Oct. 4, for equipment for the complete assembly of 250 Simplex telegraph sets. (Circular PR 9385-1CP.)

North Central States

DETROIT, MICH.—The Ternstedt Manufacturing Company, Muster Street, will build a power house at its factory, to cost about $25,000.

DETROIT, MICH.—The Board of Works will build a power house on Byron Street, to cost about $50,000. Albert Kahn, Marquette Building, is architect.

KALAMAZOO, MICH.—The Bryant Paper Company will build a one-story power plant at its mill.

SAGINAW, MICH. — The Baker-Perkins Manufacturing Company will soon begin work on construction of a one-story addition to the power plant at its local factory.

LARUE, OHIO. — Sufficient funds have been subscribed by local citizens for the construction of a new municipal electric plant. Work will be started in the near future on the new system. The village has been without electrical service for several months.

HAMMOND, IND. — The Commonwealth Edison Company, Chicago, contemplates the construction of a power plant in Hammond, to cost about $100,000.

MICHIGAN CITY, IND.—The Pullman Company, Chicago, will build a power plant in connection with a new local foundry, to cost about $500,000.

PENDLETON, IND.—Bids will be received by the Board of Trustees, New Indiana Reformatory, until Oct. 4 for equipment for the power house at the local institution, including generator, exciter, boilers, pumps, etc. Charles W. Mouch is president.

SOUTH BEND, IND. — The Studebaker Corporation will soon begin work on an addition to the power plant at its local automobile works, to cost about $125,000.

TERRE HAUTE, IND. — The American Hominy Company is said to be planning to rebuild its local factory and power plant, recently destroyed by fire, causing a loss of about $3,000,000.

CHICAGO, ILL. — The Commonwealth Edison Company has prepared plans for an addition to its substation at Fifty-sixth and Lowe Streets, to cost about $20,000.

MARSHALL, ILL.—The City Council will receive bids until Oct. 5 for the construction of a new municipal power plant, with ice-making and refrigerating plant extension, to include two generators, Corliss engines, two water-tube boilers, feed-water heater, feed pumps, piping, etc.; also ice-manufacturing machinery for an initial capacity of 15 tons per day.

CAMPBELLSPORT, WIS. — The Badger Public Service Company has been granted permission to erect an electric transmission line along the State Trunk Highway to the village of Campbellsport.

EAU CLAIRE, WIS.—Construction has started on the $150,000 hydro-electric power unit for the Dells Paper & Pulp Company. The work is being done by C. R. Meyers & Sons, Oshkosh, and when complete will give the paper company 3,000 additional horsepower.

LA CROSSE, WIS.—Local business men have raised $2,200 for an ornamental lighting system on Caledonia and Clinton Streets. Efforts are being made to raise an additional $800 to extend the system another block.

GREEN BAY, WIS.—The Wisconsin Public Service Company is to begin the construction of a power line from Pound to Marinette and Menominee, a distance of 22 miles, at an estimated cost of $105,000. The new line will tie the High Falls property to the Marinette property of the company in such a way as to make it possible to use High Falls power in Marinette, or, if necessary, to send Marinette power to Green Bay. Surveys for the work have been completed. The work is now in charge of Charles M. Hasseler of Green Bay.

MADISON, WIS.—Applications have been filed by the Northern States Power Company with the State Railroad Company for permission to construct three power projects to supply electricity in St. Paul, Minneapolis and other Northwestern cities.

MOSINEE, WIS.—Work has begun on the cofferdam for the new spill gate and power house for the Wausau Sulphate Fibre Company. A new power house will be erected near the present building and the old wooden spill gates will be replaced.

OSHKOSH, WIS.—A 500-kw. rotary converter has been installed at the Oshkosh railway substation of the Eastern Wisconsin Electric Company. The work of rebuilding the Oshkosh car shops and barns destroyed by fire last spring is under way. The new building will house the machine shop, blacksmith shop, carpenter shop and armature department.

CEDAR RAPIDS, IOWA. — The Iowa Railway & Light Company has prepared plans for the construction of a two-story meter house on Dewey Avenue, 25 ft. x 60 ft.

MAQUOKETA, IOWA.—The Iowa Electric Company, it is reported, will soon call for bids for the construction of a 200-hp. hydro-electric power plant, to cost about $175,000. Holland, Ackerman & Holland, 53 West Jackson Boulevard, Chicago, are engineers.

MARSHALLTOWN, IOWA.—Bids have been rejected for the proposed electric substation and transmission line to be constructed in connection with a new electrically operated pumping plant at the municipal waterworks. New bids will be asked at an early date. Burdick & Howson, 8 South Dearborn Street, Chicago, are engineers.

KANSAS CITY, MO.—The Kansas City Southern Railroad Company has preliminary plans in progress for the erection of new locomotive and car shops at Pittsburg, Kan., including steel car shop, engine shop, power house, etc., to cost about $1,000,000, including machinery.

RICH HILL, MO.—The Common Council has approved a bond issue of $20,000, the proceeds to be used for the purchase of new equipment for the municipal electric power plant.

ST. LOUIS, MO.—The United Railways Company has plans under way for the construction of a new power house and a number of one-story substations in different parts of the city.

HASTINGS, NEB. — Contract has been awarded to the Gedney Construction Company, Hastings, for extensions and improvements to the municipal power plant, to cost about $20,000.

CALDWELL, KAN. — Plans are being prepared for extensions and improvements to the municipal electric plant, including the installation of new equipment. H. G. Olmsted & Company, Oklahoma Building, Oklahoma City, are engineers.

WICHITA, KAN. — The Kansas Gas & Electric Company has arranged for an issue of $3,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

Southern States

BELHAVEN, N. C.—Bonds to the amount of $30,000 have been issued for the installation of a municipal electric plant.

GREENSBORO, N. C.—Plans have been completed for the extension of the ornamental street-lighting system on East Market Street.

ROBBINSVILLE, N. C.—The construction of a municipal electric light plant in Robbinsville is under consideration. It is proposed to build a dam and hydro-electric plant on Wiggins Creek, near Robbinsville.

WILSON, N. C.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system on several streets in the city.

FLORENCE, S. C.—The Palmetto Power & Light Company is reported to have purchased the municipal electric plants in Dillon, S. C., Latta, S. C., and Rowland, N. C. The company is planning to erect a transmission line from Maxton, N. C., to Marion, S. C. (40 miles long) to supply electricity to the above towns.

ATLANTA, GA.—The Georgia Railway & Power Company is planning to build a transmission line from Rome to Chattanooga, Tenn., about 100 miles, to connect with the system of the Tennessee Power Company.

MARIANNA, FLA.—The Hardaway Construction Company is planning for the construction of a new hydro-electric plant on the Chipola River, to cost about $100,000.

CHATTANOOGA, TENN. — The Signal Mountain Mining Company is planning for the development of extensive coal properties in the Suck Creek field, and will install electrical and other equipment. The cost is estimated at $200,000.

KNOXVILLE, TENN. — The Knoxville Power & Light Company has increased its capital stock from $2,050,000 to $10,000,000, part of the proceeds to be used for extensions and improvements.

LAWRENCEBURG, TENN.—Plans are under consideration to double the capacity of the municipal electric plant.

NASHVILLE, TENN.—The Douglas Coal Mining Company, 504 First National Bank Building, recently organized, is planning for the edevelopment of properties in the vicinity of Island, Ky., to include the installation of electrical machinery and other apparatus.

PARKVILLE, TENN. — The Tennessee Power Company, Chattanooga, has been granted permission by the State Public Utility Commission to issue $250,000 in bonds, the proceeds to be used for extensions and improvements.

TUSCALOOSA, ALA.—The Van de Graff Coal Company, recently organized, has acquired the properties of the Brookwood Coal Company and plans to increase production. New electrical equipment will be installed.

CROSSETT, ARK.—The Crossett Lumber Company will build a one-story power plant at its mills, to cost about $75,000.

NEW ORLEANS, LA. — The Citizens' Light & Power Company has plans under way for the construction of an addition to its electric generating plant to cost about $200,000, including machinery.

HUGO, OKLA.—The Hugo Light & Power Company has applied to the County Commissioners for permission to erect a transmission line from its local plant to Boswell and Soper, to supply electricity in those towns. Franchises have been granted to the company in both places.

PONCA CITY, OKLA. — The Marland Refining Company is completing plans for extensions in its local oil refinery. A number of new plant units will be constructed. A new water-works system, with electrically operated pumping machinery, will be installed. The entire project is estimated to cost about $1,500,000.

HOUSTON, TEX.—The installation of an ornamental lighting system on Washington Avenue is under consideration.

DALLAS, TEX.—The Dallas Investment Company will install an electric lighting and street-lighting system on a tract of property recently acquired in the vicinity of Preston Road and University Boulevard, to be developed for residential service.

Pacific and Mountain States

CHEHALIS, WASH.—The Council has approved plans for the installation of an ornamental lighting system on Pacific Avenue from Park to Front Streets.

POMEROY, WASH.—The Pacific Power & Light Company has been granted a franchise to erect a transmission line from Pomeroy to Pataha.

SPOKANE, WASH. — The Washington Water Power Company contemplates the erection of a transmission line on the Inland Empire Highway from the city boundary line north.

STANWOOD, WASH.—The Washington Coast Utilities Company will erect a transmission line from Arlington to Stanwood and will make improvements in the local system.

STEVENSON, WASH.—Work will soon begin on the erection of a power house on Herman Creek above Cascade Locks for the Skamania Light & Power Company. The company has recently increased its capital stock from $20.000 to $50,000.

ASTORIA, ORE.—The Hammond Lumber Company will construct a one-story power plant in connection with the rebuilding of its mill, recently destroyed by fire, causing a loss of about $750,000.

PORTLAND, ORE.—F. K. Masters, Lewis Building, and associates, have applied to the State Water Department for permission to construct a hydro-electric plant on the McKenzie River, in Lynn County.

PORTLAND, ORE.—George L. Cleaver, 524 Railway Exchange Building, and associates contemplate the construction of a number of hydro-electric power plants on the Deschutes River in Jefferson, Wasco and Sherman Counties. The Hydro-Electric League of Oregon is interested in the project.

PORTLAND, ORE. — R. W. Cary, 455 Prescott Street, and associates have applied to the State Water Department for permission to build a hydro-electric plant on the Clackamas River.

PORTLAND, ORE.—The Portland Railway, Light & Power Company has issued $2,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

DINUBA, CAL.—Contract has been let to the Osborn Electric Company, Turlock, for the installation of an ornamental lighting system, to cost about $60,000.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has preliminary plans under consideration for the erection of a new hydro-electric generating plant on Whiskey Creek, with capacity of about 24,000 hp. Application has been made to the State Water Supply Commission for permission to build the plant.

SAN BERNARDINO, CAL.—The Council has approved an ordinance for the installation of an ornamental street lighting system on portions of F and E Streets.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has acquired the property of the United Light, Fuel & Power Company. Improvements will be made to the system, which will be consolidated with the San Diego company.

SAN DIEGO, CAL.—A company is being organized by Edward Fletcher, 920 Eighth Street, to construct and operate a hydro-electric power plant on the Santa Ysabel and Black Canyon Creeks. It will have an initial capacity of about 3,100 hp. and will cost approximately $350,000.

SAN FRANCISCO, CAL.—The San Gorgonio Power Company, San Francisco, has preliminary plans under way for the erection of a new hydro-electric power plant on the San Gorgonio River, San Bernardino, with an initial capacity of 4,900 hp., to cost approximately $300,000, including machinery and transmission line. Application has been made to the State Water Supply Commission for permission to use the site.

SALT LAKE CITY, UTAH.—The Public Utilities Commission has granted the Utah Power & Light Company permission to extend its electric lighting and power system in Soldier Summit, a franchise having been granted by the Town Council.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has issued $2,112,000 in capital stock, part of the proceeds to be used for extensions and improvements.

AJO, ARIZ.—The New Cornelia Mining Company will build a power house and will install motors and other electrical equipment in connection with its new concentrating plant, to cost about $2,000,000.

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Canada

BANFF, ALTA.—The Calgary (Alta.) Power Company, is reported to be contemplating extensive developments to its property near Banff.

AGASSIZ, B. C.—The Chilliwack (B. C.) Electric Company, Ltd., it is reported, is installing a new hydro-electric plant at Agassiz.

FERNIE, B. C. — The East Kootenay Power Company, Ltd., successor to the British Columbia & Alberta Power Company, Ltd., is planning to erect a transmission line, which will be a duplication of a line already in operation.

NEW GLASGOW, N. S.—Arrangements have been made between the Nova Scotia Power Commission and the Pictou County Power Board whereby the former will begin work immediately on the development of Maley Falls on the East River of Sheet Harbor.

CALEDON, ONT.—The Cataract (Ont.) Electric Company, Ltd., has applied to the town officials for permission to erect its transmission lines in the township of Caledon.

OTTAWA, ONT.—Negotiations are under way between the Ottawa Electric Company and the Ontario Hydro-Electric Power Commission for the extension of the electric light and power service on the Montreal road from Eastview to St. Joseph d'Orléans.

Electrical Patents

Announced by U. S. Patent Office

(Issued Sept. 5, 1922)

1,428,499. Sign Flasher; J. H. Wheelock, Worcester, Mass. App. filed May 11, 1917. Controlling system for sign flasher consisting of motor-operated contactors.

1,428,507. Wireless Repeater System; E. A. Sperry, Brooklyn, N. Y. App. filed March 12, 1920. Two step-by-step repeater motors controlled by wireless where one motor follows movements of other.

1,428,510. Concentrated Flaming-Arc Lamp for Projectors; P. R. Bassett, Brooklyn, N. Y. App. filed June 26, 1920. Positive carbon has small mineralized core and negative electrode of smaller diameter.

(Issued Sept. 12, 1922)

1,428,529. Electric Welding; F. S. Calswell, Columbus, Ohio, and A. M. Bennett, Westfield, N. J. App. filed Jan. 10, 1917. Initial impressed voltage higher than working voltage.

1,428,535. Adjustable Jack; O. C. Dennis, Wilmette, Ill. App. filed April 17, 1922. Used with plugs of various styles, lengths and contours.

1,428,563. Cleaning and Plating Apparatus; G. W. Schweinsberg, Brooklyn, N.Y. App. filed Feb. 18, 1919. Apparatus automatically cleans and drains articles and maintains continuous supply to plating equipment.

1,428,567. Combined Telephone Receiver and Transmitter; J. S. Timmons, Yonkers, N. Y. App. filed July 31, 1919. Transmitter held against throat transmits by muscular vibrations.

1,428,588. Speed-Regulating Arrangement; L. A. Hawkins, Schenectady, N. Y. App. filed Aug. 11, 1920. Controls voltage of motor-generator fed from trolley circuit.

1,428,603. Lighting Fixture; F. W. Mathieu, New York, N. Y. App. filed Dec. 4, 1918. Indirect and semi-indirect units.

1,428,631. Testing and Adjusting Apparatus for Cord Circuits; W. H. Harrison, Brooklyn, N. Y. App. filed Feb. 7, 1920. Determines whether supervisory relays function properly.

1,428,635. Ignition System; J. H. Hunt, Dayton, Ohio. App. filed Sept. 28, 1918. Dual ignition system.

1,428,638. Process for Production of Heat Exchanging Bodies; H. F. B. Jorgensen, Copenhagen, Denmark. App. filed July 24, 1920. Electrolytic deposition of automobile radiators on matrix of fusible metal that is melted out after the form has been deposited.

1,428,666. Short-Circuit Terminal for the Magneto-Electric Ignition Apparatus of Internal-Combustion Engines; G. Steiner, Solothurn, Switzerland. App. filed May 28, 1920.

1,428,667. Testing and Adjusting Apparatus for Cord Circuits; J. F. Toomey, New York, N. Y. App. filed March 9, 1920. Determines if supervisory relays function properly.

1,428,717. Heater for Stitching Machines; J. Stangl, West Bend, Wis. App. filed Oct. 22, 1919. For maintaining wax in liquid state for waxing thread.

1,428,727. Protective Device for Automobile Batteries and Generators; F. C. Wassman, Melrose Park, and E. Kendall, Maywood, Ill. App. filed Sept. 17, 1920. Switch operated from handbrake on Fords prevents back flow of current.

1,428,743. Electrical Measuring Instrument; E. C. Ballman, St. Louis, Mo. App. filed July 19, 1918. Ammeter with constant magnetic field and a magnetic field varying in accordance with measured current.

1,428,761. Trunk Circuit with Instantaneous Disconnect and Recall; H. D. Currier, Chicago, Ill. App. filed Jan. 29, 1914.

1,428,762. Telephone System; H. D. Currier, Chicago, Ill. App. filed Jan. 29, 1914. Simplified call distributing system.

1,428,803. Electrical Device for Heating Liquids and the Like; H. J. Preston, Sydney, New South Wales. App. filed March 19, 1921. Placed in kettles, pans, etc.

1,428,825. Electric Cooker; G. H. Bindon, Ottawa, Can. App. filed Jan. 24, 1921. Portable electric resistance oven.

1,428,833. Magnetic Balance; T. S. Bindschedler, Detroit, Mich. App. filed Sept. 9, 1918. Means for testing relative penetrability by alternating magnetic flux of different materials for determining their relative hardness.

1,428,834. Electric Resistance for Regulating the Candle Power of Incandescent Lamps; G. J. Bjerre, Copenhagen, Denmark. App. filed May 4, 1921. Granular resistance in bent tube with electrodes forming contact.

1,428,837. Relay; A. H. Candee, Pittsburgh, and L. J. Hibbard, Wilkinsburg, Pa. App. filed Aug. 7, 1917. Protective device and system for electric railway vehicles.

1,428,856. Spark-Gap Apparatus; L. O. Parker, Swissvale, Pa. App. filed May 13, 1918. Method of adjusting gaps to utilize peak of voltage wave.

1,428,863. Electrical Connection; H. M. Smith, Farmington, Conn. App. filed Jan. 6, 1921. Connection for vacuum cleaners and floor-scrubbing machines.

1,428,865. Commutator Cylinder; C. W. Starker, Pittsburgh, Pa. App. filed Jan. 14, 1918. Cross-connectors supported at end of commutator cylinder opposite the armature.

1,428,869. Protective Device; G. M. Woods, Pittsburgh, Pa. App. filed April 9, 1919. For railway motors.

1,428,889. Dynamo-Electric Machine Construction; C. E. Johnson, Los Angeles, Cal. App. filed Feb. 19, 1921. Induction-motor construction increases ventilation space.

1.428,909. Electric Furnace; I. Rennerfelt, Djursholm, Sweden. App. filed March 3, 1921. Granulated resistance for heating crucible.

1,428,909. Electric Furnace; I .Rennerfelt, Djursholm, Sweden. App. filed Aug. 12, 1921. For melting metals that vaporize at low temperatures.

1,428,910. Method of Operating Electric Furnaces; I. Rennerfelt, Djursholm, Sweden. App. filed Aug. 12, 1921. Operating furnace with either two-phase or three-phase current.

1,429,002. Tester for Electric Devices; W. Weinberg, Chicago, Ill. App. filed Sept. 20, 1920. For testing lamps, dry cells, buzzers, etc.

1,429,003. Telephone-Exchange System; N. T. Whitaker, New York, N. Y. App. filed April 4, 1916. Busy line signal.

1,429,013. Furnace for Oxidation of Atmospheric Nitrogen; A. U. Avera, Florence, Ala. App. filed March 26, 1921. Static electrical stress imposed on gases as they pass around arc.

1,429,025. Electrically Driven Grinding Machine; H. W. Dunbar and A. Turner, Worcester, Mass. App. filed Dec. 1, 1920. All control of motors placed at operator's station on moving table.

1,429,060. Water-Heating Faucet; O. F. Bruman, Zurich-Enge, Switzerland. App. filed April 13, 1921. Liquid itself acts as resistance element.

1,429,079. Split Insulator; C. W. Kettron, Macomb, Ill. App. filed Feb. 4, 1916. Split insulator knob with means for preventing separation.

1,429,085. Heating Apparatus; A. McGary, New York, N. Y. App. filed Feb. 28, 1921. Parabolic resistance heater with motor fan forcing air through reflector.

1,429,094. Electric Hammer; L. Paulero, Petersburg, Va. App. filed Dec. 5, 1917. Forced draft maintained through casing and around coils for cooling.

1,429,110. Insulator; H. D. Seavey, Greenfield, Mass. App. filed July 3, 1918. Method of connecting suspension or strain insulators.

1,429,120. Heating Device; A. E. Dutton, Cleveland, Ohio. App. filed July 9, 1921. Electrically heated radiator with forced draft.

1,429,170. Electroplating Barrel and Catcher; E. A. Severance, Burlington, Vt. App. filed June 30, 1921. Articles thoroughly drained and quickly removed from barrel in bulk.

1,429,172. Electrical Outlet Box; S. L. Sopenoff and M. Katcher, Brooklyn, N. Y. App. filed Feb. 24, 1920. Firmly clamps conduits into position.

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Volume 80

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Number 15

A Plea for Pride

WE ELECTRICAL men are rendering a tremendous service to mankind. We shall stand in history as benefactors of the race. We are contributing to civilization one of its most priceless possessions. We are enriching our nation. We are bringing new prosperity to our communities and greater happiness to every home.

As a mass, as an industry, we know that this is so. But individually and personally we lack conviction and we take small credit for it. It is a costly weakness in electrical men—understandable, but still a weakness—that is really slowing down the progress of this work of ours.

STUDENTS of ethnology say that there have been ten great fundamental influences that have shaped the evolution of man. First came fire; second, the bow and arrow; third, pottery; fourth, domestic animals; then iron smelting, then writing, then gunpowder, then printing, then steam, then electricity.

In turn each of these great inventions or discoveries has greatly influenced man's mode of living and his thinking. Each has put into operation new forces that have touched life in some vital spot. Following the impulse of the new idea, habits have been changed, hardships have been softened, the mental horizon has been lifted, and life itself has taken on a broader purpose and new meaning. And the greatest and the most far-reaching and beneficent of all these quickening influences is electricity.

For electricity has brought into the world not just a new kind of light and power and heat. These are but the agencies by which it works. Rather, say it has bestowed upon man safety and peace for his cities, infinite relief to his labors, a limitless expansion to his industries, cheer, health and comfort for his home, new ease of transportation, contact with all the world through universal intercommunication—an infinite variety of benefactions within the knowledge and experience of this generation.

ALL this is true. And yet the public little thinks of it, and we electrical men, busy in the day's affairs, also forget that it is so. When we ask for needed higher rates it is with fear and hesitation, and too often when we sell we price our merchandise down low and offer an inducement to the customer to buy what is a vital service.

But the central station needs no apology. It is the great heart of the modern city—vital to its prosperity, its health, its happiness, its very life—a boon to every farm and hamlet. Every community today is just what electricity makes it. And 99 per cent of our central stations have rendered good and honest service.

The electrical man must have more confidence and must take more credit to his industry and to himself before the world. For more frank pride and courage will win a broader recognition and a fuller understanding. And this will bring more rapid progress and greater rewards.

Frank G. Baum

A pioneer in the hydro-electric and transmission developments of the Pacific Coast who is an advocate of high-voltage transmission and super-power systems.

TO BRING the consumer and the producer together is the most important economic problem of the age. Frank G. Baum, consulting engineer of San Francisco, who has achieved more than national distinction in his profession, has made this effort the keynote of his remarkable career. He saw early that the greatest loss in efficiency has been in the step between consumer and producer. He saw that if it were possible to produce, distribute and consume all other products as efficiently and as simply as electricity this loss would be reduced 90 per cent. For this reason the electrical method will always be to him the ideal one, and, in his own words: "Some time in the future a nation's civilization will be measured largely in terms of kilowatt-hours consumed per human being per year, because as the kilowatt-hours consumed are large so the non-productive inefficient labor will be small. Therefore a nation having large natural water powers need never fear decay."

This scientific imagination, which thus visualizes what harnessing water power will do for civilization, informed Mr. Baum's earliest work. After his graduation in 1898 from Stanford University, where with true American spirit he had made his own way, he entered the employ of the Standard Electric Company of California. Here he determined line-charging currents and their reaction for three-phase transmission. On the basis of this and other work the frequency of 60 cycles and the grounded system—now coming to be recognized as standard—were adopted. From 1900 to 1912 he was instructor in electrical engineering at Stanford University, at the same time doing special work in the transmission of electrical energy for the Bay Counties Power Company and other companies. In March, 1902, he became electrical engineer of the California Gas & Electric Corporation. From 1907 to the present Mr. Baum has practiced as a consulting engineer with special reference to hydro-electric power developments.

Besides putting into practical form the type of high-tension oil switches now used by the Pacific Gas & Electric Company and many other companies, Mr. Baum also invented the outdoor high-tension switch which is utilized generally in the Western transmission systems. He was responsible for the first high-head turbine installed in Centerville, the forerunner of all the high-head turbines. To him has been due the development of about 200,000 kw. in water power, most of it in California, some in Alaska and some in South America.

The conception and much of the engineering outline of the Pit River power development of the Pacific Gas & Electric Company are to be credited to Mr. Baum's foresight and sense of hydro-electric possibilities. His is the design of Hat Creek No. 1, Hat Creek No. 2 and Pit River No. 1, the 220,000-volt Pit transmission line and the great Vaca substation at the receiving end. His work during the past two years in developing insulators and regulation systems is outlined in a paper by him, entitled "Voltage Regulation and Insulation of a Large-Power, Long-Distance Transmission System," for which the American Institute of Electrical Engineers awarded its yearly transmission prize for 1921.

Mr. Baum has grasped the importance of linking business enterprise and scientific thinking together for the betterment of social conditions. He has caught the fundamental principle that, as he himself says: "The best control of a utility is that which develops an eagerness and ability on the part of the company to furnish the service and an equal eagerness and ability on the part of the consumer to purchase the service."

Editorial Comment

Electrical World, October 7, 1922

Volume 80

Number 15

The Extravagance of Government Ownership

IT IS doubtful whether people take naturally to government ownership. In most cases they turn to it as the only available means to redress certain wrongs. Possession of a proper historical background, however, would show them the futility of knocking at the door of government for relief, because government is notoriously inefficient, slothful and wasteful. Time has always revealed this condition. No better example of government extravagance and failure need be sought than in the case of our vast war-built merchant fleet. Constructed at enormous cost a few years ago, these boats cannot be disposed of now except at the price of junk. Worse still, the government, in addition to owning the vessels, attempts to operate them through the Shipping Board, and it is costing that board fifty million dollars annually to keep a few boats going, not including interest, full insurance and depreciation on invested capital.

The Shipping Board, of its own volition, has now reached the conclusion that free competition with the privately owned shipping of the world is impossible. "The restrictions of congressional legislation, the demands of varying sections of the country, the limitations on free play from which private business does not suffer," the chairman of the board maintains, offer insuperable obstacles to profitable government operation. Thus does history repeat itself, and another failure is added to the long list of government ventures that have gone wrong.

A Welcome Change of Procedure

IN THE past there has been frequent criticism of the Illuminating Engineering Society for being too scientific and not devoting enough attention to the application of fundamentals to commercial problems. This objection can hardly be raised this year. The papers and discussions were intensely practical; still, the more scientific subjects which must always be the basis of professional society activity were not neglected. The grouping of subjects for discussion was especially commendable since it induced the attendance of practicing engineers and commercial engineers who must be depended upon to put the best thought on illuminating problems into execution. Besides, it brought them into contact with the devotees of science who congregated on the last day of the convention. This intermingling of commercially and scientifically inclined minds cannot help but be beneficial.

Another innovation was the interpretation of every paper by means of the abstract published with it. A continuation of this practice will help to draw hitherto uninterested persons into I. E. S. activities if advance publicity is given to the interpretations through affiliated organizations and if they are emphasized by chairmen in introducing the speakers. Incidentally such treatment may prevent high-class contributions from moldering on library shelves.

Two other lessons might be learned from this and previous conventions. First, the ample material made available through this society should be used more extensively to educate architects, contractors, fixture dealers and the public in the fundamentals of good lighting. Second, renewed attempts should be made to bring about closer co-operation between men of the callings just mentioned and illuminating engineers. The Illuminating Engineering Society, as an organization, may be counted upon to do its part. In addition, individuals must study how they can help—and then do something.

Nonsense About Hydro-Electric Development

FOR years there has been a great deal of nonsense floating around in the non-technical press regarding the possibilities of hydro-electric development. The possibilities are surely big enough without the augmentation of absurd exaggerations. Unfortunately some of the news bulletins issued by central-station agencies occasionally assist in spreading such stories. A recent issue of a holding-company news bulletin, quoting a magazine, makes the assertion that development of hydro-electric resources will not only do away with coal strikes but will also solve the smoke nuisance created by city factories. As a sober fact, there are, of course, sections of the country without large water-power resources, and some form of fuel will be necessary in the production of electrical energy at least until present methods are completely revolutionized. In some sections even those water-power resources in existence are so tied up by other developments, or the value of the property that would be destroyed by overflowing is so great, that development is at present economically out of the question.

The real truth is that water-power resources in some sections of the country can be ultimately developed to conserve fuel resources tremendously. In those sections important developments have already taken place, and additional ones must wait on the further development of industry. In many cases such development means a migration of industry from overcrowded centers in which, for one reason or another, industrial enterprises have concentrated. Such developments mean big things for the country. In other sections the dominating problem is, and probably will be for decades if not centuries to come, the best way in which to make use of fuel resources. Hydro-electric energy is to industry a boon which will grow in magnitude as the problems surrounding its generation and transmission are solved. It will never be a panacea for the industrial ills of the nation.

Coal Situation Will Bear Watching

EVEN though the coal and rail strikes are virtually ended so far as industry is concerned, we are not yet out of the woods. Coal operators complain of car shortage, and abnormal production of fuel will avail industry little if it cannot be moved. The chief concern of the country now is to get coal, and the railroads and coal operators should bend every effort to supply it or be held strictly accountable for neglect of obligation and duty. It will be well also for industry to watch the joint conference of miners and operators now being held in Cleveland.

The coal strike, it must be remembered, although settled for a short time, will break out again next year unless the Cleveland conference adopts an acceptable wage scale binding on both operators and miners. Even then the question will not be definitely settled, for no matter what labor and capital may do at Cleveland, the government fact-finding commission to be appointed by the President has yet to be heard. It is doubtful whether either the miners or the operators look with any favor on government interference, yet a solution which will avoid it is entirely in their own hands.

If wisdom is displayed at the Cleveland conference, the government will have little to redress, but it is questionable whether either the miners or the operators will rise to the opportunity which the situation affords. Uncertainty can be removed only by quick action on the part of the government fact-finding commission. Meanwhile industry must be vigilant, husband its coal supply and add to it constantly whenever and wherever fuel can be obtained at reasonable cost. The coal situation will be critical until next spring.

Interconnection Yields Latent Economies in Operation

OPERATING economies unattainable in individual plants are being realized through the interconnection of steam and hydro-electric stations in many parts of the country. Diversities in loads and variations in stream flow lie at the bottom of these gains. Just how far such economies may be pushed toward their limit remains to be seen, but clearly we are far from the end of this significant movement in power supply and distribution.

The reward of handling interconnections skillfully appears in reduced consumption of fuel, water and labor, in more reliable service and in decreased investment in plant required to handle the electrical needs of a given geographical area. Engineers understand these benefits in general so well that their elaboration is superfluous here. All these economies mean lower cost and better service to the public, whether embodied in reduced reserve capacity, smaller coal or oil costs or quicker installation of power supply in establishments too large for immediate service from strictly local central stations.

The price of real success in interconnection is 100 per cent co-operation between the men and plants involved. Such an organization as the New England System Operators' Club has accomplished much good through development of personal acquaintance and friendship among members formerly known to one another only by telephone, if at all. Such relations among operating men must arise from the desire of executives to play the interconnection game fairly and for the good of all.

A certain amount of give and take must be permitted in handling interconnected plants. Adequate tie lines are imperative, and continuous profound study of operating data, costs and loads is equally important. Upon the ability of system operators to forecast loads and water-supply conditions depends in no small measure the possibility of attaining high efficiency in interplant administration. This integrating of plant economies so as to yield maximum economy over a wide area means lower total costs and hence increased net earnings. There is room for more accurate forecasting in this field and for the improvement of records and interpretations of interconnected plant performance. In a word, if the principles of scientific management are applied still more deeply to interconnection, the results will be most attractive from the standpoints of finance and quality of service.

Three Desirable Qualities in Street Lighting

A STREET-LIGHTING fixture should be inconspicuous by day and sink into its surroundings. No safer rule for selecting standards can be laid down, simply for the reason that in nineteen cases out of twenty there is not enough money available to give the standards such decorative value in themselves as justifies conspicuousness. There are, of course, delightful exceptions to this rule, particularly in the best foreign practice, as witness some exquisitely decorated standards along the Quai de Mont Blanc in Geneva, and for that matter along the Thames Embankment. Generally speaking, rigid economy must be exercised in choosing the fixtures, and the most that one can fairly ask is that results shall be agreeably self-effacing. This furnishes a telling argument against the use of clusters. Were it not from dislike to rub in their failings upon well-meaning communities and those who supply them with light, we should be tempted to publish a series of horrible examples.

In many situations it is desirable to allow a modest amount of light to turn upward so as to show the façades of the buildings. This assumes that the façades are of such character that they deserve to be lighted, which is not always the case. A rule always sound is that the intensity of illumination should be graduated in accordance with the situation, and this, with the present-day equipment of incandescent lamps, is a comparatively simple matter. It is much easier to hold a reasonable spacing and vary the illumination through the size of the lamp than it is to attempt to obtain a similar variation by changing the spacing. Occasionally both size and spacing must be changed, as when lamps are used merely as markers along unfrequented streets. In general terms two or three sizes of lamps are sufficient to give an adequate gradation of illumination on an incandescent circuit, and the usual arrangement of compensators gives facilities for providing sufficient variety of luminous output while retaining conveniently the same standard amperage on the circuit. At present the installation of underground circuits for the street-lighting service is simpler than in the old days, when a somewhat elaborate system of conduits had to be provided. Since the introduction of the steel-armored, lead-covered cable which can be laid in a shallow trench, underground service has been cheapened and simplified so that it is available in many districts where before overhead wires were a virtual necessity.

With suitably spaced lamps it is often worth while to consider the possibility of dividing the system into two circuits, one operating all night and the other until midnight or 1 o'clock in the morning. If this plan be skillfully worked out, it not only reduces considerably the cost, but it does so in a strictly sensible and logical manner. In other words, it provides illumination which bears some relation to the hours of heavy traffic. Many a street requires the highest grade of lighting until, let us say, after the theater, and from that time on the needs are greatly reduced. In any event the split circuit operated in the way described is a vast improvement over that petty and mean economy, the moonlight schedule.

Will Centralized Motor Control Spread?

LARGE installations of motors for the direct driving of machines in considerable numbers in industrial plants offer unusually good opportunities for engineering study, and recent tendencies toward improved test facilities in the operation of such establishments are very gratifying. These arrangements for both routine and special analyses of power requirements have been pushed far afield in some cases where extreme centralization of circuit and motor control has been adopted. One may soon find power dispatching from a single switchboard a regular practice in industrial circles, including provision for the starting and metering of individual motors from the dispatcher's post. All the machine operator has to do with power supply in such a case is to energize a pilot-lamp signal and to stop his motor when he is through using it, with the usual interim control of speed variations at the machine when required.

When combined with a symmetrical wiring layout, such an installation affords the maximum opportunity for power check-ups in relation to production, opening the door of a second heaven to the cost department. If the instrumental readings and records of such an installation be not only expertly studied but also acted upon, the results in efficiency of motor application should be of surpassing value to both the manufacturing and engineering departments. Since the character of materials worked upon, the type of product manufactured, disposition of machinery to meet different production requirements and the hours of service of particular tools or apparatus are frequently changing in modern industries, such a system of motor control and supervision should cut to the limit lost motion in power applications, reducing energy losses and improving power-factor conditions generally.

Idle motor capacity is one of the banes of the industrial engineer's existence, and any reasonable means of preventing its excessive accumulation deserves thorough study. Restoration of power at individual machines should be greatly hastened in an installation provided with centralized motor control, both in the use of circuit breakers as against fuses and in the forestalling of protracted breakdowns. Of course, a thorough investigation of the economics of centralized motor control should precede its adoption in any plant, for there are many installations in which the refinements it offers may not be worth the investment cost plus the expense of dispatching.

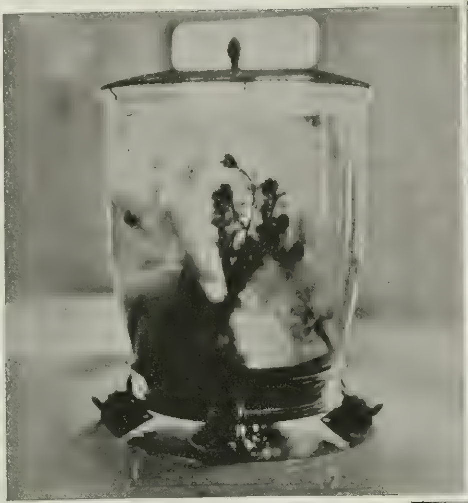
Visible Progress in Central-Station Organization

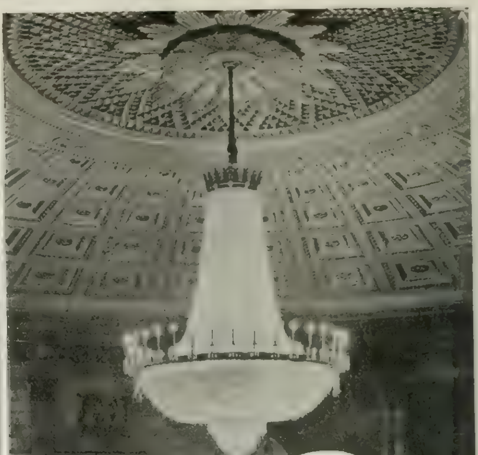
THE recent meeting of the Technical Section of the National Electric Light Association at Milwaukee is a good illustration of the progress of the central-station industry in understanding and handling its problems. There were approximately two hundred men, representing all sections of the country, at the meetings of the eight committees. The decisions taken were necessitated by no sensational development or crisis in the field but covered what may be styled the routine technical business of the association. Ten years ago such a gathering as this would have been impossible. In fact, even the 1915 conference on the National Electrical Safety Code in New York brought together a far less representative group than the Milwaukee meeting. Ten years ago men in the field in many parts of the country had little realization of the national scope of the industry and no thought that the purely local problems of the day were destined to become the national problems of a few years to come. The kind of interest in the work of the National Electric Light Association felt by many individuals was shown in cursing, rather energetically, some of the things that certain committees had done, because these accomplishments, in a back-handed fashion, were used to hit some one over the head. That the work done might have been more satisfactory to them had they themselves taken part in it and brought their point of view to the committees' notice never entered the objectors' heads.

All this is a part of history. Although the results of lack of interest in the past are still in evidence, the problems of today are really being faced in a national way. The organizations needed to deal with them on a country-wide basis are going concerns on a solid foundation. Mention has been made of the Technical Section particularly, because in the past there has been a lack of organization to handle problems adequately as they arose and the work has had to be done in a more or less hit-or-miss fashion. The present organization may not be all that its founders would like to see, but it has already provided a rallying point from which all pressing problems are being met before they get beyond the stage where successful guidance can be given. The same is true of all the other phases of the association work. Those executives who shrink from the expense involved in the attendance of their men at such meetings should remember that the present activities are the result of a situation that threatened more than expense, in that without organization and common study of problems the members of the industry in various sections of the country would be pitted against one another by those whose selfish interests might be opposed.

The significant thing about the work of the association is that its efforts are not restrictive and aimed at monopolistic control, but constructive and so conducted that outsiders not only can be but are invited into the deliberations of many of the committees without any pledges or hints that secrecy is desirable. The self-interest in the work is of that character which seeks to attain its ends by giving others full consideration and a square deal. Self-seeking and narrowness may be encountered here and there, but they are the incidents that normal human nature brings into any activities and are not in control of the work that is being carried on.

Utilitarian and Artistic Illumination in Eastman Theater and Music Hall





ARTIFICIAL illumination is provided not only that people may see but also that the "sights" may be more pleasing. In other words, light may be effectively used as the handmaiden of art in emphasizing decorations, paintings, etc. Moreover, light has a policing function. All of these purposes have been fulfilled in the new five-million-dollar music hall and motion-picture theater which George Eastman has presented to the city of Rochester. Its most notable feature, perhaps, is the showing of pictures in a lighted theater, this being made possible by increased screen illumination and the use of indirect lighting. A novel element is the use of illuminated fish bowls to give diffused light and artistic appearance combined.

I. E. S. Convention Decidedly Practical

By Increasing the Number of Papers on Applied Illuminating Engineering and Interpreting the More Technical Papers a Much Greater Degree of Interest Has Been Stimulated than Formerly Prevailed

WITH an attendance numbering well over 300 and discussions that held the audiences throughout all sessions, the Illuminating Engineering Society had an unusually successful convention last week at Swampscott, Mass. Various members attributed the greatly increased interest to the broader policy displayed in devoting more attention to applications of illuminating engineering fundamentals and in interpreting the highly technical papers.

While it was not brought out in discussion on the convention floor, the opinion was quite generally expressed informally that it is a pity that architects, contractors and fixture dealers cannot be more generally interested in the benefits they can secure from attending the I. E. S. meetings. This situation raised the necessity of renewing efforts at establishing closer contact with these allied interests. Opportunities for spreading the gospel of better lighting were also voiced and suggestions made that some methods of doing so be definitely undertaken.

Of the subjects formally considered on the convention floor, residence and show-window lighting aroused the most discussion, although a variety of other subjects came up for attention. Points brought out by the most practical papers and discussions are recorded below, while papers of a more scientific nature, such as the ones dealing with photometry, will be noticed in the section of the *Electrical World* headed "Digest of Electrical Literature."

Progress in Illumination

A remarkable range and diversity of *materiel* today lie at the base of illuminating engineering practice, declared F. E. Cady in his report as chairman of the committee on progress. The report recounts little revolutionary development in the past year, but it emphasizes an extraordinary wealth in physical resources available both to the scientic investigator and to the engineer specializing in this field. All along the line steps have been taken toward the more efficient application of lighting units and toward better service from available equipment.

In street lighting very encouraging interest has been shown by small cities and towns throughout the Middle West and Southwest in single-lamp ornamental installations. Noteworthy "white way" installations of the year include 336 1,500-cp. units at Salt Lake City, mounted three lamps per pole, with further extensions planned on this line, and others at Seattle, Stamford, Conn., and Portland, Ore. Incandescent street lighting is growing in favor as well. All old gas and arc lamps in East Cleveland, Ohio, have been replaced by gas-filled incandescents, those in the residential district being of the 110-volt multiple type, fed from secondary circuits already serving residential needs.

Floodlighting continues popular in connection with pageants, fairs and other celebrations. Apart from street lighting, floodlighting and sign lighting display the greatest activity since the last report. Sign lighting has assumed such importance that architects are now designing signs in keeping with the rest of the building.

A marked increase is apparent in the number of electric signs using lamps of from 25 watts to even 100 watts rating. Striking effects have been reached by making up letters with 75-watt lamps and filling the border with 25-watt units. In modern sign lighting increased attention is being paid to the clearness and smoothness of the results, and the use of translucent letters instead of exposed lamps is popular.

HIGHER INTENSITIES IN INTERIOR LIGHTING

A decided trend toward higher intensities is apparent in office building and factory illumination. In an installation of the former type 10 foot-candles was decided upon as the required minimum average intensity, 200-watt lamps being employed for general illumination and 300-watt units for drafting rooms. The effect on factory output of increased illumination has been studied further, and in a noteworthy case outlined production increased 8.5 per cent, the cost of lighting in percentage of factory cost of products increasing from 0.033 to 0.066 per cent. Energy was available at 1.5 cents per kilowatt-hour, and 15 per cent depreciation was allowed on reflector equipment with 6 per cent interest on the investment. The intensity was increased from 3.8 foot-candles to 11.4 foot-candles.

Questions of safety are being considered in relation to illumination. The use of floodlighting in providing concentrated flux upon the working plane where tools are used in locations subject to severe dust conditions appears to be growing in favor.

Zinc white has been found to absorb ultra-violent radiation almost completely. It is suggested that in all cases where it is possible for such radiation to be reflected into the eyes of operators, as in arc welding, the walls and ceiling be painted with this material, known as "Chinese white" with a matte finish. By the use of a specially constructed color filter which transmits only the extreme red and blue-violet, X-ray examination rooms may be lighted.

Figures taken from a survey of 1,500 middle-class urban homes show that the average home has 5.7 rooms with a lamp wattage of 863, an average of two convenience outlets, 1.6 portable lamps and two wall brackets.

REDUCING SUPERFLUOUS SIZES IN FIXTURE DESIGN

Considerable progress has been made in the line of standardizing certain fixture dimensions. The National Council of Lighting Fixture Manufacturers has practically completed its research work to determine the maximum and minimum allowance for the several dimensions of the "heels" on blown glassware in the 2.25-in. to 8-in. sizes. The tendency is toward the production of a standard holder for each size of glassware. The committee has also been busy on the standardization of screw threads. In the fixture trade there are about eighty-seven different sizes of threads, pitches, lengths and diameters of screws used. The opportunity for luminaire application is indicated by the estimate that 97 per cent of the electrically lighted homes have luminaires of the direct-lighting type, while only 56 per cent of such luminaires have glassware and 31 per cent have no shades whatever. Reflector designs of late types illustrate varied uses of glassware, mirrors and diffusers for both ornamental and commercial applications, and recent designs of portables exhibit the ingenuity of the bric-à-brac maker.

Tests have been made in Germany lately on the materials used in making globes, reflectors and shades for lighting service. The tests included the effect of heating to 150 deg. C. for two minutes in an oil bath followed by a one-minute cooling in a water bath at 10 deg. C. The transmission of various kinds of glass was determined, and it showed for simple lamp glass of 1.6 mm. to 2.2 mm. thickness 90 per cent; for ornamental glass, 3 mm. to 6 mm. thickness, 56 to 75 per cent; for diagonal rippled glass, 5.6 mm. to 5.9 mm. thickness, 67 per cent; for cathedral glass, 3 mm. to 3.7 mm. thickness, 90 per cent.

Present practice is in the direction of non-ventilated units in the inclosing globes and fixtures used with high-wattage lamps, because of the protection from dust and possibility of more attractive design.

FEWER LAMP VOLTAGES IN DEMAND

Of all the lamps produced in 1921, 87.2 per cent fell within the standard range of 110, 115 and 120 volts, as compared with 81.2 per cent the previous year. Only 3.6 per cent of last year's total sales were carbon incandescents as against 4.3 per cent in 1920. The distribution of tungsten lamps according to size and types shows 79.4 per cent for vacuum lamps and 20.6 per cent for gas-filled, and the average lumens per watt shows an increase from 10.6 to 11. The 40-watt vacuum tungsten lamp appears most popular in North America.

New mill-type lamps in tipless bulbs were listed last fall. A movement is now afoot to reduce the number of kinds of lamps used for train-lighting purposes in passenger service. Lamps of 30 volts to 34 volts rating and of 15, 25, 50 and 75-watt size have been recommended by the committee on train-lighting equipment of the Association of Railway Electrical Engineers.

In the past year there has been a marked growth in the use of the neon vapor-tube lamp, especially in the low candle-power sizes. This development has been rapid for both lighting and sign applications. In the former case one electrode takes the shape of an open-type wire spiral. In the sign lamps one electrode is a metal plate in the form of a letter of the alphabet. The lamps are designed for both alternating and direct current on 200-volt and 250-volt circuits. Some manufacturers guarantee 2,500 hours' life.

ARC-LAMP DEVELOPMENTS

The Beck searchlight arc has been improved of late by reduction in the diameters of electrodes. A 225-amp. size lately developed is reported to have a surface brightness of 1,250 hefner-candles per square millimeter, which is seven times that of the ordinary arc and about the same as the Lummer high-pressure (6-atmosphere) arc. A recently produced tungsten arc is provided with a funnel-shaped screen on which the evaporated and sputtered tungsten is deposited to prevent tube blackening. The arc discharge takes place between small tungsten spheres in an atmosphere of rare gas. The lamp is available in small sizes and the spheres are about 1 mm. in diameter in the 1-amp. unit. They can be used for projection purposes and are designed for 200 volts on alternating-current circuits. A new tungsten arc has been reported in Holland which is designed for 220-volt alternating-current service at 50 cycles, giving 1.5 candles with an energy consumption of only 3 watts.

Progress in projection lamps includes a new flash-lamp provided with three lamps for independent or other operation in signal service, etc.; improved spotlamp equipment for show-window illumination, new designs of automobile parking lamps and headlamps featuring accessibility of parts, portable arc-lighting equipment for motion-picture news-reel work, more varied types of traffic signals, and modified optical projection equipment in which the real image of the light source is placed at the first lens focus. The last permits of the employment of as many sources as desired, with the use of elliptic mirrors, and yields the advantages of a more solid source as well as considerable additional intensity.

The report of this committee drew forth little but commendation. The point was made that there should be more uniformity in referring to effectiveness of lighting. For street lighting it is important to know the average and minimum foot-candles illumination on the street surface.

A Survey of Residence Lighting

Two excellent papers surveying the status of residence lighting and outlining the opportunities for development were presented by M. Luckiesh and N. D. Macdonald, the former collecting information by questionnaire and the latter by means of surveyors.

Rented homes, in the opinion of M. Luckiesh, are more deficient than owned homes in all details of wiring, wattage, fixtures, portables, convenience outlets, etc. This conclusion was based upon a very elaborate survey of about 1,500 representative homes in various cities. All items except ceiling fixtures are less than 50 per cent of what they should be to give convenient, proper and adequate lighting in the middle-class home today. The deficiency in wiring is chiefly found in convenience outlets and outlets for brackets. The deficiency in lighting equipment is chiefly found in the cases of shades, wall brackets and portables. In general the watts per socket should be increased somewhat, but the chief need is increase in the number of sockets. From 12 to 38 per cent of the wall brackets, depending upon the room, were found without shades, and 7 to 21 per cent of the ceiling fixtures had no shade.

Wall brackets are much less plentiful than they should be, an increase of 250 per cent appearing justifiable. Considering the advantages of the portable brackets, their number is much less than it should be, and an increase of 400 per cent would be desirable. The well-known scarcity of convenience outlets is verified, an increase of 250 per cent being called for.

One-half the population of this country live in places with more than 2,500 inhabitants, according to Mr. Luckiesh, and only one-half of the homes within easy reach of electric service are wired; one-half the homes wired are rented; the middle-class home is less than half lighted, and the lower-class home is only half as well lighted as the middle-class home.

The survey reported by Mr. Macdonald was made for the Association of Edison Illuminating Companies and covered 1,500 central-station customers equally distributed among six electric service companies. It was found that the rooms in general are illuminated in spots, but the watts per square foot indicate that the general illumination is low, although the most used portions of the rooms are fairly well illuminated. The customer selects home decorations from the viewpoint of custom or appearance and pays relatively little attention to their influence upon illumination. He has far too few convenience outlets and therefore uses drop cords for table lamps and appliances. He needs 4 per cent more lamps at once to replace outages and has not been taught the value of keeping spare lamps on hand. He has abandoned 11 per cent of his original installation as unsatisfactory or superfluous.

Owing to height or inconvenience, he has trouble in replacing 25 per cent of his bulbs. He needs to be taught the value of light-reflecting decorations and that his lighting appliances need to be cleaned as often as his windows. Last, and most important, he is unadvised of the advances in lighting practice. A rough estimate would indicate that less than 10 per cent of the luminaires reflect modern engineering thought. This is further emphasized by the fact that in living rooms 50 per cent of the lamps are so placed that bare lamps are in the line of vision, and in 33 per cent of these rooms portable lamps have been introduced to improve the original installation.

A big opportunity for service will be lost if a channel is not soon found through which the residence consumer may be impressed with the need for better lighting conditions and the need for proper advice in securing them, declared Mr. Macdonald.

Considerable interest was shown in residence lighting. George H. Stickney expressed the belief that Dr. Luckiesh assumed the existence of too many portable lamps in the average home, but Dr. Luckiesh pointed out that these furnish one of the most desirable forms of lighting and had consequently been chosen in place of ceiling and bracket fixtures for some rooms. E. D. Tillson and others suggested giving vigorous backing to portables as being one of the best means of residence lighting.

R. S. Hale declared that the reason there are so few convenience outlets in residences is that too narrow an interpretation is put on the National Electrical Code by inspectors. If they can be educated and the revisers of the code can be induced to remove ambiguities now hampering development, two big obstacles will be removed.

Louis Bell contended that the most abominable lighting which has ever been experienced will result if great caution is not exercised in applying gas-filled lamps to residence lighting. To avoid this trouble Dr. Luckiesh declared that it would be necessary to conceal the lamps with heavier glass shades.

O. R. Hogue referred to the popular lectures on lighting subjects which are being made in Chicago, the demonstration equipment being carried around on trucks. He also outlined the "more and better business movement" of the National Electric Light Association, which is planned as a continuous concerted drive of all branches of the industry to electrify America. He referred to the clearing house afforded at N. E. L. A. headquarters, the publicity work which the Society for Electrical Development can do, the part of contractors and jobbers, and plans for national advertising.

A residence-lighting bulletin that can be distributed among the public by central stations, manufacturers and dealers was proposed by S. G. Hibben, chairman of the residence-lighting bulletin committee.

Application of Illuminating Principles in School Lighting

The lighting of many school buildings is far below the standards prevailing in commercial and industrial establishments, Henry B. Dates asserted.

Recognizing the seriousness of the situation, the city of Cleveland engaged Professor Dates to make a survey of 123 schools in that city. One school that was typical of the general conditions to be met was selected as a working laboratory. Many types of units were installed, four and six outlets per room, and thoroughly tested for various factors, such as brightness, quality, glare and distribution of light. This study led to the adoption by the Cleveland board of specifications of standard layouts for the public schools. These specifications as well as some for inclosing globes of diffusing glass were included in a paper by Professor Dates. Among the data presented the most important showed the average maximum and minimum intensities and watts per square foot with various sizes of lamps, numbers of units and prices of glassware.

The desirability of providing unsymmetrical layouts of lighting units in some cases to take care of uneven distribution upon desks near the wall was emphasized in the discussion. In a 28-ft. x 30-ft. room six units are ordinarily considered sufficient. A totally inclosing globe was favored on account of the reduced maintenance cost. D. H. Tuck, New York, felt that too much emphasis is placed on brightness and not enough consideration given to glare.

Drawing Power of Show Windows

Good returns in popular interest result from increasing the intensity and quality of show-window lighting, Walter Sturrock and J. M. Shute declared in a paper on that subject. It was found that displays of goods must be changed every few days in order to attract interest, apart from the quality of the lighting. The tests showed that by raising the level of illumination from a plane of 15 foot-candles to about 100 foot-candles there was an increase of 48 to 78 per cent in the number of persons who viewed the displays in Cleveland and Newark stores respectively. The use of colored light and spotlights increased the popularity factor or drawing power substantially. As compared with 15 foot-candles, the drawing power of certain windows tested was increased 33 per cent by the use of 40 foot-candles and 73 per cent by the use of 100 foot-candles. At the same wattage the use of colored light increased the drawing power about 40 per cent.

Experiments have shown that the reflection in plate-glass show windows made by a bright sky or outside objects can be overcome by lighting displays at 1,000 to 2,000 foot-candles, according to Ward Harrison and H. T. Spaulding. Special lighting equipment for furnishing this intensity, involving high-power spotlights, was described by the authors.

In the discussion of these two papers, J. Daniels, Boston, cited a 45 per cent increase in drawing power in a show window equipped with twenty 150-watt type C lamps in modern reflectors as against one having twenty 50-watt lamps in old-style reflectors. A. L. Powell, Harrison, N. J., pointed out that in overcoming daylight reflection objects to be displayed must be light in color and have good reflecting capacities. Norman Macbeth, New York, predicted an extension of spotlighting in window displays in the next two years.

W. D'A. Ryan, Schenectady, said that in the next few years window illumination should average at least 100 foot-candles. The later the hour, the greater the drawing power of well-lighted windows. Plate glass of small curvature does not yield the results in reducing reflection that come with larger curvature. In some cases the addition of 250 foot-candles of artificial light compensates for the darkening effect of the glass, viewed from outside the window.

Relative Cost of Daylight and Artificial Light

The initial net cost of equipment for natural lighting is 80 to 225 per cent that of electric lighting, and the annual cost for natural lighting is 95 per cent to 135 per cent that of electric lighting, depending upon the nature of the interior illuminated and the work carried on therein, according to detailed estimates presented by M. Luckiesh and L. L. Holladay. The initial net cost for equipment for natural lighting was assumed to include the different costs of the building with and without windows and skylights, the cost of the ground area occupied by light courts and the cost of extra heating systems to supply the difference in heat losses from windows and skylights and from the wall replaced by glass areas. The annual cost of natural lighting is assumed to include interest on the net cost, depreciation, cost of repairs, washing and extra fuel. A number of other factors which have made natural lighting appear still more costly have been omitted so that the conclusions could be based on the major factors only.

For dwellings the initial net cost of natural lighting was found to be 110 per cent to 225 per cent that of electric lighting; for apartments and hotels, 100 per cent to 140 per cent; for offices, about 160 per cent, and for art galleries, 80 per cent to 180 per cent. The annual cost of natural lighting was found to be 95 per cent to 125 per cent that of electric lighting in dwellings, 50 per cent to 100 per cent in apartments, hotels and offices where artificial lighting is used freely, and about 135 per cent in art galleries.

In the discussion which followed the paper the point was made that the authors did not desire to depreciate the value of daylight, but felt that the figures presented showed the advisability of increasing the amount of artificial illumination in many cases where the cost of daylight would be insufficiently low to preclude such investment. The point was made that in silk mills the spoilage item from exposure of material to daylight for protracted periods may be considerable as compared with artificial illumination.

Lighting the Food Industries

Lighting men have found that proper illumination is a very important factor in maintaining sanitary conditions; still, an investigation by W. H. Rademacher, Edison Lamps Works, disclosed the fact that this important factor is to some extent overlooked in plant management. Inadequate lighting exists in a large percentage of the plants allied to the food industry.

In discussing the lighting requirements the following points were included: General character of building, analysis of the processes of manufacture, present lighting practice, recommended practice as to intensity, type of equipment, method of lighting and special or peculiar lighting requirements.

Other uses for artificial lighting in the food industries, the interest-stimulating effect of lighting investigations; and the necessity of dustproof fixtures with large radiating surfaces in grain elevators were emphasized in the discussion by Norman Macbeth, George H. Stickney and C. S. Fox respectively.

Office Lighting

"Office Lighting from the Viewpoint of Hygiene" was the topic of a paper presented by Dr. A. B. Emmons, 2d, Boston, of the Harvard Medical School Department of Industrial Hygiene. Dr. Emmons pointed out that twenty-five stores recently requested the co-operation of the department in studying the working conditions of their employees, these stores being mainly in Boston but also in points as far distant as Cleveland and Washington. The investigation of the illumination aspects of the problem is proceeding along the line of informing the office manager how to obtain proper lighting.

The speaker recommended paying more attention to the use of daylight, the location of offices on upper floors, the use of sawtooth roofs, the prevention of glare from desk tops by the use of green linoleum, and to ventilation through transoms. Poor lighting tends to affect posture adversely, as does poor seeing power. A minimum of 5 foot-candles was recommended by the speaker for office lighting.

Maximum co-operation with the medical profession was urged by G. H. Stickney in commenting upon Dr. Emmons' paper.

Motion Picture Studio Lighting

Following the presentation of a paper on motion picture studio lighting by F. S. Mills, the trend toward the use of panchromatic films with incandescent lamps of high power was cited as a means of obtaining greatly improved illuminating effects. The concentration of heat in such cases is relieved by the use of indirect lighting by large mirrors.

Motor Vehicle Lighting

The principal work of the committee on motor-vehicle lighting, Clayton H. Sharp chairman, during the past year has been the revision of rules governing headlighting devices. The major change has been an increase in allowable intensity, it being pointed out that it is just as important for a driver to see the road ahead properly as it is to avoid glare. The revised rules have been adopted by Massachusetts and unanimously accepted by the Conference of Motor Vehicle Administrators.

L. C. Porter and E. C. Crittenden emphasized the need of educating the public in the proper use of headlamps.

Owing to the prevalence of color blindness, Ward Harrison raised the question whether it would not be advisable to have distinctive shapes as well as colors for traffic signals.

Lighting of Eating Places

Commenting on the paper presented by J. L. Stair on lighting eating places, A. L. Powell said that it should be of great value to architects in laying out work. The speaker referred to the use of inverted RLM reflectors of the dome type in color lighting at Association Island this summer. Red, green and yellow lamps were installed and skirts of cheesecloth provided for the reflectors, with the result that successive waves of color were gradually transferred back and forth across the ceiling with most pleasing results. Small colored table lamps completed the display, which was inexpensive and attractive.

Influence of Daylight Illumination on Energy Used for Artificial Lighting

With sudden darkening due to clouds or the approach of a shower a heavy load is thrown on the electric service system, causing a relatively unexpected peak. To take care of these emergencies requires very prompt action on the part of the central stations to get the additional generating capacity on the system and oftentimes causes the use of expensive storage batteries, banking or forcing of boilers, and sometimes the floating of additional generating capacities on a line to absorb the peak. The necessity of such precautions can be greatly minimized, A. Smirnoff, Potomac Electric Power Company, declared if automatic devices indicating daylight illumination are installed at what might be called strategic points in the surrounding country to warn the operators of the expected load as well as the possible magnitude. The light intensity or "psychological darkness" at which consumers begin to turn on lamps at a surprisingly rapid rate is found to be approximately 1,500 foot-candles in the open air, according to some elaborate investigations which the author has made.

Outline of Code of Luminaire Design Available for Criticism

A tentative draft of a code of luminaire design was presented by the committee appointed to co-operate with fixture manufacturers (M. Luckiesh chairman). This draft will be submitted to interested persons for criticisms and suggestions before the council of the Illuminating Engineering Society considers it for approval. The outline is about forty pages long and includes discussions on the purpose of a luminaire; characteristics of media; shading reflection, regular reflection, diffuse reflection, mixed reflection, spread reflection, diffusion, refraction, total internal reflection, various phases of design such as light distribution, shape and distribution, shape and efficiency, size of luminaire and light sources; ventilation and radiation, maintenance, construction details of luminaires, and definitions.

In presenting this report Dr. Luckiesh called attention to the importance of installation methods in securing proper illumination. Because of the importance of the luminaire code, P. S. Millar said that every member should give special consideration to criticising it and offer suggestions for its betterment.

Effect of Alternating Current and Direct Current on Performance of Tungsten Lamps

That modern high-grade tungsten lamps exhibit comparatively little difference of commercial importance in life and efficiency whether run upon 60-cycle alternating current or direct current was the conclusion of an extended paper by John W. Lieb, New York. The data presented were drawn from tests of the lamp committee of the Association of Edison Illuminating Companies. Tests have been made of both the straight-filament vacuum-type lamp and the coil-wound gas-filled lamp. Up to 1,000 hours' life the behavior of lamps on both alternating-current and direct-current service showed comparatively little variation, gains in life being offset by losses in efficiency on alternating current, and vice versa.

In the discussion J. B. Taylor suggested comparing lamps on the basis of average rather than initial efficiency. Louis Bell, Boston, congratulated the industry on attaining lamps which hold up their efficiency and candlepower well until the normal useful life of around 1,000 hours is reached and then drop suddenly as an indication that replacement is desirable. Other speakers emphasized the importance of obtaining research data concerning the effect of vibration upon flashing, railway-signal and other lamps subjected to shocks in service and thought there was no need in purchasing lamps to be concerned with small differences in service voltage.

C. H. Sharp, Washington, pointed out that a very small filament will give a power-factor effect in alternating-current service.

Nomenclature

In presenting the report of the committee on nomenclature and standards, Clayton H. Sharp, the chairman, pointed out that while the report has been accepted as an American standard by the American Engineering Standards Committee, provision has been made through the machinery of a sectional committee, composed of all interested parties, for undertaking necessary revisions.

F. E. Cady and several others objected to the use of the term "lighting" for the time integral of luminous flux because of its present employment to express other things.

Both M. Luckiesh and Louis Bell were very much opposed to using "light" to express "luminous flux," in view of the existence of the latter term, and advocated that "light" be used to indicate visual sensation instead.

The continued use of the candlepower for expressing lamp ratings was severely criticised by E. C. Crittenden, who said that the proper expression, "luminous flux," is used entirely too little.

Analyses of Glare Show Need of Further Research

An attack upon the problem of glare from the angles of visual acuity and shade perception was the basis of research described by a sub-committee on that subject headed by Louis Bell, Boston, the other members being F. H. Verhoeff and L. T. Troland of the same city. Experimental investigation led to the following three conclusions: (1) That a quantitative study should be made of veiling glare with respect to the extent by which reduction of contrast actually interferes with acuity so as to produce discomfort; (2) that it is not definitely known with respect to dazzle glare just how and where in the refractive media the effect is produced, and in particular a quantitative examination of the extension of the dazzle area with increase in intensity of the incident light is much needed; (3) that studies made on light sources of considerable area be extended to make clear their effect, not only in reducing dazzle glare, but in lowering the retinal sensibility so as to interfere with vision through the production of negative after-images of the luminous area.

Education

Lighting education, as conducted by the committee of which Prof. F. C. Caldwell was chairman, has consisted chiefly of popular lectures before clubs and societies of various kinds and the suggestion of subjects for research. The chairman declared that this work must be supplemented by individual effort on the part of members.

Dalmarnock Station Operating Results Reported

Glasgow Power Station, Embodying Latest Features in British Design, Generates a Useful Kilowatt-Hour for Every 1.716 Lb. of Coal Consumed

THE Dalmarnock power plant of the Glasgow (Scotland) Corporation represents the latest development in British power-station design. It is on the bank of the Clyde River near the eastern boundary of the city and is being constructed in two stages, ultimately to have a capacity of 150,000 kw. The first section comprises one-half this amount. There are five 15,000-kw. turbo-generators supplied with steam from two independent boiler houses, each containing eight marine-type Babcock boilers of 6,948 sq.ft. of heating surface. The cost of the present part of the plant will be at the rate of £20 per kilowatt.

The units are rated at 15,000 kw., but they can carry 18,750 kw. continuously. Three-phase current is produced at 6,500 volts, and the voltage is raised to 22,000, at which the principal switching operations are performed.

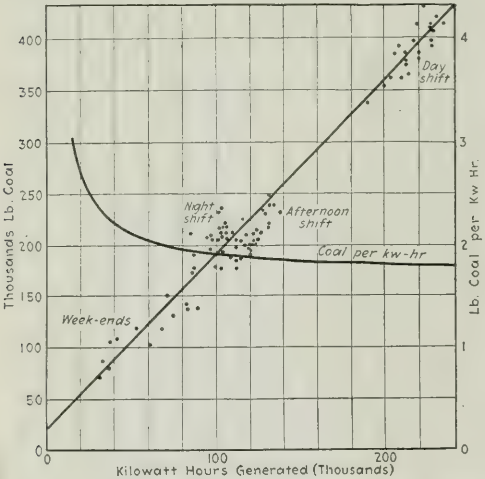


FIG. 1—COAL CONSUMED PER SHIFT IN DALMARNOCK STATION DURING ONE MONTH

The boilers are equipped each with three chain-grate stokers of 273 sq.ft. grate area. They contain B. & W. superheaters of the "integral" type of 2,452 sq.ft. heating surface each. There are one Green economizer for each boiler and a chimney for each pair of boilers. The working boiler pressure is 275 lb. and the steam temperature 700 deg. F.

A set of curves showing the performance of the Dalmarnock station for a recent month, with comments, was given in the issue of *Engineering* (London) for Sept. 1. Two of these are reproduced in Figs. 1 and 2. As was explained by R. B. Mitchell, chief electrical engineer of the Glasgow Corporation, in a paper read May 30, 1922, before the Institution of Electrical Engineers, he uses the R. H. Parsons plan for keeping a check on the station performance. The water and coal consumption and the electrical energy production are determined for each eight-hour shift. Thus the operating efficiencies of the different shifts can be compared.

The data given in the curves cover eighty-four shifts, making up the four-week period, during which the output per shift varied between about 3,000 kw.-hr. and more than 230,000 kw.-hr. The aggregate for the period was 9,784,000 kw.-hr. The average thermal content of the coal, from daily analyses, was 10,500 B.t.u. The straight line shown in Fig. 1 was drawn to pass as nearly as possible through the plotted points and its equation is found to be

$$C = 20{,}000 + 1.716\,K,$$

where C is the number of pounds of coal burned per shift and K the kilowatt-hours output per shift. The figure 20,000, of course, represents the coal consumed to supply the constant no-load losses.

The curve of coal consumption per kilowatt-hour was derived from this equation.

Fig. 2 shows similar data for water consumption. The equation of the straight line in this case is:

$$W = 100{,}000 + 11.535\,K,$$

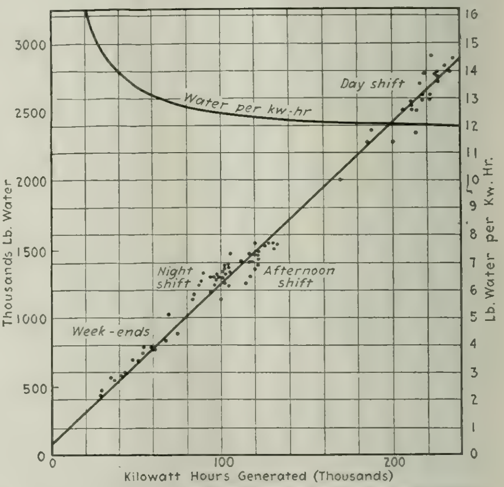


FIG. 2—WATER EVAPORATED PER SHIFT FOR SAME PERIOD AS IN OTHER FIGURE

where W is the total number of pounds of water evaporated per shift and K is as above. The no-load steam consumption per shift is obviously 100,000 lb.

From the third equation given a third relationship can be deduced, in either of these forms:

$$C = 5{,}123 - 0.1487\,W$$

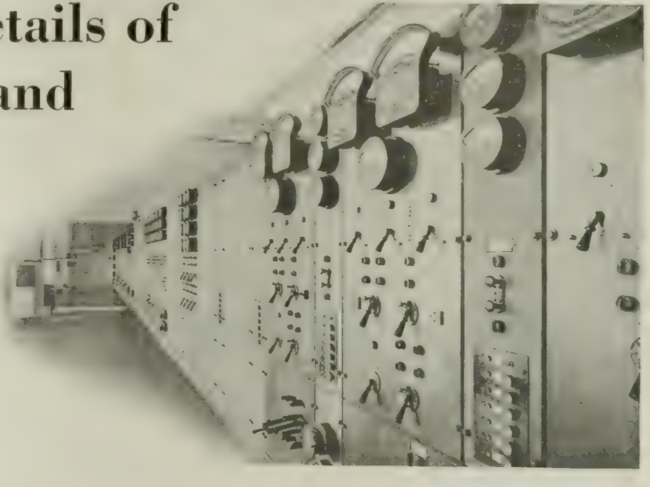
or

$$W = 6.722\,C - 34{,}440.$$

The first of these shows that if no water were evaporated, the coal consumption would be 5,123 lb. per shift, representing the radiation and other heat losses in the boiler room. The difference between 20,000 lb. and 5,123 lb., or 14,877 lb., is the coal consumption per shift to cover losses in the turbine room. This is the coal required to generate the 100,000 lb. of steam required at no load.

Summarizing the above data, it appears that every useful kilowatt-hour generated requires the expenditure of 1.716 lb. of coal and the evaporation of 11.535 lb. of water, apart from standby losses. These figures represent conditions for the period taken.

Installation Details of Switchboards and Control Pits



By W. FRANK SUTHERLAND
Toronto Hydro-Electric System

Disadvantages of the Standard Switchboard Base—Examples of Sightly and Convenient Construction—Red Floor Tile the Best Surface—Details Applicable to Boards of Various Kinds

With increasing capacity and the equipment now available, the well-designed present-day station offers opportunity for refinement in detail impossible of achievement in the smaller hand-operated stations of a few years ago. Electrically remote-controlled switching is now standard in even the lower voltages, and with its adoption the unsightly busbars, oil switches and cables of directly operated alternating-current switchboards have been eliminated. Remote-controlled, hand-operated switching equipment, which likewise had a distinct sphere of usefulness in the smaller installations, is no longer considered for works of any magnitude, and the cumbersome bank of operating rods is also done away with. The remote operation of oil circuit breakers and of carbon breakers in direct-current work by electrical means has, on the other hand, added to the complexities of conduit layout. The amount of control wiring is increased, and it is necessary to provide more adequate facilities for conduit termination at the switchboard than formerly was the custom.

For this reason it is desirable to arrange for some type of construction superior to the standard switchboard base consisting of a 6-in. channel fastened to the concrete floor with expansion bolts. This type of base is shown in Fig. 1, and according to usual practice the control conduit is brought up at the rear of the switchboard. In thin floors the necessity of having the bends from horizontal to vertical exposed makes an unsightly job. This arrangement also suffers from the disadvantage of not providing any means of cross-connecting panels other than by running the desired control leads in a horizontal direction across the back of the switchboard, complicating the wiring and preventing the neat arrangement so greatly to be desired. Panel wiring in all cases is greatly aided if most of the leads run in a vertical direction from points of entry at the bottom of the panel with as few cross-overs as possible. The control-wire exit from the conduit bushing is another point which is difficult to make much of, since the leads are apt to present a somewhat unsightly appearance no matter how carefully arranged.

Apart from the foregoing considerations, which rule out of the question a base of this character in any but moderate-sized stations, the necessity of bringing each conduit up behind the panel to which it belongs and the well-nigh impossible task of making alterations, relocating panels, etc., render it advisable to secure a more flexible arrangement.

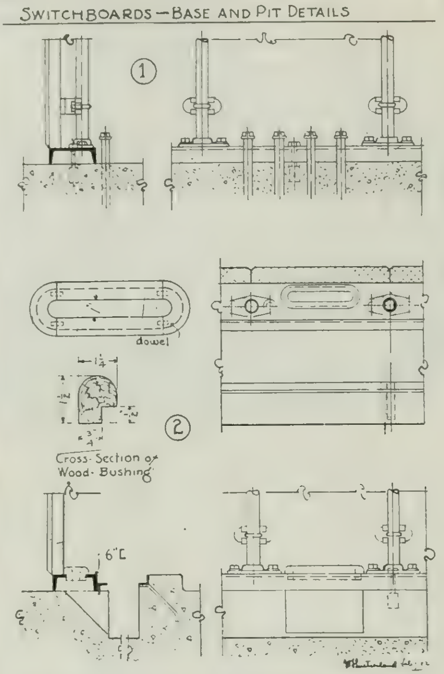
Such a plan is shown in Fig. 2. The concrete-finished floor has been retained, making it suitable for a comparatively inexpensive installation. The pit shown at the rear of the board can be made as deep as desired, although if the switchboard is installed on a beamed floor, little is gained by carrying it below the top of the floor steel, since a level pit bottom is preferable for ease in laying control cables. Usually a depth of about 6 in. or 7 in. can readily be secured. The width is somewhat dependent on the length of board, location of conduit entrance with respect to control panel and the probable number of cross ties between panels. In general a width of 2 ft. 6 in. will be found sufficient for the usual station, while for extremely large ones the pit may readily be made wider or another type of construction may be used. The 6-in. channel-base has been retained, fastened in the usual manner to the floor by expansion bolts, but underneath each panel the floor has been cut away, forming a wiring space through which the control leads pass to the wooden bushing shown in the channel web. The acetylene torch provides a handy means for cutting the hole in the web for the bushing, and with reasonable care quite a satisfactory job can be made. The bushing itself is formed from two pieces of molding doweled into the semi-circular ends, turned from a single piece and split.

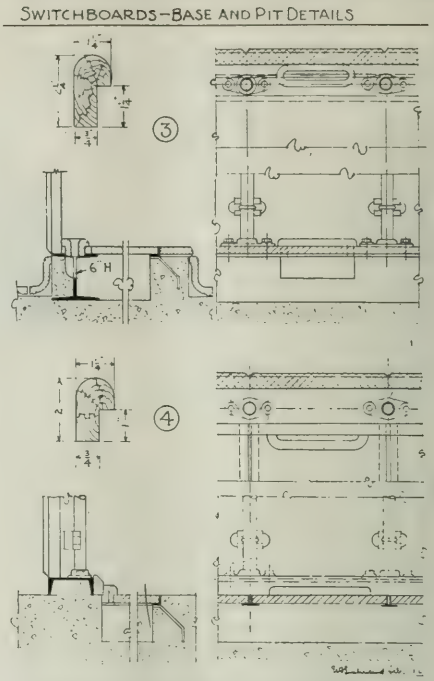
The expansion bolts holding the channel to the floor are placed immediately underneath the pipe flanges terminating the panel supports. This allows them to be placed in solid concrete and improves the appearance by hiding them from view.

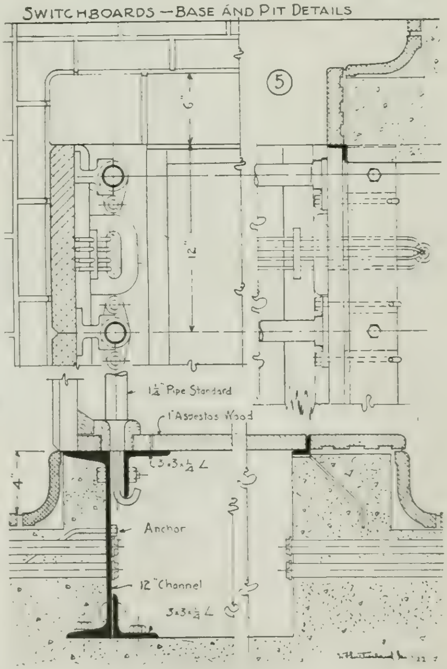
Advantages of Asbestos Wood for Pit Covers

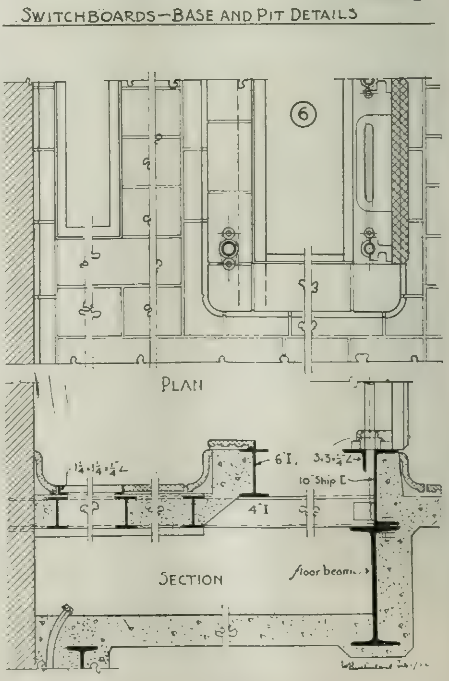
Several materials are available for covering the pit—wood, steel plate, or preferably 1-in. asbestos wood. Wood, of course, constitutes a fire hazard which should be eliminated. Checkered steel plate, while presenting

Convenient Arrangements for Switchboard Mountings and Control Wiring Pipes


SWITCHBOARDS—BASE AND PIT DETAILS
①
dowel
1¼
②
¾
Cross-Section of Wood-Bushing
6" [







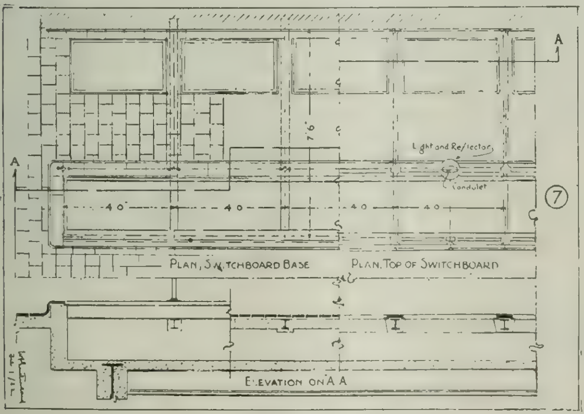
a neat appearance and being reasonably cheap, is open to the objection that if a plate slips while being removed or replaced the sharp edges are apt to cut the control cables underneath. Asbestos wood can readily be obtained in 1-in. thickness and is quite strong enough to withstand any of the abuse to which it may be subjected. It has also an attractive appearance and is easily removed or replaced.

To provide a pit curb and a smooth surface for the asbestos-wood cover, angle iron is shown, anchored into the concrete on one side and riveted to the channel base on the other. Throughout this article where such angle is referred to it is 1¼ in. x 1¼ in. x ¼ in. in size, this particular shape permitting the asbestos-wood cover to come flush with the top edge of the angle and to lie flat with the concrete or tile curb.

A development of the arrangement shown in Fig. 2 which eliminates the cutting of the web of the channel is shown in Fig. 4. Here the leads are not brought up through the channel but up against a cleat block of oak or other wood of good appearance. Onto this block, which runs the full length of the board, the leads are fastened by means of the usual fiber or metal cleats.

The asbestos-wood pit cover is cut away for a suitable distance at each panel and the opening finished off with a wooden curb. This construction provides a wiring slot through which the leads pass and still leaves the pit covers freely removable. The cover is, however, weakened and should be supported by T-irons or angles placed back to back. These supports can be let into pockets under the channel and can be riveted to the curb or left freely removable, a notch being cut in the bottom flange of the curb angle for their reception. This construction is suitable for boards of moderate length where cheapness is a first consideration.

Too little attention is frequently paid to the character of floor surface in stations. Concrete is the usually accepted material, and its frequent painting becomes a matter of necessity if a presentable appearance is to be maintained. In transformer houses, stations of moderate capacity and buildings of like use, where traffic is light and appearance of no consequence, a concrete floor, painted if need be, can hardly be improved on. On the other hand, a more permanent and better-looking floor should be used in stations of any importance.



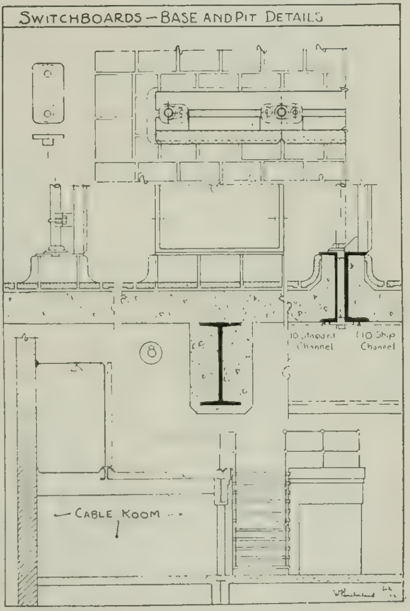


FIG. 7—SWITCHBOARD FOR MOUNTING ON TILE WITH AMPLE ROOM FOR PIPE RUNS.
FIG. 8—ELEVATED BOARD WITH CABLE ROOM BELOW

A bare concrete surface makes dust, and the addition of floor hardeners, etc., only delays the evil day when the floor requires painting. Painting to obtain satisfactory results is a difficult task, and a liberal quantity of paint is required. The finished result, too, is frequently of good appearance only for a short time, a new coat being required once a year.

The choice of more suitable surfacings is limited. Wood is out of the question, and mastic or other forms of bituminous or asphaltic floorings are equally unsatisfactory. Of the various floorings on the market probably the best, everything considered, is red floor tile of the vitrified variety. Such tile comes in various sizes, the 6-in. x 6-in. or 6-in. x 9-in. shapes being usually preferred. The tile runs about ⅞ in. thick over all and is provided with grouting grooves on the underside. It should be laid up with about a ⅜-in. joint, and in the design of the building about 1½ in. should be allowed from top of concrete floor to top of finished tile for bedding.

Objections may be raised to the use of a supposedly fragile material, such as tile, under transformers and other heavy equipment through fear of its cracking and chipping. Experience extending over a considerable number of years has proved this fear groundless, and the marked improvement in station appearance and cleanliness has amply compensated for the initial expense involved. Transformers weighing 15 tons can be set down on a tile floor by crane or moved by rollers on skids with no fear of its cracking.

The cost of laying tile floors varies with the locality, and no very definite costs can be given applicable to all conditions; but in general, comparing the annual charges on a tile floor with the cost of annual painting for concrete, it is found that tile will stand at least on an equal footing.

In designing a switchboard floor, together with the supporting structure for panels, tile lends itself to the attainment of attractive results. Cove and other special tiles are available, and their use permits the raising of the switchboard panels above floor level by about 4 in., adding to the general appearance of the board. What is of more importance, this form of construction renders it possible to keep the sub-panels free from dirt.

An arrangement of switchboard steel patterned somewhat after that of Fig. 2 but adapted to the use of tile floors is shown in Fig. 3. A 6-in. "H" beams replaces the channel of Fig. 2, raising the board sufficiently to accommodate the 4-in. cove tile underneath. The pit curb at the rear of the board is also raised by a corresponding amount, permitting a greater pit depth if desired.

In Fig. 5 is shown the nucleus around which several quite successful switchboard designs have been developed. The arrangement shown is adapted for use in places where a fairly deep pit can be used. A 12-in. structural channel forms the main member of the base. To it is riveted a 3-in. x 3-in. x ¼-in. angle for adequate bearing on the concrete pit bottom. Expansion bolts are provided as well as anchors into the floor concrete midway up the channel. Another 3-in. x 3-in. x ¼-in. angle is riveted to the top of the channel, a ¾-in. slot being left by means of spacer blocks 2½ in. wide by ¾ in. thick at each panel support. The width of panels is usually determined beforehand, and the location of these spacers can thus be fixed. If the panels are less than 2 ft. in width a spacer at every other panel support will be found sufficient.

The slate panels are supported directly by the channel, while at their rear 1-in. asbestos wood strips cut to panel length and of width sufficient to leave a 1-in. ledge are placed on top of the structural members. The floor flanges for pipe supports are placed on top of the asbestos wood, being fastened down by "J" bolts passing through the slot and engaging the vertical flange of the angle. The asbestos-wood filler is slotted to permit of the insertion of the wood bushings, and the resulting wiring channel offers a free run for control wires with no obstructions or sharp corners.

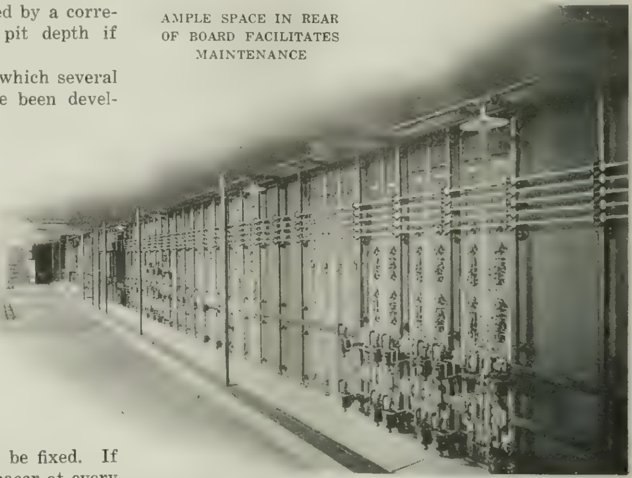
Choice of Panel Sizes Permitted

The construction above outlined has several important advantages, one of which is inherent in the choice of panel sizes afforded. For instance, 12-in., 18-in. or 24-in. panels can also be readily mounted as well as larger ones if desired, since no holes have to be redrilled and tapped, while the asbestos-wood fillers can be replaced with those of the desired length and a change made with very little trouble. Should one of the spacers holding the channel and angle apart come within one of the wiring ducts, it occupies little room and does not cut down the wiring space materially.

A further advantage is seen in the ease with which the board can be brought into alignment from end to end, since about ½-in. adjustment is possible without any drilling and tapping of holes for floor flanges, as is the case where they are rigidly bolted to the channel base.

Slate seldom comes in exactly even widths and frequently is oversize. On a long board with holes drilled in the channel or other support there is no latitude for this, and the placing of panels is sometimes a matter of some difficulty. At times too when a panel is to be removed a hacksaw blade has to be run down the joint to permit of pulling the slate out. It is advisable in all switchboard design where long boards are being erected to allow about $\frac{1}{16}$ in. clearance in every 2 ft. to facilitate slate erection and removal.

With the supporting design here shown this allowance can still be made, but individual panel adjustment is greatly facilitated.



AMPLE SPACE IN REAR OF BOARD FACILITATES MAINTENANCE

Fig. 5 also shows conduit entering the pit from the front through the channel support. Holes for it can be either drilled or punched during fabrication, which facilitates the installation.

Fig. 6 shows a further development of the idea suitable for switchboards on galleries or other floors supported by structural steel. The facilities for running control cable are also greater, and the method is thus suitable for larger stations. A 10-in. ship channel now supports the slate and provides a greater flange width than the standard 10-in. channel. It is carried directly by the floor steel, which also supports floor members spanning to the building wall. These members also serve to brace the ship channel. Small I-beams are framed in to carry the concrete floor and tile work. The cable pit thus provided gives ample space for longitudinal runs of cable from conduits to panels or from panel to panel on the board itself.

Fig. 7 shows a general plan of a switchboard detail of the same type. A better idea is gained of the pit openings and tile arrangement, and a portion of the pipe framework is also shown. Vertical standards are carried down every 4 ft. or so, depending on panel sizes, to the rear curb of the switchboard pit, while the longitudinal pipe joining them at the top serves as a conduit for rear switchboard illumination.

Story heights in stations are defined by headroom over transformers, switch-structure dimensions or some other like consideration, and are oftentimes considerably greater than necessary for switchboard bays. Where this is the case and where much control conduit has to be run it is frequently possible to elevate the switchboard floor 7 ft. or 8 ft. and thus make provision for a cable room underneath. An arrangement such as this is shown in Fig. 8, and an economy in over-all width is evident. The switchboard base is now formed of two channels—a 10-in. ship channel and a similar standard channel bolted together with a ¾-in. wiring slot between. A cleat block is attached to the front channel or to the panel, no asbestos being used. The floor flanges now rest on a cast washer, detailed to larger scale, and the bolts through the flange draw up against a similar washer underneath. Control cables may be racked on the walls of the cable pit and on intermediate supports, or the conduit itself may be similarly treated, exit being made as close to the controlling panel as possible. This arrangement renders an exceedingly satisfactory architectural treatment possible and elevates the operating platform sufficiently for good observation.

The above constructions have been developed with the requirements of control boards largely in mind, although the details given are equally applicable to railway boards mounting carbon breakers and automatic equipment where many control circuits are found.

Both angle iron and pipe are used for the supporting of switchboard panels. For heavy boards mounting large breakers and boards subjected to much shock a heavy structural framework is almost essential, but for control boards and for boards mounting remote-controlled or hand-operated breakers up to say 3,000-amp. capacity a pipe framework is perfectly satisfactory. Needless to say, adequate bracing should be given to either structure. The details here set down have been developed with pipe framework in mind, although a number of them with suitable modifications are applicable to angle-iron construction as well.

In conclusion the writer wishes to acknowledge his indebtedness to the Toronto Hydro-Electric System for permission to incorporate in this article data based on its practice.

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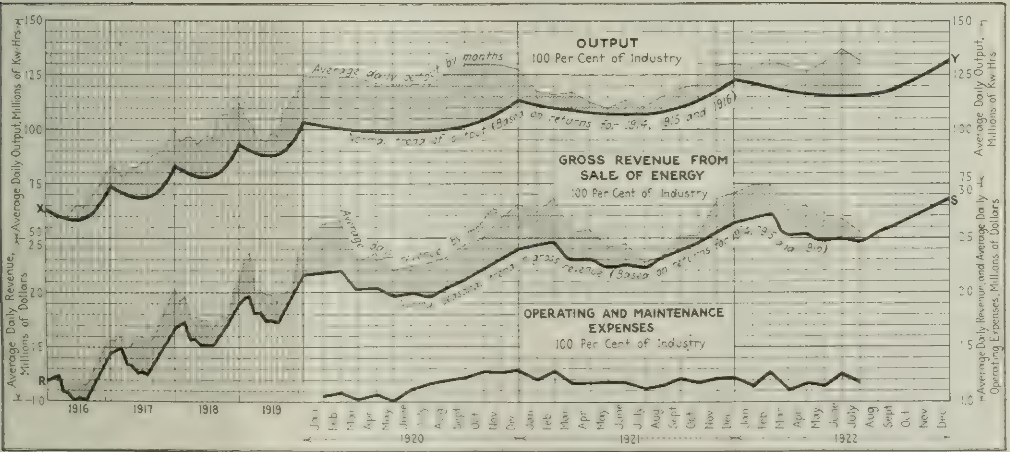
Midsummer Energy Output Increases 20 per Cent



REPORTS received by the *Electrical World* for the month of July from central generating and distributing companies representing 83 per cent of the installed rating of the country indicate that the output in the aggregate was about 4.2 per cent below the record output reported during June. According to government reports, several of the primary industries which purchase large quantities of electrical energy from central-station companies were operating considerably below the point of activity reached in June, with resultant reduced energy requirements. It is probable that the addition of new domestic lighting customers during July was more than sufficient to overcome any seasonal decrease in domestic lighting requirements, and that the decreased output must be attributed almost solely to decreased industrial energy requirements.

The gross revenue during July was the lowest since October, 1921, being about 16.3 per cent under the record revenue reported during February, 1922.

The extent of the real progress of the electric light and power industry during the period of rehabilitation of American industry in general is seen when current figures are compared with those for a year ago. The electrical energy from which revenue was received totals 4,080,000,000 kw.-hr. in July of this year, as against 3,390,000,000 kw.-hr. during July, 1921, an increase for the twelve-month period of about 20.4 per cent. The gross revenue from sale of energy increased from $71,500,000 during July, 1921, to $79,400,000 during July of this year, or an increase of about 11 per cent. Moreover, going back to 1920, the peak year of activity in American industry in general, the output of July, 1922, was about 9 per cent above that of July,

TABLE I—CENTRAL STATION RETURNS FOR THREE MONTHS

Month	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)				Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
														Steam Plants		Hydro Plants		Combined Systems of Steam and Hydro	
		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase			1922 Thousands of Dollars	1921 Thousands of Dollars	Per Cent Increase	1922	1921	1922	1921	1922	1921
May..	83	3,380,602	2,804,535	20 2	76	$62,295	$57,789	7.8	May.	62	22,785	22,378	1.8	53.7	58.1	25.1	22.4	43.3	46.0
June..	83	3,402,951	2,809,183	21.0	76	61,324	55,291	10.9	June.	62	22,758	21,849	4.2	54.2	56.9	26.4	28.1	44.9	48.5
July...	83	3,393,882	2,818,309	20 2	76	60,303	54,365	10.9	July.	62	22,800	21,586	5.5	55.3	56.8	27.9	28.5	46.1	48.1

1920, and the revenue showed an increase of about 12.3 per cent during the same period. These figures, taken in conjunction with the fact that during the last twenty-four months about 2,500,000 new customers of all classes were added to the central-station lines, present a picture of progress and prosperity which is probably unsurpassed by any other primary industry of the country.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to gross revenue from sale of energy, gives further evidence of the increased prosperity of the electric light and power industry. Although in July the operating ratio of companies having steam generating plants only, taken in the aggregate, was 55.3 per cent, as against 45.7 per cent in January of this year, such an increase in operating ratio between winter and summer months is to be expected on account of the relatively higher percentage of low-revenue industrial energy sold during the summer months. The evidence of the tendency toward financial prosperity in the industry is found in the fact that the operating ratio decreased from 56.8 per cent in July, 1921, to 55.3 per cent in July of this year.

The Mountain and Pacific States are the only section which reported energy consumption on a par with the record month of June. Every other section of the country reported a material drop in output, it being most pronoounced in the New England section.

International Efforts to Reduce Radio Interference

COUNTRIES which are employing radio communication in rapidly increasing degree have been compelled to arrive at a mutual understanding in order to avoid interference and delay in traffic. Five different types of waves have been standardized which produce various amounts of interference at a given distance from the transmitting aërial, the decrement serving as a criterion. Thus radio telephony is to be carried on by waves ranging from 1,550 m. to 1,650 m. for fixed stations and 300 m. to 340 m. for mobile stations, but the decrement of the waves used must not be greater than 0.005.

For mutual benefit it is proposed to ask every nation represented at the next international conference on radio communication to supply particulars not only of stations in use, but also of projected stations that may be erected in the succeeding five years.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States			Percentage of Installed Ratings Represented	Atlantic States			Percentage of Installed Ratings Represented	North Central States			Percentage of Installed Ratings Represented	South Central States			Percentage of Installed Ratings Represented	Pacific and Mountain Sta es		
		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 T cusands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousand-	1921 Thousands	Per Cent Increase
KW.-HR. OUTPUT:																				
May......	82	241,879	200,030	20.1	83	1,207,306	984,646	22.5	82	1,108,924	935,268	18.5	62	166,171	138,576	19.9	95	656,322	546,015	20 1
June......	82	242,700	200,343	21.2	83	1,194.549	978,178	22.0	82	1,113,375	917,708	21.2	62	167,420	140,425	19.2	95	684,907	572,529	19.6
July......	82	227,768	193,144	17.9	83	1,182,792	967,859	22.2	82	1,109,572	910,088	21.8	63	165,982	142,140	16 8	95	707,768	605,078	17.0
REVENUE:																				
May......	82	$5,787	$5,508	5.1	76	$22,579	$21,204	6.5	69	$20,237	$18,175	11 3	62	$4,131	$3,782	9.2	95	$9,561	$9,120	4.8
June......	82	5,791	5,422	6.8	76	22,354	20,440	9.5	68	19,025	16,763	13.5	61	4,138	3,806	8 8	95	10,016	8,860	13.0
July......	82	5,728	5,300	8.1	76	21,868	19,829	10.1	68	18,669	16,408	13.8	63	3,981	3,717	7.1	95	10,057	9,111	10.4
OPERATING EXPENSES:																				
May......	53	$1,617	$1,692	-4 4	57	$7,537	$7,397	1.9	55	$8,369	$7,848	6.7	61	$1,866	$2,043	-8.6	93	$3,396	$3,398	-0.0
June......	53	1,751	1,937	-9.6	57	7,691	7,362	4.5	55	7,720	7,133	8.3	61	2,179	2,051	6.2	94	3,365	3,421	-1.6
July......	53	1,782	1,765	1.0	57	7,784	7,327	6.2	55	7,875	7,181	9 6	62	1,896	1,951	-2.9	94	3,463	3,362	3.1

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months	
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
Steam Plants:																				
May	58 8	62.4	57.1	66.0	54.4	58.0	50.6	56.6	50.6	58.8	61.5	52.0	54 1	56.1	50 1	55.1	54.7	56.3	48.8	55.3
June	56.5	66.3	56.8	65.7	54.8	56.6	50.4	56.3	54.8	56.8	51.9	60.4	52.2	54.5	49.9	55.7	46.6	54.2	48.3	55.0
July	54.3	62.4	56.3	64.5	56.2	57.3	50.3	55.9	56.7	55.8	51.8	59.3	51.9	53.9	49.7	54.9	49.7	52.6	48.0	54.4
Hydro Plants:																				
May	32.0	28.7	33.2	42.1	16.2	18.0	18.5	22.7	22.1	22.7	22.3	22.6	33.0	28.0	36.4	34.4	35.2	32.8	27.2	26.8
June	36.5	37.0	33.8	43.1	26.9	26.1	19.9	23.4	21.3	20.5	22.6	22.4	32.0	27 3	36.5	34.8	25.1	20.0	29.6	26.1
July	40.6	49.9	34.4	43.8	24.5	22.1	20.5	23.4	20.5	26.0	22.6	22.9	50.2	47.8	42.1	39.6	28.2	28.1	27.3	26.9
Combined Systems of Steam and Hydro Plants:																				
May	46.2	49.4	52.4	52 5	44.8	45.3	45.4	49.5	50.6	55.1	47.7	55.8	38.5	44.5	43 1	45.3	31.3	34.4	36.6	40.7
June	48 8	58.7	51.9	52.4	48.7	51.0	45.8	49.8	51.4	53.7	48.3	55.2	43.7	49.3	43.0	45.8	31.9	38.0	35.8	40.0
July	53.2	56.7	51 6	52.1	51.3	52.0	46.7	50.0	54.8	56.3	48.9	54.6	41.2	48.4	42.9	46.1	30.5	33.6	35.3	39.0

Marked Interest in Electric Ovens

Fourteen Papers on This and Allied Subjects Constituted the Major Portion of the Montreal Convention of the American Electrochemical Society—Development of Enameling Ovens and Construction Given Chief Consideration

MORE than the customary attention was directed at industrial electric heating and allied subjects by the American Electrochemical Society in its convention at Montreal this year. Fourteen papers were presented on electric enameling ovens, properties of resistor alloys and granular carbon, heat insulation, high temperature furnace design, electric steam boilers and the like. High points in some of these papers and discussions are reported below. There was much animated discussion due to a strong representation by opposing factions. The manufacturers of apparatus claimed perfection in design and high efficiency in operation; the users of this apparatus, however, were anxious to point out what they considered inherent weaknesses of the product. The general impression gained was that even closer co-operation than practiced in the past was needed between designer and builder of electric ovens, furnaces and other apparatus on the one hand and the user or consumer of these on the other.

Electric Heating for Enameling

"The development of the electrically heated enameling oven within the past seven years is due to a concentration of effort on the part of electrical manufacturers and central-station companies upon a single industry—the automotive," said Wirt S. Scott in his paper on this topic. At first the cost of operation was excessive as compared with gas, and for this reason attempts were early made to reduce the amount of heat carried off in the vent ducts, since no air was required for combustion. However, the experiments indicated that a certain amount of air was required for oxidizing the enamel. Furthermore, it was found that with restricted ventilation explosions were possible regardless of the temperature of the heating element. A sufficient amount of air must be admitted to the oven to keep the mixture lean or sufficiently dilute to make an explosion impossible. The vapors should be withdrawn at or as near the floor as possible. Repeated tests showed that one-third loss air could be used when ventilating from the floor, and that the length of time required for baking was reduced 25 per cent. To overcome the difficulties arising from the enamel dripping on the floor of the oven it was found advisable to place the heaters along the side wall but as near the floor as possible. Ventilating from the floor, the heated air passed up along the side walls across the roof and down through the middle of the oven. This method of circulation produces a uniform distribution of temperature. Since conduction of heat by metal extending from the inside of the oven to the outside was found to account for 50 per cent of the entire radiation loss, attempts have been made to reduce this loss as much as possible. Approximately 95 per cent of all electrical troubles occurred in the terminals or connectors in the early ovens, but this has been reduced.

One of the most important developments has been that of the automatic temperature control for ovens. In ventilating electric ovens from the roof twenty changes of air at room temperature were figured as sufficient, but later, with the use of the floor method of ventilation, ten changes of air at oven temperature were estimated to be sufficient to keep the volatile gases sufficiently dilute to prevent explosions. To provide for these conditions, motor-driven exhaust fans were used. In order to eliminate the possibility of explosions due to vapors condensing and solidifying in the vent ducts, a system has been perfected which, in connection with a motor-driven exhauster, automatically shuts off the power the instant the exhaust duct becomes restricted in any manner or if the runner of the exhaust fan becomes loose on its shaft.

With electric ovens the baking period has been reduced less than one-half, and with enamels baking at 450 deg. F. the baking period has been reduced to one hour and in some cases to thirty minutes. However, too short a bake is injurious to the enamel. Two things are essential in the baking of enamels—a uniform protective coating of enamel and maximum adhesion between the enamel and the work. The greatest amount of adhesion and the thickest and smoothest surface of enamel is obtained when the work is heated at such a rate as will permit the metal to become uniformly heated at the same rate as the enamel on its surface.

Explosions have occurred owing to the volatile gases being driven off too fast for the vent ducts to handle them properly. Naphtha vapors begin to come off at room temperature and for best results should be entirely liberated by the time a temperature of 250 deg. F. has been reached. Therefore, it is evident that if the work is placed immediately in an oven having a temperature of 450 deg. F. and the heat turned on the gases will be generated at an enormous rate.

Advantages of Industrial Electric Heating

Wirt S. Scott also contributed a splendid résumé of the "Advantages of Industrial Electric Heating." He pointed out the following specific advantages: (1) With electric heating no products of combustion are produced that might impair the quality of the product. (2) Automatic temperature control. (3) An easier and better temperature distribution, possessing a flexibility of installation and operation not obtainable with any other form of heat. (4) Danger of gas explosions is eliminated. (5) Electric heaters respond quickly when the current is turned on and have a sufficient temperature head to force the heat quickly into the work.

Successful application of electric heat to varied processes involves not only a knowledge of the physical and chemical characteristics involved, declared E. F. Collins in a paper on this subject, but the heating device in question should be of such design as to take account of at least the laws governing the outlined conditions, tempered with good judgment resulting from experience.

Mr. Collins' paper drew forth considerable discussion. Dwight Miller dwelt at length upon the persistent prejudice against electric heating as compared with gas heating due to a biased idea of cost of operation and quality of product. The user is apt to lay too much stress upon the relative higher cost of electric power as against gas or other fuel, overlooking entirely the great improvement in quality and the increase in production. Wirt S. Scott laid stress upon the proper design of apparatus.

F. A. Lidbury deplored the lack of sufficient detailed information on the part of the manufacturer of apparatus as to the processes to be carried out in the electric heater or oven. The direct energy cost is not sufficient comparison; the first cost of apparatus and the maintenance cost must also be taken into account. Too much importance has been laid by apparatus manufacturers on the efficiency of the apparatus. Often simplicity of design is of much more importance.

Frederick J. Ryan agreed that altogether too small attention has been paid to the demands and wants of the consumer. Dwight Miller added that consumers' specifications are usually based on fuel heating practice. The consumer does not always appreciate the uniform heating with electricity as against intermittent heating with fuel. Seldom, too, has the consumer any accurate knowledge as to actual manufacturing costs.

RESISTIVITY OF GRANULAR CARBONS

To be satisfactory for resistor material, the granular carbon must have a small change in resistivity with different temperatures, a low ash content, high resistance to oxidation, and sufficient density, physical strength and hardness to withstand mechanical forces, Clyde E. Williams and Gordon R. Shuck asserted in their paper. According to investigations made by the authors the difference in resistivities of various types and sizes of carbon resistors is not very large at 1,000 deg. C. to 1,200 deg C. The temperature coefficient of resistivity is negative for all the forms of carbon tested up to 1,000 or 1,200 deg. C., at which temperature it approaches zero and then becomes positive as the temperature increases further. This change is more pronounced in graphite than in other forms of carbon. The resistivity increases as the size of the particle decreases. High resistivities are caused by the presence of volatile matter in the resistor material, the resistivity and volatile matter bearing a direct relation for the same material. Ash contained within the particle of carbon increases the contact resistivity and the thermal coefficient somewhat, but the effect is not nearly so large as is that of contained volatile matter. Extraneous ash or foreign matter of high resistivity increases the resistivity and the thermal coefficient to a very marked extent.

RESISTIVITY OF VARIOUS MATERIALS

Resistor Material	Size, Inches Passing	Size, Inches On	Ash Content	Resistivity Ohms per Cubic Inch 20 Deg. C.	Resistivity Ohms per Cubic Inch 1,000 Deg. C.	Temperature Coefficient of Resistance
1. Acheson graphite..	0.5	0.25	0.25	0.175	0.085	—0.00052
2. National carbon...	0.5	0.375	0.45	1.3	0.90	—0.00032
3. National carbon ..	0.25	0.125	0.45	2.4	0.95	—0.00061
4. *National carbon ..	0.25	0.125	....	1.8	0.6	—0.00068
5. *National carbon 600 gm. per sq.in. pressure..........	0.25	0.125	....	0.81	0.23	—0.00073
6. Retort carbon.....	0.5	0.25	2.0	1.27	0.83	—0.00036
7. Coal-tar residue ..	0.5	0.25	0.50	1.9	1.0	—0.00048
8. Carbonized non-coking coal (Tono)	0.5	0.25	26.0	2.8	1.5	—0.00047
9. Gashouse coke.....	0.5	0.25	24.0	2.55	0.65	—0.00075
10. Utah coke...... ..	0.5	0.25	14.0	3.7	1.5	—0.00061
11. Carbonized non-coking coal........	0.5	0.25	31.0	2.1	1.0	—0.00053
12. Charcoal..........	0.5	0.25	2.5	4.0	1.1	—0.00073
13. Charcoal mixed, 20 per cent silicious material..........	0.5	0.25	22.5	12.5	3.5	—0.00074

* Calculated from values taken from "The Carbon Electrode."

ELECTRICAL PROPERTIES OF ALLOYS

Data were presented in a paper by M. A. Hunter and A. Jones which should enable the calculation of specific resistance of any material for either high-temperature or low-temperature ovens at any operating temperature. For ovens operating at temperatures not exceeding 500 deg. C. the various grades of nickel have been investigated together with two alloys of copper and nickel—"Monel" and "Advance"—and two alloys of iron and nickel—Alloy No. 141 and Alloy No. 193. For ovens operating at temperatures up to 1,100 deg. various grades of nichrome have been considered. Ten very valuable tables were presented, chief among which were those giving the analyses of elements in seven types of resistance material, resistance of various materials at 20 deg. to 1,000 deg. C., variation in resistance of seven alloys of nickel and chromium, variations in resistance of nickel-iron-chromium wires of two types, variation in resistance of iron-chromium wire, increase in resistance at 1,000 deg. C. for three types of nickel-chromium wire and for nickel-iron-chromium wire, the comparative life of nickel-chromium and iron-chromium wires, and the change in resistance on oxidation.

In discussing the paper Colin G. Fink referred to the present limiting percentages of chromium in the two types of nichrome wires due to the difficulty of rolling and drawing alloys with higher percentages. As knowledge of the cause of brittleness is gained, it seems safe to predict that resistance wires with as much as 40 or even 60 per cent of chromium can be produced. The influence of other elements, such as carbon, silicon, etc., is not yet fully appreciated. On the other hand, it was pointed out by Professor Hunter and Frank S. Weiser that nichrome brought into contact with asbestos, mica or other silicates at high temperatures will produce brittleness at the point of contact. E. F. Collins considered nichrome ribbon better than wire for most purposes.

HEAT-INSULATION MATERIALS

Selection and application of heat-insulating materials for electric heating apparatus were the chief topics considered by J. C. Woodson in his paper. Numerous curves and data were presented. Although the insulation materials available for low temperatures are more or less numerous, he concluded that there are few satisfactory products on the market for high temperatures.

Discussing Mr. Woodson's paper, Carl Hering of Philadelphia mentioned his experience of whitewashing the outside of his furnace and thus very perceptibly improving the heat insulation. Upon compressing a porous insulating material, the heat flow through the material at first decreases, but upon further compression the heat insulation value drops off rapidly.

Prof. Alfred Stansfield of McGill University emphasized the importance of avoiding too thick a layer of outside insulating materials, such as "Sil-o-cel," especially in high-temperature furnaces. The melting point of "Sil-o-cel" and similar materials is comparatively low, and if all the heat is trapped, it soon accumulates in the inner layers, a temperature approaching that of the bath is attained and the "Sil-o-cel" melts.

Similarly it does not pay to make the roof of the electric steel furnace too thick.

Frank W. Brooke mentioned using 4½-in. "Sil-o-cel" as outside insulation, saying that it started to fuse after ten heats.

Replying to Henry Howard as to the advantages of using air spaces at definite intervals between the layers of brick or asbestos, Mr. Woodson said that above 300 deg. C. air spaces are of no advantage on account of the convection currents. There undoubtedly would be some advantage were these spaces evacuated.

High-Temperature Furnace Design

The chief requirements which should be met in electric furnaces are judged from the viewpoints of highest quality of products, lowest cost of operation and maintenance and greatest safety in operation at high temperatures, as outlined by E. L. Smalley. For example, the muffled type should be used where suited to the process. The exposed element or radiant form only should be used when adapted to a process, and these must be in a sufficient number to enable cheap renewal. The coils must be fully supported and yet free for expansion. Refractory parts must be thorougly supported, but free for expansion. No internal connections of coils should be tolerated and terminal sizes should be larger than the element size. The source of heat must be uniformly distributed and the size of the furnace must be governed by the charge. Placement of elements should not control the furnace size, since thermal efficiency is the controlling factor. Experiments have proved that the transverse section of heating elements should be round and that exposed elements should preferably be placed in corrugated grooves. Voltage should not be the determining factor in the selection of elements. To assure long life the total weight of the heating element should be high in proportion to the weight of the charge. In addition, the efficiency of the heat insulation must be adapted to the work to be performed.

Electric Steam Generators

In general the cost of electrical energy is such that it cannot be used commercially for the production of steam, but there are circumstances under which the conversion of electricity into steam even on a large scale becomes economically feasible. The required conditions, according to the paper of P. S. Gregory, are a surplus amount of electric power for which there is no other use at certain times or a cheap supply of power. On the basis of 4,840 kw.-hr. being equivalent to one ton of coal, 1.65 mills per kilowatt-hour could be paid for electrical energy if coal cost $8 delivered under the boiler.

In the steam generator described by the author energy is made to flow through the water from a central electrode to the shell of the vessel or to a metallic inner lining. Alternating current is used at a pressure varying from 110 volts up to 12,000 volts. Three electrodes can be used in one vessel or each electrode can be housed in a separate vessel and the three shells connected in star.

The chief advantages of the water-resistance type of steam generator over the metallic-resistance type, as outlined by the author, are freedom from electrical and mechanical troubles, ease of regulation and cheapness. Considerable of the steam pressure is accomplished by means of a float valve which will adjust the water level so that for a particular conductivity of water the steam supply will be equal to the demand, the depth of immersion of the electrodes determining the amount of energy released within the boiler. The danger of an arc striking between one of the electrodes and the wall of the vessel has been avoided in two ways—by the use of an inner protective shell and by the development of a potential-balance relay system.

Eric A. Lof, recently returned from a trip to Sweden, reported that hundred of electric steam boilers are in daily use in Europe, largely operated on surplus power. In Europe there are forty-two successful installations of that kind. Dr. Carl Hering inquired whether any appreciable decomposition of the water were discernible, due to electrolysis. Philip H. Falter of the Canadian Electro Products Company observed that electrodes wear out entirely out of proportion to the energy consumed. With twenty-five-cycle current there is greater electrode wear than at sixty cycles.

Crucible Furnace for Aluminum

A simple electric crucible furnace for melting aluminum was described by A. Glynne Lobley. It consisted essentially of a nichrome ribbon resistor wound in a helix and supported on thin firebrick shelves round the crucible but not touching it. Surrounding the heating element is a wall of kieselguhr and special bricks, held in a container of ordinary brickwork. Details of this furnace were presented.

Effect of Heat Treatment

According to tests made by Norman B. Pilling, a relatively high temperature (800 deg. to 900 deg. C.) is necessary for complete and rapid softening of electrolytically deposited iron. By annealing at 300 deg. to 400 deg. C. the initial hardness may be considerably increased. With the material investigated the scleroscope hardness was increased fron 26 to 45, the latter being equivalent to the hardness of an annealed high-carbon steel (1.2 per cent C.).

A New Induction Furnace

A new induction furnace was described by J. Murray Weed in which the electric current induced by transformer action occurs in a looped portion of the molten charge. This portion is distinct from the melting pot, in which the cold charge is received, melted and held for refining and pouring. The success of the furnace depends upon a continuous, automatic circulation of the molten metal between the secondary and the melting pot, to prevent overheating in the former and to deliver the heat to the cold metal in the latter.

Firing of Ceramics in Electric Furnaces

Properly designed electric furnaces can be depended on for ceramic firing at temperatures up to 1,100 deg. C., according to E. L. Smalley. Grinding wheels have been produced by the use of the electric furnace in a shorter time and of greater wearing durability than is possible in the kiln process. The cleanliness of atmosphere, the uniformity of temperature control and other features of electric furnace operation have made it very adaptable in the automobile and china industries and in the manufacture of glassware and bi-focal lenses, where substantial reduction in the percentage of rejects has been experienced.

L. E. Saunders pointed out that a commercial process for the electric firing of grinding wheels has not yet been worked out. Organic binders for these wheels require but 100 deg. to 200 deg. C., and wheels with the sodium silicate binder are not heated above 250 deg. C. Professor Bancroft considered a small high-temperature electric furnace for porcelain firing a very desirable and welcome piece of apparatus. Artists could then fire their own china.

Certain types of varnishes are capable of developing substances of low electrical resistance during drying and oxidation, H. C. P. Weber pointed out. These substances are acidic, slightly volatile and may be shifted about and accumulated by temperature differences. In varnishes used for insulating purposes the amount of these substances formed during drying is of importance. Further work is necessary to determine the relation between the amount of these low-resistance materials formed and the composition of the varnish, the author declared.

The nature of gas emitted when insulating compound of high dielectric strength is subjected to arc action and the amounts developed per kilowatt-second were given in a paper by C. J. Rodman. From the data presented it appears that there is a consistent decrease in gas evolution per kilowatt-second with the increase in molecular weight of the paraffines. In both the halogenated aliphatics and aromatics there is a decided decrease in gas evolution per kilowatt-second as the halogenation increases.

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Short-Wave Radio Transmission

EXCELLENT radio transmission has been obtained by using waves of 15 m. generated by thermionic valves giving a power of 200 watts and an aërial current of 1 amp. After a successful attempt over land, a test was recently made from Carnarvon, Wales, to a receiving apparatus on a boat running to Kingstown, Ireland, and speech was received in that harbor, 70 nautical miles from Carnarvon. It had previously been found that the diminution in strength of the received energy was greater at low levels than at high, and it was expected that greater distances than 70 miles could be covered under suitable conditions on land. The result of a test between Hendon and Birmingham, England, was very satisfactory, and it was proved that the effect of the use of a reflector at each end was to increase the received energy 200 times.

The work with experimental stations is to be continued, and the results have so far been such as to make it clear that this new method of direction finding will certainly be developed further. The use of small wave lengths precludes the likelihood of interference from disturbance, but it introduces some difficulties in tuning of the receiving circuit.

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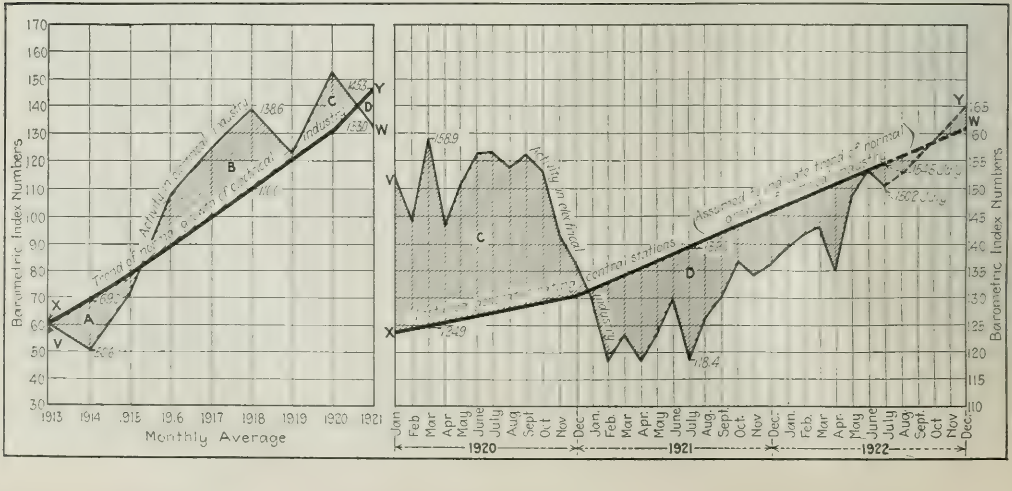
Rate of Business Progress Slackens During July

INDEX figures upon which the "Electrical World Barometer of Business Conditions in the Electrical Industry" is based indicate that during July activity within the industry as a whole was slightly below that during June. As indicated for June, a part of the falling off was no doubt due to seasonal slackening, but more potent causes were the long-continued coal strike and the uncertainty connected with the railroad difficulties. In addition, building contracts let during July declined about nine million square feet, being reported as 51,705,000 sq.ft., the lowest figure since last April. Some of the large users of electrical energy and electrical supplies, such as the textile, rubber, paper, brick and automobile industries, reported decreased activities during July. Preliminary figures for July indicate, also, that the operations of the electric light and power branch of the industry were about 4.2 per cent under those of June. It must be remembered, however, that the central-station output during June was far above any previous record, and a slight decrease during July was to be expected.

The "Electrical World Barometer" indicates that during the month of July business conditions in the electrical industry, taken as a whole, showed a decrease of 2.4 points on the barometer scale. The electrical industry as a whole during July was operating at 4.3 points below what would have been the point of seasonal demand if growth in the industry had been normal. In June it was operating at only four-tenths of a point below the point of normal demand.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Danger from the Fused Neutral

To the Editors of the Electrical World:

The editorial in the Sept. 16 issue of the *Electrical World* entitled "A Code Requirement That Courts Danger" brings out a very important point in connection with interior wiring. The hazard to life that resides in the fused neutral was brought quite forcibly to my attention when one of our city firemen met his death from this source. In this particular instance a small fire originated in the basement of a three-story rooming house and shortly after the flames were extinguished one of the firemen entered the basement to determine, if possible, the cause of the fire. At this time there was approximately an inch of water on the basement floor, and in some way he came in contact with a long cord extension in such a manner as to cause it to be wrapped around his neck. Because of the very low contact resistance which the wet basement floor presented, and also because of the manner in which the cord (with insulation burned off) was entangled about his neck, an abnormal current flowed through his body to ground. Unsuccessful attempts were made by those present to disentangle him from the wire, and it was only after a lapse of several seconds that the current was interrupted by breaking the connection at the socket.

A test was made on the afternoon of the same day to determine if the electrical conditions on this circuit were normal, and the results of this test indicated that the neutral was well grounded, which precluded any possibility of excessive potential due to a cross with a high-voltage circuit.

The insulation on the cord with which the fireman came in contact was, as already stated, completely burned off, resulting in a short circuit which blew the branch circuit fuses. It happened, however, that the fuses were of unequal capacity, consisting of a 10-amp. fuse in the neutral wire and of 20 amp. capacity in the outside wire, so that when the short circuit occurred the 10-amp. fuse in the grounded neutral was blown, leaving the outside leg still connected to the system. Therefore, the possibility of shock existed even though one of the wires was disconnected from the supply by the blown fuse.

From the standpoint of protection to life there is little doubt that the solid neutral from service to final outlet would prove the best. From the standpoint of fire hazard it is possible that some increased protection is afforded by having both wires of a branch circuit fused. This is true, of course, only in the case that a short circuit occurs between wires. Should the short circuit occur from the outside wire to ground, no additional protection is afforded by the neutral fuse. The usual argument in favor of the double fusing is the increased factor of safety, as short-circuit protection is provided even where one of the fuses has been doctored.

In connection with a revision of the rulings along this line, should such a revision be adopted by the underwriters, it would be well to standardize on a foolproof single-fused panel, one that would make it difficult to insert pennies or to use other methods of bridging the lighting cut-out. It would also be advisable to standardize the lighting circuit panels with 0-15-amp. cut-outs, as the present practice tends toward excessive overfusing of branch circuits inasmuch as it is a very easy matter to replace fuses of the proper size with others of 30-amp. capacity.

I am very much interested in the question of the solid neutral and should be glad to see this matter discussed in your columns.

L. W. GOING,
Chief Electrical Inspector.

Department of Public Works,
Portland, Ore.

Laminated-Frame Arc-Welding Generators

To the Editors of the Electrical World:

In one of your recent issues a letter appeared from a Milwaukee reader who questioned the benefits derived from a laminated yoke in direct-current electric arc-welding generators. It is believed that a few points were overlooked in his discussion of this subject.

The statement that laminated frames permit a very rapid change of flux density, which in turn makes it possible for the arc current to adjust itself almost instantly to any demand, is quite correct in that the damping effect of eddy currents is almost entirely eliminated, thus allowing the change in terminal voltage to take place almost instantaneously with the change in flux density. Thus, in a differentially wound generator, with an increase of arc length or resistance there is a corresponding increase in effective flux density, causing a proportional increase in arc voltage with reduced arc current, so that the product of the arc volts and amperes remains practically constant throughout the welding range of 16 to 22 volts. The statement then applies to the so-called "variable-voltage, constant-energy" generators and not to "constant-current" generators as indicated in the letter which is under discussion.

The main purpose of the reactor in the arc circuit is to aid the operator in starting his arc by preventing a sudden inrush of current upon shorting the electrodes and causing what is commonly known in practice as "freezing" the electrode to the work. The damping effect of eddy currents in the cast yoke is not sufficient to get the desired results, and, besides, it would be an inefficient way of obtaining this desired condition, as both hysteresis and eddy-current losses are greatly increased. It is true that the time constant (L/R) should be made quite large in order to derive all possible benefit from this source.

The hysteretic coefficient η of ordinary annealed sheet iron is 0.004, while that of cast steel is 0.12. From the Steinmetz formula $W_h = \eta V B^{1.6}$ (where W_h = hysteresis loss in ergs, V = volume of iron in cubic centimeters, and $\pm B$ = range of flux density during complete magnetic cycle), we note that the actual hysteretic core loss of cast steel is practically thirty times that of sheet iron. This is one of the main advantages of the completely laminated magnetic circuit.

The eddy-current loss is proportional to the volume of iron or steel, to the square of the number of magnetic cycles per second, to the square of the thickness of laminations, and to the square of the maximum flux density, i.e., $W_e = V f^2 t^2 B^2$.

Here again we see the big advantage of using the laminated frame in preference to the cast yoke, since the eddy-current core loss in the laminated structure is only a very small fraction of that found in the cast frame.

In conclusion, it is observed from the foregoing that by using completely laminated magnetic circuits in the designing of arc-welding generators the core loss is reduced to a minimum, and the high efficiency of the equipment is maintained by using a proper design and size of reactor in the arc circuit (all laminated construction), thus reducing all possible loss in the external circuit. In no case has it been found possible to eliminate the stabilizing inductance in the arc circuit on differential-wound generators with satisfactory operation. PLINY P. PIPES.

New York City.

Power-Factor and Property-Investment Methods of Charging for Power

To the Editors of the Electrical World:

Referring to the article in the *Electrical World* of May 6 by Messrs. Doran, Hodtum and Fryer on the kilovolt-ampere basis of charging for alternating-current power business and Professor Rittenhouse's comments and the reply thereto, in the issues of Aug. 12 and Sept. 2 respectively, it may be of general interest to show the following result of an analysis of the figures given in the original article. I have omitted, for the sake of brevity, the steps by which the figures were obtained, but they can be easily calculated by any one. For the sake of simplifying the comparison, I have also omitted the charge for losses under the property-investment method:

Customers Having Power Factor of (Per Cent)	Fixed Charge per Year for 2.800 Kw. "Power-Factor" Method	"Property-Investment" Method	Differences Between Methods	Per Cent Difference
100	$35.100	$43,500	$8,400	24.0
80	43,500	52.320	8,820	20 3
75	43,500	55,256	11,756-	27.0
61	53,145	65,550	12,405	23.3
Increase due to low power factor.......	$18,045	$22,050		
Per cent increase due to low power factor.......	51.	51 7		

This shows that, with the rates assumed, the property-investment method would charge a customer having 100 per cent power factor with $8,400 more than would be charged the same customer under the power-factor method; furthermore, it will be seen that the percentage of increase in each of the rates on account of the power-factor penalty (omitting the losses) is almost exactly the same under the two plans.

The reduction in the amount charged at 100 per cent power factor under the power-factor method is due to the fact that this method offers a premium for power factors above 80 per cent, so that at 100 per cent it charges for only 2,240 kw. instead of the 2,800 kw. which is charged under the property-investment method.

This difference seems to add an unwarranted complication and to obscure the real effect of using the two methods, inasmuch as the above table shows that the 23 per cent increase pointed out by the authors as the result of using their method is really a little less than the percentage of difference between the charges at 100 per cent power factor. The result, consequently, is not so much due to the method used as to the basis of figuring.

There are two other points in connection with the property-investment method to which attention should be called.

The first is including a demand charge to cover losses. This is a comparatively minor feature, but if used should be used so as to operate equitably. I feel that the authors' method would not so operate, inasmuch as the ground for the imposition of an additional charge for decreased power factor is that the consumer is calling for excess capacity. If he pays for this excess capacity, I believe the losses should be figured on the assumption that the capacity paid for is supplied, and not on the basis of the original capacity.

The second feature is making a credit on the kilovolt-ampere charge against customers with low power factors on account of the fact that the steam end of the system is practically unaffected. In this connection attention should be called to the fact that an average ratio (e.g., 16-84 for steam and electrical investment respectively) would differ so materially from the actual ratio of large consumers that it is very doubtful if its use could be justified for all sizes. This difference is due to the fact that the kilovolt-ampere cost of connecting consumers to the generating station decreases with increasing size; hence, if with the average-size consumer the steam investment is 16 per cent of the total investment, then with a customer the size of the one in the example used (viz., 2,800 kw.), the ratio of the steam end would become very much greater owing to the decreasing cost per kilowatt of connecting so large a consumer to the generating station. A. S. KNIGHT.

84 State Street,
Boston, Mass.
Consultant.

Italy's Electrical Industries

To the Editors of the Electrical World:

English and American capitalists and financial groups have on several occasions expressed the desire to invest capital in Italy's electric enterprises and especially in those utilizing their own water power. The Italian State Railways have already tried to control the water power of the country and to erect their own power stations. Their success would not be in the interest of the industrialization of hydro-electric developments.

The capital at the present time invested in the electrical industries of Italy amounts to about 2,000,000,000 lire. It controls 9,458 enterprises and produces 4,700,000,000 kw.-hr. per annum. The number of concessions amounts to 3,486, with a capacity of 1,702,000 hp. It has been calculated by experts that the total power obtainable will amount to about 6,000,000 hp.

Of course, such figures are only to be considered approximative. Taking into consideration the power stations now in operation and those to be completed within the next ten years, it will be safe to say that the total amount of electric power available will amount to 10,000,000,000 kw.-hr., equivalent to 20,000,000 tons of coal. This fact is the more remarkable when it is remembered that Italy in the year 1913, during which period the country consumed the largest quantity of coal ever used, imported altogether 12,000,000 tons of coal. The electrical energy now (September, 1922) directly available for the consumers amounts to 5,000,000,000 kw.-hr.

The largest enterprises are in the north of the country, where the industrial consumption is very large and where the streams flow much more rapidly than they do in other parts of the country.

HENRY L. GEISSEL.

Beaurivage, Thoune, Switzerland.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Rural Line Costs Prorated on Mileage Basis

VARIATIONS in the cost of rural service depend upon the distances between customers and the length of serving lines. In a municipality fifty customers per mile is usually a minimum, while in farm service five customers per mile is a high average. It is readily seen, then, that this business is at a great disadvantage when compared with urban service. It means large costs per customer for extension lines, large transformer losses, high cost of service per customer, and small return per customer per mile.

The committee of the Ohio Electric Light Association on rural-line extensions has prepared the accompanying tables for assisting utilities in developing this type of service. Monthly costs for 6,600-volt rural service are divided in Table I according to transformer rating and number of customers per mile. The item of $1,100 as primary costs has been assumed from extended investigations merely as a starting point. The committee intended that this table should serve as a guide and did not mean to fix these costs on every rural installation without further study.

The Ohio plan of financing rural-line extensions is that they shall be built by the customer, then turned over to the utility, which will own and maintain them, charging regular urban rates for energy, plus a service charge sufficient to cover the maintenance, depreciation, taxes, operating costs and losses. The item "B" in Table I, which is subtracted from total primary cost, is merely a duplication of the urban secondary distribution costs. The monthly charge per customer for the various sizes of transformers is one-twelfth of the 10 per cent annual charge per customer, based on the total cost per customer. This charge does not include core losses. The core losses and the value of energy consumed by the core are given in Table II. Taking this added cost into consideration, we obtain Table III, which is the monthly rural-service charge for maintenance, depreciation, etc., plus the core loss. As may be seen, this table gives the charge for any number of customers per mile up to twelve.

TABLE I—MONTHLY COST FOR 6,600-VOLT RURAL SERVICE, DIVIDED ACCORDING TO TRANSFORMER RATING AND NUMBER OF CUSTOMERS PER MILE

	Number of Customers per Mile					
	1	3	5	7	9	12
Total primary cost, assumed	$1,100.00	$1,100.00	$1,100.00	$1,100.00	$1,100.00	$1,100.00
Material, labor, etc., installing transformer	15.00	45.00	75.00	105.00	135.00	180.00
Service drops (100 ft.)	12.00	36.00	60.00	84.00	108.00	144.00
Total, item A	1,127.00	1,181.00	1,235.00	1,289.00	1,343.00	1,424.00
Direct credits equivalent to cost for urban customers:						
Transformers	4.28	12.84	21.40	29.96	38.52	51.36
Secondaries and services	17.50	52.50	87.50	122.50	157.50	210.00
Material, labor, etc. installing transformer	1.22	3.66	6.10	8.54	10.98	14.64
Total, item B	23.00	69.00	115.00	161.00	207.00	276.00
Total net cost without transformers (A—B)	1,104.00	1,112.00	1,120.00	1,128.00	1,136.00	1,148.00
Cost of transformers at 6,600 volts:						
1½-kw. transformer:						
Cost of transformer	54.00	162.00	270.00	378.00	486.00	648.00
Total cost	1,158.00	1,284.00	1,390,00	1,506.00	1,622.00	1,796.00
Cost per customer	1,158.00	428.00	278.00	210.80	180.50	149.80
Monthly charge per customer (10 per cent)	9.63	3.57	2.32	1.76	1.50	1.25
3-Kw. transformer:						
Cost of transformer	70.00	210.00	350.00	490.00	630.00	840.00
Total cost	1,174.00	1,322.00	1,170.00	1,618,00	1,766.00	1,988.00
Cost per customer	1,174.00	440.66	294.00	230.80	196.00	165.70
Monthly charge per customer (10 per cent)	9.78	3.68	2.45	1.92	1.63	1.38
5-Kw. transformer:						
Cost of transformer	85.00	255.00	425.00	595.00	765.00	1,020.00
Total cost	1,189.00	1,367.00	1,545.00	1,723.00	1,901.00	2,168.00
Cost per customer	1,189.00	455.66	309.00	246.00	211.00	181.00
Monthly charge per customer (10 per cent)	9.90	3.80	2.58	2.05	1.76	1.51
7½-Kw. transformer:						
Cost of transformer	102.00	308.00	510.00	714.00	918.00	1,224.00
Total cost	1,206.00	1,418.00	1,630.00	1,842.00	2,054.00	2,372.00
Cost per customer	1,206.00	472.66	326.00	263.20	228.00	197.80
Monthly charge per customer (10 per cent)	10.05	3.94	2.72	2.19	1.90	1.65
10-Kw. transformer:						
Cost of transformer	124.00	372.00	620.00	868.00	1,116.00	1,488.00
Total cost	1,228.00	1,484.00	1,740.00	1,996.00	2,252.00	2,636.00
Cost per customer	1,228.00	494.66	348.00	285.00	250.00	219.50
Monthly charge per customer (10 per cent)	10.21	4.12	2.91	2.38	2.08	1.83

TABLE II—VALUE AND AMOUNT OF CORE LOSSES FOR FIVE SIZES OF TRANSFORMERS

Size Transformer, Kw.	Core Loss, Kw.-Hr. per Year	Value at 2 Cents per Kw.-Hr.	Value per Month	Core Loss, Watts
1½	260	$5.20	$0.43	30
3	375	7.50	0.62	43
5	440	8.80	0.73	54
7½	665	13.20	1.10	76
10	790	15.80	1.32	90

TABLE III—RURAL SERVICE CHARGE PER CUSTOMER PER MONTH

This is determined from the monthly charge for maintenance, depreciation, etc. (Table I), plus the core losses (Table II.).

Customers per Mile	Transformer Sizes				
	1½-Kw.	3-Kw.	5-Kw.	7½-Kw.	10-Kw.
1	10.06	10.40	10.63	11.15	11.53
2	5.50	5.82	6.05	6.57	6.97
3	4.00	4.30	4.53	5.04	5.44
4	3.21	3.53	3.79	4.28	4.68
5	2.75	3.07	3.31	3.82	4.23
6	2.44	2.77	3.10	3.51	3.91
7	2.19	2.54	2.78	3.29	3.70
8	2.06	2.38	2.62	3.13	3.54
9	1.93	2.25	2.49	3.00	3.40
10	1.83	2.15	2.39	2.90	3.30
11	1.75	2.06	2.30	2.82	3.22
12	1.68	2.00	2.24	2.75	3.15

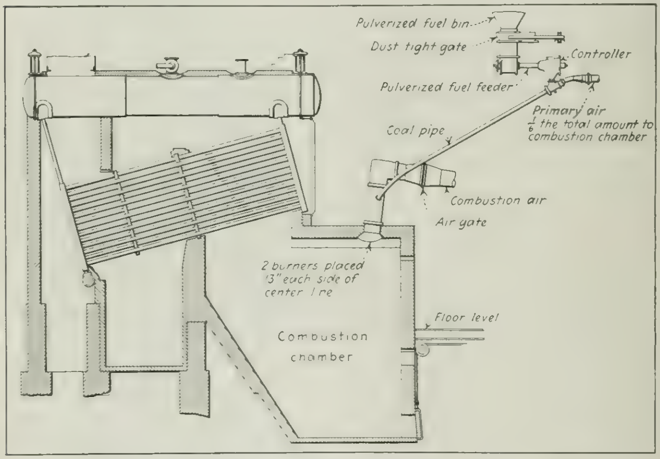
Although the assumptions in Table I may vary in different localities, the methods of determining the service charge will be practically the same.

Without an extended study of these charges the use of electricity on the farm will be hampered by high rates and friction between the user and the utility.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Pulverized Waste Coal Efficiently Burned

A SERIES of conclusive tests on burning waste which have attracted considerable attention among French engineers have recently been completed by the Société des Mines de Houille de Blanzy, at Montceau-les-Mines, France. The tests demonstrated that mine waste of not more than ⅛-in. size, which corresponds in analysis to low-grade American anthracite or river coal, could be burned in pulverized form under boilers with a combined furnace and boiler efficiency ranging from 82 per cent to 85 per cent. These figures were obtained with a boiler not equipped with either superheater or economizer. The average analysis of the fuel, after drying, was as follows: ash, 29.2 per cent; volatile matter, 11.2 per cent; fixed carbon, 59.1 per cent; moisture, 0.5 per cent; B.t.u., 10,728 per pound; fusing temperature of ash, 2,120 deg. to 2,228 deg. F.



COMBINED FURNACE AND BOILER EFFICIENCY OF 82 TO 85 PER CENT ATTAINED WITH THIS PULVERIZED FUEL EQUIPMENT

The installation for the test consisted of one Babcock & Wilcox boiler having 2,368 sq.ft. of surface equipped with the Quigley powdered fuel system. Coal preparing and burning equipment consisted of one five-roller pulverizer, one drier, two powdered-coal feed controllers and two low-pressure burners at the combustion chamber with the necessary blowers for supplying air and for carrying the coal from the powdered-coal feeders into the burners. The general layout and arrangement of the pulverized-fuel feeders and burners is shown in the accompanying diagram. The combustion chamber is 7 ft. 4 in. wide and has a volume of 1,500 cu.ft. The two burners were placed 13 in. each side of the center line of the furnace (26 in. apart on centers) with a slight tilt toward the rear. Placing each burner near the center and tilting was done to prevent scoring of brickwork.

To prevent air streams and eddy currents so frequently encountered with ordinary blast gates a specially devised gate for the combustion air control was used. In this gate the flow is controlled by two overlapping grids, permitting the air to occupy the entire area of the pipe instead of hugging one side when the gate is partly closed. The pipe diameter on either side of the gate is enlarged to compensate for the area occupied by the stationary grid.

The test conducted on this equipment consisted of an uninterrupted thirty-day run of 704 hours. During this period the hourly evaporation for each 10 sq.ft. of heating surface was 30.19 lb. of water per hour. Evaporation of from 36 lb. to 45 lb. per 10 sq.ft. was easily attained for periods of several hours at a time. The average evaporation for the entire test per pound of coal was 6¾ lb. of water.

For the first twelve days of the test the best method of operation and regulation was determined and, once having been attained, was maintained until the end without any difficulty. The hourly evaporation per 10 sq.ft. of heating surface showed an average of 30 lb. of steam, and the average evaporation per pound of fuel was 7.38 lb. of steam, which corresponds to an over-all efficiency of 82 per cent for furnace and boiler. For periods of more than forty-eight hours the evaporation per pound of fuel was maintained between 7.61 lb. and 7.65 lb., which is equivalent to an efficiency of 85 per cent.

During the whole time of the test the ash was extracted easily—partly in a state of dust and partly in a spongy and vitrified state. The smoke leaving the stack was light and of a clear color and caused no deposit of dust in the neighborhood or surroundings of the installation. After cooling off, the combustion chamber was found in good condition and ready to operate again without requiring any repairs whatever. Considering the high efficiencies obtained, this speaks very highly for the installation of the combustion chamber.

EDWARD BRITT,
Resident Engineer.
Quigley-France Company,
Montceau-les-Mines, France.

Preservation of Red-Cedar Poles Advocated

THE preservation of red-cedar poles was discussed at the recent New London convention of the New England Division of the National Electric Light Association by E. L. Clark of Minneapolis. Mr. Clark pointed out that the supply of red-cedar poles is adequate for some years, but that high transportation charges have for some time militated against their wider use in New England and other Eastern districts. The best red cedar is obtained from the so-called Rocky Mountain area, embracing Idaho, Montana, British Columbia and eastern Washington. There being from twelve to sixteen rings per inch in the Rocky Mountain cedar as against four to seven rings in the coarser cedar from the Puget Sound district demonstrates the superior qualities of the former. The high-land cedar also seems to give the best results. The present freight rate on a 40-ft. pole to New England is about $8 on a class B pole, or about half its total cost. This means about 87 cents per 100 lb. from the producing section to the East. As to the specifications on red-cedar poles, good progress is being made by the Western Red Cedar Association in conjunction with the National Electric Light Association and the American Telephone & Telegraph Company.

The importance of building for permanency by treating poles was emphasized by Mr. Clark. "We have been treating poles for fifteen years," he said, "and not yet have we found a pole showing any sign of decay at the ground line. An untreated pole costing $20 might have a useful life of fifteen years and its annual cost would be $1.34, including depreciation. A treated pole costing $4 more, or $24, would last thirty years, and the increased life would reduce the yearly cost to $1.04, interest being computed at 6 per cent."

Several methods of treatment were then outlined:

AA. Treatment with creosote (A. T. & T. standard), short-time dip, fifteen minutes, hot oil just below the boiling point.

A. Treatment with carbolineum, fifteen-minute dip.

B. Treatment with grade No. 1 oil, four hours hot and two hours cold, after seasoning.

"Pentrex" treatment (½ in. or ⅜ in. guaranteed penetration) by puncturing process.

Treated Poles When Wet Should Not Be Painted

In the "Pentrex" treatment the oil is forced into the pole whether it is green or dry. However, in this process the poles must not be painted until they are absolutely dry or sap rot will follow. In one case half the poles of a sixty-thousand-dollar order were damaged by sap rot because they were painted before they were dry. For painting poles a good shingle stain of dark green is useful as this leaves the pores open so that the preservative is readily absorbed.

The value of poles of good appearance, especially in the red-cedar variety, was brought out by W. H. Cole of the Boston Edison company. Long life saves the expense of transferring overhead-line construction from old to new poles.

Mr. Clark then pointed out that red-cedar poles offer a superior footing for linemen's spurs. In treating poles of this kind it is desirable to get away from a pitchy oil, the carbolineums being better than most other oils for this purpose. Portable treating outfits have failed in many cases in giving proper treatment at the ground line.

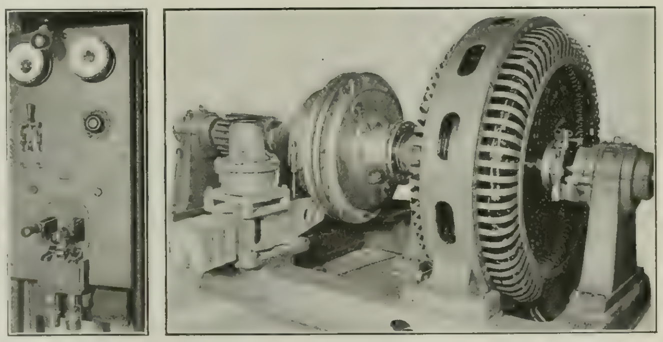
FIELD EDITOR ELECTRICAL WORLD.
Boston Mass.

Synchronous Motor for Heavy Duty

Magnetic Clutch Brake Allows Large Starting Torque and Gives Quick Stop in Emergency—Interlocked Control Insures Proper Sequence of Operation

SYNCHRONOUS motors have successfully met all starting and running conditions imposed upon them by such machines as air and ammonia compressors, fans, blowers, centrifugal pumps and many other similar applications. Only recently, however, has attention been given to the driving of machines by synchronous motors where excessive starting or pull in torque is required. It was usually cheaper and less complicated to drive such machines by a motor which would develop the required torque. Consequently an incentive had to be provided to bring about the use of synchronous motors in places where they would not ordinarily be considered. This incentive is now being supplied by the power companies in the form of decreased rates for improved power factor. In many cases the saving that may be effected in the monthly bill is so great that the entire investment charges of the synchronous installation may be paid for in two or three years, and sometimes much less.

By far the greater part of the mill lines in rubber factories are now driven by wound-rotor induction motors either coupled to gear reductions or connected by chain to the line shaft. Some motors of 150-hp. capacity are used, but most of them are between 250 hp. and 600 hp. and usually operate at speeds from 450 r.p.m. to 600 r.p.m. Low-speed synchronous motors have been installed by some of the larger rubber companies, and these were connected to the mill shaft through magnetic clutch brakes; but the gear or chain reductions are still used by most companies. The accompanying illustration shows how the problem of mill line drive and power-factor correction was solved for one rubber mill. The synchronous motor is rated at 250 hp., three-phase, 440 volts, 60 cycles, 100 per cent power factor, 450 r.p.m., but it is expected that the average mechanical load will be considerably less than the above rating and that the excess capacity will be available for power-factor correction.



WHERE POWER-FACTOR CORRECTION IS REQUIRED AND HEAVY LOADS ARE TO BE DRIVEN A SYNCHRONOUS MOTOR SET IS ADVANTAGEOUS

Left—Starting and control panel for synchronous motor unit. Right—Synchronous motor with magnetic clutch brake and pinion for chain drive.

Between the motor bearing and the next pedestal bearing is installed a Cutler-Hammer 36-in. magnetic clutch brake. This makes it possible to start the motor without load and then accelerate the mill line by means of the clutch. The brake is required to give a quick stop in case of emergency, and it disconnects the motor from the mill line, bringing the latter to a quick stop. It has been found that to give best service these clutches must be carefully installed and aligned. This is often not the case in small plants, or if the object is originally obtained, changes in alignment may occur later through wear or settling of foundations. To eliminate the difficulty encountered when one-half of the clutch is pressed on the motor shaft by the motor manufacturer and the other installed by the customer on his shaft, the bedplate was extended and two additional pedestals with extra shaft were installed as shown in the illustration.

A similar combination, except that there is a pulley for belt drive instead of chain drive, and that there is no brake, is being supplied to drive a tube mill and also correct power factor. Such outfits could be used to advantage in many industries where power-factor correction is required and heavy loads are to be driven. The magnetic clutch makes it a very simple matter to start and stop the driven machinery from a distance or to leave the motor running idle as a condenser at times, if desired. In some cases where widely varying loads are encountered a scheme has been employed of using two overload relays, one set at the desired value for motor protection and the other set slightly lower. The latter one operates either to open the clutch circuit or to light signal lamps, indicating that the motor is about to be tripped off the line, so that by reducing the load the motor circuit may not be interrupted and the inconvenience of restarting may be eliminated.

PROPER SEQUENCE OF OPERATION BY SUITABLE INTERLOCKS

Besides combining the mechanical apparatus as shown, it is also possible to combine and interlock the starting equipment for the motor and that of the clutch and brake so that they must be operated in the proper sequence. For instance, the starting equipment for the rubber-mill motor consisted of a standard synchronous motor panel (shown at the left) with double-throw oil circuit breaker, double-throw field-discharge switch, field rheostat and necessary meters. The clutch is operated by means of a push-button and contactor mounted on this board, but these are so connected that it is necessary for the running breaker to be closed and the field excited before the clutch circuit is energized. This prevents attempting to start the motor with the clutch engaged, throwing load on the motor while it is running on the starting tap, or without field current, if the operator forgets to throw over the switch. The safety switches on the rubber mills disconnect the clutch only, while if the motor breaker is opened and the motor stopped either by overload or low voltage, the clutch is also opened, making it necessary to start again in the proper sequence. If desired, either because of the location of the apparatus or because an efficient class of operators is not available, full automatic starting equipment may be used.

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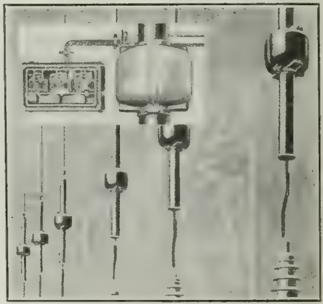
General Engineer.
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Protective Apparatus for 60,000-Volt Cable

GREAT importance has been attached to an efficient method of protection for the high-tension cables which have recently been installed in and around Paris, according to the *Electrical Review.* At the new Gennevilliers power station the current is transmitted by 60,000-volt cables to the surrounding substations. The cables are run in duplicate, and in view of their importance with respect to continuity of service, the protective apparatus must be sensitive to fault currents, absolutely discriminative, and must possess maximum stability.


CABLE PROTECTIVE APPARATUS IN THE GENNEVILLIERS STATION

Transformer and relay equipment is shown in the "insert," while the installation of the transformer in the switch house is shown in the other part of the picture.

These factors have been realized by the engineers who have designed the Gennevilliers station and who have adopted the protective apparatus for the high-voltage cables shown in the accompanying illustration. The problem of design presented greater difficulties than in previous cases since more sensitive operation was required than had hitherto been necessary. Besides this the apparatus was required to be perfectly stable when heavy "through" currents were passing. These requirements have been made simpler by the use of the compensated pilot, in which the capacity current in the pilot is rendered ineffective. Improvements also in the manufacture of the balancing transformers have assisted in obtaining the necessary stability. The transformers are of such dimensions that efficient protection can be given for feeders 50 miles or more in length. The type of transformer that has been adopted and the relay are shown in the "insert" of the illustration, while the installation in the switch house at the Gennevilliers station is shown in the other part. The sensitive relay controls the large circuit breakers near by. It will be noted that the transformers are inclosed in metal cases and are constructed in a thorough and robust manner. Experience has already been obtained with this apparatus under fault conditions, and in each case the damage has been negligible, consisting of a small burn through the insulation of the cable. The damage was very easily and quickly repaired and the feeder recommissioned within a few hours.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Strip Charts Preserved by Folding

THE construction of a reel for winding the strip-type charts used in a curve-drawing meter was described in the *Electrical World* for Aug. 19 on page 381. This company does not attempt to preserve strip charts in roll form as they not only take up too much room in this form, but it is very hard to find any particular date without unrolling a great deal of chart. We therefore fold these charts in sections of eight hours each, starting with midnight. The charts are so folded that when lying flat it is possible to handle them much in the same manner that the pages of a book are handled. The date is put in the upper left-hand and right-hand corners of each eight-hour section, and these sections themselves are again folded in the middle. It is then possible to open out any eight-hour section. Flat filing also takes up very much less space than roll filing.

LOUIS D. MOORE,
Electrical Engineer.
Missouri Pacific Railroad Company,
St. Louis, Mo.

The Chicago Railways Power Contracts*

Rates and Terms of Agreement Under Which the Commonwealth Edison Company Sells Energy to Entire Traction System

IN SUPPLYING all of the electrical energy for the operation of the surface and elevated lines in Chicago the Commonwealth Edison Company has in effect power contracts and rates with the various railway companies which embody many interesting provisions designed to meet the conditions presented in the operation of a great metropolitan traction system.

The sale of power by the Commonwealth Edison Company is based upon contracts made with the Chicago Railways Company and the Chicago City Railway Company. Similar contracts are in effect between the elevated railway companies and the Commonwealth Edison Company. In the early years of the rehabilitation of the railways such contracts were entered into, and power was sold under them until 1912 and 1919, when new contracts were made. In both cases these were made retroactive to Aug. 1, 1909. They involved several features not in the original contracts, such as a sliding primary and secondary scale, provision for change in rate with change in price of coal, provision for limitation of maximum demand in very cold weather, and changes in location of measuring the energy furnished. Subsequently additional contracts were made between the Commonwealth Edison Company and each railway company in which they mutually agreed to convert energy for the use of the other. These latter contracts involved only conversion and not the purchase and sale of energy.

In 1913 the Commonwealth Edison Company took over the generation of energy and operation of all substations of the elevated lines, these lines having been joined into one operating organization in 1911. By this arrangement it became necessary for the Edison company to furnish direct current to the elevated railways. It was also evident that economies would be effected if energy for the elevated roads could be secured from some surface railway substations, and some energy for surface railways from elevated railway stations. As a result of such an arrangement a very satisfactory power supply system has been developed. Its chief operating merits are its reliability and the elimination of overlapping territories in which are several independent systems of power supply.

CONVERSION AGREEMENTS

The power contracts and the conversion agreements result in several operating conditions which are interesting. These may be enumerated as follows:

1. Railway company buys alternating-current energy.
2. Railway company buys direct-current energy.
3. Railway company converts alternating current to direct current for Edison company.
4. Railway company operates joint substations with the Edison company.

In the first case the railway company owns and operates its own substations and purchases alternating-current power at the substation, under the terms of the contract.

In the second case the railway company purchases direct-current power from the Edison company at stations owned and operated by the latter. In this case the railway company buys the alternating-current power under the terms of the contract, and in addition pays for the conversion to direct current in accordance with the conversion agreement. The companies divide the operating expenses of the substation in proportion to the output used by each.

In the third case the railway company furnishes direct current to the Edison company from stations owned and operated by the railway company. The railway company receives from the power company only a conversion charge, as the alternating-current energy furnished to the substation for the Edison company is not included in the bill to the railway company. As in the second case, the operating expenses of the substation are divided in proportion to the output to each company.

In the case of joint substations now in operation the Commonwealth Edison Company owns the land and building and the machinery for its own output. The railway company owns the equipment for its own output and buys alternating-current energy from the Edison company. The operating expenses are also divided in proportion to the output of the two companies.

PRIMARY AND SECONDARY CHARGES

These contracts extend to the date of expiration of the railway company franchises, Jan. 31, 1927. The rates are composite, having a primary charge covering fixed charges on investment, taxes, insurance and depreciation based upon the maximum demand for energy, and a secondary charge proportional to the actual cost of production, comprising fuel, labor and supplies and based upon the energy actually used. Both of these charges have a sliding scale. That for the primary charge is as shown in the accompanying table.

PRIMARY CHARGE, BASED ON MAXIMUM DEMAND

	Per Kw.
Up to and including 30,000 kw (maximum demand)	$1 25
Over 30,000 kw and including 60,000 kw	1 00
Over 60,000 kw and including 90,000 kw	0 91⅔
Over 90,000 kw and including 120,000 kw	0 87
Over 120,000 kw........................	0 83⅓

The secondary charge is, monthly, up to and including 5,000,000 kw.-hr., at the rate of 0.4 cent per kw.-hr.; over 5,000,000 kw.-hr. and up to and including 10,000,000 kw.-hr., 0.395 cent per kw.-hr., and then reducing by 0.005 cent per kilowatt-hour for each additional block of 5,000,000 kw.-hr. or fraction thereof, to a

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*From an article in *Electric Railway Journal* by Ralph H. Rice, principal assistant board of supervising engineers, Chicago Traction.

minimum of 0.36 cent per kilowatt-hour for all energy above 40,000,000 kw.-hr. per month.

Determination of Demand

To ascertain the monthly maximum demand, the Commonwealth Edison Company selects any three consecutive days and takes the maximum hourly demand during the morning and evening peaks for these three days. The average of these six peaks is taken as the maximum demand. The three days which produce the highest maximum are selected. The maximum demand as thus determined becomes permanent until exceeded by a larger one. A new maximum established in the winter months holds over the succeeding summer period when the actual demand is much less.

The computation of the maximum demand is somewhat involved as it is evident there may be several maxima. These are:

A. The main alternating-current maximum at railway company stations or joint substations, due to purchase of alternating-current power.

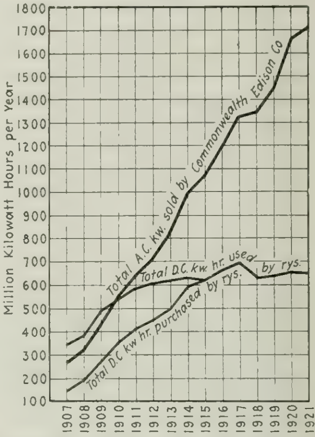
B. The alternating-current maximum due to the direct current purchased by the railway company at Commonwealth Edison Company stations.

C. The alternating-current maximum due to energy converted for the Commonwealth Edison Company at railway substations.

The maximum demand upon which the primary charge is paid, or the "billing maximum," is the total resulting from adding A and B above and deducting C. This result is the total demand by the railway company for energy used by it. In determining this the three successive days which produce the greatest resultant total are selected, and of course the values of A, B and C are simultaneous maxima. But the cost of conversion to be paid by the railway and the Edison company is based upon the actual maxima required for conversion, and these may not be the same in amount or coincident in time with the values used in determining the billing maximum for alternating-current energy as previously explained.

There is one condition which may affect the primary rate and one which may influence the secondary rate. When the temperature falls to 15 deg. F. or lower, the excess over the previously established maximum is not to establish a new maximum to be paid for at the above primary rates, but the excess is to be paid for at the rate of 25 cents per kilowatt per day.

The secondary cost is dependent upon the cost of coal, and this is recognized by a provision in the contract that when the price of coal exceeds $1.90 per ton delivered there shall be an increase in the secondary charge and if the price falls below $1.40 per ton there shall be a decrease in the secondary charge. This adjustment may be made every two years. The amount of adjustment in dollars is obtained by dividing by 1,000 the number of kilowatt-hours used during the two year period and multiplying the quotient by the difference between the average coal price and $1.90, if an increase, and $1.40, if a decrease.



ENERGY USED BY RAILWAYS AND TOTAL LOAD OF COMMONWEALTH EDISON

The kilowatt-hours sold have reached the enormous total of 1,700,000,000 per annum, of which amount 770,000,000, or 45 per cent, are for railway use. In 1907 both the railway and total loads were much less and the railway load was then 55 per cent of the total. The decrease in per cent has been due to the steady growth in the retail and wholesale light and power loads. Conversion losses are not included in the railway load. Only the net direct-current kilowatt-hours used are shown.

The conversion agreement stipulates that both the railway company and the Edison company shall pay for conversion from alternating-current to direct-current on the basis of 23 cents per kilowatt up to and including 10,000 kw. and 18 cents per kilowatt for all in excess of 10,000 kw. This is a conversion charge only and does not involve the initial cost of the energy. The Edison company owns and operates all high-tension lines between power houses and substations. Meters are placed at each substation on the incoming high-tension lines for measuring the maximum demand and consumption, and all alternating current energy is purchased by the railway company upon the basis of readings of these meters.

Division of Operating Expenses

In stations furnishing energy to both the railway company and the Edison company the operating expenses each month are borne jointly by the two companies, the division being determined by the energy received by each. If the output of the station is all direct current, divided between surface lines and Edison company for elevated railway use, then the division of expense is made simply on the basis of kilowatt-hours delivered to each. However, if the output is direct current to the surface lines and alternating current of a higher voltage to the Edison company for general power purposes, then the division must be made on the basis of equivalent alternating-current energy. The railway output in direct-current kilowatt-hours is divided by the efficiency of conversion to get the equivalent alternating-current kilowatt-hours. The actual efficiency of conversion for each station is used, which averages 93 per cent. The output to the Edison company is likewise divided by a conversion factor to reduce it to an equivalent alternating-current value. From some stations energy is furnished to the surface lines, to the Edison company for elevated railway use, and to the Edison company for general power purposes. In such cases the railway company pays its share of the operating expense resulting from the division as outlined.

The portion of the total load used by the railways, converted to direct-current kilowatt-hours, is shown in the accompanying curve. It will be noticed that the railway load in 1907 exceeded the total of the Commonwealth Edison Company. At this time and up to 1915 the railway companies generated a portion of their own energy. The lower curve shows the kilowatt-hours purchased from the Commonwealth Edison Company from 1907 to date. The difference between the curves represents the energy produced by the railway companies in their own stations. In 1915 the last railway generating station was shut down, and from that date on the two curves coincide. This railway load is the largest of its kind carried by any one central-station system in the world.

New Battery Service Rate at Hartford

TO FIT the cost of battery service more closely to the use of electric trucks in different kinds of service, the Hartford (Conn.) Electric Light Company has established a revised rate embodying an ampere-hour adjustment charge above or below the regular monthly mileage bill. The monthly mileage bill is now subject to decrease or increase at the rate of 8 mills for each ampere-hour used below or above the following basic ampere-hours per mile: 4, 6, 8, 10 and 12, corresponding to trucks of the following sizes: 1,000 lb. and under, 1, 2, 3½ and 5-ton equipments. This arrangement requires the truck user who imposes unusually severe service upon the battery, as in coal deliveries, to pay relatively higher prices for his service than the user who is able to handle his equipment with comparatively easy demands as compared with its capacity. In a sense the ampere-hour charge corresponds somewhat to a coal-charge adjustment as applied to electric power rates.

The base prices for battery service at Hartford are twofold. There are fixed charges per year as follows on battery service contracts: For trucks of 1,000 lb. capacity or less, $470; 1 ton, $570; 2 tons, $670; 3½ tons, $770; 5 tons, $870. These amounts are payable in twelve equal monthly payments, with discounts as stated below.

There are also mileage charges billed monthly as follows:

Truck Size	Cents per Mile: Up to 1,000 Lb.	1 Ton	2 Tons	3.5 Tons	5 Tons
First 250 miles per month	7	10	12	16	18
Next 250 miles per month	6	8	10	13	15
Excess.	5	6	8	10	12

The ampere-hour adjustment is given above, and the discounts from the fixed charge part of the bill are as follows:

To all customers there is payable at the end of the contract year a discount of 2 per cent of the yearly fixed charge if the total number of contracts in force among all customers exceeds fifty; this increases by 0.5 per cent for each multiple of ten above fifty contracts in force. In addition to the above, for customers operating more than one truck there is a discount of 0.5 per cent of the yearly fixed charge for each contract above one which the customer has in force at the end of the contract year, up to a total of twenty contracts.

Space rates for trucks of the foregoing sizes in connection with battery service contracts are $110, $110, $120, $130 and $140 per year. Greasing service costs $75 per year in connection with battery service and space contracts, and washing service weekly in the foregoing connection is $50 per year. Batteries are the property of the Hartford Electric Light Company, and all trucks operating under the new rates will be equipped with ampere-hour meters. W. M. Thayer is manager of the battery-service department.

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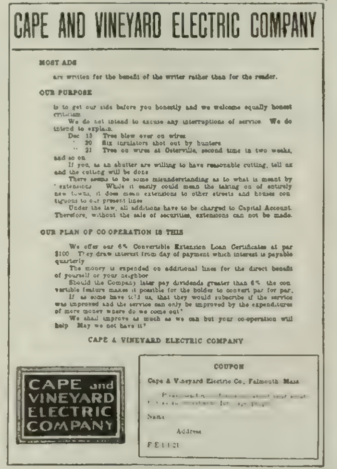
Making Operating Troubles Help Security Sales

DUAL-PURPOSE advertising by the Cape & Vineyard Electric Company of Falmouth, Mass., as illustrated herewith, appeals to the desire of the local public for uninterrupted service and exemplifies the company's desire to share its financial development with the communities reached by its lines. Eugene Carpenter, treasurer of the company, took the interruptions of service due to tree obstructions as a text for a short statement about more liberal policies by property owners in the way of trimming permits and from this starting point discussed the question of line extensions and the manner in which the public could insure more of these by participating in the company's financing through purchase of its extension loan certificates.



CAPE AND VINEYARD ELECTRIC COMPANY

MOST ADS

are written for the benefit of the writer rather than for the reader.

OUR PURPOSE

is to get our side before you honestly and we welcome equally honest criticism.

We do not intend to excuse any interruptions of service. We do intend to explain.

Dec 15 Tree blew over on wires
" 20 Six insulators shot out by hunters
" 21 Tree on wires at Osterville, second time in two weeks, and so on

If you, as an abutter are willing to have reasonable cutting, tell us and the cutting will be done

There seems to be some misunderstanding as to what is meant by "extensions." While it easily could mean the taking on of entirely new towns, it does mean extensions to other streets and houses contiguous to our present lines

Under the law, all additions have to be charged to Capital Account. Therefore, without the sale of securities, extensions can not be made.

OUR PLAN OF CO OPERATION IS THIS

We offer our 6% Convertible Extension Loan Certificates at par $100 They draw interest from day of payment which interest is payable quarterly

The money is expended on additional lines for the direct benefit of yourself or your neighbor

Should the Company later pay dividends greater than 6% the convertible feature makes it possible for the holder to convert par for par.

If as some have told us, that they would subscribe if the service was improved and the service can only be improved by the expenditures of more money where do we come out?

We shall improve as much as we can but your co-operation will help May we not have it?

CAPE & VINEYARD ELECTRIC COMPANY

COUPON

Cape & Vineyard Electric Co., Falmouth Mass

[illegible]

Name

Address

F E 1 1 21

INVITING PUBLIC CO-OPERATION FOR BETTER SERVICE

What Other Companies Are Doing

California—An appeal recently sent out by the California Electrical Co-operative Campaign to all members of the electrical industry in California urges the adoption of the term "convenience outlet" in all dealings within and without the industry. This means the use of the term on all advertising, bids, specifications, orders, shipping tickets, shipping marks, invoices, stock cards and other records and in all personal contact with the public or such mediums as engineers, architects, builders and real estate agents. In this connection the fact is of interest that the departments of electricity of the principal cities of California have given recognition to the term "convenience outlet," which appears repeatedly in the recently drafted rules pertaining to the installation of such outlets in homes and stores.

Seattle, Wash.—An "Electrical Week" promoted by the Seattle Electric Club was held in this city from Sept. 22 to 29 with two model electrical homes as the central features. Both homes were dedicated with appropriate ceremonies and are to remain open until Oct. 9. Harry J. Byrne was chairman in charge of arrangements.

Providence, R. I.—In the first three and one-half days of a customer's stock sale to new holders beginning Sept. 16, the Narragansett Electric Lighting Company received applications for 5,500 shares out of a total offering of 6,000. Since 1907 the number of stockholders in the company has increased from 1,140 to 7,600. The company now has 70,000 customers and customer-ownership is growing in favor. The company purchased the 6,000 shares mentioned in the open market and offered them to subscribers at a price to yield about 6 per cent.

Hartford, Conn.—To facilitate accounting for costs and to concentrate production activities, the Hartford Electric Light Company has created within the company a manufacturing division which will sell it energy at cost. The manufacturing division will be a distinct entity in itself to the extent of separate books, order blanks and stationery. The division has taken over the operation of all generating stations and the office of the system operator.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

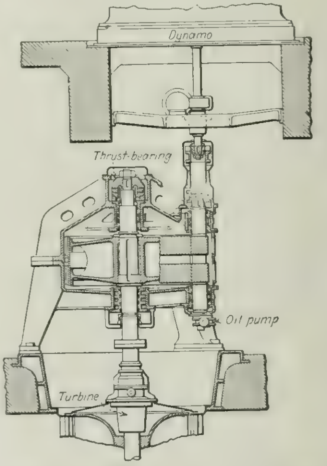
Geared Generator Drive for Water Turbines with Vertical Shafts.—E. Trieber.—The economic necessity of harnessing all available low-head water powers is frequently counteracted by the very high weight and cost of the low-speed, vertical-shaft turbine generator sets usually installed. The highly developed modern gear drive is a welcome solution of the problem thus presented. Vertical-gear sets with a ratio of 1:10 to 1:12 and a mechanical efficiency of 87½ per cent to 88½ per cent, interposed between the turbine and the generator, are coming into use and have already been installed in several plants for capacities of 200 hp. to 1,300 hp. The illustration on this page shows a drive for a turbine speed of 108 r.p.m. and a dynamo speed of 750 r.p.m. for 1,000 hp.—*Zeitschrift des Vereines Deutscher Ingenieure*, July 22, 1922.

Modern Condensing Plant for Leeds.—A description is given of the condensing plant for a 12,000-kw. turbogenerator at the Whitehall Road electric lighting station of the Leeds Corporation in England. The condenser is of special construction, arranged vertically, and is designed to deal with 220,000 lb. of steam per hour, while maintaining a vacuum of 28.5 in. To avoid the necessity of deep foundations or an excessively high engine house, the exhaust inlet has been arranged at one side and the condenser placed on the same level as the turbine.—*Electrical Times*, Aug. 24, 1922.

Rebuilding a Large Boiler Plant Without Interrupting the Service.—Alfred Iddles and J. Walter May.—A description of the way in which a modern boiler plant containing five water-tube boilers, each of 4,900 sq.ft. of water heating surface, was built on the same location as an old, obsolete and overloaded plant containing seventeen hand-fired horizontal return-tubular boilers.—*Power*, Sept. 12, 1922.

Generation, Control and Switching

High-Tension Transmission System Protection.—Four papers are given on this subject, dealing mainly with the Petersen coil. T. Nishi, in a paper on "Abnormal Voltages and Protective Devices," describes the main causes of abnormal voltage in transmission systems and discusses some of the defects in the lightning arresters now in general use. K. Kato, in "Calculations Relating to Petersen Coil Problems," discusses the performance and computes the capacity of a coil for a 150,000-volt, 140-mile transmission line. S. Bekku gives two papers, "The Resonance Caused by the Petersen Coil" and "Petersen Earth Coil as a Remedy for Electromagnetic Inductive Interference." In the first he considers the danger of abnormal voltage caused by the unbalance of each phase when the neutral of the transmission circuit is grounded through a reactance. In the second paper Mr. Bekku gives a detailed description of the method used in the first paper to calculate the electromagnetically induced voltage of a telephone line by the accidental grounding of the power line.—*Journal of the Institute of Electrical Engineers of Japan*, August, 1922.



Geared Drive for Small Water-Power Stations Gives Smaller Over-All Dimensions (E. Trieber)

Hunting of Alternators in Parallel.—J. Fischer-Hinnen.—Starting with the vector diagram of a machine driven by an internal-combustion engine and connected in parallel to other machines, the author shows that, in addition to the forced vibrations received from the driving engine, the synchronizing force causes the flywheel to swing at its natural frequency, and if the impulses from the prime mover have nearly the same period as the natural oscillations, the amplitude will increase and the machine fall out of step. The various phenomena that occur under these conditions are treated mathematically and a general case is developed.—*Electrician*, Aug. 18, 1922.

Power-Plant Management.—Robert June.—In keeping performance records the compilation of unnecessary data is to be avoided and all records compiled should at all times be available to the men who control the figures which go to make up the records. Operating men should not be bothered with dollars-and-cents computations. In cases where the latter are involved the records should go through the accounting department, where the cost of the various items can be readily and expertly arrived at. Typical sheets are shown for daily operating logs, steam-plant report, daily report for men employed, water-softening and purifying-system report, boiler-house operation cost, etc.—*The Central Station*, September, 1922.

Transmission, Substations and Distribution

Energy Supply of Berlin from Outside Stations.—R. Wichmann.—The insufficient capacity of the power stations of Berlin made it necessary to introduce into the city energy from one, and later from a second, generating station, each about 80 miles from Berlin near soft-coal mines. These stations are connected to substations on the outskirts of Berlin with double three-phase steel-aluminum lines operating at 110,000 volts. The author points out that a much larger amount of energy could be transmitted over these lines either by restoring their power factor to unity or by increasing the voltage to 150,000, or both, and gives complete electrical data and cost figures for each suggestion. At the end of the paper he gives an interesting tabulation of the itemized cost and all electrical data of the existing 80 miles of double line.—*Elektrotechnische Zeitschrift*, Aug. 7, 1922.

Economic Advantages of Power-Factor Compensation by Means of Phase Advancers.—W. Seiz.—A very effective means of improving the power factor of a line consists in fitting a phase advancer in the rotor circuit of a slip-ring induction motor. The advantages of adopting a phase advancer, although entailing a supplementary outlay, are investigated by means of examples showing the savings that can be made. A brief comparison of the various methods of phase compensation is made.—*Brown-Boveri Review*, August, 1922.

Units, Measurements and Instruments

By Measurement of Current Used and Extended Records Large Savings Can Be Made in Power Cost.—Importance of cost records, need for more recording devices, specifications for contracts and the control of power factor are the features dwelt on in the report of the committee on methods of checking power costs presented at the convention of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers held Sept. 19, 1922, at Huntington, W. Va. When a mine operates its own power station, totalizing plant watt-hour meters must be installed and accurate accounts kept of all items of expense such as oil waste, repairs, etc. In the case of purchased power, superintendents should check the accuracy of the monthly power bills.—*Coal Age*, Sept. 28, 1922.

Distribution Photometer of New Design.—C. C. COLBY, JR., and C. M. DOOLITTLE.—No one photometer is preeminently best for all cases, but the authors describe a new type of photometer which embodies the good points of other types and some new features besides. In general, it is a two-mirror selector type with the lighting units suspended or mounted on the rotating head, which can be moved vertically to bring the light center to the proper position on the photometer axis. Light from the unit is reflected by the two mirrors on to a diffusing screen placed between it and the Lummer-Brodhun photometer.—*From a paper presented at the annual convention of the I. E. S., Swampscott, Mass.*, Sept. 25-28, 1922.

Illumination

Nomenclature and Photometric Standards.—Illuminating engineering nomenclature and photometric standards which were approved by the American Engineering Standards Committee as American standard on July 11, 1922, are presented in this paper. Seventy items are specified. Among the most interesting are radiant flux, luminous flux, mechanical equivalent of light, unit of exposure, hue, variation factor, output, lamp efficiency and visibility factors for different wave lengths.—*Paper presented at the annual convention of the I. E. S. at Swampscott, Mass., Sept.* 25-28, 1922.

Effect of Absorbed Gas on the Conductivity of Glass.—V. BUSH and L. H. CONNELL.—The article presents the results of experiments on the electrical properties of glass which were carried on during the last two years in the research laboratories of the Massachusetts Institute of Technology. These results show that gases, in particular water vapor, penetrate throughout the volume of glass and quartz and radically affect their volume conductivity. There is also a large change in the volume conductivity when the glass is heated in vacuum. Upon subsequent exposure to the air the resistivity decreases slowly, but does not reach its original value. A considerable improvement in insulating value or dielectric loss can be obtained by vacuum treatment.—*Journal of the Franklin Institute*, August, 1922.

Motors and Control

Steel-Mill Motor Failures.—ARTHUR J. WHITCOMB.—Owing to the severity of service and the peculiar operating conditions in a steel mill, a certain percentage of motor failures must be anticipated. The author shows the importance of keeping a detailed record of these failures and how a careful analysis of them has made it possible for the maintenance man to devise ways to reduce them in a large mill that operates 900 auxiliary motors ranging from 1/12 hp. to 300 hp. in a wide variety of applications.—*Industrial Engineer*, August, 1922.

Electric Motor Drive in Steel Industry.—GORDON FOX.—The author considers the rolling-mill requirements as to power, speed, adjustability and changing of speed, mill layouts to utilize electric power, the flow of metal under rolling pressure and its effect on power demand. The greatest advantages of electric drive are derived at the motor. The compact form, light weight and wide range of characteristics of electric motors permit their effective application to all classes of main and auxiliary apparatus. The general mill type of motors and motor characteristics best suited to their drive are outlined.—*Iron Age*, Aug. 10, 1922.

Heat Applications and Material Handling

Material-Handling Equipment as Used in the Iron and Steel Industry.—F. L. LEACH.—A description is given of the handling machinery and apparatus used in the manufacture of steel. From the time that the ore leaves the mines until the steel goes through the last process at the mill it is moved about exclusively by different types of heavy machinery designed especially for the purpose. This equipment is described with the idea of bringing out weak points in present-day practice and opening the way for strengthening the weakest links in the conveying methods used.—*Mechanical Engineering*, August, 1922.

Basic Electric Furnace Operation.—C. W. FRANCIS.—The author considers the grade of lime necessary, reduction and removal of phosphorus and sulphur, malleable and gray-iron castings, and the selection of voltage for the furnace.—*Iron Age*, Aug. 17, 1922.

Cleaning, Testing, Machining and Shipping in the Carbon Electrode Industry.—CHARLES L. MANTELL.—The finishing steps in electrode manufacture are considered in this concluding article on the technology of the carbon electrode industry. The author also discusses the factors affecting the properties of electrodes for use in electrolytic and electrothermic applications, the economics of the industry and the trend of developments.—*Chemical and Metallurgical Engineering*, Aug. 23, 1922.

Electrophysics, Electrochemistry and Batteries

A New X-Ray Diffraction Apparatus.—WHEELER P. DAVEY.—Many materials may be readily identified and their crystal structure determined with a high degree of accuracy by X-ray analysis. The apparatus described in this article has been developed to provide a convenient means for applying this laboratory method of analysis to general crystal research and factory-control work.—*General Electric Review*, September, 1922.

St. Paul Utilities Co-operate on Stray-Current Control.—O. J. LENMARK.—Results are given of the survey conducted by the Co-operative Committee of Utilities to determine the results of applying remedial measures in the prevention of electrolytic corrosion. These measures were suggested by the Bureau of Standards. The committee also studied the effects on electrolysis of changes in the distribution system and elimination of competitive drainage in underground structures.—*Electric Railway Journal*, Sept. 16, 1922.

Traction

Rotary Converters for 1,500-Volt Direct-Current Railway Service.—N. WIDMER.—A French railway, operating on 1,500-volt direct current, recently installed seven rotary converters which, the author claims, are the first of their kind. Three-phase current is used at 750 r.p.m. and 50 cycles. The normal constant load is 750 kw., with an 1,125-kw. two-hour overload capacity and a 2,250-kw. five-minute overload capacity. The no-load voltage is 1,650. It was required that the converters withstand five short circuits at one-minute intervals.—*Brown-Boveri Mitteilungen*, August, 1922.

Survey of Electric Traction on American Railroads.—GEORGE GIBBS.—The author describes and compares heavy electric traction systems now in service, outlines the trend of locomotive design and presents a tabular review of the present standard of freight and passenger locomotives. He also discusses overhead trolley and third-rail conductors, voltage limitation, substations, types of drive for locomotives, motor cars and choice of systems. The article is an abstract from the report made by Mr. Gibbs for the ninth congress of the International Railway Association.—*Engineering News-Record*, Sept. 14, 1922.

Telegraphy, Telephony, Radio and Signals

Transient Track Circuits.—The possibilities of transient track circuiting for railway signaling are stated to be considerable from an economical and safety standpoint. While many signaling problems can be solved by extensive use of track-circuiting, the cost of installation and maintenance is in many cases prohibitive. The principle of the transient system lies in the momentary application of current to the track, which, if occupied, will permit the current impulse to pick up a relay. It is claimed that complete immunity from stray current effects is obtained and that the alternating-current signaling current can be superimposed upon the track rails, which may already be carrying propulsion current.—*Electrician*, Sept. 1, 1922.

A Vacuum-Tube Alternating-Current Potentiometer.—E. C. WENTE.—A description is given of an alternating-current potentiometer which is suitable for the measurement of electromotive forces having frequencies up to 10,000 cycles per second. Both the phase and magnitude are read directly from the dial reading. A special differential galvanometer used with the potentiometer is also described.—*Bulletin B-5-1 of the Engineering Department, Western Electric Company.*

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

Accounting Pact Likely

Concessions by Both Federal Power Board and State Commissioners May End Long Controversy

AS AN outcome of the conference in Washington on the accounting system to be prescribed by the Federal Power Commission for utilities coming under its control (see *Electrical World* for Sept. 30, page 730) the chief accountant for the Federal Power Commission has agreed to make a number of changes and modifications in the revised tentative draft of the proposed system which formed the basis for discussion at the conference. The representatives of the National Association of Railway and Utilities Commissioners agreed on their part to recommend important changes in and modifications of the proposed uniform system of accounts for electric utilities adopted by the association at its 1920 convention.

Recommendations to Be Made

The chief accountant of the Federal Power Commission will lay the following recommendations before that body:

"1. To insert in the revised tentative draft of the accounting regulation a clause to the general effect that the functional classification of non-project land and structures will not be required, but that if the licensee so desires all non-project land may be included in a single land account, and that all non-project structures may be included in a single structure account. So far as non-project land and structures are concerned the accounting is to be optional. As to project land and structures, to insert a clause to the general effect that where, in case of peculiar or unusual conditions, it seems impracticable to classify project lands and structures according to the prescribed accounts, licensees may bring the matter to the attention of the Federal Power Commission and that consideration will be given to permitting a special classification.

"2. To create another general group of fixed-capital accounts for certain transmission and distribution fixed capital, in which to include the cost of capital used jointly for transmission and distribution purposes where it is impracticable or undesirable to assign or allocate such costs to other specific transmission or distribution fixed-capital accounts.

"3. To make such other and further changes in, and correction and modification of, the other fixed-capital accounts and the general instructions relating thereto as were agreed to by the conference.

"4. To change the title and the text of certain balance-sheet accounts which are now in both drafts to agree with the title and text of the national committee's draft where the language used by the national committee clearly expresses the meaning intended to be conveyed, and further to make such changes in the balance-sheet account as were agreed to in conference. Unfinished construction is to be retained as a balance-sheet account and is not to be included among the fixed-capital accounts.

"5. To make such changes in the general rule or in any other rules or accounts as may be necessary to make it clear that nothing in the system of accounts for licenses is intended to relieve the licensees which are public utilities from conforming to all accounting rules prescribed by the state commission, including such rules as may be applicable to the project property or any other rule or regulation of the state regulatory body.

"6. To carry out in good faith all promises made during the conference as to changes in accounts and rules not specifically referred to, and to consider carefully the matters discussed concerning which no definite conclusion was reached or promise made.

"7. It is not proposed to depart materially from the general plan and general arrangement of the accounts as at present set forth in the revised tentative draft, but only to make such modifications of and changes in the accounts themselves as already have been indicated, preserving the general plan and arrangement in all material aspects."

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New Plant for Chicago

Commonwealth Edison to Build One on West Side Besides Completing Calumet Station

THE directors of the Commonwealth Edison Company of Chicago on Oct. 3 authorized plans for an immediate enlargement of the company's Calumet station and the construction of a new plant on the West Side of Chicago. These developments are expected to take care of the growth of the city until 1925. The total cost of the plans added to that of the work already done on the Calumet station will exceed $53,000,000.

The enlargement to the Calumet station, which is the third section, comprising two 30,000-kw. units, will start immediately. The first section began operation two years ago, and the second section will soon be placed in service. When finished this station will contain six 30,000-kw. units, or a total of 180,000 kw. The building of the third section calls for an expenditure of $6,000,000, which brings the total cost of this station up to $21,000,000.

Plans for the new West Side plant have been drawn up. It will eventually contain eight 35,000-kw. units, or a station capacity of 280,000 kw. The initial installation will call for two of these units. This station will be built near the Drainage Canal, at Crawford Avenue adjacent to Thirty-ninth Street. This site of 67 acres was purchased several years ago by the Commonwealth Edison Company in anticipation of growth. It will be near the industrial center of the West Side, where there is a heavy demand for electrical energy.

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A. M. E. S. Takes in Council

Offices Are Consolidated and Frederic Nicholas Succeeds C. E. Dustin as Secretary

ANNOUNCEMENT is made by the board of governors of the Associated Manufacturers of Electrical Supplies that, "as an important step in the program of economy and increased efficiency" felt to be necessary, the offices of the association and those of the Electrical Manufacturers' Council have been consolidated and are now established at 30 East Forty-second Street, New York. The office occupied by the council at 522 Fifth Avenue has been given up.

Charles E. Dustin has tendered his resignation as general secretary of the association and Frederic Nicholas, former secretary of the council, takes his place. In accepting Mr. Dustin's resignation the board of governors extended to him a vote of appreciation for his efficient work. In addition to Mr. Nicholas, officers of the association for the ensuing year have been elected by the board of governors as follows: President, S. L. Nicholson, Westinghouse Electric & Manufacturing Company; vice-president, William H. Thornley, Tubular Woven Fabric Company; treasurer, H. W. Bliven, Harvey Hubbell, Inc.

President Nicholson has invited the chairmen and secretaries of all sections of the association to meet at the association rooms on Monday evening, Oct. 16, to discuss the plan of industrial statistics drawn up by Secretary Hoover, the work of the Department of Commerce's division of simplified practice, the National Industrial Conference Board, the tariff and the underwriting situation.

West New York Conference

Electrical Men Meet for Two Days in Buffalo, Where They Are Guests of Local Companies

ELECTRICAL men from nearly a hundred communities of western New York State gathered on Thursday and Friday of last week for a "western New York electrical conference." The meetings were held at the Hotel Lafayette, Buffalo, with an attendance of more than six hundred. The conference was sponsored by the Niagara Falls Power Company, Buffalo General Electric Company, Niagara, Lockport & Ontario Power Company, Tonawanda Power Company, Niagara Electric Service Corporation, General Electric Company, Westinghouse Electric & Manufacturing Company, Western Electric Company, Robertson-Cataract Electric Company, McCarthy Brothers & Ford, H. I. Sackett Electric Company, Lloyd A. Wooley, Inc., and the Electric Club of Buffalo.

PURPOSE OF THE GATHERING

The purpose of the gathering was to picture the opportunity for business development and crystallize opinion throughout the region served by the great power systems of the Niagara frontier and to put forth a direct effort to apply through original local work the principles around which the industry is trying to build up a broad program of business promotion. The conference opened with a welcome from Mayor Schwab of Buffalo, a greeting from W. R. Huntley, vice-president Buffalo General Electric Company, and an address by W. E. Robertson, Robertson-Cataract Electric Company.

Then came an analysis of the "present and future" market by Earl E. Whitehorne, commercial editor *Electrical World*, in which he reduced the opportunity to the basis of a thousand average homes and showed the vast number of electrical appliances still waiting to be sold in every city. Three addresses followed by E. W. Minor, president Contract Purchase Company; C. L. Parsons, Jr., Commercial Credit Company, and F. C. Trubee, Morris Plan Bank, who explained in detail how the dealer may finance the sale of wiring and appliances on a larger scale under the easy-payment plan.

J. C. McQuiston, manager of the Westinghouse department of publicity, and C. S. Woolley, of Barton, Durstine & Osborne, talked on the function of advertising in local market development. Mr. McQuiston made a graphic point of the fact that modern selling is merely an evolution from the peddler and his pack. The need for taking the goods to the customer still exists in the same fundamental way, but merchants today have recourse to advertising, store-window display and other methods made necessary by the increase in the variety and volume of merchandise.

A TWO-ACT PLAY ON WIRING

A most interesting demonstration of the need for complete and convenient wiring and the ease with which it can be sold by the contractor who makes service and not price his object was given in a clever two-act play presented by three members of the local companies. This was the feature of the session on wiring presided over by A. K. Baylor and J. A. Corcoran, General Electric Company. The subject of power was discussed by George H. Jones, Commonwealth Edison Company, Chicago; S. Bennis, United Electric Light & Power Company, New York; A. C. Smith, Buffalo General Electric Company; Ken Parker, McCarthy Brothers & Ford, and D. F. Potter, Robertson-Cataract Electric Company, who presented the opportunities for business in many fields and in the changing over of private plants to central-station service.

Frank A. Coupal, commercial manager Buffalo General Electric Company; Julius Tuteur, president Electric Vacuum Cleaner Company, and Lloyd A. Wooley led the discussion of the appliance market, and the subject of lighting was covered by R. W. Shenton, National Lamp Works, and A. S. Turner, Jr., Edison Lamp Works, supported by a demonstration of lighting effects by D. W. Atwater, Westinghouse Lamp Company.

AMPLE ENTERTAINMENT PROGRAM

An unusual amount of hospitality and entertainment marked the conference. After luncheon on Thursday the entire company, as guests of the conference, motored to the River station of the Buffalo General Electric Company. There was a banquet on Thursday night, at which Charles R. Huntley, president Buffalo General Electric Company, was toastmaster and addresses were made by him, by George C. Lehmann, general secretary Buffalo Chamber of Commerce; Paul A. Schoellkopf, president Niagara Falls Power Company; George H. Jones, power engineer Commonwealth Edison Company; William L. Goodwin, of the Society for Electrical Development; Frederick M. Feiker, of the McGraw-Hill Company, Inc.; Fred D. Corey, president Niagara, Lockport & Ontario Power Company, and A. Monro Grier, president Canadian Niagara Power Company.

The conference ended with a trip to Niagara Falls and a visit of inspection to the American Niagara Falls plant. The visitors were served with dinner on the roof of this station, as guests of the Niagara Falls Power Company.

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Early Electrical Inventions Shown in New York

Preceding by five days the opening of the annual New York Electrical Show, of which it forms a part, the Museum of Edisonia and the exhibit of historical electrical apparatus were opened last Monday at the Grand Central Palace. The Edisonia exhibit has been arranged as part of the celebration of forty years of Edison service in New York. Together with the noteworthy collection of apparatus illustrating some of the most important contributions of Thomas A. Edison to the field of science, it tells not only the story of the progress of the electric light from the pioneer arc-light days, but also the history of the growth of the successful incadescent electric lamp.

Conspicuous in the exhibit, of which the nucleus was exhibited at the St. Louis Exposition in 1904, are the William J. Hammer historical collection of incandescent lamps, 1878 to 1913; a collection of historical electrical apparatus contributed by the American Institute of Electrical Engineers, historical instruments and lamps loaned by Thomas A. Edison and donations and loans from universities, private corporations and individuals. The collection is exhibited under the joint auspices of the Association of Edison Illuminating Companies, the Edison Pioneers and the Electrical Show.

HISTORICAL EXHIBIT OF THE ELECTRIC LIGHTING INDUSTRY

Italy Seeking American Capital

Tax-Exemption Bill Brought In to Facilitate the Investment of Foreign Funds in Water-Power Projects—United States Capitalists May Invest $35,000,000

THAT the Italian government is anxious to bring about the immediate and increased exploitation of hydro-electric resources in Italy through the intervention of foreign capital is evidenced by a bill recently presented to the lower house of the Italian Parliament for the exemption from taxation of all bonds issued in foreign countries and in foreign money for the purpose of development of public utility works, including specifically hydro-electric plants and the electrification of railways.

Experts who have thoroughly examined the situation in Italy and studied carefully the investment of American capital in water-power and electric light and power systems operating in north Italy assert that conditions there are very satisfactory and that the immense supply of water provided by the Alps can ultimately make that section one of the most important industrial areas of Europe.

The main difficulty hitherto has been the double taxation to which foreign capital was subjected, that is, by the country whence the loan would emanate and also by the country in which the money would be placed for the increase of capital, payment of previous loans, additions to plants, construction of new power houses and completion of those already under construction.

The new bill clears the way for the entrance of foreign capital into Italy by construing as balance-sheet liabilities to be deducted from the taxable capital, and therefore to be exempt from taxation, the proceeds of loans issued abroad and invested in public utility works before Dec. 31, 1925.

By far the most important plan for the investment of American capital in Italian hydro-electric works is that now being negotiated by the firm of J. E. Aldred of New York conjointly with Lee, Higginson & Company of Boston and Dillon, Read & Company of New York. It is stated on good authority that about $35,000,000 will be invested by American capitalists in hydro-electric companies operating in the Piedmontese, Lombard, Venetian and Genoese regions, covering the whole of north Italy, which is considered as the richest field of exploitation of water power for industrial and domestic purposes.

The investment is said to be in the form of a loan to be issued on the New York market in thirty-year bonds, bringing a substantial interest and guaranteed by the actual value of the plants and machinery already in operation and of those well under construction, the value of which is held by experts as leaving a safe margin of security for the investors. The obligations, it is said, will be issued under the protection of the American and the Italian laws and with all the stipulations required for the protection of bondholders. Negotiations for the loan are now almost completed, and it is expected that definite arrangements will be made soon for the public issue.

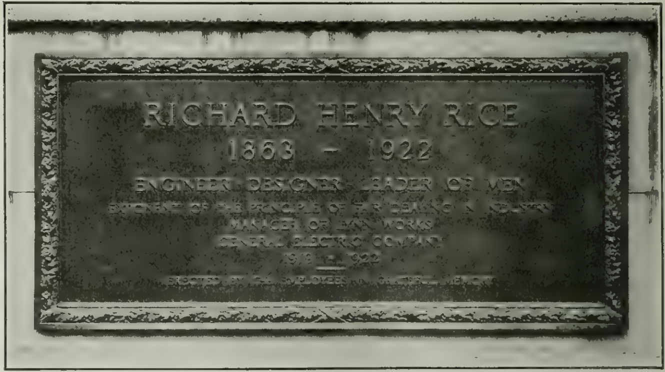
Some of the Projects in View

The works to which the capital thus obtained by the Italian companies will be devoted are said to include the construction of new plants for the exploitation of the Tanaro River and the high Po Valley in the Piedmontese region and the completion of the first unit of another big plant now under construction in Lombardy and of the Monviso plant, able to produce 40,000,000 kw.-hr. in summer and 32,000,000 kw.-hr. minimum in winter. The last-named plant started operation with the first unit late in August and supplies the paper mills in the territory. Another plant, the best in north Italy, is the Moncenisio station, which produces from 90,000,000 kw.-hr. in winter to a maximum of 120,000,000 kw.-hr. in summer, and arrangements have been made to turn over this plant for operation to the Società Alta Italia of Turin on Jan. 1, 1923. It delivers most of its energy to the important Fiat automobile industry of Turin and through a system of interconnection can supply eventually other zones in case of shortage or interruptions. Another plant, in the Aosta Valley, will be enlarged and will be able to double its capacity and supply energy as far as Milan and through interconnections also to the Genoese region. Still other works are now under way, and several plans are under examination by the government as a preliminary to the granting of franchises. These projects include the construction of seven new power houses in the Aosta Valley, which will be started as soon as franchises shall have been granted and sufficient capital obtained for their completion. The aggregate capacity of the seven plants is figured at 200,000 hp. as the minimum. The market for the energy thus produced is already provided, applications having been made for it by industries, mostly mechanical and textile, in the Piedmontese and adjoining regions.

It is interesting to note that under Italian law the franchises for derivation of water power are granted by the government for sixty years and automatically renewed. Those already granted prior to Oct. 2, 1919, were thus renewed automatically to expire Jan. 31, 1977.

Lynn Workers Honor Memory of R. H. Rice

In commemoration of the life and work of the late Richard H. Rice, manager of the Lynn (Mass.) works of the General Electric Company from 1919 to 1922, a bronze tablet was dedicated at the works on Sept. 19. John J. Kelley was master of ceremonies, and the speakers included Nelson J. Darling, Frank P. Cox and Stanley S. Ringer. The tablet was unveiled by Mrs Hershel McKnight of Schenectady, N. Y., a daughter of the late manager.



TABLET TO MEMORY OF LATE MANAGER GENERAL ELECTRIC WORKS AT LYNN

Mr. Rice was a pioneer in developing the system of employee representation. The money for the tablet was raised in 5-cent subscriptions from the ten thousand employees of the factory.

Ford Men Said to Be Surveying Wisconsin Streams

Engineers in the employ of Henry Ford have been, according to a report from Wisconsin, engaged in a survey of the water-power possibilities of the Kickapoo and Wisconsin Rivers. Options on zinc-producing mines in Wisconsin are said to have been taken by the Ford interests, and it is thought that if sufficient water power can be developed zinc suitable for use in automobile tires will be manufactured electrically in industrial plants to be established.

Water Power in New York

Hydro-Electric Development and Utility Regulation Will Play Large Part in State Campaigning

THE platforms of the Republican and Democratic parties in New York State this fall both pay special attention to the questions of water-power development and the regulation of public service companies. The Republican party indorses the policy of Governor Miller on these questions. Of water power it says:

"The subject of developing the potential water powers of the state has been discussed for more than a quarter of a century, but no forward step was taken until 1921 to inaugurate a definite state policy. Such a policy has now been established for the development by license under state supervision and regulation, securing general distribution at a fair price to the consumer and with a preferential right in municipalities to purchase any power developed on terms prescribed by public authority. Already plans are well advanced for developing the possibilities of the Black River and upper Hudson watersheds, which will produce more than 350,000 continuous horsepower, representing an annual saving of more than 3,500,000 tons of coal.

"The surplus waters of the canal afford a development of at least 40,000 continuous horsepower, representing an annual saving of 400,000 tons of coal. That power only remains to be harnessed, but it has been allowed to run to waste for many years while the question as to who should harness it has been debated. The debate has now been ended, the plan of development decided on and the work of development actually started. Inasmuch as the state has constructed and now maintains the canal for navigation purposes, the development of water power is to be made by the state itself in order that it may retain complete control of the entire project undertaken by it and safeguard the needs of navigation. We pledge the continuance of that policy."

Democrats for State Ownership

The Democratic party declares for the "development and distribution by the state of hydro-electric power for the benefit of all the people in order to bring about cheaper light and power." "Hydro-electric power," it says, "can and should be developed as a state-owned public utility to operate railroads, the state barge canal and industrial enterprises of every description at an immense saving to the consumer. We are opposed to the Republican policy of private exploitation of the water resources of the state and to the proposed Miller amendment to the constitution passed by the Republican Legislature of 1922, which would deliver the state resources to private monopolies."

The Republicans claim that under their control "more efficient regulation of the public utilities with exact justice to the public and those who serve the public" has been attained. The Democrats come out flatly for "home rule," declaring:

"We pledge the Democratic party to the enactment of statutes that will give the fullest measure of home rule to local communities in dealing with and regulating public utility corporations. Divided responsibility must cease and adequate power to discharge their duty be given to local officials, who are best fitted to solve the public utility problems of their community. We favor the delegation by the state to municipalities of power to control public utilities operating wholly within their limits. The state should retain the power to control only public service corporations whose activities are statewide."

Federal legislation which will prohibit the appointment of federal judges as receivers for local public utility corporations, or the issuance by them of injunctions restraining local authorities from administering and enforcing state laws or the provisions of franchises and contracts to which a community is a part, is also favored in the Democratic platform.

Great Lakes Men Discuss Appliance Selling

John F. Gilchrist Submits Cost Data and Recommends Help to Independent Dealer—Finance and Interconnection Also Among Topics Discussed at French Lick Springs

WITH nearly 500 delegates registered, the convention of the Great Lakes Division of the National Electric Light Association at French Lick Springs, Ind., set a mark last week for the other geographic divisions to shoot at in their future activities and indicated the way in which the division organization can and is beginning to function in central-station activities. Not only was the attendance large but the program attracted unusual interest and comment.

The discussion by John F. Gilchrist, vice-president Commonwealth Edison Company, of policies in merchandising electric appliances attracted intense interest because of the merchandising costs shown in an analysis of the experience of that company, which was illustrated by a tabulation of washing-machine transactions in June and July, 1922. Mr. Gilchrist used the washing machine as more or less typical of the entire merchandising situation and pointed out the urgent need for a full knowledge of the costs of merchandising, since the central-station companies, with all their influence and prestige, will do the industry an incalculable injury if they sell merchandise on a basis that does not result in reasonable profits.

Mr. Gilchrist made a convincing plea that the central station back the independent dealers and lend all the aid possible in establishing them on a profitable business basis.

Customer Ownership of Securities

President Harry Reid referred to the increase in the volume of securities owned by customers in the four states making up the Great Lakes Division and to the better public relations that had resulted. He maintained that more capital is invested and more energy sold in the Great Lakes Division than in any other division of the national association.

In his address at the banquet President Frank W. Smith of the National Electric Light Association congratulated the convention on the development of the Great Lakes Division, saying that recognition of the duty of mutual help had been attained. The division, he said, occupies a dominating position in economical production of electrical energy from steam, some of its plants being among the largest and most efficient in the world.

E. Hill Leith of Halsey, Stuart & Company divided industry into stages of promotion, reorganization, expansion and the period in which the problems of financing future growth are uppermost. The last ten years, Mr. Leith said, have been the period of expansion. The financing problem is the big one of the future.

Inductive Co-ordination

The status of the inductive-co-ordination work was discussed by R. F. Pack for the National Electric Light Association and H. P. Charlesworth for the American Telephone & Telegraph Company. Continued co-operation between the two utilities was urged.

John H. Mitchell, chairman of the educational committee, reported a proposal to divide the four states of the division into sections, to be assigned to individual members of the committee.

E. W. Lloyd, chairman of the Joint Committee for Business Development, outlined its work and urged co-operation through electrical leagues or other local bodies.

Chairman R. F. Schuchardt of the power survey committee defined its object as the formation of a comprehensive and economical scheme for the interconnection of the various systems in the four states, saying, however, that their geographic position is such that systems in adjoining states will be concerned.

Rural service was discussed by several delegates, led by Eugene Holcomb, chairman of the division committee. Chairman Neff of the national committee participated. Co-operation with the farmers' associations was the burden of the discussion.

Industrial Power Rates

Morse DellPlain of Hammond, in discussing "Power," expressed the view that the industrial power field is a competitive one and held that the central station should be allowed to increase its industrial rates as it thought right, leaving the competition from other forms of power to regulate the price just as competition regulates the price of any commodity.

S. M. Kennedy, vice-president Southern California Edison Company, in a paper on "Greater Service," read by E. W. Lloyd in the absence of the author, said that in one California company forty persons are devoting their time to discussing service with the consumers.

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Boston Edison Will Begin Its Weymouth Plant

The Edison Electric Illuminating Company of Boston has decided to start building its new Weymouth station immediately, and Stone & Webster are now in collaboration with I. E. Moultrop, assistant superintendent of construction, to that end. The initial installation will probably be 60,000 kw.

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Oklahoma Light and Power Men to Meet at Tulsa

Modern power-plant construction and operation and the manner of improving electric service will be among the topics discussed at a conference of the electric light and power division of the Oklahoma Utilities Association to be held at the Hotel Tulsa, Tulsa, on Oct. 17. This will be a conference of the light and power men residing in the First District of the association, comprising several counties in northeastern Oklahoma. Other district conferences will follow.

S. J. Smallwood, manager of the Hominy Light & Power Company, chairman of the First District, will preside, and J. F. Owens and O. D. Hall of Oklahoma City, F. W. Insull and J. H. Buell of Tulsa, P. B. Stockwell of the Corporation Commission, C. H. Tingley of Sand Springs and C. L. Proctor of Joplin, Mo., will speak.

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Edison Companies' Program for Next Week

On Tuesday to Friday, inclusive, next week the Association of Edison Illuminating Companies will hold its thirty-seventh annual meeting at the Greenbrier, West Sulphur Springs, West Va., the attendance, as usual, being confined to representatives of member companies and invited guests. The following technical program, subject to revision, has been adopted:

TUESDAY, OCT. 10

Afternoon — Committee appointments; presidential address; report of executive committee; report of treasurer, W. H. Atkins; report of Committee on Standards, W. C. L. Eglin, chairman.

WEDNESDAY, OCT. 11

Morning—Report of Committee on Steam Turbines and Generators, C. F. Hirshfeld; "Alternating-Current Underground Distribution," M. T. Crawford; "Recent Developments in Direct-Current Distribution," C. W. Wilder and C. H. Shaw; "Future Development of Distribution Systems," W. C. L. Eglin.

Evening—"Threatened State Control of Water Powers" (address), P. S. Arkwright; symposium on European impressions by member-company representatives who have recently visited Europe.

THURSDAY, OCT. 12

Morning—Report of Committee on Electricity Distribution and Use, L. L. Elden; report of Committee on Metering and Service Methods, F. V. Magalhaes; "Household Electric Refrigeration," T. I. Jones.

Evening—Report of Committee on Merchandising Policy, J. F. Gilchrist; "The Wiring Situation and What to Do About It," R. S. Hale; "The Industrial Relations Department of the Commonwealth Edison Company," Homer E. Niesz; report of Committee on Street Lighting, J. W. Cowles.

FRIDAY, OCT. 13

Morning—Report of Committee on Residence Survey, H. B. Gear; report of Lamp Committee, John W. Lieb.

Election of officers; report of Committee on Resolutions; banquet.

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September Financing at Lower Rates

THE lull in the bond market which was so evident in electric light and power public utility financing during the month of August was followed by a period of brisk activity during September, when stocks and bonds of this type amounting to $54,461,100 were offered investors. This figure represents an increase of more than $13,000,000 over September, 1921. Attention is called to the low average rate which the issues yielded, 5.97 as compared with 6.60 for August and 6.61 for July. Two one-hundred-year issues appeared in the month's flotations, and the largest single offering was the twenty-one-million-dollar issue of the Kansas City Power & Light Company. An unusually interesting feature of September financing was the redemption by the American Light & Traction Company of $3,000,000 of the $6,000,000 in five-year 6 per cent gold notes issued only two years ago.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN SEPTEMBER

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Offered at	Per Cent Yield
Iowa Falls Elec. Co.	$600,000	Fifteen-year.....	First mortgage gold bonds	To retire maturing obligations and for other purposes...	6	97½	6.25
Vermont Hydro-Electric Corp...	100,000	One-year..	Gold notes	....	7	100¾	6.20
Quincy Electric Light & Power Co.	250,000	Twenty-five-year.	First mortgage bonds	To call ten-year, 7 per cent notes	5	Placed privately	
Northwestern Electric Co. (Ore.)	1,000,000		Cumulative first preferred stock		7	Par	7
Shawinigan Water & Power Co. (Que.)	1,111,500	Twenty-nine-year.	First refunding mortgage sinking-fund gold bonds, series B	To pay floating debt and provide for construction....	6	104½	5.65
Consolidated Gas, Electric Light & Power Co. of Baltimore...........	5,000,000	Thirty-year	First refunding mortage sinking-fund gold bonds, series E	To refund bonds to be called for redemption....	5½	99½	5.50
Kansas City Power & Light Co.	21,000,000	Thirty-year	First mortgage gold bonds, series A.........................	To retire outstanding funded debt and for new property...	5	93	5.47
Kansas City Power & Light Co.	2,400,000		First preferred stock, series A (cumulative dividend)	To retire outstanding funded debt and for new property	7	96	7.30
Nebraska Power Co.	3,500,000	One-hundred-year	Gold debenture bonds, series A.	For retirement of bonds, notes and floating debt	6	90½	6.60
Philadelphia Suburban Gas & Electric Co..............	400,000		Cumulative preferred stock..	...	7	97	7.2
Portland Railway, Light & Power Co.	2,500,000	Twenty-five-year.	First lien and refunding mortgage, series B	To reimburse expenditures for property and acquisition of bonds	6	96	6.30
Kansas Gas & Electric Co.	3,000,000	One-hundred-year	Gold debenture bonds, series A.	To retire bonds and for other purposes	6	90½	6.60
Columbus, Delaware & Marion Electric Co...........	1,374,000	Twenty-year	First and refunding mortage gold bonds of 1917		5	96½	6.35
Kansas Electric Power Co.............	1,000,000		Cumulative preferred stock	To refund bonds for acquisition of property and for additions	7	92½	7.57
Ohio Public Service Co.	3,625,600		Cumulative first preferred stock, series A	To provide funds for unification of properties by new construction	7	94	7.40
Pennsylvania Power & Light Co.	7,000,000	Thirty-year	First and refunding mortgage bonds, series B	To reimburse in part expenditures for construction and other purposes	5	92¾	5.50
Western New York Utilities Co., Inc...	600,000	Twenty-four-year.	First mortgage gold bonds of 1916		5	90½	5.75
Total	$54,461,100						

Commission Grants Licenses

Projects for Development on Ouachita and Clarion Rivers Approved—New Applications

FINAL action upon the grant of licenses has been taken by the Federal Power Commission in four cases.

The Caddo River Power & Irrigation Company of Little Rock, Ark., has received a license for fifty years to develop a power project on the Ouachita River, partly on land of the United States within the Arkansas National Forest in Garland and Montgomery Counties, Ark.

The Clarion River Power Company of Foxburg, Pa., has received a license for fifty years for a power project on the Clarion River in the county of that name.

A license for twenty-five years has been granted the Royal Development Company of Butte, Mont., for a small power project on Dry, Chipmunk and a third unnamed creek, all tributary to Phelps Creek, on lands of the United States partly within Wenatchee Forest, Wash.

To the County of Mineral, Nev., a license for a transmission line across lands of the United States in that county has been granted for a period of fifty years.

PRELIMINARY PERMITS GRANTED

Four applications for preliminary permits have been granted by the commission.

The California-Oregon Power Company of San Francisco has received a permit for two years looking toward a power project on the Klamath River in Klamath County, Ore., involving one or more dams. Investigations are being made of the so-called Klamath-Shasta irrigation district, and the permit is granted with the understanding that the formation of such a district and the diversion of water from the Klamath River might make a license for the power project impracticable or undesirable.

The application of the Saw Tooth Power Company of Wilmington, Del., for a preliminary permit for a power project on Pass, Smith and other creeks, twenty-six in all, in Kougarck recording precinct, Alaska, involving conduits, reservoir, power house and auxiliary works, has been granted for thirty months.

The application for a preliminary permit of the Willow Creek Mines, a corporation of Seattle, Wash., for a power project on Craigie Creek, in Knik recording precinct, Alaska, has been granted for thirty months. This project involves construction of a diversion dam, conduit, power house and auxiliary works.

James H. Mays of Salt Lake City, Utah, and Henry L. Gandy of Rapid City, S. D., have obtained a preliminary permit for two years for a power project on Huntington Creek, Emery County, Utah. This contemplated project involves the construction of a three-mile conduit, a power house and other works.

The Alabama Power Company has applied for a preliminary permit covering its project for the development of 60,000 hp. of primary power on the Tallapoosa River in Elmore, Randolph, Chambers and Tallapoosa Counties. The construction of four dams is proposed—one 110 ft. high at Cherokee Bluffs, 10 miles above Tallahassee; one 85 ft. high just below the mouth of Higby Creek, 5 miles from Alexander City; one 60 ft. high at a point on the river 10 miles north of Dadeville, and one 150 ft. high just above the mouth of Crooked Creek, a few miles below the junction of the Tallapoosa and the Little Tallapoosa. The application follows the report of the Chief of Engineers to the effect that the project comes under the jurisdiction of the Federal Power Commission. It is understood that the company plans the full development of this project within a period of ten years, and that it is the intention of the company to go through with it regardless of any rights that it may acquire at Muscle Shoals.

The commission has reaffirmed after investigation its previous decision that the proposed power development of the Grafton-Caledonia Power Company of New Hampshire on the Connecticut River in New Hampshire and Vermont does not affect interstate commerce inasmuch as the Connecticut River at the point concerned is not a navigable stream.

The declaration of intention by Morrison & McCall of St. Louis, Mo., for dams across and in Eleven Point and Spring Rivers in Randolph and Lawrence Counties, Ark., was declared by the commission to affect interstate interests and therefore to be within its jurisdiction.

New England Men Discuss Power Problems

At the New England regional meeting of the American Society of Mechanical Engineers, held in Springfield, Mass., Sept. 25-27, problems of power and plant efficiency of interest to electrical men were discussed. The opening session Monday resolved itself into a forum on power, with C. C. Chesney, manager of the General Electric Company's Pittsfield plant, in the chair. A paper on "Multiple Source of Power for Reliable Industrial Plant Operation" was read by R. A. Packard, superintendent for power and shop for the Ludlow (Mass.) Manufacturing Associates. He explained how with its two hydro-electric stations, a steam-power plant and three substations for transforming current, one of which is fed from the Turners Falls company's transmission wires, the company is enabled to avoid more than two minutes' interruption of power in any except the most unusual emergencies.

He was followed by R. J. S. Pigott, works manager of the Crosby Steam Gauge & Valve Company, Boston, who gave a talk on "Economics in the Use of Fuel for Small Industrial Plants." As only comparatively few plants can afford to install such a system as that which provides power at Ludlow, he said, the problem of the rest is to obtain all possible economy from existing sources. The introduction of mechanical stokers is an increasing necessity, and along with this should go the installation of flowmeters, taking accurate account of every element of power service. Many industries that now maintain power plants of their own would be better off, he thought, to buy their power from some large central station.

In the discussion following these papers the relative advantages of the single and multiple power systems were considered, and R. E. Woolley of the General Electric Company's Schenectady plant told of the progress being made in introducing flowmeters. W. N. Polakov, a consulting engineer on power for the New York municipal government, said the human element must be kept in mind at all times as essential to the success of every so-called automatic device that might be introduced. No such contrivance can be really automatic, he said; there must be a brain to direct it, and the trouble with a great many efficiency devices was that, once installed, they were left to gather dust and cobwebs.

Power Exposition Planned for New York in December

Following the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers, a national exposition of power and mechanical engineering is to be held in the Grand Central Palace, New York City, to continue from Dec. 7 to Dec. 13. Irving E. Moultrop of the Edison Electric Illuminating Company of Boston heads the advisory committee, and among his colleagues are Dexter S. Kimball, president A. S. M. E.; Milan R. Bump, N. A. Carle, E. B. Katte, Calvin W. Rice and Fred R. Low.

The exposition will stress the engineering phases of the problems involved in the economical uses of fuel and the more effectual generation and utilization of power.

Telephone Pioneers in Ohio Hear California and Cuba

The spectacular feature of last week's convention of the Telephone Pioneers of America, held in Cleveland, was a public demonstration of the marvels of modern telephony, attended by thirteen thousand persons, who heard distinctly a conversation carried on between Gen. J. J. Carty, president of the Pioneers, present in Cleveland, and telephone officials in San Francisco, Havana and many less distant cities.

More than two thousand delegates from all parts of the country attended the convention. Leonard H. Kinnard, president of the Bell Telephone Company of Pennsylvania, was elected president of the association for the ensuing term.

Brief News Notes

Sweden's Consumption of Energy.—Recent figures reported by Trade Commissioner Sorensen to the Department of Commerce put the present yearly consumption of electrical energy by Sweden at 2,143,700,000 kw-hr., of which industrial establishments take 1,347,100,000 kw.-hr.

Australian Electrification Under Way.—The electrical plans for the State of Victoria, Australia, which involve the use of brown coal to develop 50,000 kw. at the mines, the energy to be transmitted over a 112-mile transmission line to Melbourne, are now well under way, and the new plant is expected to be in operation within two years. A large part of the apparatus has been delivered, and the five 12,500-kva. turbo-generators are in process of erection. The brown coal will be made into briquettes at the station site.

Appleton Celebration Postponed.—The ceremonies planned to celebrate the opening of the Appleton (Wis.) electric central-station plant forty years ago, soon after the inauguration of commercial service in New York City, were not held on Sept. 30, the date that had been announced. It has been thought best to postpone the event until a permanent bronze tablet of commemoration can be made, rather than to erect a temporary wooden one, as was first intended. The celebration will probably not take place till next year.

New York's Electric Truck Parade.—With more than 150 trucks entered, the electric truck parade scheduled for Tuesday, Oct. 10, in connection with the New York Electrical Show, promises to be one of the most successful events ever arranged by the local electric vehicle interests. The trucks will represent about sixty individual owners in thirty different lines of industrial activity. The parade will start at 10 a.m. from Fifth Avenue and Sixty-fifth Street and, escorted by a squad of motorcycle police, will proceed down Fifth Avenue to Washington Square.

Michigan Villages to Say Farewell to Municipal Plant.—Montcalm County (Mich.) villages are reported as hailing with satisfaction the expected passing of the municipal plant at Stanton, on which they have been dependent for such electric service as they have had, and its replacement by hydro-electric service. The Stanton steam plant has never paid expenses, has been subject to frequent breakdowns, and when the coal strike came ran out of fuel. Glenn Gardner, until recently head of the Prairie Creek Power & Light Company, Muir, Mich., has moved to Stanton with the intention of building a dam on the Flat River at Langston, one of the complaining towns, and establishing a central station which will be able to serve all the nearby communities.

Japan Has an Electrically Driven Naval Vessel.—The 20,000-ton fuel ship Kamoi of the Japanese Navy, said to be the first vessel of any navy other than that of the United States to be electrically propelled, has completed successfully its builders' trials off the Delaware Capes. The electric drive equipment of the Kamoi, designed and installed by the General Electric Company, includes the use of synchronous motors for the first time in any twin-screw vessel. Tests demonstrated that the Japanese ship is the most economically operated steam vessel of her size afloat, observers declared.

Long Island Railroad Planning Ahead.—The Long Island Railroad, which carries many thousands of persons employed in New York City to and from their suburban homes, is planning the ultimate electrification of its entire 40-mile commutation zone through the installation of additional power equipment in its Long Island City plant. The plans to replace steam with electricity will be carried out first probably on the Montauk division to Babylon. Eventually the company hopes to electrify the entire Oyster Bay branch and the Wading River branch to Huntington or Northport, thus providing through service from Manhattan and Brooklyn and eliminating the present necessity for changing trains at Jamaica, where electric service now ends.

Alabama Power Company Sends Emergency Power 600 Miles.—Coming to the rescue of cotton mills and other industries in the Carolinas whose energy supply was crippled both by low water in the rivers and the car shortage at the coal mines, the Alabama Power Company, according to W. E. Mitchell, assistant general manager, has been sending 35,000 hp. a day through its connecting lines to supply the deficiency. This power has been generated at the Gorgas and federal plants at Muscle Shoals and at the company's Birmingham plant and has been sent to Greenville and Spartanburg, S. C., thence as far east as Raleigh, N. C., and north to Greensboro and Henderson, N. C., some of it being transmitted 600 miles.

Cable 13,800 Ft. in Length Brings Electricity to Fisher's Island.—By the installation of a 7,000-volt submarine cable, 13,800 ft. long, between Groton Long Point, Conn., and Fisher's Island, N. Y., the inhabitants of the island are now afforded modern central-station service. Energy is brought to the Groton substation over the existing transmission line from the Montville plant of the Eastern Connecticut Power Company. A two-mile line from this substation was built down to the water's edge. The present load is about 125 kw. at 2,300 volts and is virtually all lighting load. Any future increase in load can be supplied by tripling the voltage. The cable, which is armored with No. 6 galvanized-steel wire, consists of three No. 2/0 standard conductors, weighing 8.6 lb. per foot with an over-all dimension of 2.8 in.

Associations and Societies

Canadian Engineers Discuss Hydro-Electricity.—At the annual meeting of the Engineering Institute of Canada, held last month at Winnipeg, Manitoba, the first day was given up to the presentation and discussion of papers describing the hydro-electric plants in the vicinity of Winnipeg. On the following day an inspection of these plants was made by the 200 members in attendance.

Small-Residence Wiremen Form Association in Vancouver.—A step forward in the organization of the small-residence wiremen has been taken in Vancouver, B. C., by the formation of the Electrical Contractors' Association of British Columbia under the auspices of the Electrical Service League. This organization is entirely independent of any existing electrical contractor association and is formed for the purpose of bettering conditions among the residence wiremen.

Section Meetings, A. I. and S. E. E.—The Pittsburgh Section of the Association of Iron and Steel Electrical Engineers, meeting on Oct. 14, will hear a paper by G. E. Stoltz, Westinghouse Electric & Manufacturing Company, on "Improved Rolling-Mill Practice Obtained by the Use of Direct-Current Motors for Main Roll Drive." The paper presented at the October meeting of the Cleveland District Section will be on "Electric Smelting of Iron Ores," by Alfred Stansfield, Birks professor of metallurgy at McGill University, Montreal.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Society of Motion Picture Engineers—Rochester, N. Y., Oct. 9-12.
National Association of Electrical Contractors and Dealers—Cincinnati, Oct. 9-14. F. Johnson, 15 West 37th St., New York.
Association of Edison Illuminating Companies—White Sulphur Springs, W. Va., Oct. 10-13. Preston S. Millar, 80th St. and East End Ave., New York.
Society of Industrial Engineers — New York, Oct. 18-20.
Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 20-21. A. Bliss McCrum, Charleston, W. Va.
Electric Power Club—Asheville, N. C., Oct. 30-Nov. 2. S. N. Clarkson, Kirby Bldg., Cleveland, Ohio.
Arkansas Utilities Association—Hot Springs, Ark., Nov. 7 and 9. R. P. Brown, Little Rock Ry. & Electric Co., Little Rock.
Electrical Credit Association (interstate convention)—Philadelphia, Nov. 10. J. W. Crum, 1328 Land Title Bldg., Philadelphia.
Ontario Association of Electrical Contractors and Dealers—Toronto, Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.
National Association of Railway and Utilities Commissioners—Detroit, Nov. 14-17. J. B. Walker, New York Transit Commission, New York.
Electrical Credit Association, Central Division—St. Louis, Nov. 16-17. F. P. Vose, 1347 Marquette Bldg., Chicago.
Electrical Supply Jobbers' Association—Cleveland, Nov. 20-24. Franklin Overbagh, 411 S. Clinton St., Chicago.
American Society of Mechanical Engineers—New York, Dec. 7-13.

Commission Rulings

Invasion of Territory for Special Purpose Disapproved.—The Borough of Ashland, Pa., complained to the Pennsylvania Public Service Commission against the Schuylkill Electric Company and the Schuylkill Railways Company, asserting that electric light wires had been installed on the poles of the railway company by the lighting company to carry energy into the territory of the complainant. It appeared that this had been done with the object of serving gratuitously the general manager of the Schuylkill Electric Company, who resided in Ashland Borough. The commission ordered the service discontinued unless its consent and that of the borough authorities was first obtained.

Unprofitable Rural Rates.—The Wisconsin Railroad Commission has ordered the Rio Electric Company to increase its rural charge for a 1½-kw. transformer from $1 to $1.50 a month, finding the old rate entirely inadequate to carry the maintenance and retiring expenses due to the lines being longer and installations more expensive than those used by average village consumers. It found that the company's local customers were carrying slightly more than the cost of service to them, while the rural customers were served at a material loss despite the fact that they had contributed to the construction of the lines. The commission held that rural rates must therefore be increased to permit a reduction in the village rates paid.

Basing Rates on Advance Construction.—In granting an increase in electric rates to the Consolidated Gas Company of Long Branch, N. J., which furnishes electrical energy to a number of New Jersey communities, the New Jersey Board of Public Utility Commissioners criticised the company for including in its rate base for 1922 virtually all its new investment, including a generating set which should, the commission held, be "taken into the rate base on installments running over perhaps three years. In other words, a schedule based on 1922 anticipated operations and with the value stated by the company for 1922 would in the long run be unfair to the customers as representing too high an average value for that year."

Utilities Must Bear Average Costs of Extension.—Consumers of gas and electricity in Birmingham, Montgomery, Mobile and other points served by the Alabama Power Company will not be required in the future to bear the total cost of extensions of mains and connections under a decision recently announced by the Alabama Public Service Commission. Instead, the companies serving the towns will be required to bear the average cost of extending the system in order to accommodate new customers and will be permitted to assess any additional cost against the consumer, allowing him credit on his bills at regular intervals until he has been repaid in full for the amount advanced. Exceptions were made whereby an electric company cannot be forced to pay for extensions in a development for speculative purposes and whereby wholesale power consumers may be required to meet the cost of extensions subject to repayment at fixed intervals. The decision of the commission is directed against the Birmingham Railway, Light & Power Company, the Alabama Power Company, the Montgomery Light & Water Power Company and the Mobile Electric Company.

Damages for Interruptions of Service.—The Pennsylvania Public Service Commission dismissed a complaint asking for damages for interruptions of electric service brought against the Philadelphia Suburban Gas & Electric Company by the McClintic-Marshall Construction Company. The claim put forth was because of wages paid during periods of service interruption. The company showed that the failure was due to the coal strike and a shortage in the allotment of cars made to it for transporting fuel, to the poor quality of coal purchased in the open market, and to high water in the river bringing down débris and choking the intake. The commission held that these occurrences constituted a cause reasonably beyond the company's control and were, by the terms of the service contract, a sufficient reason for the interruption.

Principles Governing a Partition of Territory.—In dividing between the Vallejo Electric Light & Power Company and the Great Western Power Company certain territory in Solano County where both companies claimed rights (see *Electrical World* for Aug. 19, page 395) the California Railroad Commission said regarding the portion assigned to the Vallejo company: "It must be borne in mind, however, that the present lines of the Great Western company are closer to parts of this territory than are the present lines of the Vallejo company. The requirement that this territory be served solely by the Vallejo company might work a hardship either on that company, by requiring it to make extensions which might be more economically made by the Great Western company, or else upon applicants for service by preventing them from securing service from the adjacent lines of the Great Western company. The order will therefore provide that extensions in this intermediate territory be made by the Vallejo company, but in the event that the Vallejo company refuses to serve any applicant for service, then the service may be supplied by the Great Western company. Should such a contingency arise it will, of course, be expected that the Great Western company will serve any other future consumer adjacent to the lines so constructed and that the Vallejo company will refrain from paralleling any such lines of the Great Western company."

Recent Court Decisions

Supreme Court May Make Its Own Finding of Facts in Review of Case Affecting Commission.—In a steam-railroad case (State ex rel. St. Louis-San Francisco Railway vs. Public Service Commission), a suit affecting a commission order, the Supreme Court of Missouri declared its right to make its own finding of facts, asserting that on review of a Circuit Court judgment the proceeding must be treated as a suit in equity. (242 S. W. 938.)*

Provision of Pennsylvania Law Giving Commission Control Over Municipal Contracts with Utilities Not Retroactive.—The Supreme Court of Pennsylvania has declared, in Borough of Collingdale vs. Philadelphia Rapid Transit Company, that a provision of the Public Service Commission law making contracts between municipalities and utilities subject to commission approval is not retroactive and that lack of such approval does not take away the jurisdiction of a court to enforce the conditions of a franchise granted in pursuance of a contract made before passage of the commission law. (117 At. 909.)

Grantee of Flowage Rights Pertaining to Riparian Land Must Not Flow Lands Not Conveyed.—In Eley vs. Twin State Gas & Electric Company damages were sought because of the flooding of plaintiff's cellar owing to a dam maintained by defendant company. Flowage rights under a deed of conveyance of part of certain riparian lands were claimed, but the Supreme Court of New Hampshire decided that although, by the provisions of the instrument, the grantee had the right by maintaining a dam to raise the water opposite the grantors' land to an extent which would cause only nominal damages, it had no right to flow the part of land not conveyed. (117 At. 817.)

Electric Company Responsible for Injury from Its Wires to One Using Footpath as Licensee.—The Appellate Court of Indiana has confirmed damages awarded in Sanders vs. Terre Haute, Indianapolis & Eastern Traction Company for the death of a boy who while walking on the railway's right-of-way took hold of a wire dangling from its overhead transmission wires and in contact with high-voltage lines. The court found that the public had been using the right-of-way as a footpath for many years, that the boy was therefore a licensee for whose safety from its wires the company was responsible, and that the complaint, which did not set out the exact location of the wire alleged to be dangling and which described in general terms the alleged neglected and unsafe condition of the company's lines, was sufficiently specific. (136 N. E. 54.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Guy L. Bayley Has Joined Staff of Sanderson & Porter

Guy L. Bayley, formerly chief of the mechanical and electrical departments of the Panama-Pacific International Exposition and for many years engaged in hydro-electric work on the Pacific Coast, has joined the staff of Sanderson & Porter, consulting engineers of New York, Chicago and San Francisco, and will be particularly concerned with water power. For a number of years Mr. Bayley, who was born and educated in California, was employed by electric public utilities on the Pacific Coast, notably the Pacific Gas & Electric Company, the Sierra & San Francisco Power Company and the Universal Electric & Gas Company, as an operator of hydro-electric systems, and in 1916 he erected the hydro-electric plant in Yosemite for the Department of the Interior. More recently he became interested in foreign exportations, and he has toured Japan, Korea, China, Siam, the Straits Settlements, Java and Sumatra as assistant to the president of the Federal Export Corporation of New York City. He had already had experience in this work, having represented the American Trading Company from 1900 to 1904 in Japan.

G. L. BAYLEY

◆

E. G. Quarnstrom, for the last five or six years superintendent of the municipal electric light plant, Madison, S. D., has resigned that position and taken one with the Union Public Service Company, Canby, Minn. He was a member of the executive committee of the North Central Electric Association last year and also chairman of the membership committee for South Dakota.

E. H. Fischer has been assigned to supervise the manufacture of the high-tension line insulators of the Illinois Electric Porcelain Company of Macomb, Ill. Mr. Fisher has been engaged in this work with some of the largest manufacturers for more than ten years.

Charles A. Coffin, one of the founders and until recently chairman of the board of the General Electric Company, celebrated the fiftieth anniversary of his wedding in characteristic fashion last week. With Mrs. Coffin he slipped away quietly to the home of his daughter, in Connecticut, and there amid his immediate family passed the day in domestic quiet. Despite Mr. Coffin's modest avoidance of any public commemoration of the happy event, felicitations from his friends and associates were showered upon him.

◆

Hibben Succeeds Law as General Secretary of the I. E. S.

Samuel G. Hibben was chosen last spring to fill the role of general secretary of the Illuminating Engineering Society and took office at the beginning of this month. Mr. Hibben is manager of the illumination bureau of the Westinghouse Lamp Company, New York City, and has taken a prominent part in I. E. S. activities.

Clarence L. Law, the retiring general secretary of the society, was the guest of honor at a dinner on Wednesday evening, Sept. 27, at the New Ocean House, Swampscott, Mass., where the society held its sixteenth annual convention.

◆

Professor Ryan's Candidacy Well Received

Reports indicate that the candidacy of Prof. Harris J. Ryan, head of the department of electrical engineering at Leland Stanford, Jr., University, for the presidency of the American Institute of Electrical Engineers has been received with enthusiasm throughout the country. Professor Ryan's candidacy was brought about by an enthusiastic indorsement from both Eastern and Western engineers at the recent Vancouver convention of the Institute, a recognition prompted by his brilliant attainments in the engineering field. His position in electrical engineering has been gained through his many contributions to the art and through his leadership in educational and scientific societies.

Professor Ryan for many years occupied the chair of electrical engineering at Cornell University, Ithaca, N. Y. In his early days important patents were awarded to him, notably in conjunction with M. E. Thompson for the Thompson-Ryan equipment and for repulsion and interpole motors. Since he has been at Stanford University Professor Ryan has acted in a consulting capacity for many of the large hydro-electric systems of the Pacific Coast. He has also done important research work in connection with high-tension insulation.

◆

Arthur Simon New President of Engineers' Society of Milwaukee

Arthur Simon, the new president of the Engineers' Society of Milwaukee, has been connected with the electrical industry since 1903. After being graduated from the Technical University of Darmstadt, Germany, in 1902, with the degree of electrical engineer, he devoted some time as post-graduate to the study of power-transmission problems. In 1903 Mr. Simon came to America and joined the Cutler-Hammer Manufacturing Company as draftsman, and two years later he was placed in charge of design and development of alternating-current apparatus, a position he held until 1920. Since then Mr. Simon has been engaged in general development and patent work for the company, covering the application of electric power to industrial and domestic purposes. He is a fellow of the A. I. E. E., a member of the A. S. M. E. and an associate of the Radio Institute. He was section chairman of the A. I. E. E. and his interest both in the Engineers' Society and in the civic problems of the city has been very active.

ARTHUR SIMON

◆

Henry L. Doherty President of Denver Gas & Electric

Henry L. Doherty has again taken over the presidency of the Denver Gas & Electric Light Company, filling the vacancy resulting from the recent death of Frank W. Frueauff. Mr. Doherty's headquarters will remain in New York.

Fred J. Singer has resigned as instructor of electrical engineering at the University of Wisconsin and is now in the department of development and research of the American Telephone & Telegraph Company, New York.

B. F. Jakobsen, who has held the position of chief designing engineer for the San Joaquin Light & Power Corporation for the past three years, has severed his connection with that company and opened offices in Fresno, Cal., as a consulting hydraulic and electrical engineer.

C. S. Gilbert, Sr., was elected treasurer of the Wisconsin Valley Electric Company at a meeting of the directors held recently at Wausau. Mr. Gilbert succeeds the late M. C. Ewing. Harold L. Geisse, who was acting manager in the past year during Mr. Ewing's illness, was elected secretary and general manager in Mr. Ewing's place.

D. C. Hess is now allied with the municipal electric light and power plant of Richmond, Ind., succeeding J. P. Dillon.

J. H. Crossley, electrical engineer of Manchester, England, recently spent considerable time in California visiting noteworthy hydro-electric developments.

Leland D. Wood, formerly electrical engineer with Edward C. Brown & Company, engineers, Boston, is now connected with the light and power department of Hudson, Mass., as manager.

Edwin A. Barrows, president of the Narragansett Electric Lighting Company, Providence, R. I., was recently elected president of the New England Division of the National Electric Light Association for the coming year.

Frank H. Woodward, formerly district manager of the Oakland division of the Great Western Power Company, has been appointed general sales manager in San Francisco, to succeed J. B. Black, promoted to the position of general manager.

George L. Smith of Fort Wayne, Ind., has been selected as superintendent of the new municipal electric light and power plant at Troy, Ohio. Mr. Smith became interested in the electrical profession in early boyhood and for several years was in the employ of the General Electric Company in the construction of electric plants. He has constructed as well as operated a number of municipal plants in Michigan.

N. J. Mittenthal has severed his connection with the International General Electric Company, Schenectady, N. Y., to become sales engineer with the Pacific States Electric Company, San Francisco.

J. J. Raftery has been appointed manager of the New York branch of the Manhattan Electrical Supply Company, Inc., the executive offices of which are now at 125 Church Street, New York City. Mr. Raftery was formerly with the Western Electric Company and recently on the staff of the Curtis Publishing Company.

W. S. Rugg Is Westinghouse General Sales Manager

W. S. Rugg, assistant to the vice-president, has been appointed general manager of sales of the Westinghouse Electric & Manufacturing Company. The position of general sales manager is a new one in this company, and Mr. Rugg's appointment to the post is a recognition of his broad experience in almost every line of the electrical industry and his capabilities in sales work, in which he has been engaged for many years. He may be said to combine the exact and analytical training of an engineer with the broad economic experience of a commercial executive.

Mr. Rugg was born in Broadhead, Wis., and was graduated from Cornell University. He became identified with the Westinghouse Electric & Manufacturing Company in 1892 and three years later was transferred from Pittsburgh to the Chicago office as district office engineer. While engaged in this position Mr. Rugg attracted the attention of the manager of that office, who decided that Mr. Rugg would make an excellent salesman. Mr. Rugg adapted himself to his new work with marked success, and in 1901 he was transferred to the New York office as special sales engineer. In 1909 he was made manager of that office, and in 1917 he was transferred to the East Pittsburgh works and made manager of the railway department. Soon afterward he became manager of the marine department also.

W. S RUGG

It was during Mr. Rugg's administration of the railway department, started when, because of the war, the industry was at its lowest ebb, that the most constructive work ever accomplished in that department was done. His success here resulted in his promotion in 1920 to be assistant to Vice-President Shute, in charge of sales. His duties in this position gave him special jurisdiction over negotiations and district office personnel and especially fitted him for the general sales managership.

Frank L. Blanchard, publicity director for the Cities Service Company of New York, recently inspected all of the Colorado holdings of the Doherty interests, including developments of the Denver Gas & Electric Light Company.

H. E. Dalzell has resigned as chief mechanical and electrical engineer of the Southern Railway of Peru after fifteen years' service in the tropics. Mr. Dalzell is taking eight months' holiday and expects to take up an appointment on the east coast of South America in the spring.

O. E. Hubbard, vice-president and general manager of the Clarksville (Tex.) Light Company, has been elected president of the Clarksville Chamber of Commerce, succeeding B. F. Marable, who has retired after serving two years at the head of the organization.

H. Pendergraph, who has been selected to succeed W. P. Guinan as new-business manager of the Montgomery (Ala.) Light & Water Power Company, goes to Montgomery from Athens, Ga., where he has been for the last three years business manager and representative of H. L. Doherty & Company. Prior to that he was manager of the Durham (N. C.) Utilities Company.

Markham Cheever, chief engineer and general superintendent of the Utah Light & Power Company, has been named chairman of the water-power development committee of the Salt Lake City Commercial Club and Chamber of Commerce. Other members of the committee are R. R. Lyman, E. H. Eardley, Lafayette Hanchett, H. B. Waters and A. M. Jackson.

Hugh M. Atkinson, chairman of the board of directors of the Georgia Railway & Power Company of Atlanta, has returned to this country after a three months' trip through various parts of Europe, during which he visited France, Switzerland, Italy and Austria. He was accompanied on the trip by Mrs. Atkinson, and its primary purpose was to visit the grave near Paris of their son, Capt. Harry Atkinson, Jr., who was killed in action during the latter part of the war. Mr. Atkinson also devoted considerable time to a study of economic and financial conditions in the countries visited.

W. L. Johnson, formerly with the Southern California Edison Company and the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company, is now connected with the Los Angeles office of the Westinghouse company as automatic control specialist.

James D. Blackwell, Seattle, president of the Northwest Society of Engineers, has been appointed city engineer of Seattle, to replace A. H. Dimock, who had been in office since 1911. Mr. Blackwell went to Seattle in 1899 for Stone & Webster interests and aided in laying out a part of the city railway system. Since 1905 he has been associated with H. D. Hanford in general engineering practice.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic
Problems of the Producer and Distributor, with Market Reports, Trade
Activities, Foreign and Construction News

A Review of the Jobber's Rôle—Part II

The Many Important Functions Which Are Filled by Him Serve Materially to Lessen the Burdens Imposed on Both the Manufacturer and the Dealer

THE following comments on the service which is rendered by the stocks of the electrical supply jobbers concentrated at centers of population throughout the country have been contributed from various sources and have been gathered together under appropriate general heads, but without any attempt to knit them into a narrative. They are presented rather as the opinions of many men on the practical usefulness of this service element in the machinery of distribution.

Credit Service

1. By operating in a more or less restricted territory the jobber is in position to know accurately the financial conditions that exist. That means not only the condition of each individual customer but the general financial situation throughout the territory. With this knowledge he is equipped to extend credit with the expectation of making collections in accordance with established terms and of incurring no more than reasonable losses through the accounts. The result is of real economic value, as it means a lower cost of distribution.

2. The jobber through close contact can develop the credit of the individual customer. It is within his power, through constant observation, to guide his customer along the right business channels, with the result that many a "moral risk" is gradually being placed upon a firm financial foundation.

3. Through the jobbers' operations, credit losses for all branches of the industry are materially reduced. This result is obtained through the jobber's closer contact with and knowledge of financial affairs in the trade within his more localized fields.

4. The jobber with accurate first-hand information is able to take on and develop into good customers for the manufacturer accounts which at a distance would not appear worthy of credit. For the same reason, the jobber can temporarily finance contractors beyond their actual worth.

5. The manufacturer is enabled to reduce his losses through poor credit work to a minimum because the jobber pays the manufacturer promptly.

6. The jobber is able to place the manufacturer's goods with small concerns because the jobber's credit man is in close touch with the situation and knows just how much credit to allow. The manufacturer at a distance would be greatly handicapped.

7. Were it not for the jobber, the retailer would find it practically impossible to finance his business. With the jobber providing proper service, the retailer, instead of having a multitude of bills payable, has but few bills-payable accounts, as would be the case were the product to go through from the manufacturer to the retailer. This serves two purposes, (1) the reduction of overhead expense, and (2) a better credit rating for the retailer, because where there are a large number of accounts with various concerns claims are bound to occur, and with such claims comes a disgruntled feeling on the part of the producer which might be reflected in the credit extended to the retailer.

8. Because of closer relationship with customers, jobbers extend more liberal lines of credit than could distant manufacturers, thus greatly aiding the development of many enterprises. This close relationship permits the jobber to operate with much smaller credit losses than would be possible if purchases were made from many manufacturers.

9. The existence of an electrical jobber permits his customer to concentrate his buying power and thus capitalize his credit.

10. With representatives in the field in personal and almost daily contact with their trade, the jobber is placed in a position where the confidence of the dealer is secured, and the dealer is educated along the lines of proper accounting and is impressed with the necessity of making prompt collections.

11. Oftentimes the jobber actually assists in making prompt collections for the dealer. This results in the retailer's obtaining a better and stronger financial position, something that could not be accomplished by the manufacturer because of the extremely large amount of work and detail involved.

12. Many financial losses to manufacturers and many financial failures are prevented each year by reason of the closer personal contact between jobber and dealer than would be possible between dealer and manufacturer.

13. One great service rendered by the jobber's able credit man is the guiding of a growing contractor-dealer business. He helps the dealer by suggesting better bookkeeping methods, time payment plans and proper collection practices. Often he is in a position, by proper consideration, to save a business from the financial disaster which in many cases will occur if a dealer's accounts were widely scattered between manufacturers far away and with whom he has little or no personal contact.

14. Without the jobber's stocks the contractor-dealer and central-station company would be compelled to carry accounts with forty or fifty manufacturers or suppliers instead of two or three stable jobbers, which would add materially to the cost of doing business and retard efficient operation.

Responsibility

1. The average jobber inventories between 4,000 and 5,000 items representing many classes of material procured from numerous sources of supply. Aside from the economies effected by reason of bringing material in in carload lots and distributing it in less than carload lots, he also provides another economy in the concentration of representation and responsibility.

2. The jobber stands back of the manufacturer's products. The manufacturer may be a thousand miles away, but the consumer knows that the jobber will "make good" at once.

3. The jobber stands responsible for all his transactions, no matter what products may be concerned, and is near at hand and available for all complaints.

4. Confidence in the jobber and the merchandise he handles saves all classes of buyers the expense of individual investigations and tests.

Cost of Service

1. In addition to the quality of service, the cost of service should also be considered. For an ordinary wiring job, involving from twenty-five to fifty items of merchandise, the jobber can make one shipment, with the result that the transportation cost is small in proportion to the value of the shipment.

2. If it were necessary to have this order shipped by the manufacturers, the number of shipments might, in an extreme case, equal the number of items, and to the user of the material the cost of transportation and of handling would be all out of proportion to the value of the goods.

3. The requirements of the average consumer are so small in any one line as to make it unprofitable for the supplier to furnish all his needs. They might fill his largest orders with profit, but not his "pick-up" or "fill-in" needs. The combination, however, of his purchases of all lines, together with his potential purchasing power, makes the consumer an attractive customer for the jobber. The consumer can obtain an assortment of material along similar lines from the jobbers, thus obtaining deliveries in a more economical and expeditious way.

4. The jobber to a large extent absorbs small orders, reducing at the factories warehousing, shipping and office operations.

Service to Manufacturers

1. The elimination of the jobber would seriously handicap the manufacturer in his operation because of the fact that in the main the jobber discounts his bills and provides the manufacturer with the necessary capital with which to continue his business, whereas, on the other hand, were the manufacturer to sell direct to the dealer, his capital would be tied up for periods from sixty to ninety days, or even longer. This, in turn, would make it necessary for the manufacturer to obtain a greater margin of profit in order to secure a reasonable return on his investment.

2. The jobber directly helps to reduce overhead expenses at the factory as follows: He eliminates all necessity of allowance in manufacturing costs for bad accounts. He reduces the amount of capital needed by carrying slow-paying accounts. He eliminates the expense of a credit department.

3. The existence of the electrical jobber permits the manufacturer to arrange a definite uniform production rate on standard items, resulting in minimum manufacturing costs, a stable factory force and a regular schedule for purchase of raw materials.

4. Among the benefits which the manufacturers derive from the jobbers are purchases in large quantities, with the resultant lower manufacturing costs and expenses; the reduction in the number of accounts handled, and a reduction in the number of salesmen, all of which make for reduction in the accounting and selling expenses.

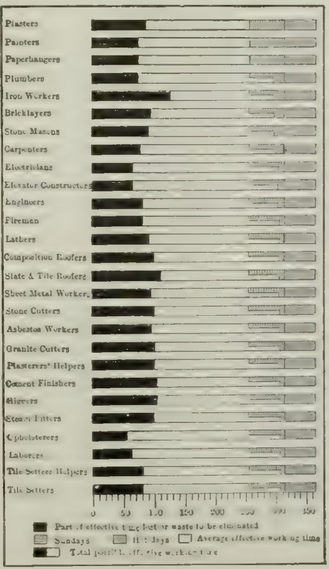
Service of Education

1. The proper and efficient distribution of supplies in a given locality is of course largely dependent upon a thorough understanding of the conditions and requirements of the locality, and here again the jobber functions in a most important service to the industry as well as the public.

2. It is recognized that much of the potential development of the electrical industry can be accomplished through developing retail distribution. The jobber, by personal contact and by intimate knowledge of his territory, is in far better position than the distantly located manufacturer to educate the retailer along lines of better merchandising, selling, advertising and finance.

3. Education in the conduct of the business of the dealer covers all branches of the trade, including service and finance, this education being always directed toward doing business in a businesslike way and assisting the dealer in the proper conduct of his business. Here, again, the personal contact of the jobber is effective, as by such contact the dealer can be educated in proper merchandising.

A Picture of Time Waste in Industry



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Local Trade Needs Selective Development

By a Manufacturer

One of the things that the electrical business needs above all others is the development of more contractor-dealers who are skilled in their work, enterprising and well founded financially, and therefore prosperous. There are many of this kind scattered through the country, but there are many more who are not prospering, and it is time that the manufacturers and jobbers of America realized that it is their responsibility and their job to build up more strong dealers and let more weak ones die.

Here is a picture of the typical situation in a town where there are, say, six contractor-dealers:

A is a small man but a good one. He is a worker. He takes care of his customers. He pays his bills. But he has too little capital and too much competition. He cannot afford to advertise and expand enough to walk away from the others, and so he has to be content with a small share of the business in spite of the fact that he has more real merchandising ability than any other man in town.

B is a good man too, though he is more a wireman than a merchant.

He has come up from helper to wireman to boss through the construction end of the business, and does good work and gets a price that pays a profit. But he has never developed much system or organization. He is a typical small contractor who doesn't push his wiring business as he should and beyond the stock of a few appliances pays little attention to business.

C is a dealer with a dirty, ill-kept store that has no hope of prosperity because its owner has no imagination and no enterprise. He buys all the cheap stuff he can pick up and cuts the price when he gets a chance.

D does both a wiring and an appliance business, dividing his attention between them as the notion strikes him and never pushing either line enough to make it go. He owes a lot of money and wastes much of his time feeding the wolf.

These are the contractor-dealers in this town—these four and two more who are screw-driver electricians pure and simple — and whose fault is it? It is the fault of the manufacturers and the fault of the jobbers. In this town there is one man who could be developed into a successful appliance merchant and one man who could become a prosperous wiring contractor for whom the other four might better be working. But, instead of supporting A as an appliance distributor and helping B to build and broaden out his contracting enterprise, the manufacturers and jobbers whose salesmen are traveling to that town are selling to C and D and the other two and maintaining them in business as competitors of the only pair that are really deserving of encouragement and help. They keep on supplying articles to these "lame ducks," permitting them to get extra time on collections, small-order shipments and sales helps out of all proportion to their merits, without hope or prospect of their ever amounting to anything as an outlet for goods.

The result is that the available business in that town is divided between six instead of two and nobody can make profit enough to really get anywhere. Yet if A and B had all the business between them, they could employ the other four and all their help at better wages and with more security. With the resources combined they would become two real distributors, for they would create business and stimulate sales, and the progress of electrical development in that town would be hastened and prospered.

This is something that the manufacturer and the jobber should think about. It is their fault, and they have got to overcome it, not by waiting for a new generation of dealers or by complaining about things as they are, but by deliberately selecting as their customers the kind of men who have a chance to win. Those are the men to help with credit, stock and publicity. Let us stop propping up the weaklings and keeping them in competition with the men who really deserve support.

Survey of Business Conditions

Optimistic About Future

A canvass of fifteen district sales offices of the Westinghouse Electric & Manufacturing Company at the beginning of September as to the outlook for future months' business showed distinct encouragement. Of the fifteen managers, eleven expressed the opinion, after careful analyses of their territories, that the electrical business would show much improvement during the next twelve months over the preceding period of 1922 and 1921, and the remaining four contended that the electrical business will hold its own.

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Motor Sales in Middle West Show Improvement

Motor sales in Chicago and the Middle West for August and September have been active. Reports from five manufacturers indicate that the rate of sales on small-sized motors has been affected very little by the usual summer slump in trade. Motors under 10 hp. are included in this classification. The best sales were on the 3-hp. to 5-hp. motors, which were sold to manufacturers of unit-drive motorized machinery.

One company tells of a good volume sold for pump and elevator use. The demand for larger sizes has been fair but spotted, depending upon prices and time of delivery. With the cost of labor advanced 10 per cent over that of last January added to the increased cost of raw materials, prices are tending upward and remain firm. Stocks of all companies are good, although those of the smaller sizes are a little spotted.

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Wiring Devices Reported in Healthy Demand

Improving sales of wiring supplies are bettering conditions among manufacturers and distributors of this class of material. The growth of building operations in various parts of the country has stimulated the demand to a volume considerably in excess of last year's. Stocks of finished material which were made up during the spring and summer have been drawn down to some extent, and at present there are enough nearly finished items in hand to make the delivery situation highly satisfactory.

Raw materials are in reasonable supply barring steel, and considerable attention to orders is being paid by manufacturers lest deliveries fall too far behind. Porcelain is being shipped more regularly, and brass is readily obtainable, the proximity of many wiring-device makers to the mills being a favorable factor. Prices of raw material are firm and tend toward higher quotations in steel.

Leading factories are now operating full time, which means about fifty hours per week in Connecticut establishments. More employees have been taken on within the past few months. Export business is looking better, especially for heavy-duty switches. Prices are firm, but manufacturers are apparently trying to increase their present volume of business without stiffening quotations to jobbers. Collections are being very sharply watched, and distributors' trade acceptances are being received more and more by wiring-device producers.

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Manufacturers' Foreign Trade Will Be Expanded

Optimistic answers have been received by the American Manufacturers' Export Association to the inquiry it sent out to its members asking what they found to be the outlook for expansion of business abroad in their several lines of trade. Practically no exception to the general attitude of confidence was found in the numerous replies received.

The Otis Elevator Company, manufacturer of electrically driven elevators, reports as follows: "We can say that whereas the amount of actual new business has been falling off slightly in the last two months, 1922 thus far is ahead of 1921. In addition, indications are, when judged from the number of new inquiries we are receiving daily, that a very satisfactory quantity of new orders should be received before the end of the present year. The inquiries are diversified as to countries, coming from all the South American republics, China and Japan."

"The conclusion to be drawn from letters is that the large volume of orders canceled during 1920 and 1921 is now at last coming on the market, and that the steady effort to push the sale of American-made goods abroad is at last bearing fruit," says a statement issued by the association. "Some of the replies show a surprising volume of business being conducted at the present time."

Prevailing Conditions Affecting Cost and Volume

Bank Clearings.—The volume of bank clearings decreased this week, as compared with that of last week, but the total of $6,175,597,000 at twenty cities in the United States represents a gain of 8.1 per cent over the $5,715,124,000 reported to *Dun's Review* a year ago. A continued loss—15.9 per cent in the present instance—appears in comparison with the figures of 1920, however, the clearings for the same week of that year being $7,343,611,291. Only one of the cities included in the statement reports smaller clearings this week than a year ago, a reduction of 11.4 per cent occurring at Kansas City, Mo. With increases at all other centers, ranging from 1 per cent at Louisville to 39 per cent at Detroit, the current week's clearings at points outside of New York—$2,382,597,000—are 14.8 per cent in excess of the $2,075,424,000 of this period of 1921. At $3,793,000,000 this week's total of New York City is 4.2 per cent larger than the $3,639,700,000 of a year ago.

Failures.—Whereas last week all sections of the United States except the Pacific showed increases, this week all except the Pacific showed decreases in the number of failures reported to R. G. Dun & Company. This week's total was 380, compared with 410 in the previous week and 369 in the corresponding period a year ago.

A decrease was evident also in the number and proportion of the defaults with liabilities of more than $5,000 in each case. This week 214 was the total, which was 56.3 per cent of all for the week, while in the preceding period the corresponding aggregate was 244 and the percentage 59.5. A year ago 203 similar insolvencies were 55 per cent of the total.

Issues Foreign Trade Handbook

A handbook on foreign trade has just been issued by the foreign commerce department of the Chamber of Commerce of the United States. Within the space of thirty-one pages this publication condenses a mine of information as to sources of service in foreign trade. Its alphabetical arrangement makes it a handy reference work for the busy exporter or importer. The book contains also a list of the topics of national importance that are engaging the attention of the National Chamber's foreign commerce department committee under the chairmanship of Willis H. Booth of New York City.

Jobber Sees Advance in Armored Cable Prices

That the present price of armored conductor cannot be held much longer and that quotations will soon be higher is the prediction of a bulletin just issued by the Newark Electrical Supply Company, 223 Market Street, Newark, N. J., to dealers in the Eastern territory.

The bulletin says in part: "There is no question but that the bottom has been reached in so far as prices on the general line of wiring materials is concerned. Prices on copper wire and pipe have already turned upward; some armored cable is sold right now at less than what it cost to manufacture it, and any one who has some money to invest had better buy what cable he may need in the next two or three months, as an increase is sure to be announced in the course of the next week or ten days. The present price for armored cable cannot be held much longer. Prices on appliances as well as radio material are expected to remain firm the rest of the year."

Push Flush Switches Improve

Current sales of push flush switches compared with those of six months ago are improving, according to important manufacturers in the field. No price changes are expected.

A producer in Connecticut says: "Our current sales of push flush switches as compared with those of six months ago show a slight increase. Our deliveries are normal. No price changes have recently been made on this line of material, nor does it look as though there would be any in the near future. The outlook for sales on this line for the next six months is good because of the large volume of new building going on."

Another states: "Deliveries are still normal. There will probably be a slight slowing up of deliveries as the demand continues to increase this fall. Prices have just changed on one or two devices. It is an open question whether other changes will be necessary. We look for a gradual increase in this line of business for at least nine months as a natural result of the increase in building throughout the country."

Better Tone in New England Collections

Jobbers report a very perceptible improvement in collections during September as compared with August, and with increasing sales this fall in virtually all lines of business and industry easier credit conditions are anticipated. Banking conditions are much improved. Railroads purchasing electric material are settling their accounts more promptly than for a long time; central-station payments are satisfactorily regular, and industrial concerns are meeting their obligations more readily. A fair average of fifty-five to sixty days is being reported for settlements in jobbing circles. Collections among contractor-dealers are spotty, according to representative distributors, but some of the delays experienced are due to the absorption of contractors in wiring jobs, business being very active in the building field.

The Metal Market

Domestic Buying Improved—Producers Reluctant to Sell Far Ahead—Surplus Decrease Continues

Buying of domestic copper is improved. Inquiries from the brass and the electrical industry are somewhat better than those from the wire mills. There is considerable demand for shipments into the first quarter of 1923 at present quotations. Producers, however, are reluctant to sell that far ahead at 14 cents, as many now expect an advance of ⅛ to ¼ cent before the end of the year. Because of this long-held price level of 14 cents the trade feels that something is bound to happen soon to vary the situation.

The continued decrease of the copper surplus in this country at an average rate of 30,000,000 lb. monthly has brought down stocks of refined copper to less than 275,000,000 lb., of which between 150,000,000 lb. and 160,000,000 lb. is held by the Copper Export Association. In some quarters it is estimated that sales in September totaled 120,000,000 lb., which brings the total so far this year up to 1,200,000,000 lb. Average sales for the second quarter are put at 163,000,000 lb. monthly, while those during the third quarter show a sharp decline to a monthly average of 120,000,000 lb.

The antimony market remains unchanged. A few isolated parcels can still be had in the outside market at 7 cents a pound, f.o.b. New York.

No new business has been done in manganese lately and none is expected for several months to come. A few cargoes are still on the water and will be subject to the high duty of 1 cent per pound on the manganese contents.

Of all the ores, probably tungsten was the first to feel the effect of the new tariff. Prior to the tariff enactment comparatively little business was done with the actual consumers in either the ore or the ferros. What business has been reported in recent months has been done mostly by importers who were willing to take the risk of the arrival of the material. The tariff, however, being in effect, caused actual consumers to come heavily in the market, and the price for tungsten ore, which but two months ago was $3 per unit, has now reached $7.50 per unit sellers and $7 per unit actually paid.

It is difficult to give any actual price at which ferro tungsten can be bought. Prices ranging from 70 cents to 85 cents per pound are reported, and somewhere between these figures lies the actual market. Tungsten metal powder of a good quality is scarce and is quoted at 90 cents to $1 per pound.

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE electrical market continues its steady increase. Jobbers are buying in conservative amounts and most of them express optimism concerning the coming fall and winter months. Central-station business shows decided improvement over the corresponding period of last year. Poles and line hardware are selling most actively as much repair work and the construction of new lines are being undertaken by power companies. Motors in the smaller sizes are selling actively. Better sales in the hollow-ware field are reported.

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New York

Radio Stocks Very Heavy—Meter Sales Falling Off—Fixtures Sales Are Steady

Business in the electrical industry is steady. Sales of hollow ware are increasing steadily but have not reached the even stride that is expected within a few weeks.

Radio.—Business is reported even. A gradual pick-up is expected before the end of the month. Stocks are very heavy.

Meters.—A falling off in the sale of residential meters is reported this week. Stocks are only fair.

Electric Heaters.—Jobbers are stocking up in anticipation of large sales during November. A slight stiffening in prices is noted.

Fixtures.—All kinds of fixtures are selling steadily. Stocks are heavy and prices firm.

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Chicago

Motor Sales Increasing, with Smaller Sizes Most Popular—Wiring Material Demand Steady

Electrical business for this territory has changed very little, although wiring materials are moving at a constant rate. Manufacturers of high-tension equipment are actively engaged in filling orders.

Wire.—The week's sale of rubber-covered has been active, according to most jobbers. No. 14 sells for $6.25 per 1,000 ft. in lots of 5,000 ft. Stocks are in good shape. Prices on bare and weatherproof wire vary between 16¾ cents and 17 cents per pound.

Flexible Armored Conductor.—A fair call is noted and the No. 14 two-wire, single-strip, is available in 5,000-ft. lots for $48 per 1,000 ft. The supply is good.

High-Tension Equipment.—Manufacturers are reporting active sales. One company disposed of three 33,000-volt, 600-kva. outdoor substations for a utility in the Middle West. A steady sale of high-tension fuses is reported by another firm.

Motors.—Sales on small motors for August and September have been active according to reports from five manufacturers. In most cases the usual summer slump was felt only slightly, but sales in general have been better than some had previously expected.

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Boston

Conduit Prices Firm—Wire Moving Actively—Heater Sales Increasing—Socket Trade Better

New England business is steadily gaining, both industrial and mercantile conditions exhibiting healthy improvement over the summer. Building and engineering contracts for the week ended Sept. 26 totaled $6,335,900 against $4,379,500 a year ago. The textile, leather and paper industries report better trade, and metal-working plants are more active.

Rigid Conduit.—Prices are firm and the recent shortage of smaller sizes has been overcome. It is hard to obtain 2-in. pipe and upward in any quantity.

Wire.—Rubber-covered wire is moving actively, with ample supplies but little opportunity to build up stocks. No. 14 quotes $6.25 per 1,000 ft. in 5,000-ft. lots. Weatherproof is moving slowly but steadily on 17 cents bases. Bare copper wire is very dull, although interest in smaller sizes for radio installations is picking up a little.

Heaters.—Retail sales are extremely active and jobbers' stocks are cut low by recent demand. Factory production is heavy in volume. One manufacturer reports ability to ship occasional carload sales, but stocks are greatly reduced. Some lower-priced units are in the market, but the demand for all reliable makes is so great that competition is scarcely acute.

Sockets.—Trade is better and deliveries excellent. Prices are firm, pulls in case lots being quoted at 32.5 cents net, keys at 18.5 cents and keyless at 17 cents each. Interior wiring is very active in eastern Massachusetts.

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Atlanta

Knobs and Tubes Continue in Heavy Demand—Jobbers' Stocks of Batteries Are Fair

Continued betterment of conditions is noticeable The settlement of the rail strike is in a great measure responsible for the great improvement in the mental attitude, the feeling of uncertainty that was so pronounced a few weeks ago having disappeared.

Porcelain.—Knobs and tubes continue to be in heavy demand, with insufficient stocks to take care of the situation unless rail shipments materially improve.

High-Tension Transformers.—There is a fair demand for the 11,000-volt to 38,000-volt oil-cooled types, with prospects good for an increased market by spring. The larger central-station companies have placed very satisfactory orders for heavy equipment of the higher rating, with prospects for additional purchases of this material in the near future.

Distribution Transformers.—Only a fair volume of business is reported, the general depression which has existed until of late in the rural districts having served to slow down purchases. The small distribution systems have shown little growth throughout last year, but the prospects are bright.

Dry Batteries.—The usual fall movement in this line is to be noted, with rural districts taking a fair quantity of goods. Jobbers' stocks are in good condition, with shipments satisfactory but deliveries slow.

Schedule Material.—Satisfactory sales are reported throughout the entire line, owing to the large number of stores and homes under construction. Sockets are reported particularly good.

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St. Louis

Contractors Increasing Orders—Porcelain Stocks Ample—Lighting Fixtures Active—Portable Lamps Slow

Business in electrical supplies is about 8.8 per cent better than a year ago and about on a level with the preceding months of this year, according to reports obtained by the St. Louis Federal Reserve Bank. There has been a marked improvement in sales of equipment and supplies in the coal-mining section since the settlement of the strike. Contractors are increasing their orders, and all varieties of goods employed in new buildings continue in strong demand.

Porcelain. — Ample stocks are on hand. Prices are tending upward, about 10 per cent higher than a month ago, and some jobbers report slight declines in demand, though general construction work is quite active.

Bell-Ringing Transformers.—Somewhat better demand is reported, but total movement is comparatively small. Prices are steady with stocks conservatively maintained.

Lighting Fixtures. — Exceptionally good business has existed for several months and will probably continue because of the volume of construction under contemplation. Schools, churches, lodge buildings, hospitals and hotels have been heavy buyers. Prices are firm, with increasing tendencies. Industrial fixtures are quiet.

Portable Lamps.— Retail purchasing is not active, but dealers are placing orders for the holiday trade. Stocks have been kept low and present orders are conservative, though it is expected the volume of trade this year will be at least equal to that of last year. Delivery conditions are considered satisfactory.

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Cleveland

Weatherproof Wire Active—Small Heaters Moving Rapidly from Well-Stocked Shelves

Wire.—Weatherproof has been the most active, but orders are few and prices unchanged. No. 14 rubber-covered has experienced a slight increase in demand. Bare wire is inactive. Deliveries are prompt.

Conduit.—A continued shortage of the smaller pipe and an active demand has tended to stiffen quotations. Deliveries are slow.

Flexible Armored Conductor. — A slight increase in demand has lessened stocks a bit, but an abundant supply remains. Prices are firm with fair deliveries.

Motors.—Sales have been active in the smaller type, but no greater than anticipated. Unchanged prices and prompt deliveries indicate a satisfactory supply.

Radio Equipment.—General sluggishness prevails, but jobbers are hopeful that greater interest in radio will result from regulation of broadcasting.

Radiators.—The abrupt precipitation into fall weather has invigorated this market appreciably. The small heaters are moving rapidly but from well-stocked shelves.

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Portland-Seattle

Jobbers Report Business Keeping Up in Splendid Shape—Radio-Equipment Demand Improving

The electrical interests of Tacoma have just concluded a highly successful electrical show, while the Electric Club of Seattle is very busy attending to visitors at its two electrical homes. Work is progressing rapidly on a transmission line about one hundred miles in length between the White River plant of the Puget Sound Power & Light Company at Derringer and Wenatchee, Wash.

Electrical jobbers report that business is keeping up in splendid shape. Demand seems to be very active in all lines and stocks generally are in fair condition with the exception of conduit. Heavy demand and some difficulty in securing shipments have caused quite a serious shortage in the smaller sizes of conduit. An advance in price of about 8 per cent is reported in loom and porcelain. Increasing interest in farm-lighting sets has been reported, also greater activity in air-heater equipment and lamps. The demand for radio equipment is again improving.

Shortage of water power has caused heavy use of steam generation for the past few weeks. Recent rains, however, have relieved the situation somewhat. Generation for the Portland district for the month of September was 15 per cent greater than for September, 1921.

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Salt Lake City

Important Central Stations Planning Immediate Expansions — Vacuum-Cleaner Sales Reported Satisfactory

Important central-station companies are planning immediate extension of power lines and erection of new generating hydro-electric plants. Favorable weather conditions promise the continuation of home building to a date late in autumn.

The trend of wage schedules is upward, with builders and artisans in good demand.

Retail buying shows a 5 per cent increase for the past eight months. The metal market is firm and the price schedules warrant expansion and production up to capacity.

Vacuum Cleaners and Washers.—These appliances are being vigorously advertised, and reports indicate that sales are satisfactory.

San Francisco

Schedule Material Sales Very Active — Rigid Conduit Continues to Advance—Lamps Brisk

Schedule Material.—Sales have never been better, although the higher prices received during the war period may possibly overtop the value of present sales. All schedule stocks are turning over nicely.

Conduit.—Rigid continues to advance. Shipments from the East are very slow and far below necessary allotments. Mill production, it is said, is better, but car shortage is now holding up business, with little prospect of immediate relief.

Rubber-covered Wire.—Local stocks are good.

Lamps.—The new prices effective Oct. 1 were quite unexpected. Fall business is opening briskly. Christmas-tree outfit sales are influenced by exceedingly low foreign competition, principally Japanese. An average eight-light series outfit with continuous socket attachment retails for $3.50.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Mitchell-Rand Company Reports Gradual Improvement

The Mitchell-Rand Manufacturing Company, 18 Vesey Street, New York City, in a bulletin recently issued, states that during the eight months just ended the electrical industry has witnessed a gradual improvement in underlying conditions, marked by an increasing volume of business, without any great change in prices.

Officials of this company are of the opinion that such changes in prices as may occur will be along lines of adjustment to a more reasonable relation between commodities—a narrowing of the so-called "price spread"—rather than any general advance or decline. The bulletin further says:

"The radio situation is following expected lines. Consumer demand has dropped considerably but will come back just as soon as the long days of summer pass and vacations are over. Many manufacturers of radio apparatus are preparing for a much greater volume of business in the coming months than during the season just past."

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Freeman Electric Company Plans Extension to Plant

The Freeman Electric Company, Trenton, N. J., is perfecting plans for extensions in its plant to include a new building on Prince Street and the removal of the present works on East State Street to the new location. Equipment will be provided for the manufacture of switches, metal-jacketed sockets, cut-outs and kindred specialties. Edgar H. Freeman is head of the company.

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Southern Tier Electrical Supply Closes Retail Department

Announcement is made by the Southern Tier Electrical Supply Company, Binghamton, N. Y., that it now sells in wholesale amounts only, having recently closed its retail department. Among the recent changes in the company have been an enlargement of its warehouse and the appointment of a sales representative in Scranton, Pa.

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Westinghouse Makes Numerous Changes in District Offices

Important changes, affecting a number of district offices, have been announced by the Westinghouse Electric & Manufacturing Company. The changes, including the establishment of a merchandising division in many of the offices to co-operate with the new merchandising department established several months ago, have been made to keep pace with increased business and seem to indicate a definite upward trend in business conditions, officials state. The district offices affected by the appointments are New York, Buffalo, San Francisco, St. Louis, Atlanta, Seattle, Chicago and Boston.

The changes affecting the New York

and Buffalo offices have been made for the purpose of furnishing better service to customers in those districts. C. W. Underwood, manager of the Buffalo office, has been appointed Northern representative, with offices in Buffalo. The territory of the Buffalo office has been united with that of the New York office, and A. E. Allen, manager of the New York office, will have charge of the Buffalo office also.

Other changes affecting these two offices include the appointment of W. R. Marshall as branch manager of the Buffalo office, of E. W. Loomis as manager of the industrial division of the New York office, of W. A. Rossell as special power representative of the combined districts and of G. T. Dunklin as manager of the merchandising division of the New York office. The supply and power divisions of the New York office have been merged into the central station division under C. E. Stephens, manager, and the present railway division will in the future be known as the transportation division.

In the San Francisco office the power division is changed to the central-station division and W. P. L'Hommedieu has been appointed manager. Mr. L'Hommedieu will also be responsible for the sale of supply apparatus in the San Francisco district. The railway division has been changed to the transportation division, and E. A. Palmer has been appointed manager. The establishment of a merchandising division, with H. L. Garbutt as manager, has also been announced.

The appointments of S. W. Perry as chief clerk, of W. F. Barnes as manager of the industrial division, of J. S. Warren as manager of the central-station division and of G. F. Leake as manager of the merchandising division make up the changes made in the St. Louis office.

W. L. Southwell has been made manager of the merchandising division of the Atlanta office.

J. W. Robinson, manager of the central-station division of the Chicago office, has also been assigned the general responsibility for the sale of supply apparatus in the Chicago territory, and W. A. Dalrymple has been made district auditor in the Chicago district.

Changes in the Boston office included the establishment of a central-station division, with G. M. Bates as manager and F. L. Nason as assistant manager. A merchandising division has been established in that office with Mr. Nason as acting manager. J. P. Alexander has been appointed manager of the new transportation division in the Boston office.

Joins Sales Staff of Furnace Specialties Company

M. F. King, formerly of the Kings Refractories Company, has joined the sales and service department of the Quigley Furnace Specialties Company, New York City. He will devote his attention to service and sales work in New York City.

Hoover Suction Sweeper Company Holds Sales Convention

The second annual international sales convention of the Hoover Suction Sweeper Company was held last month at North Canton, Ohio. There at the Hoover farm, several miles from city and factory distractions, gathered nearly two hundred of the organization's sales force and officials, representatives from America, Canada, England, Holland and Switzerland. The personnel included sales, advertising, service and engineering officials, district and divisional sales managers, American and foreign, and a number of salesmen who had in the past year exceeded their fixed sales quota and "delivered the blue vase"—symbolic of great achievement—as did "Bill" Peck, celebrated by Peter B. Kyne in his short story "The Go-Getter." Incidentally, this short story had been the inspiration for a sales contest, called the "blue vase contest," which kept these salesmen on the alert all through the spring and summer and finally rewarded them with a trip to the convention.

Hoover Salesman Delivering "The Blue Vase"

The convention site lay in a grove where sleeping quarters were afforded the delegates by means of a number of small tents. Meals were served in a large tent, and another canvas-covered area provided a place for the real business of the conference. In this tent sessions were held both morning and afternoon devoted exclusively to the study of methods designed to increase Hoover sales. Qualified sales instructors and officials led the meetings, and every moment was employed. For an hour or more during the evening special sessions were held in smaller tents adjoining the conference headquarters. Here the sales, engineering, advertising and service departments had exhibits portraying the work of each, and departmental officials were on hand to give the field force a more comprehensive knowledge of the way in which the organization functions.

Recreation and amusement were provided. Baseball and volley-ball held sway following the afternoon meetings. There were bathing and boating in a pool adjoining the camp site. Every effort was put forth to insure the comfort of the delegates. The sleeping tents were cool and roomy, and the beds were comfortable. Ample meals were served. The camp was illuminated by electric light, hot and cold running water was provided, and there were a number of shower baths. There was also a barber shop, and a doctor was in attendance for emergencies. Each day a special convention newspaper gave the delegates a résumé of the convention news.

Much enthusiasm was evinced. For the entire week each man's interest was centered on how to make more sales, and he could not help but gain a more thorough knowledge of successful methods of merchandising his product.

The Hoover company held its first convention of this kind in 1921. That session was so successful that plans were immediately laid to make the 1922 affair as attractive and as fruitful as possible. The Hoover people are confident that material results from this second convention will soon manifest themselves on the sales sheets of the company.

An Offer of Co-operation in Foreign Trade

W. L. Urquhart, export sales manager of the Hart & Hegeman Manufacturing Company, Hartford, Conn., manufacturer of electric switches, sockets and wiring materials, announces that he is able to recommend a manufacturer's representative, an individual who is a resident of Johannesburg, South Africa, and who has had a wide experience in the past seven years in the electrical and allied machinery lines. "He is well known in the trade," says Mr. Urquhart, "and in an endeavor to have him specialize on American electrical supplies and thus obtain more intensive working in the electrical trade in South Africa, we would like to bring this to the general attention of all of the electrical firms which are interested in developing this market.

"This opening is especially advantageous to manufacturers of heater appliances, motor appliances, special instruments, pole-line material, batteries, lighting fixtures, glassware, bells, annunciators, fans and specialties. The manufacturer's representative works only on a commission basis."

Philadelphia Jobber to Have Larger Quarters

In order to take care of its increased business and in anticipation of a larger demand for electrical supplies of all kinds, the Frank H. Stewart Electrical Company, Philadelphia, announces that it has purchased and is remodeling to its needs the property adjoining its present quarters.

Steiner Electric Company Increases Floor Space

The Steiner Electric Company, 115 North Wells Street, Chicago, has increased its floor space about 75 per cent. This was accomplished, declared George S. Steiner to a representative of the *Electrical World*, by obtaining the basement as a storage room for stock and by placing the office upon a newly built balcony. The appliance and radio equipment was then placed in shelves on one side of the store up toward the front in order to facilitate more rapid sales and allow more room for display. The other side remained unchanged and contains regular lines of electrical construction material. Several booths exhibiting electrical fixtures were also constructed.

Mr. Steiner also said that his business for September, 1922, averaged an increase of 20 per cent over September, 1921. He felt that both the radio and open-air-heater business would be active this winter and declared that this was one of his reasons for regrouping these commodities.

Broughton Assumes Charge of Apex-Rotarex Department

H. B. Broughton of the Illinois Electric Company of Chicago has recently arrived in Los Angeles and has taken over the Apex-Rotarex sales department of the Illinois Electric Company of Los Angeles. Mr. Broughton was with the Illinois Electric Company of Chicago from 1913 to 1919, going from there to the Northwest, where he was Apex-Rotarex representative for three years. After that he was with the Chicago company prior to assuming his present duties.

Trump Manufacturing Company to Increase Production

The Trump Manufacturing Company, Springfield, Ohio, manufacturer of turbines, has been granted authority by the Secretary of State of Ohio to increase its capital stock from $125,000 to $200,000, according to an announcement made by John J. Hoppes, the company's president.

This step has been taken, Mr. Hoppes said, to increase the company's facilities for taking care of the large volume of business now being offered and for the purpose of installing machinery to reduce operating costs.

Southwest General Electric to Have Larger Quarters

The Southwest General Electric Company, Dallas, Tex., has awarded a contract for the construction of three additional stories to the three-story brick building which it occupies at 601 North Lamar Street. The cost will be $92,000. The top floor will be fitted up as general offices for the company, which will be moved from present quarters in the Interurban Building to its own building.

Three light and air courts to be provided in the building will provide an outside opening and windows in every office or room in the addition. Passenger elevators will be installed for employees. The three floors and basement of the present building and the two lower floors of the three-story addition will be used for storage room.

International Combustion Firm Gets Large New Property

George E. Learnard, president of the International Combustion Engineering Corporation, New York City, has announced the acquisition of the entire capital stock of the Green Engineering Company, East Chicago, Ind., manufacturer of chain-grate stokers, auxiliary boiler-room equipment and special furnace arches. The stockholders of the Green Engineering Company have taken in exchange 47,000 shares of International Combustion Engineering stock in full payment for all of the stock of their company.

It was stated by Mr. Learnard last week that the taking over of the Green Engineering Company was in line with the general policy which has been pursued by the International Combustion Engineering Corporation since its incorporation of adding other lines and plants to take care of its increasing business so that it would at all times be able to offer and manufacture in its own works all types of automatic stokers or other equipment demanded by the consumers of coal and large producers of electric power.

The works of the Green Engineering Company are within 15 miles of Chicago and are served by all the principal railroads entering that city. The company's plant covers about 12 acres and is equipped with all modern labor-saving machinery, approximately 50 per cent of the entire plant having been built within the last three years. The company's plant and inventory is conservatively valued at slightly under $1,000,000, with more than $500,000 cash on hand and with accounts payable of less than $50,000.

The official announcement adds: "The International Combustion Company has for a long time considered it desirable to have a large manufacturing plant in the Middle West to handle its constantly increasing business in that section of the country. This plant is now greatly needed not only for automatic-stoker business, but also to provide facilities for the manufacture of the equipment used in the rapid growth of the pulverized-fuel department. This plant, owing to its location, will also provide manufacturing facilities for the subsidiaries of the International Engineering Company and will thereby effect greater economies in the operation of its business in America.

"The Green Engineering Company is one of the oldest concerns in the United States manufacturing stoker and boiler-room equipment. P. Albert Poppenhusen, who will remain with the company, has for twenty-five years been the active head of the concern. It is proposed by the company to continue the operation of the Green Engineering Company on an independent basis, and Mr. Poppenhusen, who is closely connected with some of the largest power and public utility developments in the country, will give his entire time to the further development and enlargement of its business. The Green Engineering Company will continue to manufacture the equipment which it has been selling and installing in this country and will add to its present line other apparatus for the economical burning of fuels. This equipment is now being manufactured by the foreign subsidiaries of the International Combustion Engineering Corporation."

The General Electric Company, through its president, Gerard Swope, has announced that a bonus of 5 per cent in cash or securities redeemable in cash will be paid to each employee receiving compensation of $4,000 or less annually who has completed five years or more of continuous service at Jan. 1 or July 1 of each year.

The Abbott-Stuart Sign Company, 2814 Main Street, Dallas, Tex., is planning for the establishment of a new plant for the manufacture of electric signs and operating displays.

Johns-Manville, Inc., New York City, announces that it has been appointed a selling agent by the H. H. Robertson Company, Ambridge, Pa., for the distribution of asbestos-protected metal products.

The Johns-Pratt Company, Hartford, Conn., manufacturer of fuses and protective devices, announces the appointment of G. V. W. Ingham as Eastern sales manager for its electrical division. He will make his headquarters at the New York City office of the company. Mr. Ingham formerly was with the Bryant Electric Company as Eastern sales manager. Prior to that time he was associated with Pass & Seymour, Inc., as Western sales agent.

The Square D Company, Detroit, Mich., manufacturer of safety devices, announces that it has appointed R. J. Parisian as district sales manager in the Cleveland territory. The Cleveland district office serves not only the Cleveland territory, but Pittsburgh, Buffalo and Syracuse territories as well.

The F. S. Pearson Engineering Corporation, Fisk Building, New York City, announces that it has re-established its department for industrial management and technical auditing of industries. This department will be managed by the firm, along with its usual work of financing, developing, design and construction of engineering projects and industrial plants.

The Clark Electric & Manufacturing Company, 24 Vanderbilt Avenue, Brooklyn, N. Y., has disposed of its two-story brass foundry and machine shop, 75 ft. x 100 ft., at 22 Vanderbilt Avenue, equipped for service, to Smith & McCrorken, Inc., which will use the plant for the manufacture of brass, bronze and other metal castings.

Foreign Trade Notes

THE SOCIETA ELETTRICA DEL PIACENTINO, Salerno, Italy, has been organized with a capital stock of 250,000 lire, according to the *Electrical Review*, for the purpose of utilizing the water power of the River Piacentino to generate and distribute electricity.

EXTENSIONS CONTEMPLATED TO ELECTRIC PLANT AT NEWCASTLE, AUSTRALIA.—To meet the increasing demand for electrical service the City Council of Newcastle, New South Wales, Australia, the *Electrician* states, has decided to appropriate £50,000 for extensions and improvements to the municipal electric plant and system.

AUTOMATIC TELEPHONE EXCHANGES TO BE INSTALLED IN STOKE-ON-TRENT, ENGLAND.—Decision has been reached, according to *Commerce Reports*, to replace the present system of manual telephone exchanges in the Stoke-on-Trent area with those of automatic type, the substitution to be completed by April 1, 1925. The cost is estimated at between £50,000 and £80,000.

EXTENSION TO ELECTRIC SERVICE IN AUCKLAND, NEW ZEALAND.—The ratepayers have voted, *Commerce Reports* states, to extend the Electric Power Board's service through the outlying districts. To install this service it is proposed to raise a loan of £600,000, part of the proceeds to be used in defraying the consumers' expenses in installing the system.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Equipment is desired in Switzerland (No. 3,726) for hydro-electric power plants, including turbines, electrical equipment and especially high-pressure steel pipes.

The purchase of fiber conduits is desired in Norway (No. 3,745).

Telephone equipment is desired in Spain (No. 3,765) for installation in offices and dwellings.

An agency is desired in Australia (No. 3,781) for wireless telephones, new ideas in electrical and motor car fittings, etc.

Telephone posts, wooden crossheads for telephone posts, pins and aërial telephone wires are desired in the Canary Islands (No. 3,784).

The purchase of electric washers is desired in Canada (No. 3,788).

The purchase and sole agency is desired in India (No. 3,789) of electrical fittings and fans, etc.

An agency is desired in Lithuania (No. 3,790) for electrical equipment for power stations.

Telephone and telegraph material, including telephones, bells, wire, insulators, nails, cross-arms, etc., is desired in Mexico (No. 3,792).

The purchase and agency is desired in Canada (No. 3,793) of electrically driven ice-cream freezers of 10 gal. to 20 gal. capacity and also of necessities and specialties which are used in the manufacture of ice cream.

Purchase is desired in England (No. 3,799) of electrical porcelains of the highest quality, high and low tension, which are especially manufactured to drawings or samples.

CONTRACT APPROVED FOR CARTAGENA (COLOMBIA) ELECTRIC PLANT.—The Municipal Council of Cartagena, according to *Commerce Reports*, has approved the bases for a contract with the Cartagena Water Works, Ltd., for extension of the water system and the construction of an electric light plant in connection with the proposed reservoir. The municipality reserves the right to purchase the waterworks system and electric plant.

CONCESSION FOR AN ELECTRIC PLANT IN CUBA.—The Secretary of Public Works of the Cuban government, by decree No. 1,285, dated Sept. 11, 1922, *Commerce Reports* states, has authorized the construction of an electric plant at Taguasco, in the Province of Santa Clara. All details may be obtained from the concessionnaire, whose name will be furnished to American firms interested in submitting offers for this work by the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C.

HYDRO-ELECTRIC SCHEME PROPOSED FOR TAUMARUNUI, NEW ZEALAND.—Arrangements have been made by the Borough Council of Taumarunui, according to the *Electrical Review*, for a loan of £47,000 for a municipal hydro-electric project. The plans provide for 18,000 hp.

TURBO-GENERATOR FOR MONTEVIDEO, URUGUAY.—Tenders will be received by the State Electricity Department, Montevideo, Uruguay, until Nov. 11, the *Electrical Review* states, for one 10,000-kw. turbo-generator. Bids will also be received until Nov. 4 for 66,000 m. of high-tension cable and accessories.

ELECTRIC EQUIPMENT FOR MANFALOUT, AFRICA.—Tenders will be received by the Director of Technical Service, Section of Municipalities and Local Commissions, Savoy House, Cairo, Africa, until Nov. 15, according to the *Electrician*, for equipment for generating station and distribution system.

New Apparatus and Publications

SCHOOL LIGHTING.—The engineering department of the Holophane Glass Company, New York City, has issued a thirty-six-page illustrated booklet entitled "Modern School Lighting."

DEVICES FOR CEILING LIGHTS.—Pass & Seymour, Inc., Solvay, N. Y., are placing on the market three devices for use with ceiling lights, ceiling bands and in fact any standard or special unit. They fit the standard 1½-in. throat of the ceiling units and provide individual control.

CLAY PRODUCTS.—Industrial Publications, Inc., 407 South Dearborn Street, Chicago, has published the 1922 "Clay Products Cyclopedia." The book consists of two main parts, the first containing information on definitions and statistics, and the second catalog pages of the manufacturers of equipment.

GRAPHIC WATTMETERS.—The Esterline-Angus Company, Indianapolis, Ind., has issued bulletin 722, describing graphic wattmeter checks.

PLATING APPARATUS.—The U. S. Galvanizing & Plating Equipment Corporation, Brooklyn, N. Y., has issued bulletins on plating apparatus.

RECTIFIER SET.—The Mueller Electric Company, Cleveland, has issued a pamphlet describing a rectifier set.

VACUUM HEATING PUMP.—The Nash Engineering Company, South Norwalk, Conn., has issued bulletin 25, describing the Jennings Hytor vacuum heating pump, size M, electrically driven.

COMMUTATOR LATHE.—George Bender, 122 Center Street, New York City, is introducing a new commutator lathe for turning commutators of motors and dynamos.

OPEN FEED-WATER HEATERS.—The H. S. B. W. Cochrane Corporation, Philadelphia, has issued a combined catalog describing its various lines of open feed-water heaters, V-notch meters, metering heaters, flow meters for fluids in pipes, water softeners, including both hot process and cold process, pressure filters, back-pressure valves, steam and oil separators and drainers or traps.

PORTABLE POWER STAND.—A new portable power stand has been developed by the Westinghouse Electric & Manufacturing Company to supply motive power for the various appliances found in every-day use on farms and in stores, garages and small machine shops.

New Incorporations

THE LIBERTY LIGHT & WATER COMPANY, Roanoke, Va., has been incorporated with a capital stock of $100,000. The officers are M. C. Hughson, president, and F. M. Hughson, secretary.

THE SAYBROOK LIGHT, POWER & WATER COMPANY, Ashtabula, Ohio, has been incorporated with a capital stock of $10,000 by J. P. Dodge, L. Heath, E. D. Richards, Max E. Fros and C. R. Busse.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

ELIOT, ME.—The Public Utilities Commission has authorized the Kittery Electric Light Company to extend its transmission lines in the town of Eliot.

WHITINGHAM, VT.—The New England Power Company, Worcester, Mass., has awarded contract for construction of its power station at Whitingham to the L. H Shattuck Company, Manchester, N. H. The station will have a capacity of 45,000 kva.

LOWELL, MASS.—The contract for the construction of a new power house for the Hamilton Manufacturing Company has been awarded to the William T. Reed Company.

WATERTOWN, MASS.—The Edison Electric Illuminating Company will erect a substation on Spring Street, to cost about $22,000.

WINCHENDON, MASS.—William K. Brown & Son, 420 Central Street, will build a one-story power house at their local factory, 36 ft. x 50 ft .

OAKLAND BEACH, R. I.—The installation of a new lighting system at Oakland Beach, to cost about $15,000, is under consideration. The plans call for 100 standards mounted with five-lamp clusters.

WOODMONT, CONN.—The United Illuminating Company, New Haven, has been awarded a contract for lighting the streets of the borough with electricity. The contract calls for eighty-six lamps, which will replace the gas lamps now in use.

Middle Atlantic States

BUFFALO, N. Y.—The Chevrolet Motor Car Company, Detroit, will build a power house in connection with its proposed local plant, to cost about $600,000.

BUFFALO, N. Y.—A new street-lighting system will be installed on Walden Avenue.

BROOKLYN, N. Y.—The Superior Ice Company, 50 East Forty-second Street, New York, will construct an ice-manufacturing plant at Avenue Z, Sheepshead Bay, to cost about $250,000. The plant will be equipped throughout with electrically operated machinery. Waldemar Mortensen, 209 West Seventy-sixth Street, New York, is engineer.

CREEDMOOR, N. Y.—Bids will be received by the State Hospital Commission, 25 Broadway, New York City, until Oct. 31, for construction of central lighting and heating plant, kitchen and dining-room building, buildings for chronic patients (north and south) and tunnels at the Creedmoor division of the Brooklyn State Hospital, Creedmoor (post office address Jamaica). L. M. Farrington is secretary of commission.

LONG ISLAND CITY, N. Y.—The National Sugar Refining Company will build a one-story power-house addition, 24 ft. x 52 ft., at its local plant.

MADRID, N. Y.—The St. Lawrence Transmission Company, Potsdam, which recently purchased the system of the Madrid Electric Light Company, is reported to be contemplating erecting a transmission line from Madrid to Waddington, a distance of 8 miles, to supply electrical service there.

NEW YORK, N. Y.—The Long Island Railroad Company is preparing tentative plans for the electrification of its Montauk Division to Babylon, to include substations, feeder lines and additional power-plant equipment.

RENSSELAER, N. Y.—The Albany Southern Railroad & Power Company will install a new street-lighting system on lower Broadway, maintained by underground wires.

TUPPER LAKE, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 11 for erection of buildings at the United States Veterans' Bureau Hospital, Tupper Lake, including electric light and power system, telephones and call bells

BERNARDSVILLE, N. J. — The New Jersey Power & Light Company will install a new lighting system on the Boulevard Road, from Prospect Street to Simpson's Corner, Basking Ridge.

CLIFTON, N. J.—A power house will be constructed by Cupra, Inc., at its proposed artificial silk-manufacturing plant, to cost about $100,000. The Technical Advisory Corporation, 132 Nassau Street, New York, is architect and engineer.

JERSEY CITY, N. J.—The Public Service Corporation will build a one-story switch house at its power plant, foot of Duffield Avenue, to cost about $40,000.

LAMBERTVILLE, N. J.—The Merchants' Association is negotiating with the Eureka Power Company for the extension of its lines from New Hope to Lambertville to furnish electrical service here.

RAHWAY, N. J.—The Council has appointed a committee to secure estimates of cost of a municipal lighting plant.

TRENTON, N. J.—The board of directors of the Mercer Hospital have authorized the construction of a new power house, 50 ft. x 35 ft., and laundry building, 100 ft. x 35 ft.

ALLENTOWN, PA. — The Pennsylvania Power & Light Company has arranged for a bond issue of $7,000,000, the proceeds to be used for the acquisition of electric companies at Williamsport, Montoursville, Lock Haven and vicinity and for extensions and improvements to the power plants and systems. It is proposed to double the capacity of the generating plant at Lock Haven.

ALTOONA, PA. — The Bell Telephone Company, Philadelphia, is planning to erect a business block at Twelfth Avenue and Sixteenth Street, to cost about $1,000,000.

JOHNSTOWN, PA.—The Clarion River Power Company has been granted permission to construct a hydro-electric plant on the Clarion River, near Piney Creek. It will have a capacity of 22,000 hp. and will cost about $300,000, with transmission line.

LANDISBURG, PA.—Arrangements are being made to consolidate the Sherman Valley, Landisburg and Spring Township Electric Companies under the name of the Sherman Valley Electric Company. Extensions will be made to the transmission and distributing lines.

PHILADELPHIA, PA.—The Philadelphia Suburban Gas & Electric Company has arranged for an issue of $400,000 in capital stock, part of the proceeds to be used for extensions and improvements.

PITCAIRN, PA.—The Pennsylvania Railroad Company contemplates the construction of a power house in connection with its proposed new local car shops, to cost about $500,000.

PITTSBURGH, PA.—Contracts have been awarded by the West Power Company for an extension to the Springdale power plant on the Allegheny River, about 15 miles above Pittsburgh, and for other improvements, totaling about $15,000,000. Two turbo-generators of 35,000 kw. each will be installed and a steel-tower transmission line, carrying two 132,000-volt circuits, will be erected from Springdale to Charleroi.

PITTSBURGH, PA.—The Duquesne Light Company contemplates the erection of a new plant at 1305-7 Sarah Street, to cost about $35,000.

WAYNESBORO, PA. — Plans are under consideration to install a new ornamental lighting system on Main Street to replace the cluster lamps now in use. It is proposed to erect forty standards mounted with single lamps.

WILLIAMSPORT, PA.—The Pennsylvania Power & Light Company is reported to have completed arrangements for the purchase of the Williamsport Electric Company, the Lycoming-Edison Company of Williamsport, the Jersey Shore (Pa.) Electric Company and the Jersey Shore (Pa.) Street Railway Company. Plans are under way for extensive additions in the present power plants, with system connection with the purchasing company's lines. The Pennsylvania company has also acquired the Lock Haven Light & Power Company, Lock Haven, and is said to be negotiating for the purchase of the Montgomery and Muncy electric light and power companies.

NORRISVILLE, MD.—The Deer Creek Water & Power Company has been granted permission by the Public Service Commission to extend its transmission line to Norrisville to furnish electrical service here.

WILLIAMSON, W. VA.—The Pond Creek Coal Company, recently organized with a capital stock of $500,000, contemplates the installation of hoisting and mining machinery, power equipment, etc.

CLIFTON FORGE, VA. — Surveys are being made by the Virginia-Western Power Company, Clifton Forge, for a hydro-electric plant on the James River, near Balcony Falls, to cost about $250,000.

NORFOLK, VA. — The Scott Terminal Corporation, 121 Bank Street, contemplates the construction of a power house in connection with proposed piers, warehouses and terminals in the Newton Park section. An ice-manufacturing and cold-storage plant will also be installed.

North Central States

DETROIT, MICH.—Bids will be received by Donaldson & Meier, architects, Penobscot Building, until Oct. 10 for construction of six seminary buildings, power plant, with smokestack, three boilers, feed pumps, incinerator, coal bunkers, etc., on Chicago Boulevard, for the Sacred Heart Seminary. M. J. Gallagher, 1219 Washington Boulevard, is rector.

CINCINNATI, OHIO. — The Chevrolet Motor Car Company, Detroit, will build a power house in connection with its proposed plant to be erected in the Norwood section, to cost about $400,000.

CLEVELAND, OHIO.—Bids will be received by the commissioner of purchases and supplies, City Hall, until Oct. 13 for steam blower equipment. Bids will also be received until Oct. 13 for electric motors.

LORAIN, OHIO.—The Ohio Public Service Company has issued $3,625,600 in capital stock, part of the proceeds to be used for extensions and improvements.

MIDDLEPORT, OHIO.—The Middleport Electric Company is erecting an electric transmission line into the Pomeroy Bend field.

MINERVA, OHIO. — The Owen China Company plans the construction of a power house in connection with its proposed local pottery, to cost $175,000.

LOUISVILLE, KY. — Negotiations are under way between the Board of Public Works and the officials of the Louisville Gas & Electric Company relative to extending the lighting system to the suburbs of the city, including the newly annexed territory. The plans call for ornamental standards maintained by underground wires.

WHICK, KY.—The Noble Coal & Lumber Company, recently organized, will install a power house at its local coal properties.

BLOOMINGTON, IND.—An electric plant and electrically operated pumps will be installed in connection with the proposed new waterworks system, to cost about $1,000,000.

BROAD RIPPLE, IND. — The town of Broad Ripple has applied to the Public Service Commission for permission to issue $10,000 in bonds for the installation of an electric lighting system.

CLINTON, IND. — The Wabash Valley Electric Company contemplates extensions and improvements, to cost about $50,000.

CRAWFORDSVILLE, IND.—Extensions are contemplated to the municipal electric light plant, including the installation of a 3,000-kw. turbine, one service condenser and auxiliary, one 750-hp. water-tube boiler, mechanical stoker, one 35-kw. exciter, one 5,000-hp. heater, one coal-way lorry and piping.

MISHAWAKA, IND.—The Farmers' Light & Power Company, now being organized at Mishawaka to supply electricity for lamps and motors to surrounding farms and outlying farms, has been granted permission by the Board of Public Works to attach feed wires to the Spring Street line. The company will be capitalized at $10,000. Joseph Soens, Victor Shalloi and George Chandler, all of Mishawaka, are incorporators.

OAKLAND, IND. — The White Valley Power Company, a subsidiary of the Indiana Power Company, has acquired the property of the Oakland City Light & Power Company, and which will be merged with its system. Extensions and improvements are planned. Negotiations are under way for the purchase of the system of the Princeton (Ind.) Light & Power Company. A new transmission line will be erected from the Edwardsport central station.

BATAVIA, ILL.—Steps have been taken by the City Council to purchase electricity instead of generating it at the municipal electric power plant.

CHICAGO, ILL. — The Commonwealth Edison Company will erect a one-story substation, 33 ft. x 44 ft., at 50 East Lake Street.

EAST ST. LOUIS, ILL.—The installation of an ornamental lighting system in downtown section of the city, to cost about $27,000, is under consideration by the City Council.

GREEN BAY, WIS. — Bids are being asked by Foeller & Schoeber, Architects, Nicollet Building, for a dairy and power boiler house for the Fairmont Creamery Company, to cost about $60,000.

MILWAUKEE, WIS. — The Milwaukee Electric Railway & Light Company has applied to the Railroad Commission for permission to extend its electric railway on the Port Washington Road from the city limits to Lincoln Park.

STURGEON BAY, WIS.—Plans are under consideration for the installation of an ornamental lighting system in the business district, to cost about $25,000. The plans call for concrete posts mounted with a 400-watt lamp.

CARUTHERSVILLE, MO. — Plans are under consideration by the City Council for rebuilding the municipal electric power plant and ice-manufacturing factory, recently destroyed by fire.

MILAN, MO.—Plans are being prepared for extensions and improvements to the municipal electric plant, to cost about $16,000.

PARIS, MO. — Extensions and improvements to the municipal electric plant are under consideration.

LANGFORD, S. D.—Bonds to the amount of $23,500 have been sold, the proceeds to be used for the construction of a municipal electric light plant.

PIERPONT, S. D.—Bonds to the amount of $17,500 have been issued for the construction of a municipal electric light plant.

STUART, NEB.—Plans have been completed for a municipal electric light and power plant.

Southern States

HENDERSONVILLE, N. C.—Work has begun on the erection of a transmission line into the city under provisions of a franchise granted the Blue Ridge Power Company. The proposed line will extend from the hydro-electric plant of the company on Green River to Hendersonville, a distance of 7 miles.

SOUTHERN PINES, N. C.—The Sandhills Power Company plans to install a lighting system in the Weymouth Heights section.

WINSTON-SALEM, N. C.—The Westover Park Co., Inc., will install an electric lighting system in the Westover Park section. G. F. Hinshaw is engineer.

COLUMBUS, GA.—The Columbus Electric & Power Company has begun work on raising the voltage of its transmission lines between Goat Rock and Newnan. Material, it is understood, has already been purchased. The coat is estimated at $150,000.

NEW SMYRNA, FLA. — The Volusia Cypress Company plans to build a power house at its proposed new lumber mill, to cost about $100,000.

KINGSPORT, TENN.—The Mead Fiber Company contemplates the construction of a power house in connection with proposed plant additions, to cost about $750,000.

GORDO, ALA.—Plans are being prepared for the installation of a municipal electric plant, for which bids will soon be asked.

LITTLE ROCK, ARK.—Plans are being prepared by the Caddo Power & Irrigation Company for the construction of two hydro-electric power plants on the Ouachita River, near Hot Springs. The first plant will be located about 5 miles from the city and will cost about $3,000,000, including equipment. The second station will be located at Blanchard Springs and will cost about $5,000,000. The combined capacity of the two plants will be about 100,000 hp.

FRANKLIN, LA.—The installation of new machinery in the municipal electric plant is under consideration.

COLLINSVILLE, OKLA.—Extensions to the ornamental street-lighting system are under consideration.

DUNCAN, OKLA.—At a special election to be held in October a proposal to issue $800,000 in bonds will be submitted to the voters, of which $200,000 will be used for a municipal electric plant and distributing system.

OILTON, OKLA.—The Oklahoma Gas & Electric Company contemplates extensions to its local power plant.

SAPULPA, OKLA.—Plans are being prepared for the installation of an ornamental lighting system in the business district. Tentative plans provide for eighty lamp standards.

TULSA, OKLA.—The Oklahoma Power Company will double the capacity of its generating plant at West Tulsa.

DALLAS, TEX.—The Dallas Power & Light Company has been authorized by the City Commission to install 250 additional street lamps, to be erected in various parts of the city as needed within the next twelve months.

DEWEYVILLE, TEX. — The Peavy-Moore Lumber Company plans to rebuild its lumber mill and power house, recently destroyed by fire, causing a loss of about $200,000, including equipment.

FORT WORTH, TEX.—An electrically operated pumping plant will be installed in connection with the new sewage-disposal plant to be built by the city at a cost of $750,000.

HOUSTON, TEX.—The Armstrong Steel Company, Fort Worth, plans to build a power plant in connection with its proposed new local mills, to cost about $1,000,000.

TULIA, TEX.—Extensions and improvements to the municipal electric plant are under consideration.

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Pacific and Mountain States

SEATTLE, WASH.—The installation of a lighting system on Stewart Street, between Westlake and Eastlake Avenues, has been approved by the Council.

SEATTLE, WASH. — The Puget Sound Power Company has been granted permission by the Federal Power Commission to construct two hydro-electric plants on the Sultan River, including transmission system.

TACOMA, WASH.—The Council has approved the installation of an ornamental lighting system on North Cedar and South G Streets and vicinity.

EUGENE, ORE.—The installation of a third electric generating unit at the municipal electric plant at Walterville is under consideration. The work will include an extension to the power house, widening canal and the installation of a new turbine and generator. The cost is estimated at about $120,000.

EAGLE ROCK, CAL.—Negotiations are under way with the Southern California Edison Company for the installation of a street-lighting system, to cost about $129,000.

FRESNO, CAL.—The Madera Sugar Pine Company is reported to be planning to rebuild its lumber plant, including power house, recently destroyed by fire. The loss estimated at about $1,500,000.

LOS ANGELES, CAL.—The Council has authorized the installation of an ornamental lighting system on Fourteenth and San Pedro Streets, Pacific and Hamilton Avenues and other thoroughfares.

LOS ANGELES, CAL.—The Little Rock Power & Water Company has been granted permission by the Federal Power Commission to construct a hydro-electric plants on Little Rock Creek, to cost about $300,000.

SAN BERNARDINO, CAL.—The Santa Fé Railway Company has awarded a general contract to the Lynch-Cannon Construction Company, Chapman Building, Los Angeles, for the construction of a power house at its local shops, to cost about $80,000.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 24 for 100,000 ft. of bell wire for use at the Mare Island Navy Yard. (Schedule 187.)

SAN FRANCISCO, CAL.—The California-Oregon Power Company has been granted permission by the Federal Power Commission to construct hydro-electric plants on the Klamath River to develop 120,000 hp. The cost, including transmission system, is estimated at $7,000,000.

SALT LAKE CITY, UTAH.—The Federal Power Commission has granted the Utah Power & Light Company permission to erect a hydro-electric plant on Bear River, a few miles above its Grace plant. The project includes a dam, 250 ft. long, and a power station equipped with two generating units of 10,500 hp. each. The plant will be connected with the existing transmission system by a 130,000-volt transmission line.

CHANDLER, ARIZ.—The installation of a complete lighting system is under consideration by the Town Council.

PHOENIX, ARIZ. — The Southwestern Portland Cement Company, El Paso, Tex., will build a power plant in connection with its proposed new local cement mill, to cost about $1,000,000.

FROID, MONT.—Plans are under consideration for rebuilding the municipal electric plant, recently destroyed by fire.

HOPE, N. M.—Surveys are being made for the installation of a municipal electric light and power plant and waterworks system. F. L. Hancock, Denver, Col., is consulting engineer.

◆

Canada

EDMONTON, ALTA. — By-laws providing $55,000 for extensions to the municipal electric plant and $250,000 for telephone extensions, it is understood, will soon be submitted to the ratepayers. C. E. K. Cox is city clerk.

NELSON, B. C.—Extensions to the municipal electric light and power system, to cost about $15,000, are under consideration.

CAPREOL, ONT. — The Hydro-Electric Power Commission contemplates developing the rapids in the Vermilion River, north of Green Lake, to supply electricity in Capreol. It is estimated that about 700 hp. can be developed.

STEVENSVILLE, ONT.—The installation of an electric lighting system in Stevensville is under consideration by the Bertie Township Council. J. L. Burgar is engineer.

THOROLD, ONT.—The Town Council has authorized the installation of electric lamps on King Street.

WINDSOR, ONT.—The installation of a combined fire-alarm and police-signal system, to cost about $35,000, is under consideration.

YORK, ONT.—The Township Council is considering the installation of an improved lighting system in the Fairbanks district, for which an estimate of cost will be secured from the Hydro-Electric Power Commission of Ontario.

Electrical Patents

Announced by U. S. Patent Office

(Issued Sept. 19, 1922)

14,457 (reissue). Electric Storage Battery; M. Lechner, New York, N. Y. App. for reissue filed Aug. 31, 1921. Plates on supports that prevent short-circuiting with accumulation of sediment.

1,429,217. Warning Signal; E. Aufiero. Brooklyn, N. Y. App. filed June 27, 1921. Motor-operated vibrating horn.

1,429,227. Variable Condenser; W. Dubilier, New York, N. Y. App. filed Sept. 28, 1921. Variable condenser combined and operated with fixed condenser.

1,429,240. Radio Signaling System; E. C. Hanson, Washington, D. C., and E. T. Jones, New Orleans, La. App. filed Feb. 24, 1920. Underground antenna system.

1,429,241. Telephone System; J. F. Hayden, High Point, N. C. App. filed Feb. 12, 1917. Instantaneous disconnect and recall, automatic ringing and listening, etc.

1,429,243. Electric Signaling System; S. B. Hess, Jamaica, N. Y. App. filed Jan. 21, 1918. Fire-alarm system for group of buildings.

1,429,247. Electric Lock and Alarm for Automobiles; S. L. Mathews, St. Louis, Mo. App. filed Feb. 26, 1918.

1,429,248. Multiplex Signaling System; H. S. Osborne, New York, N. Y. App. filed July 28, 1919. Application of carrier currents for transmitting signals.

1,429,261. Flashlight or Battery Hand Lamp; A. W. Wellington, Waterbury, Conn. App. filed May 14, 1921. Metal cap closing lower end permanently insulated from the battery.

1,429,286. Electric Furnace; C. I. Hayes, Edgewood, R. I. App. filed March 2, 1921. Adapted for heat-treating metal articles such as jewelry, etc.

1,429,300. Negative Plate for Electric Accumulators and the Manufacture Thereof; A. Pouchain, Turin, Italy. App. filed June 22, 1920. For reducing electrochemical action on the borders of negative plates.

1,429,329. Attachment for Spark Plugs; S. Donaldson, Carnegie, Pa. App. filed April 1, 1921. Spark intensifier.

1,429,330. Process of Recovering Zinc from Complex Ores; J. T. Ellsworth, Park City, Utah. App. filed July 12, 1921. By electrolysis.

1,429,369. Attaching Device; W. M. Parker, Parkersburg, W. Va. App. filed Jan. 8, 1915. Nail or screw through knobs pinched to prevent separation.

1,429,381. Electrical Apparatus; T. W. Varley, New York, N. Y. App. filed July 24, 1918. Voltage control of axle-driven generators.

1,429,397. Hand Warmer; J. C. Barrow, Philadelphia, Pa. App. filed Aug. 13, 1921. Electric heater placed on steering wheels.

1,429,402. Electric Heater; A. A. Buck. Zurich, Switzerland. App. filed Aug. 6 1917. Resistance wire interlaced in fabric material.

1,429,438. Electroplating Apparatus; F. R. Klaus and H. W. Kranz, Cleveland, Ohio. App. filed Nov. 6, 1919. Single device for cleansing, pickling, plating, washing and drying sheet-metal tire rims.

1,429,441. Method of Making Electric Conductors; J. Lind, Kansas City, Mo. App. filed April 25, 1921. Aluminum wire insulated by being heated, then quenched in oxiding bath.

1,429,443. Therapeutic Device; H. D. McFaddin, East Orange, N. J. App. filed Feb. 15, 1919. Flexible mounted cluster of lamps for subcutaneous treatment of the body.

1,429,453. Inductance Device; H. J. Power, Somerville, Mass. App. filed March 11, 1918. Spiral inductance coil for radio work.

1,429,489. Electric Furnace; M. S. Clawson, Upper Montclair, N. J. App. filed July 13, 1920. Crucibles secured between pairs of electrodes, each pair connected to one phase of circuit.

1,429,497. Method and Apparatus for Detecting, Measuring and Utilizing Low-Frequency Impulses; R. A. Fessenden, Brookline, Mass. App. filed June 6, 1917. For detecting submarines.

1,429,572. Circuit Receiver; H. J. J. M. de Bellescize, France. App. filed Aug. 14, 1918. Receiver for wireless telegraphy comprising condenser, a closed circuit including a coil and an indicating device.

1,429,601. Electric Pocket Lamp with Mechanical Electric Generator; A. Luzy, Paris, France. App. filed May 7, 1918.

1,429,602. Base for Incandescent Lamps; F. W. Lyle, Toronto, Ont., Can. App. filed July 15, 1918. Miniature lamp bulb and socket.

1,429,634. Telephonic Repeater; C. Robinson, Reigate, and R. M. Chamney, London, England. App. filed Nov. 18, 1919. Transformer type comprising two sets of speaking-line windings, an input and an output winding.

1,429,660. Thermal Relay; L. E. Warner, Berkeley, Cal. App. filed Feb. 1, 1918. Operated by current generated within the relay.

1,429,668. Fire-Alarm Box; R. Zakrzewski and K. Sulek, Thorpe, W. Va. App filed Oct. 22, 1921. Holds arm of person turning in alarm.

1,429,693. Electric Clock; L. Pillion, Dijon, France. App. filed Aug. 26, 1920. Secondary electric clock comprising a series of rotary prisms on faces of which hours are indicated.

1,429,735. Electric Water Heater; M. W. Hornsby, New York, N. Y. App. filed Feb. 19, 1921. Automatic heater composed of carbon electrodes with water completing circuit.

1,429,799. Electric Heater for Steering Wheels; E. S. Tesdell, Des Moines, Iowa. App. filed Nov. 15, 1920.

1,429,830. Storage-Battery Electrolyte; R. E. Banks, Washington, D.C. App. filed June 2, 1922. Contains iron, aluminum and copper sulphates, sulphuric acid and water.

1,429,840. Damping Device for Electrical Instruments; H. B. Brown, Rochester, N. Y. App. filed Nov. 16, 1921. Magnet coil automatically short-circuiting when instrument is handled.

1,429,858. Rheostat; E. C. Fasoldt, Albany, N. Y. App. filed April 7, 1922. Vacuum-tube-filament rheostat.

1,429,865. Pressing Machine; S. Friedman, Atlanta, Ga. App. filed April 8, 1920. Water pipe in pressing boards surrounded by heating coils.

1,429,880. Creasing Iron; F. G. Hofmann, New York, N. Y. App. filed April 2, 1921. Iron electrically heated for marking grooves on leather articles.

1,429,898. Electric Heater; B. W. Macy Jacksonville, Fla. App. filed Nov. 6, 1920. Resistance coil placed in fat for frying dougnuts, etc.

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The Work and Tools at Hand

WE IN the electrical industry have lived our short and active lives in an age of inspiration. We have dreamed great dreams. We have planned vast plans. We have organized. We have formed into groups and associations of groups. We have painted broad panoramas of alluring opportunities. We have proclaimed far-reaching purposes. We have thought much of the future. But all that we have really done has been the product of hard work and thinking.

Ambition clamors for big achievements. The meager proportions of one day's work fail to excite enthusiasm. Yet this is, after all, the unit out of which every great structure has been fabricated. It marks the steps by which all projects are attained, all visions realized. The world has been built with the tools that men have held in their hands at the time when each job was done. Progress has been evolved by doing little things, one at a time.

WE TURN now to an age of action. We have written our specifications for future development—embracing great superpower systems and universal electrification. We are facing to the front. But we stand here all of us, today, in the middle of the hot and dusty road, burdened with excess capacity and heavy overhead and in dire need of business. And all the talking, all the planning, all the organizing in the world will not get business and build the future except as we lay good bricks of daily work with the tools now here at hand.

What shall we do? Why — electrical manufacturers, jobbers, central-station men, contractors and dealers live and work in towns and cities. In these communities are homes and stores and offices and factories. In every thousand of these homes today 280 are without electric flat irons, 888 need toasters and 947 percolators, 640 fans, 870 air heaters, 640 vacuum cleaners, 705 clothes washers, 988 ironing machines, 989 dishwashers, 952 sewing-machine motors, 984 ranges and 994 electric refrigerators must be sold before they are all equipped.

In these communities, too, 91 per cent of the grocery stores need better light and 70 per cent of the drug stores and so on. In fact, seven out of every ten stores in every town are underlighted and offer business to the electrical man. Moreover, the electrical equipment of offices, the motorization of industry, the use of electric heat for factory processes and of electric transportation is so underdeveloped that every man of us is literally hemmed in and overwhelmed by waiting market and prospective customers. Here we must make of daily work the bricks with which we will construct that glorious future which we talk about.

DAYS' work—that's what we need right now in the electrical industry—more full days of better work—following this natural course of least resistance, using the agencies now in the field, developing along our well-formed national lines of thought, but consistently applying all our power in individual and local effort. For bricks must be made of sweat and sand before they build the structure.

Howard Tuxbury Sands

Utility executive and master of public relations, whose wise counsel and inspiring example have won the high regard of the central-station industry.

THE rapid development of electric utilities along technical and commercial lines during the past quarter of a century has afforded remarkable opportunities for the advancement of industrious engineers and sales workers into posts of remunerative and well-established routine. The leaders of the central-station industry, however, have never been content to absorb themselves in purely local duties, but have struck out for themselves along lines promising progress through greater service to their employers and the art as a whole. Seventeen years ago a young man of unusual determination to apply his powers to their full was superintendent of the Lewiston & Auburn (Me.) Electric Company. The story goes that he questioned the wisdom of remaining longer on a property offering little apparent opportunity for advancement, but decided before leaving to put the dubious overhead system into apple-pie order. So well did Mr. Sands do this that chroniclers say it led to his selection to fill higher responsibilities elsewhere, until today Howard T. Sands of Boston, president or manager of half a dozen or more electric and gas companies under the control of Charles H. Tenney & Company, past-president of the New England Division and chairman of the Public Relations Section of the National Electric Light Association, stands in the front rank of utility executives noted for their thorough understanding of the problems of the industry and their ardent championship of friendship and the open door between public service corporations and the people.

It is hard to write in a restrained fashion about Mr. Sands' public relations ideas and practices. Ever since he became an executive he has been running utilities humanly. His frankness, patience, friendly interest in employees and capacity to make friends of people of different types and tempers are proverbial in the Tenney organization.

A prime mover in the establishment and maintenance of the New England Bureau of Public Service Information, Mr. Sands has rendered far-reaching service to the cause of better understanding between public and utilities in the Northeast. For years he has been speaking for "cards face up" in public relations and doing things that way himself. His knowledge of commission regulation is exceptional, and his interest in employee education is finding an outlet in comprehensive plans for the betterment of hundreds of men and women with vision to see the opportunities before the trained employee of the modern utility company. The intense loyalty of his subordinates, their respect for his judgment and their response to his leadership and stimulus are solid and sure.

Mr. Sands was born at Saco, Me., Sept. 12, 1867, and was graduated from the Saco High School in 1883. He entered the electrical field in 1896 as superintendent of construction for a hydro-electric plant at Mechanics Falls, Me., near Lewiston. His experience includes practically all branches of central-station service. From 1901 to 1905 he was superintendent of the Lewiston & Auburn company, from 1905 to 1909 manager of the Haverhill (Mass.) Electric Company, and since 1909 has been in Boston

Mr. Sands is president of the Barre & Montpelier (Vt.) Traction & Power Company, the Haverhill Electric Company and the Montpelier & Barre Light & Power Company, general manager of the Malden (Mass.) Electric Company and the Suburban Gas & Electric Company of Revere, Mass and an officer or director in other utilities. He is a man with a wide diversity of interests and has contributed much to the civic and social upbuilding of the communities in which he has been engaged.

Editorial Comment

Electrical World, October 14, 1922

Volume 80 Number 16

Plant Construction in Full Swing

REPORTS from all over the United States indicate that the electric light and power utilities have embarked on an immense program of new construction. From Chicago, Brooklyn, New York, Pittsburgh, California, Boston and other large centers news arrives of plans for new power stations and equipment involving expenditures of millions of dollars. These developments show that the load on existing stations is very large and that a future load is anticipated which must be carried by new apparatus. It fairly staggers the imagination to learn, for example, that an expenditure of $53,000,000 will care for the increase in the load at Chicago only until 1925. Then, again, the report of 62,500-kva. single-cylinder turbo-generator units for the new Brooklyn station shows the great progress that has been made in equipment development, for only last winter the manufacturers' engineers hesitated to make single-cylinder units larger than 45,000 kva.

The money market for utility financing has never been so favorable as now, and every incentive exists to utilize this situation. The wise policies of the leaders of the industry have guided the central-station companies past all the after-war pitfalls of bad financing and reactionary public sentiment, so that today the banks and the public look with confidence on the central-station industry and readily co-operate in plans for its development. Experience has proved its stability as an investment and its devotion to public service.

Keep Initiative in the Power Industry

AN EXTENDED analysis of the proposed water and power act to be passed upon by the voters in California on Nov. 7 was made in the *Electrical World* for Feb. 11 last. It is difficult to see how a thinking people can give it any support. In California the great utility properties are virtually owned by the public now. By the sale of stock to customers the utilities of the state have brought about public ownership as distinguished from political ownership. For example, the Pacific Gas & Electric Company has 23,000 stockholders, 80 per cent of whom live in California, and 35,000 bondholders, 50 per cent of whom live in California, making 58,000 persons whose money is in the securities of this company. The Southern California Edison Company has spread the stock ownership of that company among more than 48,000 individuals, by far the majority of whom live in the district served. There are, in fact, not fewer than 150,000 people interested in the four great power companies of California, either as stockholders or bondholders.

Private ownership in its technical sense exists, but, broadly speaking, what California possesses is public control and co-operation between the management selected by the technical legal owners and the government, with all the initiative which goes with private ownership still operative.

So far as hydro-electric development in California is concerned, private ownership assures the co-operative effort of federal and state controlling bodies, backed by an ever-broadening consumer ownership, all working together to bring out the highest economic use of water power. Such a broad-visioned control not only develops water power economically but preserves the individual initiative in our industrial life—an initiative that has meant so much in the establishment of America's present position among the nations of the world in all branches of industry as well as in the development of electrical industries.

Safe and Profitable Stocks for Customer Ownership

CAPITAL, as has been so often stated, is notoriously timid. It takes fright easily. Often it flees from its own shadow and is not readily induced to return. Such being the case, people or industries seeking capital should be most careful in dealing with it. Confidence and belief in the integrity of the individual or industry must be inspired first of all, and then the faith thus established must be buttressed by stability and constancy. Otherwise capital will not flow freely, to the detriment of industry, and in the electric light and power business abundant funds for expansion and development are our primary need. Hence the timeliness of the admonition regarding customer-ownership stock issues voiced by President M. S. Sloan of the Association of Edison Illuminating Companies at White Sulphur Springs this week.

It must be apparent that any public reaction caused by stocks which depreciated in value or failed to pay the accustomed return could not but be detrimental to the best interests of an electric utility. The very purpose for which the stock was issued would be defeated, and it would have been far better had the company not engaged in the business at all. The danger that confronts electric public utilities selling gilt-edged securities to customers is that others, seeing how readily the public absorbs these issues, may be tempted to try the experiment with securities of an inferior sort. A few examples of this kind have already come to light, and it will be most helpful if, as President Sloan suggests, the industry will police itself so as to preserve the market for its securities in the best condition. Until the idea of customer or public ownership is firmly established as a principle the industry cannot exercise too much care in scrutinizing what is offered to the public. A few slips would be calamitous to a cause so worthy, and, besides making it difficult to raise funds through customer-ownership campaigns, would also go a long way toward building up ill will rather than good will toward the local utility.

Dow Pleads for Simplicity in Rates

THE subject of rates is always controversial and is honeycombed with opinion and prejudice. We doubt whether it will ever reach a state of clarity or simplicity, because the element of business judgment and the diversity in central-station operating conditions enter into each case. On the other hand, a passive attitude under the plea that rates lie within the jurisdiction of regulatory commissions is not warranted. As Alex Dow says in the paper contributed by him to the convention of the Great Lakes Division of the N. E. L. A., which we print in this issue: "Regulation is not intended to substitute passive code for active business judgment."

Too largely, however, in the study of rate systems by cost analyses the attempt is made to apply rigidly the analysis to the customer in the form of a complicated rate system. Very often, indeed, the cost analysis has been made on the basis of arbitrary assumptions, yet the resultant rate is applied as though it represented a rigid and correct system. Cost analyses are warranted and desirable, however, to guide the business judgment of the rate maker and should underlie the rate systems used.

The attempt of Mr. Dow to reduce the number of rate forms to a minimum is in the right direction, and many leaders of the industry agree with him in his plea for more simplicity in the rates presented to the customer. Very recently there have occurred some attempts to make an accurate cost analysis and then to apply a rate system based on the results. Operating data founded on these efforts are awaited with interest. One effect of the present practice has been the development of new electric meters, and it may be that simplicity in rate application will be brought about by the further development of what might be called rate meters.

Electricity's Part in the "Better Home" Movement

BETTER homes are the objects sought through a campaign started this week in approximately 550 cities and towns of this country. This movement, which is rather social than commercial and which relies for its success on actual demonstrations of model homes, was organized by a woman for women. It aims at the education of women in household economies, and by the object lesson it presents it hopes to show, in addition, how the atmosphere of a home can be elevated and sweetened, household work made less irksome and the home surroundings made more comfortable and satisfying.

The work has been well organized and has been officially indorsed by President Harding, Secretary Hoover and a host of other national figures. This accounts for the rapid spread of the idea, which, fortunately, also commends itself. Thanks to the co-operation of the electrical industry, the model homes shown in the five hundred odd towns and cities are completely equipped electrically. The success of the initial movement has been such as to warrant the perpetuation of the idea, which eventually should permeate to every village and hamlet in the country. The home is the bulwark of American civilization, and anything which fosters home life is worthy of encouragement. Naturally the electrical industry, which can contribute so much toward rendering the home more comfortable and lessening the drudgery of housework, will want to become more closely identified with the movement. It is in line with the idea of the "home electric," but the approach is from a different angle and the fact that it is sponsored by women with no commercial object to serve makes it broader and more national in scope. The industry can well afford to do all within its power to make the plan an unqualified success.

Investigation of the Conditions in Residence Lighting

TWO papers on the conditions governing residence lighting were brought out by the convention of the Illuminating Engineering Society, both of them based on a careful survey of residence lighting as it is. The studies were intended to cover all types of residences, although in the average they dealt, as any statistical investigation must necessarily deal, mostly with middle-class living conditions. The total number of living quarters considered reached several thousand, and the averages obtained were, on the whole, probably as representative as could be wished. From this study several interesting features of practice emerged which perhaps were hardly looked for.

In one of the investigations the rather surprising fact was elicited that in the average house considered the artificial lighting was almost or quite as good as the natural, the fact being that in small houses, particularly in crowded city quarters, the window space is small, so that the distribution of light is bad, and in many instances the interior finish is such as greatly to reduce the effect of natural daylight even a few feet inside the windows. Dark decorations in fact proved to be one of the bad features in ordinary domestic illumination. On the whole, the values for artificial lighting were adequate if properly utilized, and where the lighting was bad the cause was unskillful dealing with the facilities at hand.

The usefulness of fixtures installed by the average speculative builder, or even by the casual owner of a house, depends very largely on two factors—how much is left of the building appropriation after everything else has been taken care of and what the fashion of the moment in decoration may be. For instance, at the present time, as has happened periodically in the past, most decorators seem to think it necessary to inflict on their clients conventional and expensive wall brackets which for illuminating purposes might just as well be non-existent, particularly when the room finish is dull, as it sometimes is in the very rooms that need the most light, to wit, libraries.

It was found, as was to be expected, that on the whole people who owned their own homes went to more trouble and expense in insuring proper lighting equipment than did those who were merely renting. But even the better class of owned houses showed a good many failings in the matter of equipment and particularly as regards convenience outlets. These ought to be rather numerous to avoid too much stringing of lamp cords. Such outlets are valuable not only for electrical appliances of various sorts, but for the portable lamps which in many rooms furnish the best available means for suitable illumination. The average provision for watts output per socket was in general found satisfactory. The total wattage, however, falls short on account of the inadequate number of outlets generally found, so that, roughly speaking, it is not much more than half what would be desirable for a well-lighted house properly equipped with conveniences. The main reason for the lack of an adequate number of outlets is the extremely high cost of wiring brought about not only by the cost of material and labor but by restrictions which add to it a large unnecessary factor. Much of this needless expense is due to underwriters' requirements which ought to have been thrown overboard long ago.

In addition, some trouble is undoubtedly due to lack of wisdom on the part of electrical contractors and workers who do not realize yet that cheap and effective methods of wiring in the long run mean an increase of use which will bring prosperity to the very men who now stand in the way.

The whole survey shows clearly the need of a general overhauling of wiring methods and material with a view to finding out what our neighbors across the Atlantic have long known, how to carry out house wiring in the interest of the man who has to pay for it and use it.

Energy Costs Are a Small Portion of Total Service Costs

IN THE discussion of rate matters and the cost of electric service the general tendency seems to be toward giving too much weight to the plant-production costs of energy in the steam plant and too little to the other items that go to make up the total cost of service. In figures covering a careful investigation of service costs recently submitted to a central-station executive it was shown that the energy costs for consumers in the residential class were much less than half the total costs of service. In energy costs the only figures included were those involved in the production of energy in the plant up to and including the switchboard.

In the absence of a clear-cut analysis of a given situation in this respect there have been many cases where embarrassment has been caused. A typical instance is one in which authorities forced a central-station company to accept temporarily a contract to supply energy to a railway at production cost plus 10 per cent, on the theory that it was bulk business and the 10 per cent was a fair contractor's profit. More than a million dollars' worth of equipment used outside the power plant to give the service was ignored entirely.

Kilowatts and kilowatt-hours are units of measurement that have been badly misused in the development of the industry of selling electric service. There is a tendency to talk about the unit as if a definite value could be assigned to it and as though it were not in the same class as the ton, pound, yard, mile or any other unit used in the measurement of physical quantities. This has produced a tendency on the part of the consumer to think of the unit in terms of its pure production cost, which is the smallest cost in the service for all but the larger commercial consumers with fairly high load factors. Some classes of service, notably the residence consumer, have an energy cost that is so small a portion of their total cost that even if the entire plant-production cost were to be dropped, 70 to 80 per cent of the service bills would still remain. In rural service the proportion remaining would be even greater. Many commercial consumers of the smaller kind have energy costs that are 50 per cent or less of the bills which they pay.

Gilchrist Raises the Issue, Should Appliance Selling Pay?

SHOULD the central-station company make money or lose money on appliance selling? To put it bluntly, this is the question which has been raised by John F. Gilchrist in his paper on merchandising policies presented at French Lick and published on another page. It is doubtful whether any message on a commercial subject ever delivered before a body of central-station men has excited more attention or been more widely discussed. In a word, he charges that most companies are selling at a loss and do not know it.

Mr. Gilchrist's company sells more merchandise than any other central station; therefore his frank admission that it has been consistently losing money on one of the most active and supposedly profitable appliances is impressive. It would indicate that other lines are also unprofitable. He has made an investigation of the retail appliance business done by nine or ten of the largest companies only to find that there is not one of the group that is making any money. Yet residence appliance load has grown to be about as great as residence lighting, and the sales of electrical appliances in a community may well equal the total sales of electricity. It is no longer a side line. It is a large and rapidly expanding business, and, as he says, losses can no longer be ignored. The necessity for profit has become imperative.

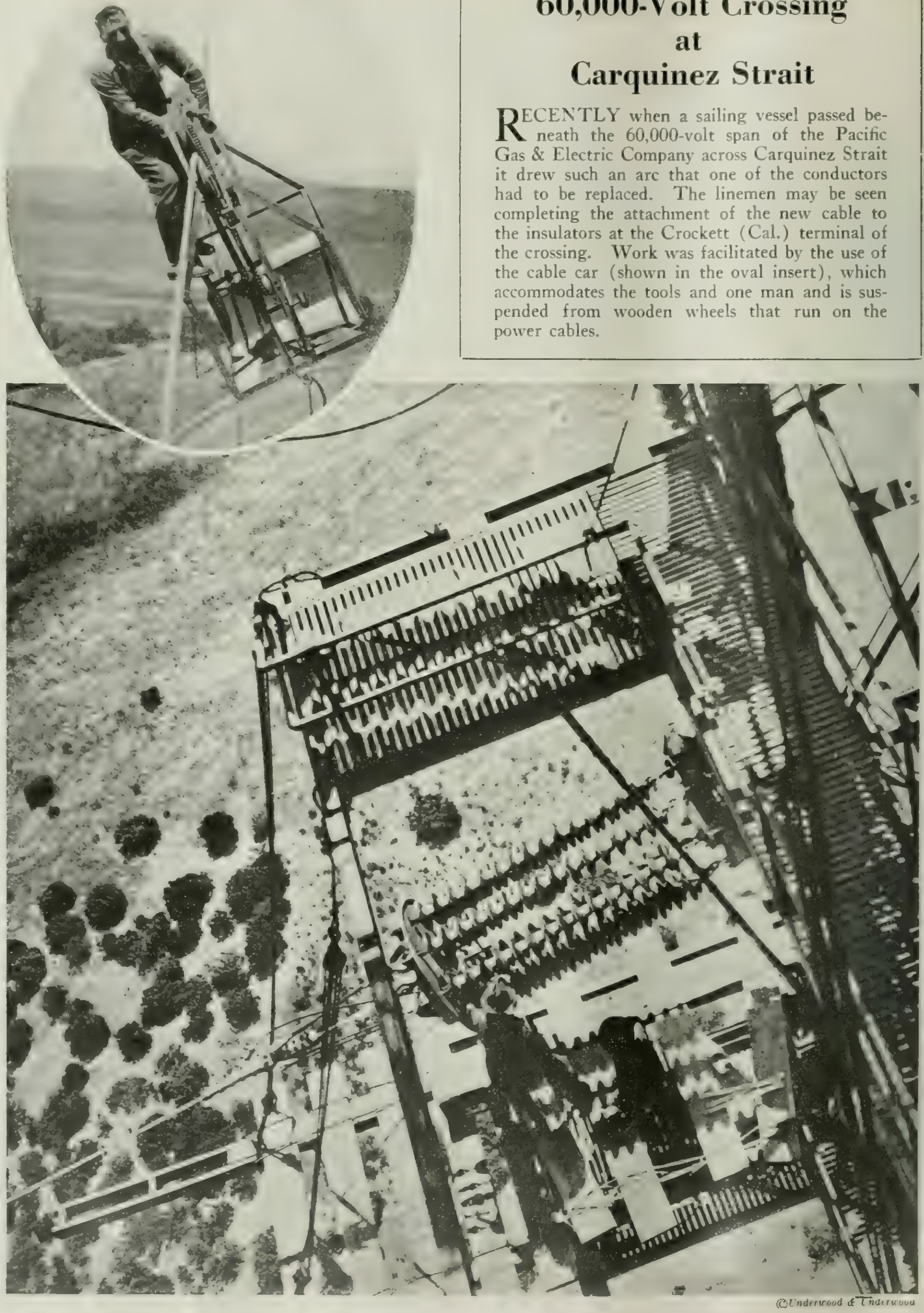
Mr. Gilchrist's argument divides itself into two parts. First, he appeals to utility men to stop fooling themselves, to learn their costs and to cease selling goods at prices that are not profitable. He urges this both for the good of the central-station company itself and for the protection and promotion of the appliance dealer who must be developed in every town if the market is to be adequately served. With this there can be no contention. In his analysis of the cost of selling washing machines in Chicago, however, he draws conclusions as to what should be done to put profit in a losing line and advocates that prices should be raised to make the selling pay, his experience being that sales were not decreased thereby. We doubt whether manufacturers and jobbers of washing machines will agree that solution lies all in this direction, or the public consent that the central station should plug the leak entirely at its customers' expense.

There are several ways to increase profit on retail sales. One is to raise prices. Another equally effective way is to increase turnover and improve efficiencies so that the invested capital earns more income and the selling actually costs less. And the fact that the ponderous organization of a great central station may sell washing machines at $192.20 and still lose money does not prove that some one else—utility or dealer—may not be able to sell them for considerably less and make a satisfactory profit because of smaller overhead, more skillful merchandising methods or some other influence.

All this Mr. Gilchrist has very much in mind, of course. His illustration is a picture only of the Chicago company's costs. But the fact remains that many of our largest central stations, the most active and experienced in appliance selling, are consistently losing money on this business and do not realize it. It is this condition that Mr. Gilchrist strikes at, and he is right 100 per cent when he says, "Know your costs and make your merchandising pay."

Repairing 60,000-Volt Crossing at Carquinez Strait

RECENTLY when a sailing vessel passed beneath the 60,000-volt span of the Pacific Gas & Electric Company across Carquinez Strait it drew such an arc that one of the conductors had to be replaced. The linemen may be seen completing the attachment of the new cable to the insulators at the Crockett (Cal.) terminal of the crossing. Work was facilitated by the use of the cable car (shown in the oval insert), which accommodates the tools and one man and is suspended from wooden wheels that run on the power cables.



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Snake River as a Source of Power

Undeveloped Power Sites Total 1,510,000 Hp., with Existing Flow Available for 90 per Cent of the Time—New Markets Must Be Created Before the River Will Be Developed

By W. G. HOYT
Hydraulic Engineer United States Geological Survey

IT HAS long been known that the lower portion of the Snake River constitutes a source of large potential water powers. But, although engineers of the Oregon-Washington Railway & Navigation Company ran a line through the canyon of the river in 1911, no complete maps had been made until the summer of 1920, when topographic engineers of the United States Geological Survey made a map of the area between Huntington, Ore., and Lewiston, Idaho, for the purpose of determining the power resources of this region and the possible interference between the development of power and the construction of a railroad. The writer accompanied the surveying party as hydraulic engineer.

The Grand Canyon of the Colorado at El Tovar and the Royal Gorge of the Arkansas are easily accessible and are therefore well known, but the canyon of the lower Snake, which is more than 1,000 ft. deeper than the gorge of the Colorado between Yavapai Point and Buddha Temple, and considerably narrower, will remain unseen to most travelers until an automobile road is constructed along the narrow ridges parallel to its course. The river is paralleled for the first 50 miles of the stretch by a branch line of the Oregon Short Line Railroad, which extends from Huntington, Ore., to the mining town of Homestead. A short distance below Homestead the river enters what is known as Hell's Canyon. In the canyon the average fall of the river is about 12 ft. to the mile, the low-water flow is about 8,000 sec.-ft. and the river is at some places barely 100 ft. wide. There are numerous rapids where the stream surges over huge rocks, and navigation on the upper reaches is practically impossible. High-powered gasoline launches make trips upstream from Lewiston for a distance that depends upon the stage of the water.

The river has certain general features which would make it a possible source of large blocks of power. Its flow is well sustained, its gradient is steep, its cross-section is comparatively narrow, and the geologic formations in the canyon would make good foundations for a dam of any height. On the other hand, construction and maintenance would be difficult and probably expensive, for the quarters during construction would be cramped, material would have to be brought from long distances, and the river is subject to enormous floods.

The rocks that make up the greater part of the canyon walls consist of several kinds of metamorphic rock—greenstone, schist, slate and argillite—with a comparatively small amount of limestone and of diabase, porphyry and other dike rocks. Most weathered surfaces of these rocks are extremely rough, for they show multitudes of open fractures. The weathered beds, however, are generally very thin, and the unweathered masses are regarded as watertight and as affording firm supports for dams of any height. Exceptions are seen in zones of rock which was broken by shear planes or faults during the later period of mountain building and which may be the cause of leaks or rock slides. The precise location of these zones can be determined only by detailed field examination. Basalt now forms the river channel only in areas that are low or depressed in contrast with the areas of uplift. The basalt may contain porous layers or partings that would allow water to escape from a dam, but such layers can be avoided by examination. Only moderate depths of

UNDEVELOPED POWER SITES ON SNAKE RIVER BETWEEN HUNTINGTON, ORE., AND LEWISTON, IDAHO

(Estimates of power based on static head and over-all plant efficiency of 70 per cent)

Location	Miles Upstream From Lewiston	Maximum Head		With Existing Flow				With Regulated Flow			
				Discharge		Horsepower		Discharge		Horsepower	
		Q90*	Q50*	Q90	Q50	08HQ90	08HQ50	Q90	Q50	08HQ90	08HQ50
Mile 154-188		90	70	8,000	16,500	57,600	92,500	6,900	11,200	49,700	62,800
Site 12HK No. 1	145.2	25	20	8,000	16,500	16,000	26,400	6,900	11,200	13,800	17,900
No. 2	143.3	25	20	8,000	16,500	16,000	26,400	6,900	11,200	13,800	17,900
No. 3	135.7	30	25	8,000	16,500	19,200	33,000	6,900	11,200	16,500	22,400
No. 4	123.2	50	45	8,000	16,500	32,000	59,400	6,900	11,200	27,600	40,300
No. 5	120.8	65	60	8,000	16,500	41,600	79,200	6,900	11,200	35,900	53,800
No. 6	118.7	75	70	8,000	16,500	48,000	92,400	6,900	11,200	41,400	62,700
No. 7	112.2	150	140	8,000	16,500	96,000	185,000	6,900	11,200	83,000	125,000
No. 8	101.0	280	270	8,000	16,500	179,000	356,000	6,900	11,200	154,000	242,000
No. 9	97.2	275	265	8,000	16,500	176,000	350,000	6,900	11,200	152,000	237,000
No. 10	95.7	350	340	8,000	16,500	224,000	450,000	6,900	11,200	193,000	305,000
No. 11	83.5	475	460	8,000	16,500	304,000	608,000	6,900	11,200	262,000	412,000
No. 12	77.4	540	530	8,000	16,500	345,000	700,000	6,900	11,200	298,000	475,000
No. 13	52.7	190	180	8,000	16,500	122,000	238,000	6,900	11,200	105,000	161,000
Site 12HN No. 1	50.7	220	210	8,000	16,500	140,000	277,000	6,900	11,200	121,000	187,000
No. 2	41.5	260	250	15,000	21,500	312,000	430,000	12,200	16,300	254,000	326,000
Salmon-Snake Tunnel Site	77.4	530	530	3,800	5,100	161,000	216,000	3,800	5,100	161,000	216,000
Total						919,000	1,510,000			866,000	1,130,000

NOTE—Total includes only those sites which will utilize full fall of river, namely, Mile 154-188, No. 1, half No. 2, Nos. 3, 12 and 13 and Salmon-Snake tunnel site. *Q90—flow available 90 per cent of time, Q50—flow available 50 per cent of time.

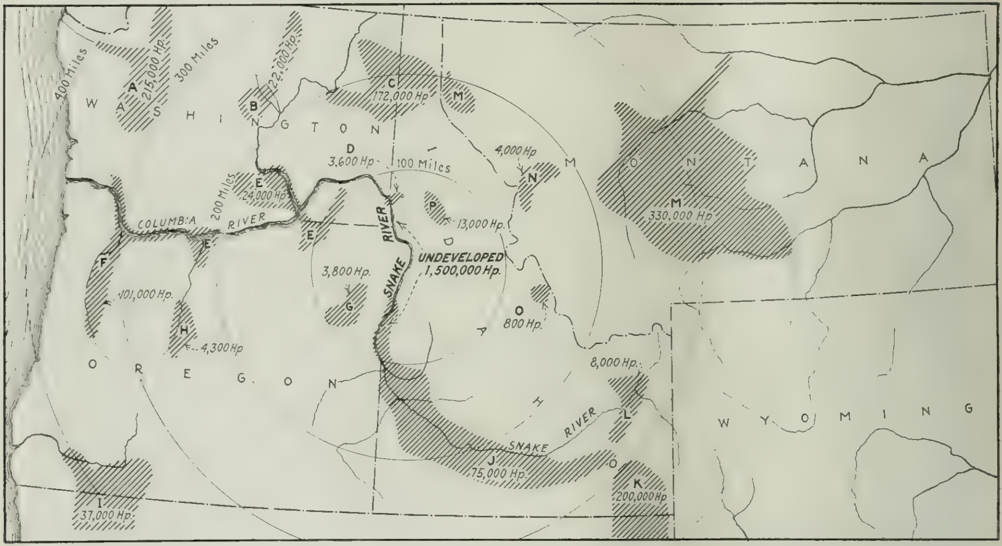
gravel and loose rock or boulders may be expected between the water surface and the bedrock in the stretch between Homestead and the mouth of the Grande Ronde River. Above and below that stretch the bedrock is probably overlain with considerable alluvium. The alluvium is probably thickest at rapids, which have almost invariably been formed by débris washed in by tributary streams. Bedrock was seen at only one place in the canyon, and even at that place what was thought to be bedrock may be only a pile of large boulders in the channel. In general, however, the geologic conditions are favorable to the construction of dams.

The low-water flow of the Snake, owing to an unusual condition existing on the plains of southern Idaho, is very well sustained. At times during the irrigation season the entire flow of the river is diverted at Milner and above for irrigation, but in the 50-mile stretch below Milner, however, there is a group of famous springs, which, with the return water from the irrigated tracts along the river, discharge continuously more than 5,000 sec.-ft. This flow will be maintained regardless of future irrigation diversions and in fact will undoubtedly increase. The flow that is available below Weiser but above the mouth of Salmon River is estimated at 8,000 sec.-ft. for 90 per cent of the time. Fortunately for the development of power, the low-water flow of Salmon River, the largest tributary to the Snake, occurs during the winter, so that the flow available for 90 per cent of the time below the Salmon is large. It is estimated as 15,000 sec.-ft. The flow available for 50 per cent of the time above the mouth of the Salmon is 16,500 sec.-ft., and that below the Salmon 21,500 sec.-ft. The flow now available for half the time will be materially reduced by the construction of the proposed reservoir of 3,000,000 acre-feet at American Falls for use in irrigation. It is estimated that after its construction and the accompanying diversions the 50 per cent flow will be reduced to 11,000 sec.-ft. above the Salmon and 16,000 sec.-ft. below.

Flood Control a Big Engineering Problem

The magnitude of the floods that may occur in the Snake below Weiser will require very careful engineering, both during construction and in the design of the structure. The proposed American Falls reservoir, although it will be one of the world's largest, will probably have little effect on the flood flow, for the majority of floods are likely to occur when the reservoir is full and, furthermore, a large part of the flood in the canyon may originate below the proposed site. A study of the floods on the Salmon and the Snake show that these may come at the same time, and consequently the flow of the Snake below the mouth of the Salmon has to be taken as the sum of the maximum flow on each river. Floods of 90,000 sec.-ft. may occur above the Salmon every ten years, and of 140,000 sec.-ft. every fifty years, and floods of 180,000 sec.-ft. may occur below the mouth of the Salmon every ten years and of 300,000 sec.-ft. every fifty years. The work of bypassing such floods during construction and of taking care of the water after the dam is constructed will require very careful engineering.

Detailed planetable surveys and other examinations were made at ten possible dam sites and on the divide between the Salmon and Snake Rivers in T. 26 N., Rs.



TERRITORIES NOW BEING SERVED BY THE LARGER PUBLIC UTILITIES OF THE NORTHWEST, AND TOTAL TURBINE CAPACITES AT GENERATING PLANTS

A Olympia Light & Po. Co.
Northwestern Po. & Mfg. Co.
City of Tacoma
City of Seattle
Puget Sound Po. & Lt. Co.
B Okanogan Valley Po. Co.
Chelan Elec. Co.
Wash. Coast Utilities Co.
Great No. Ry. Co.
C Wash. Water Po. Co.
Spokane & East. Ry. & Po. Co.
D Wash.-Idaho Wa. Lt. & Po. Co.
E Pacific Po. & Lt. Co.
Black Rock Po. & Irrig. Co.
F Northwestern Elec. Co.
Pac. Ry. Lt. & Po. Co.
Eugene Elec. Co.
Mountain States Po. Co.
G Eastern Oreg. Lt. & Po. Co.
H Deschutes Po. Co.
Bend Water Lt. & Po. Co.
I Calif.-Oreg. Po. Co.
J Idaho Power Co.
K Utah Po. & Lt. Co.
L Ashton & St. Anthony Co.
City of Idaho Falls
Utah Po. & Lt. Co.
M Montana Po. Co.
N Missoula Lt. & Po. Co.
O Salmon River Po. & Lt. Co.
P Grangeville Elect. Lt. & Po. Co.

1 E. and 1 W., Boise Meridian, Idaho, where there is a possibility of diverting Salmon River at a point 73 miles above its mouth into Snake River under a head of 450 ft. The accompanying table shows the power possibilities of each site under different rates of flow.

The probability of developing any new sites upstream from Homestead is remote. Unless the railroad is relocated, the height of dams must be less than 30 ft. The river is fairly wide, the side walls are generally basalt and are not especially desirable for abutments, and the bedrock is probably overlaid with considerable thickness of loose material. Below Homestead and above the mouth of Grande Ronde River sites can be obtained which will utilize the entire fall. Oppositely placed buttresses are rare, and as the depth of bedrock below the water surface is unknown the principal factors in locating dam sites were the character of the side walls and the width of the cross-sections. Many of the sites chosen are worthy of serious consideration, though closer examination will probably show that some of them are unfavorable.

In developing many of the sites it will be necessary to construct a railroad to transport materials. If the cost of constructing the railroad is put into the cost of development, the unit costs will be high. If, however, the railroad is constructed between Homestead and Lewiston at such a height that it will not interfere with the development of water power, construction work will be facilitated. Owing to the large expense in building foundations, high dams will probably be more feasible than low dams; but, on the other hand, if dams are built so high that floodwaters cannot pass over the crests, tunnels or other artificial spillways will have to be constructed at great cost. No sites were found at which it would be possible to construct large rock-filled dams at small expense and divert the floodwater through short tunnels across narrow necks. Even if such sites were found, the problem of making such dams watertight would be a difficult one, for comparatively little silt is carried in the water and there is almost no dirt on the river bottom or sides which could be moved. Estimates of the costs of construction at sites chosen were not made, and as the depth to bedrock is not known estimates of probable yardage are rather rough. At Coon Hollow, the lowest site on the river, it was estimated that if bedrock lay 70 ft. below the water surface, a concrete non-overflow dam to raise the water 270 ft. would contain about 1,000,000 cu.yd. The installation at this site would be about 450,000 hp., or only about 2 cu.yd. of material per horsepower.

The Pacific Power & Light Company has applied to the Federal Power Commission for a preliminary permit for ten sites on Snake River between Homestead and Lewiston. This company now operates in southern Washington and northern Oregon, the greater part of its territory lying within 200 miles of the sites applied for. The accompanying map shows approximately the limits of the territories now being served by the larger public utility companies of the Northwest and their installed wheel capacities. The centers of all the large present markets except that of the Utah Power & Light Company lie within 350 miles of the power section of the lower Snake, and because of its position the Snake undoubtedly constitutes a very valuable power resource of the Northwest. How soon we may expect its development cannot be predicted.

The industrial development of the Northwest during the next few decades will no doubt be enormously increased. To keep pace with the increased demands for power additional power sites will have to be developed, and the sites at which power can be developed and delivered to the market most cheaply will naturally be developed first. Sites on the Columbia and Deschutes Rivers, however, are capable of developing well over 1,000,000 hp. These sites lie nearer the present markets of the coast than those on the Snake. In British Columbia there is a large amount of undeveloped power on Clark Fork in its short course in Canada and on the Kootenai between Kootenai Lake and Columbia River, which are nearer the Spokane market than the sites on the Snake.

On the Flathead River there is sufficient undeveloped power to take care of a demand twice as large as that now supplied by the Montana Power Company. On the upper Snake, in the center of the power market supplied by the Idaho Power Company, there are possibilities of developing 250,000 hp. All sites mentioned are nearer present markets than those on the lower section of the Snake River between Weiser and Lewiston, and, other things being equal, they will probably be developed first. If, however, in spite of their greater distance from the present markets, a new market should be made, or it is found that power can be developed and delivered cheaper from the sites on the Snake than from the other sites, their early development will naturally follow.

IN THE CANYON SNAKE RIVER HAS A FALL OF 12 FT. TO THE MILE

The International Status of Superpower Systems

Use of High-Voltage Cables and Trend of Practice and Regulation Are Discussed by Technical Congress

A WIDE divergence of opinion and practice respecting high-voltage cables, generators, construction methods, laws and protection was brought out at the international conference on high-tension transmission held in Paris several months ago. The transactions of this body have been recently made available through M. Jean Tribot-Laspiére, general secretary of the conference; H. M. Hobart and C. O. Mailloux. The work of the congress was divided into four divisions:

1. Laws affecting superpower systems and transmission lines in the various countries.
2. Generator and transformer limitations, protection and operation.
3. Construction and installation of lines.
4. Operations and practices of the various systems.

One result of the discussion was the passage of a resolution declaring it to be desirable:

First—That the existing differences between the regulations in force in different countries in regard to crossing public highways (roads, railways, streams, telegraph or telephone and signal lines, etc.) should be reduced as far as possible.

Second—That, as far as possible, the crossings should be established along the right-of-way entailing the least mechanical stress in the line and its supports and that, instead of fixing in the rules the minimum angle of crossing, the maximum length of crossing allowable should be fixed, which maximum length should, moreover, be allowed to vary according to the nature of the highway to be crossed.

Third—That the protection provided against accidental fall of the line should be secured either by doubling the number of insulators at the supporting towers at the crossing or else by any suitable equivalent arrangement, but in any case without the use of guard wires, protecting nets or like arrangements.

Fourth—That the factors of safety to be used in the calculation of supports made of wood, steel or armored concrete, and of their foundation, should be standardized, taking as the basis the lowest values of safety factor considered adequate for insuring safety according to the experiences had in various countries.

The general tendency in the construction of alternating-current generators, it was reported, is to increase the magnetic leakage in order to secure safety. Voltage drops of 25 to 45 per cent for steam turbo-generators of 625 kva. to 43,700 kva. were found to be admissible and 21 to 29 per cent for low-speed alternators of 800 kva. to 7,000 kva. M. Boucherot voiced the opinion of the congress that designers of water turbines should simplify their methods of speed regulation and investigate the feasibility of providing a damping mechanism in connection with water admission to prevent oscillations.

HIGH-TENSION CABLES

One of the most interesting features of the congress was the discussion of cables. France uses three-conductor cables at 50,000 volts and single-conductor cables up to 70,000 volts. Tests are now going on which indicate that 120,000-volt single-conductor cables will soon be on the market. The maximum cross-sections of French cables are 100,000 circ.mil for three-conductor and 750,000 circ.mil for single-conductor. The current density allowed in the large cables is from 0.75 amp. to 1.25 amp. per 1,000 circ.mil, according to the cross-section, with an allowable maximum temperature of 50 deg. C. At 50 cycles, with 35,000 volts between conductor and lead covering, the dielectric losses are about 0.8 kw. per mile at 25 deg. C. and 1.5 kw. per mile at 45 deg. C. A 50,000-volt, three-phase, 50-cycle cable has connected Denmark and Sweden since 1913 and has never given trouble. In Italy three-phase cables are used at 30,000 volts and single-conductor cables up to 80,000 volts. In England the upper voltage limit is about 33,000, but English cable manufacturers expect to put on the market in the near future 66,000-volt and 70,000-volt three-phase cables. Holland uses cables up to 50,000 volts, and Switzerland has a 150-mile (240-kg.) line made of 30,000-volt single-conductor cable.

Concrete poles are used extensively in Alsace, Norway and Sweden. The Alsace line is 70,000 volts with 650-ft. to 725-ft. (200-m. to 220-m.) spans.

QUESTION USE OF REACTORS

The use of reactors for limiting short-circuit troubles was questioned and the opinion expressed that this practice should be limited to the protection of transformers. A general opinion was also expressed that outdoor substations are economical on lines exceeding 100,000 volts.

The use of synchronous motors or condensers for securing better line regulation was advocated. M. Blondel introduced a unique idea for securing good regulation. He suggested using a synchronous-motor-series-generator set with rotors displaced and field regulation whereby the reactive kilovolt-amperes taken from the line by the synchronous motor would be corrected for phase angle and put back into the line by the series generator.

M. Boucherot suggested a constant-impedance transmission system whereby no power-factor variation would occur and whereby voltage and current would automatically change with the load.

The whole realm of transmission was discussed by the delegates, and each country presented its views and methods of construction. The factors of safety and the sizes and types of towers proved different in the several countries. The differences could largely be accounted for by reason of a variation in density of population or a variation in legal restrictions. Since many contemplated lines are international in extent, standardization in legal requirements should exist. France and Switzerland have such an agreement for supervoltage lines. The delegates felt that uniformity in practice coupled with simplicity in installation was a primary essential.

Three reports on protection created spirited discussion. The value attached to various apparatus or particular arrangements is generally not based on observations made under conditions which could be compared. Most of the delegates declared themselves in favor of discarding any old-fashioned protective apparatus, especially horn-gap lightning arresters or protective equipment connected to the line in series with such arresters. On the other hand, the usefulness of the aërial ground wire against traveling waves or disturbances was almost unanimously recognized. For medium voltages the delegates favored the ungrounded neutral, but for high-voltage lines the grounded-neutral system was favored.

Rate Forms Should Be Minimized*

Two Principal Methods of Charging Necessary and Desirable Variations Are Few—Careful Cost-Analysis Studies Should Be Used as a Guide to Business Judgment in Formulating Tariffs

By ALEX DOW
President Detroit Edison Company

THIS is a talk about some phases of the art of rate making. It will not be long, and it presumes, with reason, that this audience knows so much of the technique of cost analysis and of the law of rate making that preliminary discussion of these phases is superfluous. The law is not voluminous, but the diversified interpretations and the local applications thereof are the makings of many books—so many that the comparatively few and simple commandments laid upon us are at times obscured, rather than displayed, by the commentaries. Moreover, our statistical associates, having analyzed and allocated our costs to the third place of decimals, having assigned values to each component of costs, and after infinite permutations and combinations, having looked upon their finished and balanced work and seen that it is good, have (some of them) told us that thus and not otherwise shall rates be made—thereby reducing rate making to a mathematical formula whose rigid factors are the costs of prior periods.

UTILITIES ARE LEGALLY TRADERS

We are traders in the eye of the law—not administrators of a trust. We are expected to use our trained judgment to anticipate social and commercial movements, so that we may be ready for our part therein, and our earnings will suffer if our judgment is amiss. True, we are under regulation—too much in a few cases, possibly too little in others—but regulation is not intended to substitute passive code for active judgment. On the contrary, it serves to protect us from those conditions of competition and of personal or political pressure which in the past tended to make us do, not the thing that our best judgment dictated, but what the stress of the moment compelled.

You see now that I am not talking in favor of any hard and fast formula for rates or set rule for rate making. My talk will be directed toward showing that there is much room for the exercise of good business judgment as to the resultant rate, the actual dollars and cents, which we should endeavor to obtain from any stated class of service; that simple and standard forms of rates will meet each practical requirement, and that the adherence by each company to the least number of rate forms is to the interest of all companies.

Any rate quoted for electric service is presumed to meet two commercial requirements. First, it is to provide the costs of the service to be rendered, together with a suitable proportion of the total return to be earned on the company's investment. Second, it is meant to be consistent, in its ordinary operation, with the other rates constituting the company's complete schedule. If it fails to meet the first requirement, then the burden of costs and of return loaded on the other scheduled rates will be more or less than is reasonable. If it seems to be inconsistent with the other rates, there will be criticism and complaint either from the class of customers to whom the rate applies directly or from the other classes who will imagine that the rate works a preference to a favored class.

Now, if all of a company's rates were of the same form—for instance, if all rates are straight-line meter rates per kilowatt-hour—there would be a fictitious simplicity of schedule which would forestall the frequent faultfinding of the uninformed to the effect that our schedules are too complicated for their comprehension and therefore are justly suspected of unfairness. I need not demonstrate here that such a schedule would sacrifice fairness and would be unworkable except in communities of the smallest size and of absolutely uniform composition. Differences in load factor make differences in cost that have forced recognition wherever are found the differing demands of residence service, commercial service, street lighting and industrial power.

Now, let us consider an extreme case of classification, such as one still occasionally finds, where the schedule has a multiplicity of rate forms, of rate classes and of optional or compulsory riders. Such a schedule undoubtedly represents an honest effort to apportion costs and a well-intended effort to collect a return from each class according to the value of the service to that class. But it requires an expert to pick just the right combination of rate and riders, and the ordinary business man throws up his hands and shouts for help when you try to explain to him the sweet reasonableness of each discount or credit or revision to which he is or is not entitled. He says it is worse than a federal tax blank—and that is saying a lot. What the professional critic or the opposing counsel in a rate case will say is left to your imagination—or, it may be, to your remembrance.

TWO FORMS OF RATES NECESSARY

In my opinion, only two principal rate forms are necessary for any company, and the variants thereof not necessary but desirable are almost as few. A straight kilowatt-hour rate, qualified by a well-considered minimum bill to eliminate the idle meter and by a very few "blocks" or quantity discounts, is desirable for some classes of service where the customers are many, the average bill is small and the diversity factor is great. A rate having a demand component is equally imperative where the average account is large, where the load factor of different customers varies materially, and especially where the investment required by any one customer or any one industry may become a measurably large part of the total investment of the company. A very simple demand rate, not requiring electrical measurement of demand, works well in residence business, but is not imperative in that class.

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*Paper presented at the convention of the Great Lakes Geographic Division of the National Electric Light Association at French Lick Springs, Ind.

Class rates have their proper place. Seasonal business, such as that of summer amusement parks, is excellently dealt with by a class rate. Business inherently off-peak is well dealt with by such a rate; but I distrust that expression, "off-peak"—it is too often misused. I would rather describe the intended class of service as "valley" business. A class rate may be made by a rider on a regular form and is better made in that way unless the class is very narrow and has permanent cost characteristics. I intentionally say nothing as to how demand is to be determined. There are plenty of choices. Some are better for one class of service and some for others. The simplest among them is usually the best. Neither do I specify the rate form. The Hopkinson form, fixed charge plus running charge, is the most generally applicable.

It is sometimes pleaded that a Hopkinson form of rate is not elastic; that the requirement that all fixed costs and charges shall be covered by the demand part of the rate serves to discourage desirable business which has seasonal slack periods during which the customer will feel the fixed monthly charge to be a burden or to be a payment for which value is not received. But, although the Hopkinson analysis rigidly places in the demand column all costs of being ready to serve and includes therein the return on capital, there is no compulsion to follow that rule in making the rate. Making the rate is not the function of the analysis. Its function is to guide your business judgment and prevent your fooling yourself. You may properly, and in many cases wisely, collect in the fixed part of the rate only those demand costs which are out-of-pocket or increment costs, and you may spread the return over the running or kilowatt-hour charge. What is important is that year by year you shall collect those costs and that return and shall know that they are collected.

Again, it is pleaded that the customer whose temporary or seasonal demand, lasting only a few months, interleaves with the temporary demands of other customers falling in other months should not be required to pay the full annual charge determined by the Hopkinson theory. Here once more is a misapplication of the analysis, permitting the analysis to make a rigid rate instead of being merely the guide to the business judgment of the rate maker. You can state this case technically by saying that the mutual diversity factor of the several customers to whom the rate applies is such that the collection of the full annual charge from each customer would give a needlessly high return to the company. The vital question in such a case is whether the diversity factor is a temporary or a permanent item in the equation. If the number of customers is large enough and the diversification of their different industries is great, the factor is probably permanent. In other words, the demand seasonally released by one customer will certainly be taken on forthwith by another. The diversity factor of all our several classes of service is the principal reason for the existence of the central station and is indispensable to us. But whether we release part of its advantage to any class of desirable business or whether we decline to do so is a matter for our business judgment, having regard not only to that one class but to the reaction on the business as a whole. If we decide that it is well to do so, all we need do is provide for revision of each customer's demand more frequently than once a year—say, at six months intervals or even monthly. It is not necessary, nor is it good policy, to make a lot of special contracts or special classes or to invent a cruel and unusual rate form, and it is seldom necessary to have a revision interval shorter than six months.

Following up this reasoning, it appears that if the customers are very numerous, if their permanent diversification is wide, and if there is no one preponderating customer nor one preponderating industrial group, then one Hopkinson rate, with the privilege of frequent revision of contract demand, may be made universal. Contrariwise, if one customer or industrial group preponderate, it will be necessary to require that customer or group to guarantee the full annual return on the investment which it requires the company to make, because there is no other certain market for such a large block of power. In the latter case two differing rates must be formulated, one for the preponderating customer or industry and the other for the generality of other industrial customers. But each rate should be of the Hopkinson form, and the Hopkinson analysis should guide the rate maker in writing the rate figures.

Cost Analysis Necessary

Let me say that I do not disparage cost analysis. On the contrary, I have analyzed costs by what we know as the Hopkinson method for more than thirty years, and I have by myself or by deputy analyzed annually the costs of one property year by year since 1896. It is absolutely necessary that costs should be analyzed, but our analysis should be only a study—a very thorough study—to guide our judgment. It would be a public misfortune to have the analysis automatically fix the rates.

I said that the law governing rate making is not voluminous. It is brief and sensible. It requires that each class of service shall carry its own costs so that it shall not be a burden on another class. It forbids undue preference or discrimination between customers, and it prohibits the establishment of a non-compensatory rate by a regulating authority. See the North Dakota lignite rate case. It does not forbid a company from making such a rate—say, for development purposes—provided the rate does not so operate as to burden other consumers or classes; but it squarely places on the company the responsibility for justifying such a rate when it shall be challenged. The law distinctly says that we are not bound to collect an identical return on each kilowatt-hour sold or on each dollar invested for differing services. After setting the lower limit of a rate at the figure which will prevent a burden being placed on one class for the benefit of another, it sets the upper rate limit as the value of the service.

I sum up this talk by pleading for thorough analysis as a guide to business judgment, while I deprecate the substitution of a rate theory or code for business judgment. I point out that the return upon our investment is a large component in our average rate and is not required to be an equal proportion of each rate. On the contrary, the law presumes that we will exercise our business judgment, placing the greater burden, within reason, on the service classes which can best afford to carry it. I have pointed out the wide limits within which we are to exercise our judgment. Finally, I plead for a minimum and a uniformity of rate forms and am positive that proper selection of values for each component of a demand type of rate will adjust it to any or all the conditions which must be taken into consideration by the rate maker.

Features of St. Louis Automatic Substation

Automatic Reclosing Outgoing Feeders—Motor-Operated Valve on Cooling System of Transformers and Regulators—Transformer Core Lifted on Steel Frame Extending Through Roof

By WALTER H. MILLAN
Superintendent of Substations, Union Electric Light & Power Company

THE new Kingsbury Boulevard automatic substation of the Union Electric Light & Power Company, St. Louis, embodies several interesting features of control and construction. Besides the regular protection afforded by directional and time relays, both the transformer and regulators are equipped with thermostatic controls which trip the transformer oil switches when the oil temperature rises above 85 deg. C. In order to maintain flexible control on the cooling-water system, motor-operated valves are used. The 4,500-volt distributing feeders are sure of continuous service since automatic timers reclose the breakers by means of single-phase wattmeter-type motors.

The automatic control equipment consists of protection of the "tap" feeder and both legs of the "loop" feeder by "IK-104" directional relays in combination with the "CO" wattmeter type relays having a definite time characteristic. The directional relays are connected to trip when short-circuit current flows out of the station only. Protection of the one 13,200-volt outgoing feeder, the three three-phase, 4,500-volt outgoing feeders and the 13,200-volt side of the transformer is provided by "CO" relays in each phase. The transformer is protected from overheating by T-313 thermal relays in each phase of the high-voltage winding. These relays are designed to have the same thermal characteristics as the transformer and are connected to trip the H-3 oil switch in the high side of the transformer when the temperature limit is reached.

THERMAL RELAYS USED

The transformer and each of the three regulators are protected from excessive oil temperature by a thermostat beneath the oil in each of the units. These thermostats are all connected in parallel with the tripping circuit of the T-313 thermal relays and an oil temperature of 85 deg. C. in any of the four units will cause the transformer oil switch to trip.

The cooling water of the transformer and regulators is turned on and off by means of motor-operated valves in the water line of each of the four units. By this means of cooling the capacity of this equipment is increased 33 per cent. These motor valves are each controlled by two thermostats placed beneath the oil, in the regulator and the transformer. The transformer cooling water is turned on at a temperature of 75 deg. C. and turned off at 65 deg. C., while the water for the regulator is turned on at 65 deg. C. and removed when the temperature drops to 45 deg. C.

The automatic regulation of voltage is accomplished in the usual way. As a single set of regulators is used, only bus regulation is obtained. However, the usual rising characteristic is given to this regulation by means of type H line-drop compensators. The three 4,500-volt outgoing feeders are not only short but are of nearly the same length, and no trouble has been encountered. For the purpose of working on any of the three regulators arrangements are made by which any or all three may be cut out completely without interrupting the service. The regulators were accurately checked to determine the exact zero position at which the secondary may be shorted out by means of a disconnecting switch and the loop cleared by opening two other "disconnects." The excitation of the primary is interrupted by a single-pole hand-operated oil switch connected in the neutral leg of each regulator primary. After the exact zero position was determined a wattmeter dial train was mounted on the end of the shaft of the operating motor, the dials being set at zero. Obviously the inspector has only to turn the regulator by hand to the zero position on the dial train in order that a very close zero setting of the regulator may be obtained.

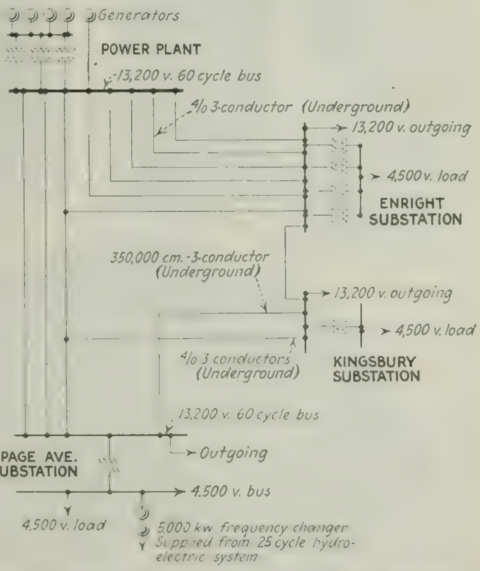
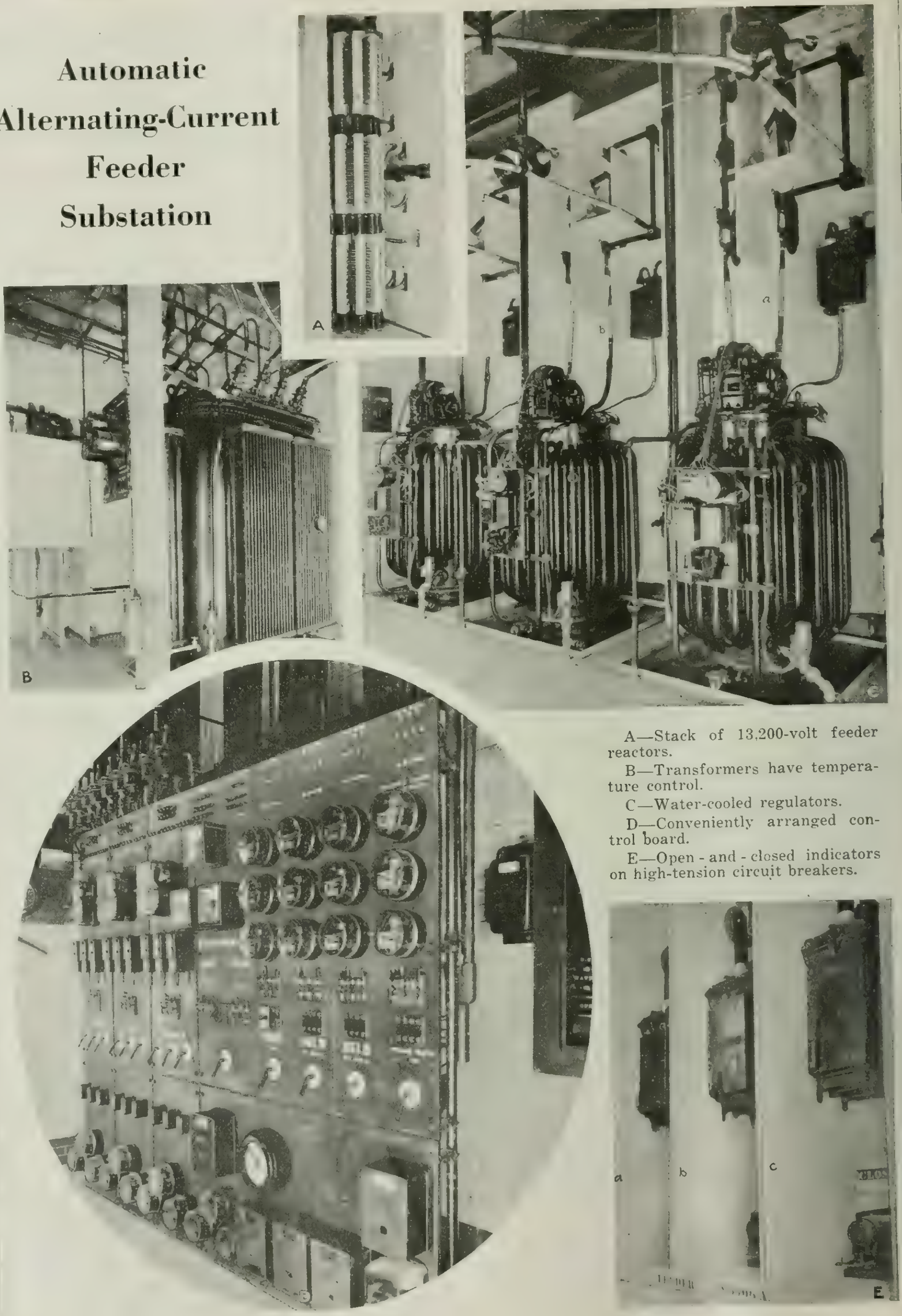


FIG. 1—DISTRIBUTION LAYOUT OF THE ENRIGHT, KINGSBURY AND PAGE AVENUE SUBSTATIONS

The automatic reclosing of the 4,500-volt outgoing feeders is obtained by standard timers. One of these timers serves for the control of the three single-phase circuits composing an outgoing three-phase feeder. These timers are operated by single-phase wattmeter-type motors installed inside of the timer cases. These motors are in circuit continuously, being held from moving by a mechanical stop which is removed whenever

Automatic Alternating-Current Feeder Substation



A—Stack of 13,200-volt feeder reactors.

B—Transformers have temperature control.

C—Water-cooled regulators.

D—Conveniently arranged control board.

E—Open - and - closed indicators on high-tension circuit breakers.

any of the three oil switches on that particular feeder drop out. The motor drives through reduction gears a set of three fingers. The entire apparatus somewhat resembles a drum controller. Once released, the motor drives the controller through one complete cycle of operation (one revolution of the drum) and is brought to a standstill by the mechanical stop.

Sequence of Automatic Operations

During the cycle of operation each of the traveling fingers in turn engages and operates a set of three quick-break contacts, each of which will operate the closing circuits of the oil switch on one of the three phases. These three contacts when engaged by one of the fingers do not close simultaneously, but are sufficiently lagged to prevent an excessive demand on the operating bus supply, should all three of the phases of the feeder be open at that instant. The traveling fingers are set at such points on the drum as to produce the following performance: The motor driving the drum is adjusted so that one revolution of the drum is made in two minutes. The finger producing the first reclosure is set to engage the contacts immediately after the dropping out of one of the switches. The three contacts are closed in six seconds, and any of the three phases that have opened will be reclosed. The drum continues to rotate, and the second reclosure takes place twenty-four seconds after the first and the third reclosure one and one-half minutes after the second. As the drum completes its cycle an auxiliary contact is closed momentarily. If any of the three oil switches are still open when this contact is made, that particular phase is "locked out" by a circuit-opening, hand-reset relay. The controller then comes to rest ready for another cycle.

The "locking out" of one or two of the phases does not affect the performance of the timer in reclosing the remaining phase or phases in the event of their being tripped out. The timer is started by the closing of a pallet switch on the oil-switch mechanism when it reaches the open position. The connections are so arranged that the tripping of a switch by means of a manual control will not start the timer and reclose the switch, nor is the timer operative for that particular phase until the oil switch is closed by the same manual-control switch. The value of this feature will be appreciated should an inspector intentionally open a feeder to clear a hazardous condition. The timers are so constructed that eight or ten fingers could be mounted on the drum and as many reclosures obtained. However, all of these reclosures would have to be made within the two-minute cycle, for when the motor is adjusted for a speed much lower than this the torque exerted is so weak as to produce non-uniform performance.

Substations Connected by Loop Feeder

This substation has a rating of 5,000 kva. and is located on Kingsbury Boulevard between the Page Avenue substation, which is on the west, and the Enright substation on the east. For better interconnection a 350,000-circ.mil, three-conductor cable from the Page substation running to the Enright substation is looped through the Kingsbury substation, as illustrated in Fig. 1. Primarily the substation was designed to receive three-phase, 60-cycle, 13,200-volt power and deliver three-phase, four-wire, 4,500/2,600-volt regulated energy distributed for both single-phase and three-phase service. However, equipment was also installed to distribute a portion as three-phase, 13,200-volt power to an ice plant in the immediate vicinity. The 13,200-volt bus receives energy from the transmission system over a No. 4/0, three-conductor cable "tapped" to the transmission cable which connects the Page Avenue substation to the power plant.

The building is constructed of red brick with a concrete roof. The location of the doors and the equipment is shown in Fig. 2. The ventilation is obtained by admitting air through a protected opening, 8 ft. x 10 ft., over the large door. Immediately beyond this opening is a baffle which deflects the air to 6 ft. above the floor, from which it passes the transformer and regulators and is discharged through a 60-in. ventilator through the roof.

In order to provide better means for equipment removal and at the same time keep the building cost down, two steel columns are extended through a hatched roof, on which is mounted a cross-beam. This beam contains a lifting eye from which a 16-ton hoist may be hung. Upon removing the hatch roof the transformer core may be raised to clear the case. The case may then be rolled to one side and the core lowered into the building for inspection and repairs.

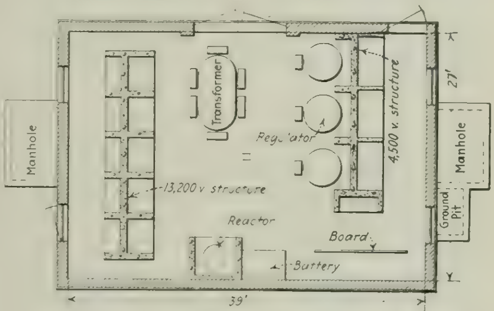


FIG. 2—ARRANGEMENT AND LOCATION OF THE MAJOR EQUIPMENT IN THE SUBSTATION

The transformer unit (see B in the halftone illustration) is of the three-phase core type having a self-cooled rating of 3,000 kva. and a water-cooled rating of 5,000 kva. The unit has head-block combinations for the following voltages: 26,400, 25,740, 25,080, 24,420, 23,760, 13,200, 12,540, 11,880/2,600-4,500-Y. The 4,500-volt leads of the transformer are connected, through disconnecting switches only, to the three single-phase automatic induction regulators having a range of plus or minus 10 per cent (shown in C, page 818), each having a self-cooled rating of 100 kva. and a water-cooled rating of 167 kva., which ratings correspond to the self-cooled and water-cooled ratings of the transformer. This arrangement makes the transformer and the bank of regulators integral. From the regulators the 4,500-volt power is connected, through disconnecting switches only, to the 4,500-volt busbars. This 4,500-volt energy is distributed over three No. 4/0, four-conductor cables treated as nine single-phase units, each unit being equipped with "disconnects," current transformers and a single-pole, 600-amp., 15,000-volt solenoid-operated automatic oil switch.

The neutral of the four-wire, 4,500/2,600-volt system is derived from the transformer neutral, which is connected solidly to a neutral busbar, to which is tied the neutral of each of the three outgoing 4,500-volt feeders and one side of the regulator primaries. This neutral bus is connected to a ground plate embedded in charcoal and salt in a pit outside of the building. To this ground plate are also connected ground wires from all current and potential transformer frames, cases and secondary circuits, all disconnecting-switch bases, the main transformer and regulator cases, iron-pipe conduit, etc. The ground connections are carefully grouped and brought to the ground plate separately, so that no danger of high potential on apparently grounded units is present in the event that any equipment should break down.

Each phase of each incoming and outgoing feeder is equipped with a special lug directly above the pothead which permits the attaching of a ground jumper by means of a wooden appliance that may be safely handled. The cable leads may also be completely detached from the disconnecting switches and carry the ground connection with them. These lugs and jumpers may also be used to "double up" two of the outgoing 4,500-volt feeders on one set of switches, thus permitting any of the switches to be inspected or worked upon without interrupting service.

An Accessible Control Board

The control board consists of six ebony asbestos-wood panels (illustrated in D), on which are mounted the overload relays, control switches for the oil switches, current and potential links and terminals, automatic timers and their auxiliaries, watt-hour and demand meters, as well as equipment for "jacking" a single set of three ammeters into any of the current circuits. The control wiring consists of multiple-conductor braided cable with color tracers, installed in 1¼-in. iron conduit carried overhead from the various points in the station to the control board. Control current is supplied from a vehicle-type storage battery which consists of fifty-five cells. The battery is kept at maximum-charge condition by means of a motor-generator set having a direct-current capacity of 1.5 amp. at 140 volts. The generator of this outfit remains connected across the battery and charges continuously at approximately 0.4 amp., this being sufficient to overcome the losses in the battery and replace whatever may be taken from the battery for operations.

There are five 13,200-volt switch positions, all of which are equipped with H-3, 500-amp., 15,000-volt bottom-and-back-connected oil switches and installed in separate compartments, as shown in E. All oil switches are provided with indicators which show "open" and "closed" positions of the mechanism. All compartments are provided with doors made of ¼-in. corrugated asbestos lumber without wood frames. Where disconnecting switches are installed in compartments, all three doors of each set are locked together so that they are opened by a single motion. There is a 5 per cent reactor (shown in A), installed between the oil switch and the pothead of the 13,200-volt outgoing feeder, on account of the close proximity of the light type of switchgear in the ice plant and also because if this feeder is ever extended to include any appreciable amount of overhead line it is expected to make such arrangements as to reclose it automatically on "trip-out." The station lighting, regulator motors, motor-generator set, timers and other auxiliaries are operated from a bank of three 2-kva. single-phase transformers fed from the 4,500-volt bus.

Largest Radio Station in France Placed in Operation

THE new high-power radio station of Sainte-Assis, powerful enough to reach all points of the civilized world, was placed in operation by the French Government last July. It is not only the largest radio station in France, but one of the largest in the world.

The two main posts are erected on the river Seine about 40 km. from Paris. One is for continental communications, to cover England, Spain, Italy, Central Europe, the Scandinavian countries and the Orient, with a radius of approximately 3,500 km. The second contains much larger equipment and is intended for transcontinental use, reaching the United States, Canada, South America, South Africa, India, China, and Japan.

The equipment of the continental station consists of a main current supply from a 14,500-volt, three-phase trunk line from Paris, two 200-kva., three-phase transformers to reduce the potential to 500 volts, an emergency current supply from two Diesel-electric groups of 100 kw. each and one 450-amp.-hr. storage battery. Four 52-kw. motor-generators convert the three-phase current into direct current, which is required to drive the high-frequency generators. The latter are rated at 60 hp., 220 volts, 6,000 r.p.m., 32,400 cycles per second. This equipment corresponds to an antenna input of 25 kw. per generator. An umbrella-type antenna is supported by a steel tower 750 ft. in height.

In the transcontinental station the main supply of energy is also taken from the 14,500-volt, three-phase trunk line. Two 1,300-kva., three-phase transformers reduce the voltage to 3,000. Several smaller transformers, aggregating 200 kva., are installed for auxiliaries. For emergency supply there are four Diesel-electric sets, two of 1,500 hp. and two of 90 hp. One 460-amp.-hr. storage battery is employed. Two 1,150-hp. synchronous motor-generator sets change the three-phase current into direct current. The sets are started with an 85-hp. synchronous starting motor on one end of the main shaft, while the other end carries the exciter. There are in all four high-frequency motor-generator sets—two of 250 kw., 20,400 cycles, 310 volts, at 3,000 r.p.m., and the other two of 500 kw., 15,000 cycles, 310 volts, at 2,500 r.p.m. An umbrella-type antenna is supported by eight steel towers, each 750 ft. in height. Particular attention was paid to insuring an excellent ground connection, more than 150 miles of copper wire being utilized for the different grounds.

At Villecresnes, about 25 km. from Paris, six small buildings for reception were erected. The actual receiving by sound, mechanical or optical registration is, however, effected in the headquarters in Paris.

As it is very desirable not only to receive but also to send all messages directly from Paris without manual relaying at Sainte-Assis, a special cable containing fourteen pairs of copper wires was designed and laid between Paris, Villecresnes and Sainte-Assis. The characteristics of this cable are so chosen that it is possible to send over each wire without interference a telegraphic message at a rate of 100 words per minute while at the same time a telephonic conversation is carried on. The cable is Pupinized with an inductance every 3 km. Within the city limits of Paris the cable is laid out in underground ducts, while outside it is suspended on a galvanized steel carrier on wooden poles. This represents the first use of a Pupinized cable of an appreciable length (30 miles) in France.

Policies in Merchandising Appliances*

Existing Ignorance of Cost Is Dangerous—Business Being Done at a Loss—Uniform Accounting Methods Should Be Developed for Central-Station Use—Independent Dealer Should Be Protected, Encouraged and Developed

By JOHN F. GILCHRIST
Vice-President Commonwealth Edison Company, Chicago

IN THIS paper Mr. Gilchrist makes some statements that strike at the very roots of present central-station merchandising practice and point of view. It is plain talk from a man whose experience and judgment make him probably our foremost authority in these matters. He says that appliance sales in a community may be made to equal sales of electricity, that today most central-station companies are selling at a loss, that with the volume of business in prospect such losses cannot be countenanced. He has proved by investigation that the average central station is absolutely ignorant of merchandising costs. He states clearly the obligation of the light and power company to protect the local trade by maintaining proper policies and build up more prosperous dealers for the better service of the market. Mr. Gilchrist speaks of the "spread" on appliances and the influence of price on volume of sales and recommends that prices be increased—a debatable point discussed editorially in this issue. No more constructive paper has ever been written on the subject of central-station merchandising.

IN MOST communities the percentage of the entire number of electrical customers who are residence customers ranges from 50 to 90. We are beginning to calculate the possibilities in the sale of electric appliances in comparison with the income from the sales of electricity, and also with the sales per capita and per customer in the communities, for the purpose of comparing one community with another, so as to "get a line" on the possibilities of the business. Recently an enthusiastic merchandising manager in one of the large syndicates has optimistically predicted that it is quite possible for the sales of merchandise to the entire body of residence customers of a central-station company to equal each year the sales of electricity. While that statement at first seemed absolutely preposterous to the writer, familiarity with it and analysis has led to the conclusion that the merchandising business might easily be brought up to a figure which would be a substantial percentage of the residence electricity income, if not quite equal to it.

If we may assume that the average annual payment for electricity is in the neighborhood of $25 per residence, it makes it easier to accept this prediction, as it would seem not out of reason to demonstrate the economy and usefulness of electric appliances sufficiently to result in sales of $25 per annum per residence customer. If each customer purchased annually three or four of the smaller devices, it would amount to this, and in the case of articles as large as washing machines, the customers need be only one in five to one in eight of the electric light customers to have this device alone account for a volume equivalent to the lighting bills, so that we begin to realize that we are dealing with a business of no mean size, and one quite worth while cultivating, provided it can be done on a basis which is profitable, because when we come to consider business in such volume it becomes immediately apparent that the question of a sure merchandising profit cannot be overlooked.

It is possible that we could have afforded to look upon this business as more or less of a plaything and experiment when in volume it did not exceed 2 or 3 per cent of our total volume of central-station business, and could even afford to ignore losses or charge them up to advertising; but in any such volume as I have been discussing the necessity for profit becomes imperative. It is this feature of the business which particularly has called forth the inquiry and interest which is everywhere in evidence at this time.

We have discovered several important matters in connection with the business. In the first place, the merits of the devices are not so widely known that any large amount of sales can be expected from people who, on their own initiative, find their way into our stores. More than the ordinary amount of advertising is necessary, and in addition to that we must have salesmen who will go out among the people and demonstrate to them in their homes the advantages of becoming users of these appliances. This means more than the average amount of expense per unit of sales for advertising and selling which the ordinary retail merchant expects to assume.

In addition to these expenses, it has been found that, like furniture, pianos and other household equipment, this merchandise must to a large extent be sold on deferred payments if a reasonable volume of business is to be expected, which introduces more cost for the carrying of accounts. Study of figures in the case of the merchandise business of a considerable number of prominent central stations has led to the suspicion that the average cost of doing this business is somewhere in the neighborhood of 37½ per cent of the gross sales. At least, this is sufficiently evident to create a desire on the part of those doing any volume of business to get to the bottom of the matter and find out as definitely as possible what the exact cost is, because if this is the cost, it is quite evident that the great majority of institutions are doing business at a loss, and the "spread" which prevails between cost and selling price of this kind of merchandise is on the average decidedly less than it should be.

General Ignorance of Cost

It might seem to the well-organized merchant, who has long dealt with the question of profit on goods and who is so organized that he not only knows each night what his sales have been during the day, but also knows what the net profit on them is, that my statement regarding the desire of knowing what the cost is is rather strange and indicates a great lack of business sense and experience. But when I make this statement to a body of central-station men, who appreciate the fact that this business is done very generally as a side issue to the larger business of distributing electricity and by making use of many of the facilities of the larger business, it will be understood how really difficult it is to determine exactly what the cost would be of doing this business if it were an entirely separate business.

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*Part of a paper presented at the convention of the Great Lakes Geographic Division of the National Electric Light Association at French Lick Springs, Ind.

The central stations are no doubt more responsible than the manufacturers for the fact that there is not a proper expense and profit "spread" in the selling of these articles. When appliances first came on the market the central stations universally had very little idea of attempting to make a merchandising profit, their whole thought being that they could afford to sell this apparatus at low prices, and even take merchandising losses, in order rapidly to place a large amount of it on their circuits and derive the income from the sale of electricity which would result. This policy on the part of the central stations has misled the manufacturers, and the study of costs and the question of what "spreads" are essential to the retailer have been rather ignored. This undoubtedly is the greatest obstacle to the extension of the business at this time, because to too great an extent the central stations are only dabbling in these sales, and yet, generally speaking, they are putting out the appliances on such a basis that the independent dealer, even though he is fortunate enough to be able to purchase at as low a price as the central station, cannot possibly compete with the central station and live, the result being that there are relatively few of these dealers and their volume of business is small.

MUCH BUSINESS DONE AT A LOSS

A matter of first importance in handling this situation is the installation of proper accounting methods and segregation from other allied businesses, so that it can be determined how much gross profit is necessary if the business is to stand on its own feet. It is not only necessary that accounting be done, but it is necessary that standard methods of accounting be used, so that institutions may compare their costs one with another, and by producing a large number of examples can develop data which will be convincing, not only to the merchandisers themselves, but to those from whom they buy goods, and whose interests are being affected quite as seriously as the retailers if the margin to the retailer is insufficient to permit of his making a reasonable profit.

This, potentially, is now a great branch of our business, and it is thoroughly worth while that the ablest men in it should give a great deal of their attention to the question of a proper merchandising policy. We are altogether too prone to optimism in convincing ourselves on the most superficial information that we are making profits, and that we are a little more clever than other people and can sell lower and still make money. It is high time that we quit fooling ourselves and get down to a careful investigation of the entire matter.

Only recently I have had occasion to attempt to secure somewhat comparable figures from nine or ten of the central stations doing the biggest retail electrical business in the country, and it was necessary to send men to nearly all of these companies to work several days before it was possible to get any figures that were at all comparable, so as to make a half-way intelligent comparison of costs among companies. Many of these companies were serene in the belief that they were making money, but on obtaining a superficial analysis, it became evident that there was not a single company in the group that was really making any money. This was confirmed by the fact that two or three of the companies that did the biggest business and came nearest to knowing what they were doing were frank in admitting losses and the very great necessity of taking some steps to correct the conditions, but most of them are not convinced yet and are hesitating over the question of the necessity of developing a separate accounting system for this part of the business and the advisability of an accounting investigation, based on figures obtained under such an accounting system, to determine just what the losses are—this notwithstanding the fact that, basing inquiry on their own insufficient information, it should not take them long to convince themselves that they are losing each year many times any possible cost of such an investigation. This condition may not be very different from that existing in many businesses.

The Federal Trade Commission from its inception has contended that the greatest obstacles to the building up of profitable enterprises in the country is the very great lack of information as to details of costs of businesses which prevails everywhere, and a great deal of its energy has been directed toward the development of cost accounting plans which will put merchants and manufacturers in possession of information to enable them to guide their businesses properly. This great body has recognized almost instantly the absolute necessity of proper cost-finding systems, standardized throughout industries, to enable those industries to compare notes as to their costs.

That is the first thing which we want in this business. When we have that we shall be prepared to seek the remedy effectively. The remedy probably does not lie in any single change. In the first place, we must get our own houses in order and find ways of conducting this business in volume, with proper service to our customers, at the lowest possible cost. We cannot do this intelligently until we know our costs. This will not give complete relief, but it will help and will enable us to see that we must get higher prices for our commodities before we can make money, and particularly before the small independent dealers can make money. The greatest importance should be placed upon the necessity of a policy which will develop prosperous independent dealers. The central-station companies should be leaders in this matter of selling and distributing merchandise, but even if it were good policy to attempt to monopolize the business—and it is not good policy—they cannot begin to cover the field. Their best interests lie in developing a large number of prosperous, well-run, independent businesses, which will become broad distributors of the electricity-using devices that are becoming each year a more and more important factor in the income account of the central stations.

INFLUENCE OF LIST PRICES

When we come to the question of raising prices, there will be some details, such as the manufacturers' lists, etc., which must be straightened out. The manufacturers' list, which in many businesses is ignored, in our business seems to have a psychological effect in that in the minds of many of us it is the limiting high price which can be charged at retail, and it is true that if a manufacturer's list is widely advertised, so that the public is familiar with it, a retailer is open to charges of profiteering if he attempts to obtain a higher price. This is particularly true because so large a number of dealers have learned to look on the manufacturers' list as the top possible price, and it would be a very strong dealer who, establishing his price above this list, might expect to influence others to adopt the higher price.

A third way of reaching a satisfactory situation will be through reduction of the manufacturer's or jobber's prices to the dealer. Personally I am not starting any clamor on this point, as I am convinced, generally speaking, that the manufacturers and jobbers have already done their share, but as we are undoubtedly in a long period of declining prices, we may from time to time expect some relief in this respect, while still leaving the manufacturer in as satisfactory a position as to percentage of profits as he is in now. What we want to urge on him particularly is to take advantage of this period to create more nearly a proper "spread" by holding his list prices where they are and reducing his net prices as his costs go down.

Washing-Machine Situation Typical

Getting down into a little detail, let us take the case of the washing machine as typical of the entire business. I want to quote this letter written about a year ago by a very able and intelligent dealer in one of the big cities of the Middle West who has had a great deal of experience:

> The average dealer's discount, as you are no doubt aware, varies from 25 to 35 and 5 per cent. The average dealer's overhead, as determined by the National Association of Contractors and Dealers, from stores in operation, is 28 per cent.
>
> Every family uses a cookstove, either gas or coal, and the discount to the dealer on cookstoves is from 40 to 60 per cent, varying with the make and quality of the product. Cookstoves sell themselves. Washing machines have to be sold and require not only an expensive sales force but expensive advertising as well. If the margin on washing machines was 50 per cent, every electrical dealer and contractor could be an outlet for the washing machines, but dealers today are only selling washing machines because they have listened to some persuasive argument of a good salesman, and not because they are making any money upon them.
>
> Checking up our own cost for the last year, taking the total machines sold at the selling price on the one hand and the cost of selling the machines on other hand, including the cost of the machine, the delivery charges, the advertising charges, the demonstrating charges and the servicing charges, we find that we paid each one of our washing machine customers during the year 1920 $8.22 for the privilege of selling the machine.

The only trouble with this gentleman's statement is that he has not done business in a big enough way to appreciate what all of the real costs are, and that in a big business they are actually much heavier than he states. Had he been doing business on a scale which would have required his going after it in the most vigorous way, he would probably have found that it had cost him $20 to $25 per machine for the pleasure of being in business, instead of $8.22. I think any of us who have done any analyzing will realize that the cost of selling washing machines is higher than the average cost of selling the general line of appliances. They must be sold on deferred payments, which means high cost of financing. In the selling of them the highest type of salesmen's service is required, if satisfactory results are to be obtained, and servicing, which custom dictates should be furnished free by the dealer, is costly.

Yet I can point out to you large companies which, generally speaking, have some ideas of making profits, and also some ideas of their responsibilities to the dealers, large and small, in their territory, which plume themselves greatly on selling a large number of low-priced washing machines at a gross profit of 33⅓ per cent, when their average cost of doing business on the entire appliance business is 37½ per cent. This means to me that their cost of selling washing machines is probably over 40 per cent. The central stations' own immediate loss of money is the matter of least importance in their transactions. The serious thing is that such policies check the whole washing-machine industry in a city by establishing in the minds of the people a standard of value of washing machines which will be hard to dislodge later and at which no well constructed washing machine can be sold without absolute loss to the dealer, to say nothing of a reasonable profit.

In my judgment, the central-station company, as a leader in the community, should pick out as its standard the highest grade of washing machine which it can find and charge a price for that machine which will cover its cost and such a profit that the small dealer can compete at the same price and make a reasonable profit; then put all the prestige and energy of the central station behind the article, knowing that every one of its customers who buys one will get good and fair value. They will get the best machine made, and get it on a basis which yields only a very reasonable profit to the distributor.

This will have the following result: Many of the independent dealers will sell lower-grade machines which go at a lower price. They will be able to sell more of them, and they will on this class of machines get a price which will let them out with a profit, and the washing-machine business will thrive and prosper in the community, because it will yield a profit which warrants the necessary effort to put out a lot of machines, and a lot of machines can never be put out in any community, even at a ruinous price, without a great deal of effort. The washing machine is something which the people do not buy. It must be sold to them. On the other hand, its very great value is evidenced by the fact that when a family has used one for six months, and has learned to appreciate thoroughly what it means in the saving of time, energy, good looks and clothes, you will find that there will not be an article of furniture in the entire home which they will not give up rather than the washing machine. This is only another illustration of my statement earlier in this paper that the public as yet does not know the value of electrical appliances, and when it does fully grasp the possibilities of efficiency, economy and help in raising the standards of living, this business will increase tremendously.

Experience in Chicago

Before we get off the subject of the washing machine, however, I want to take you into confidence. In my experience in Chicago we have been selling a machine for $192.20 which costs the Commonwealth Edison Company $94.50 in lots of five or more. When many of the other companies in more or less of a panic reduced their prices on washing machines, this company increased its price, as it had found that it was obliged to do so in order to sell a dependable machine and get out whole. Many of the people in the company, especially the salesmen, felt that the increase in price would cut down the sales very decidedly, but the reverse has been true, owing to the increased advertising and the increased salesmen's commissions which were possible. The company nets more money per machine, and sales are practically double what they were eight or ten months ago under the former policy. In fact, this company is selling at this price more washers today in Chicago than are sold in the city of all other makes of washers put together, notwithstanding the fact that Chicago is one of the most highly competitive washing-machine markets in the country.

But now comes the point which I wish to make particularly. There were so many people in the company who believed that we were selling at too high a profit that the writer called in the services of unbiased expert accountants to analyze the washing machine business, and in Tables I and II are found the results for the months of June and July of this year in percentages. While some of the costs may be open to question, and while a lot of you may think that you can do business a great deal better than the company in question, they are the actual costs. To the very great surprise of every one, they showed that even on these higher prices the machines were being sold at a loss instead of a profit. You can well imagine that this was a very great shock, when we were proceeding from the standpoint of trying to justify a relatively high price, and I say to you here that, notwithstanding the opinions you have, if you will go into your figures and have your experts analyze them as thoroughly as in the company to which I refer, and get as broad a grasp of the situation, you will, I am satisfied, find that the final net profits on the washing machines you are selling are not on a satisfactory basis.

TABLE I—STATEMENT OF AVERAGE UNIT COST OF SELLING NEW WASHING MACHINES FOR THE MONTHS OF JUNE AND JULY, 1922

	June, per Cent		July, per Cent	
Average net selling price	100.0		100.0	
Average cost per machine sold	56.6		58.0	
Gross profit per machine		43.4		42.0
Average expenses per machine sold:				
Selling:				
Commissions	17.8		18.7	
Bonus	0.8		0.8	
Premiums	1.8		2.7	
Demonstrating	1.4		1.7	
Salaries, adjustments and sundries	1.6		2.2	
Delivery and salesmen's automobiles	4.0		5.7	
Repairs	1.1		1.6	
Total selling	28.5		33.4	
Buying	2.1		2.5	
Occupancy	3.6		4.2	
Publicity	4.9		4.6	
Administrative	8.5		12.2	
Overhead expenses	19.1		23.5	
Total expenses		47.6		56.9
Average loss per machine		4.2		14.9

The situation with reference to the sale of washing machines, while extreme, is more or less typical of the entire merchandising situation, and it is time for every one in the business to give careful attention to these features. The central stations, with all their influence and prestige, will do the industry an incaculable injury if they sell this merchandise on a basis that does not result in reasonable profits, and the fact that they do not know they are selling too low does not excuse them. They might better keep out of the business and turn it over to some one else.

VOLUME SALES NOT BASED ON LOW PRICES

There seems to be a very general feeling among merchandisers, and the less experienced they are the more they are subject to such convictions, that in order to get volume of sales prices must be made very low and that prices can only move in one direction—downward. Any effort to move them in the other direction, it is supposed, will dry up the business. This is a fallacy, particularly with articles of as much real merit and real demand as electrical appliances.

As a policy in merchandising, the central stations should stay in the business, and should be leaders in it, but should recognize the very great advantage to them of having a large number of independent dealers in the field, and with this thought in mind should shape their policy so that these dealers in fair competition can make and accumulate money and become strong and resourceful, provided that the intelligence and industry which they exercise in the prosecution of their business is such as should warrant success.

We want a reasonable profit for ourselves, and we want our contemporaries to make a reasonable profit, and if there is a tendency for the central station to make too much when goods are sold on a basis which will yield the dealer in competition a reasonable profit, the matter can readily be equalized by the central station assuming more of the burden of the necessary publicity.

If you are not doing 25 cents' worth of merchandise sales for every dollar's worth of electricity sales in your territory, you are not doing what you should be doing right now, and this business should grow faster in proportion than the business of distributing electricity.

REFUSE TO SELL WITHOUT PROFIT

In the doing of this business, perhaps the most important thing to watch is your gross profit. You will merchandise a small amount of goods which might be termed staples, the margin of profit in which is small and has been from time immemorial, but you will carry this more or less as an accommodation line, and your cost of carrying and selling will also be relatively low. However, the great volume of appliances of recent introduction, which constitute the bulk of your sales and which are the articles you push, must carry a good margin, and if they do not you should resolutely put your foot down and decline to handle them until they are presented to you on a basis where they do.

TABLE II—AVERAGE COST OF SELLING TYPE "L" WASHERS, TREATING PREMIUMS AS A REDUCTION OF PRICE INSTEAD OF A SELLING EXPENSE

	June, per Cent			July, per Cent		
List price		100.0			100.0	
Average allowance	1.2			2.9		
Average premium	1.7			2.5		
Average cash discount	0.3			0.6		
Average price reduction		3.2			6.0	
Average selling price		96.8			94.0	
Cost of type "L" washer		54.0			54.0	
Gross profit per type "L" washer			42.8			40.0
Expenses as above, exclusive of premiums			45.1			51.9
Average loss per type "L" washer			2.3			11.9

Naturally, you must pass into these situations gradually. The Commonwealth Edison Company in its merchandising policy is endeavoring to work to a point of 40 per cent minimum margin and to maintain a policy that it will not place any goods on its counters which carry less than this. It is encouraging to report that the manufacturers and jobbers have begun to understand and recognize the situation, and the trend of their prices is more and more toward a basis which will permit of the realization of such a policy.

Driving Accident Prevention Home

Comprehensive Suggestions Covering the Preparation of a Safety Code, Drawn Up by the Accident Prevention Committee, Were Made Before Convention of the New England Division, N. E. L. A.

ACCIDENT prevention work in electric utilities has advanced so rapidly in recent years as to challenge the attention of far-sighted executives. At the New London convention of the New England Geographic Division, National Electric Light Association, H. W. Moses, chairman of the accident prevention committee, presented an unusually comprehensive report upon the present situation in this field. The report pointed out that, although striking achievements have been absent, progress has been made. This committee has presented so much information of practical interest since 1913 that if its recommendations were studied and applied, there would be need for little further activity on the part of the signers of the report as such. In order to make sure that the properly interested parties receive the material sent out by the committee, a list of more than 150 persons directly interested in accident prevention has been compiled and is available for the succeeding committee. It is thought that this list will be helpful in establishing more intimate relations between the committee and the various companies, with resulting closer co-operation and prompter action in gathering and distributing accident prevention material.

PRACTICAL POINTS IN CODE WORK

Instead of a set of code rules, the committee feels that it may properly make the following suggestions to those having in mind the formation of a safety code or the revision of existing codal material:

1. The term "rule" is psychologically wrong. No one minds being instructed, but the worker today in general objects to having to follow a rule. Therefore the term "Safety Instructions" or "Safety Code" is better.
2. Safety instructions should not be confused by being incorporated as part of the general operating instructions of any company. Rather let them be drawn up as a separate book or pamphlet.
3. As far as possible, they should be written in the vernacular of the particular department to which they are to apply. Too often safety instructions read more like a page from some legal document.
4. Let them be written in the affirmative as far as it is possible, that is, point out what should be done rather than what should not be done.
5. Particular attention should be paid to the printing and arrangement. The rules for any one department should be segregated and considered in a separate section of the instructions. Sub-headings should be liberally employed and the rules applying to a particular sub-heading grouped under it.
6. Keep out any extraneous rules that do not apply to your company. A smaller number of carefully chosen rules, rigidly enforced, is better than dozens of ill-considered instructions that are ignored.
7. Make every effort to include no instructions that cannot be enforced. Some employees are very critical and are always on the lookout for such slips, which they use to discredit the entire set of instructions.
8. In drawing up a code of instructions be certain that all classes of employees are comprehended.
9. No code of instructions would be complete unless there is included the N. E. L. A. instructions for resuscitation.
10. After the instructions have been completed let them be thoroughly indexed.
11. Amend the instructions as often as changes in the art, additions to equipment or growth of the company warrant. When equipment with which employees are not familiar is to be added to the plant have the new instructions covering the use of this equipment issued before the equipment is placed in service.
12. In amending the instructions from time to time let the entire staff co-operate in compiling the changes.
13. Let it be known that suggestions from any employee as to the workability of existing instructions or the desirability of new ones are always welcome. When such suggestions are made, make certain that the employee making them is finally advised of the disposition of his ideas.
14. Keep a "weather eye" out for additional worth-while rules gleaned from the experience of other companies.
15. After instructions are once issued it is important to keep everlastingly at the enforcement of them.
16. Some sort of periodic "follow-up" of safety instructions should be prescribed. This may take the form of periodic examinations of individual employees as to their knowledge of the rules, or of systematic talks by officials.
17. Enforcement of safety instructions will be easier if employees are taught to realize that the instructions are primarily for their protection rather than for the protection of the company. The company can replace material and even men lost or injured through accident, but the man cannot replace that which he himself has lost.
18. Safety instructions should be tied in with safety bulletins when an accident occurs. Immediately a suitable bulletin should be posted directed against this type of accident, and along with each bulletin may well go a copy out of the instruction book of the instruction which, if it had been observed, would have prevented the accident.
19. Let the public know that you have a code of safety instructions and that its purpose is to protect life and property not only of employees but of the public as well.

In addition to the above general suggestions, recent accident experience would seem to point to laying particular emphasis on the following:

1. *Supervision.*—Special attention should in some way be directed, either by the use of heavier type or by underlining, to the rule or rules instructing employees that they must be properly supervised in any work they are to undertake.
2. *Pole Handling.*—More complete instructions for handling poles are desirable. These should be dictated by careful experience and observation of actual practice.
3. *Resuscitation.* — There should always be included a provision whereby the "prone-pressure" method should be practiced at least once a month.
4. *Automobile Operation.* — The continually increasing number of automobiles operated by member companies make it desirable—in fact essential—that there should be included a section covering the safe operation of automobiles on the highways, together with instructions directed toward the elimination of garage hazards.
5. *Construction Hazards.*—While these have been recognized for many years, nevertheless continued and greater emphasis should be placed on any rules covering such hazards.
6. *Rubber Gloves.*—Rules covering the use of these should provide for the use of protective gloves over the rubber gloves.
7. *Fire Prevention.* — Fire prevention being a part of accident prevention work, no safety code may be considered complete without a section directed toward the elimination

of fire hazards, periodic inspection of premises, proper methods of fire protective apparatus and establishment of fire drills.

8. *Fuel Oil.*—With the increased use of oil for fuel in place of coal, a section should be included, where such oil is used, providing safeguards around the oil storage, oil-pump rooms and in boiler rooms.

9. *Office Hazards.*—Too little attention has been paid in the past to eliminating the various hazards existing in and around company offices. A section dealing with such hazards should form a part of every safety code.

10. *First-Aid Kits.*—A section should be included covering the make-up, inspection and use of the standard N. E. L. A. first-aid kits.

The report also urged the association of past committee members in some way with active members to strengthen and perpetuate the work. Once safety work has been started in a public utility, it is seldom or never set aside. At present comparisons of data are difficult between companies because of lack of uniformity in statistical records. The committee recommended the preparation of a uniform accident report blank for general use by members of the New England Division.

Continued Executive Interest Helps

Lack of executive support has hampered accident-prevention work in many cases. There is a too general belief that the cost of accidents is a fixed charge, or a tendency to think of accident prevention in terms of insurance premiums. The premium asked by the insurance carrier is paid by the employer, who feels oftentimes that he is thereby released from any further obligation or worry about the matter for at least another year. This is a short-sighted policy. There is a slow but gradual tendency to broaden the application of the compensation laws. The waiting period is shortened, the benefits are increased, medical services are more liberal, and, generally, there is a broader interpretation of the application of the law. This results in an increase in the cost of accidents, and hence in larger premiums. Accident costs may be reduced by preventive measures based on experience, and the committee urged the consideration of this subject by executives.

Other needs pointed out in the report were the greater use of safety devices, closer tabulation of causes of lost time due to illness, further study of fire hazards and protection of valuable records, extension of training in the prone-pressure method of applying artificial respiration in case of electric shock or drowning, increasing regard for safe motor-vehicle-operating methods on highways and elsewhere, reduction of hazards arising from improper or inadequate illumination, protection of distribution lines against makeshift radio aërial construction, proper inspection and upkeep of stairways and railings leading from hydro-electric plants to dams, forebays, etc., rigid supervision of live-line maintenance, better inspection of pole lines and educational efforts along accident-prevention lines for the benefit of the general public and school children. Concluding, the report cited the following rewards of safety work: (1) increased efficiency; (2) elimination of waste; (3) conservation of cash; (4) cutting of production costs; (5) saving of life; (6) promotion of better health; (7) reduction of injuries and mistakes; (8) development of standards of design and construction; (9) more clearly defined operating, distribution and maintenance methods.

President Frank W. Smith in discussing the report at New London complimented the committee on its work, characterizing the report as one of the best on accident prevention which he had heard in the past few years. Safety work lagged under war pressure, Mr. Smith said, but excellent results have come from its revival on his own company system, that of the United Electric Light & Power Company, New York. This company has an accident committee of thirty members, with monthly meetings usually devoted to an all-day discussion of accident problems. Representatives of the different departments below the rank of the higher executives attend. One committee member represents the company's insurance trustee. When it is feasible, employees who have been directly concerned in accidents are invited to tell their experiences and views to the committee in the interests of future safety.

H. T. Sands, Tenney companies, Boston, described a recent "safety-first day" conducted at Springfield, Mass., by the New England Telephone & Telegraph Company. A feature of this was a demonstration of what should be done to prepare a man struck on the street by an automobile for removal to the hospital before the arrival of an ambulance. An instance of the great value of instruction in the prone-pressure method of resuscitation was cited by Mr. Sand. A day or two after two of his linemen had been instructed in this work they saved the life of an employee who received a shock in attempting to reinstall a switch in a high-tension terminal house. The nearest doctor was seven miles away, but the short intensive training these men had received enabled them to prevent a fatality, and the victim of the accident is alive and working today.

C. R. Price, New Bedford, Mass., said that his company has succeeded in reducing its accident insurance premium through organization for better preventive work. Dr. E. W. Bullock of the New England Telephone & Telegraph Company, who gave a fine demonstration of the prone-pressure method at last year's New London convention, visited New Bedford by request to give instruction along the same line, and representatives from the local fire and police departments were present.

Deadly Risk of Suspending Treatment

Fire and police department members, as well as physicians, should be made mere familiar with the prone-pressure method of resuscitation, declared C. H. Parker of the Boston Edison company. Grave danger to victims of shock may arise if utility men are forced to suspend prone-pressure treatment before revival has been sufficiently established, J. A. Vahey, Boston, held. H. Burgi, Portland, Me., said that the local city government has appointed a committee on this matter, and Chairman Moses stated that it is hoped through the Massachusetts Safety Council to get the value of the prone-pressure method before the police and fire chiefs and the medical examiners of the state during the fall.

Financial Plans for the Development of Austria's Water Powers

AS ALREADY noted in the *Electrical World*, during the last few months great progress has been made in paving the way for the exploitation of the Austrian water powers in generating electrical energy. The technical part of the problem concerns the utilization of natural resources which, if properly exploited, could furnish up to 3,000,000 hp.

Up to the present time three great enterprises have been initiated, which will respectively develop water powers to serve Vienna, Upper Austria and Styria. These are the Upper Austrian and Styrian Water Power & Electric Company at Linz and Graz and the Vienna Water Power Company at Vienna. The capital of the Styrian company is 600,000,000 crowns, that of the Vienna company 500,000,000 crowns and of the Upper Austrian company 300,000,000 crowns. These figures, however, represent only the cost of construction for the first year, and all three companies have announced already the issue of additional stock. The financing plan of the three companies shows uniform features.

The water-power shares issued by the companies are in many respects a novelty not only on the Austrian but also on the Central European stock market. The nominal amount of the shares (200 and 400 crowns) is, even for Austria, extremely low. Another new feature of the Austrian water-power shares is the guarantee of a dividend of at least 6 per cent. Through this guarantee the shares become in fact dividend-paying bonds, which was made possible only by the Austrian State renouncing its right to tax the companies.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Why Electrical Men Should Say "Luminaire"

To the Editors of the Electrical World:

For some years progressive illuminating engineers have felt the inadequacy of the words "fixture" and "lighting fixture." Years ago, when gas began to supplant oil lamps, the word "fixture" seems to have become a term descriptive of a section of more or less ornate gas pipe, extending from the wall or suspended from the ceiling, and supporting one or more burners. In this connection the appropriateness of the word was never questioned. Nothing could be more "fixed" than the old-fashioned gas-pipe fixture.

But as the scope of the lighting field widened and electricity began to usurp the place of gas for lighting purposes, the "fixed" character of a lighting unit gradually lost its significance. Electric lighting, always flexible in character, has in recent years greatly increased its range of adaptability; but the terms used to describe the lighting units have not undergone a corresponding evolution. The word "fixture" may have been suitable for the gas age, but in neither its original nor its commonly accepted meaning is it suitable for use in connection with modern electric lighting practice.

The objections to "fixture" are three in number. First, when we examine the word from a lexigraphic point of view, we find that a fixture is "a movable that has become fastened to anything, as to a house." Such being the case, a fixture is not a fixture until it has been fastened to something or permanently installed in a certain place. What, then, is the thing that one buys at the dealer's store? If it is not a fixture until it is installed in its appointed place, what is it, and if so, why? The easiest escape from this quandary is to use the new word "luminaire."

Second, if we are to ignore the dictionary meaning of "fixture" and use the word in its hitherto commonly accepted sense to mean simply a lighting unit, why do we not also call the type of lighting unit commonly used on tables or desks a fixture instead of a lamp? The reason is the same as that which now hinders the dropping of "fixture"—an inbred reluctance to use a new name for a new object. For centuries before the advent of electricity a vessel containing oil and supporting a wick was called a lamp. The so-called electric table lamp is not a vessel and has neither oil nor wick, but it has begun to occupy to a large extent the place that the oil lamp formerly filled. Is that any reason, however, for calling it by the same name?

Third, the hitherto accepted meaning of the word "fixture" implies a condition of immobility that has a harmful reaction upon the manufacture of luminaires. If the public continues to retain the idea that "fixtures" must always remain "fixed" and cannot be changed, they will let them remain in their homes and business places despite the fact that they may be antiquated, inadequate or unsuitable for their purpose.

In an effort to correct the incongruity of this situation the word "luminaire" has been adopted. Luminaire is equally suitable for describing a pendent, wall-type, ceiling-type or portable lighting unit, or any device intended to dissipate artificial light. Luminaire was selected from among a number of terms submitted to the committee on nomenclature and standards of the Illuminating Engineering Society, and its adoption by that body has since been concurred in by the leading lamp manufacturers, engineering societies and the lighting profession generally.

The term "luminaire" is not coined nor in use as a trade name. It is easy to pronounce and is used with a similar meaning in the French language.

Pittsburgh, Pa. M. Reast.

Salesmanship and Engineering

To the Editors of the Electrical World:

The writer has read with interest your recent editorial on "Salesmanship and Engineering," and it seems to him that you have omitted from consideration in this article one very important factor, especially as applied to the electrical industry; that is, the engineer salesman or the sales engineer. The little company with which the writer is associated represents a number of Eastern manufacturers, and in every case the man who is responsible for the sales is a trained engineer. This, we believe, is the solution of the problem stated.

Certainly there are a great number of men who have the technical qualifications and ability to be designing engineers and yet who by nature and inclination prefer contact with the public and general commercial business rather than the strict routine of engineering. More of this type of men can be developed, and their efforts will go a long way to protect the customer's interest as well as that of the company.

It seems to the writer that pure salesmanship should go just as far in protecting the interest of the customer as pure engineering. The salesman who does not have the best interest of his customer at heart and is thinking only of his sales record is almost in a class with the old-time central-station company which did not have the interest of the public at heart.

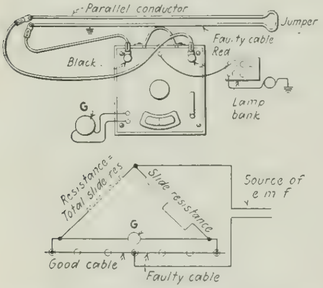
White & Converse,
Minneapolis, Minn.
Clovis M. Converse.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Portable Cable Fault Localizer

TO BE satisfactory any method of locating cable faults must enable the determination of the position of the fault with reasonable accuracy and in addition must be promptly and easily applicable by the regular station force without the necessity of calculations. The equipment shown in the accompanying illustration amply fulfills these requirements and is applicable to nearly all forms of cable failure.



PROMPT LOCATION OF TROUBLE REDUCES THE TIME FEEDER IS OUT OF SERVICE

Above—Connections for fault localizer. Below—Schematic diagram showing wiring connections.

In operation the device applies a certain, but not necessarily constant, amount of direct current to the grounded conductor and one other similar conductor on which there is no fault. The connections of the fault localizer are as shown in the illustration, the arrangement of resistors in the equipment being such as to produce in effect a Wheatstone bridge. As the knob is turned the resistance in one leg of the Wheatstone bridge is varied. The good cable is in the other leg, so that when the instrument is adjusted to the zero position of the galvanometer the location of the fault is read off directly in terms of the percentage of the distance from the point where the test is made to the total length of the cable. The percentage location of the fault is then referred to the record for that particular feeder, which gives the location of each manhole throughout its length in terms of the percentage of its total length. The manhole nearest in agreement with the percentage derived from the fault reading is the approximate location of the fault. In practice it is found to be unnecessary to read closer than the nearest manholes, which are usually spaced from 200 ft. to 300 ft. apart.

One company has had these instruments in use since 1915, within which period there have been forty-three high-tension feeder failures. Of this number, two were of such a nature that the fault localizer could not be applied. Of the remaining forty-one, one fault was located four manhole lengths from the point indicated, four were found two manhole lengths off, and the remaining thirty-six were in or near the manhole indicated. All these readings were made by the regular operating staff immediately following the fault, and all of them within about fifteen minutes after their occurrence, except in some cases where the resistance of the fault was so high that a testing set had to be employed to burn it down.

S. D. SPRONG,
Vice-President and General Manager.
Orange County Public Service Corporation,
New York, N. Y.

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Adequate Protection for Linemen

AS THE result of careful study, some excellent safety rules for the protection of men working on transmission and distribution lines have been adopted by many of the large steel companies. A good proof that the principles followed are sound is that the rules of almost all the companies were found to be practically identical by the safety committee of the Association of Iron and Steel Electrical Engineers as stated in a report made at the convention in Cleveland on Sept. 11 to 15. Some of the rules are given in the following paragraphs.

When more than one gang of men are working on the same circuit all safeguarding conditions must be separately complied with by each and every gang. Station operators must be notified, preferably in writing, by some one in every gang intending to work on the circuit.

Station operators will open all oil and disconnecting switches involved, lock the control switches, place a sign on them bearing the names of all men ordering circuit off, and then notify such men that the above conditions have been complied with.

When these conditions have been complied with all three phases of each line that is to be worked on shall be grounded and short-circuited on both sides of the place where the work is to be done. This can usually be best accomplished by the use of a chain provided with an insulated handle and a place for making a ground attachment, which attachment must be made before throwing the chain over the wires or conductors.

When the work has been completed all shorts and grounds must be removed, after which the man or men who ordered the circuit off shall notify the station operator that the line is clear and ready for operation.

The station operator has absolute authority in regard to closing switches which have been opened for the purpose of working on the circuit, and he shall obey no orders to close oil or disconnecting switches or unlock control switches until after he is absolutely sure that all men who have given notice of their intention to work on the circuit have reported to him that so far as they are concerned the circuit can be put into service.

Notification to station operator to cut a circuit out of service should preferably be made in writing. Notification to put a circuit on must be made in writing.

Station operator shall notify his relief in regard to the conditions relative to any circuits which are out of service and also give him in writing the names of all men who have reported as working on such circuits.

In case a workman who has notified the operator that he is working on a circuit should for any reason leave his job in charge of another, both he and the man taking his place shall report this fact to the operator.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Ornamental Lighting System Installed for $100,000

EVEN in these days when so many cities and towns are realizing the necessity of better street illumination and are installing new and improved types of lamps and standards in large numbers, the discarding of its entire street-lighting system by a municipality and replacing it with a new one is sufficiently interesting to make it worthy of remark. The city of Mandan, N. D., which has a population of about 4,600, has done this and in so doing has attained the distinction of having probably more ornamental lamp standards than any other place of anything like the same number of inhabitants. It has 447 in use, or approximately one to every ten inhabitants.

For a number of years its streets were lighted by fifty arc lamps, which have now been replaced by a system that is coming into very general favor—"Mazda" lamps inclosed in ornamental globes supported by ornamental iron posts. The change has been made at a cost of less than $100,000, while the gain in the appearance of the city and in the efficiency of its street lighting has been extremely noticeable and gratifying.

The lighting units are of the Novalux type, being made by the General Electric Company. In the business district the Form 9 unit, with diffusing globe, glass canopy and series film socket, is used. In the residential sections Form 8 is employed, the equipment being similar to that used in the business district. Ten-and-one-half-foot ornamental iron standards and 100-c.p. lamps are used in the residential sections, and 12-ft. standards and 250-c.p. lamps in the business district. The standards are uniform in design in both the residential districts and the business section and are of graceful and pleasing pattern, as may be seen from the accompanying illustration. The system is arranged and operated in four circuits, that of the business district being separate from those of the residential sections, and in each case the corner lamps are on a different circuit from the intermediate lamps.

ORNAMENTAL LIGHTING SYSTEM REPLACES ARC LAMPS IN MANDAN, N. D.

Mandan has about 9½ miles of street lighting and 3½ miles of paved streets. A number of standards were, of course, installed along unpaved streets. In these cases the posts were placed on the curb line at what will be the grade and street line when the street is paved, and 6-ft. sections of curb were set in for protection. All the cable was laid 12 in. below the paving grade on unpaved streets, just under the edge of the sidewalk where the sidewalk extends to the curb, and across streets at right angles to the center in 2-in. iron conduit pipes. All pipes crossing paved streets were pushed across, and no pavement was cut. It is interesting to note that in making the installation, approximately two carloads of cement, 1,200 cu.yd. of concrete and 140,000 ft. of No. 8 single-conductor cable were used.

All the lamps are operated until 9:30 p.m. The corner lights are then turned out and only the intermediate lamps are burned until morning, except on Saturday nights and special occasions, when the entire system is operated. The cost of maintenance and operation is paid out of the general fund for street lighting made by the usual levy. Power for operating the system is supplied by the Mandan Electric Company, a privately owned corporation, but the city installed and owns the switchboard panels, meters, etc. The lights are controlled by employees of the company under the direction of the City Commission. The rate paid is 5 cents per kilowatt-hour.

The lighting schedule and the consumption of current for the first half of 1921 were as follows:

	Kw.-Hr.
January, 5:00 p.m. to 7:00 a.m.	11,750
February, 5:30 p.m. to 6:20 a.m.	10,080
March, 6:00 p.m. to 5:00 a.m.	8,540
April, 6:30 p.m. to 4:00 a.m.	7,470
May, 7:00 p.m. to 3:00 a.m.	[illegible]
June, 8:00 p.m. to 2:40 a.m.	5,400

The job was divided into three contracts, other districts petitioning for the improvement after the first contract was under way. The total price for the three was $95,721.84, including engineering, assessing and advertising as required by the laws of the state. The cost of the installations was met by special assessment against the property directly benefited by the lighting system.

All Lots Equally Benefited by Improved Lighting

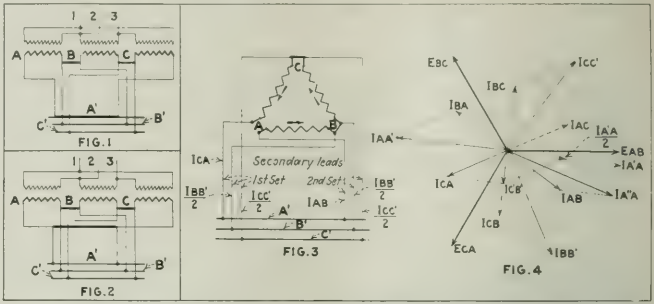
It had been decided by the special assessment commission that all lots were equally benefited whether or not there was a light directly in front of the lot or opposite, provided that they were equally spaced on the street around the entire block. The cost per lot was higher on the last two contracts let, and the average of a 50x140-ft. lot in the residential section on the main contract was $90.16, and on a 25x140-ft. business lot, $48.63, these costs being based on cash payment. The assessment was spread over a period of five years and warrants were issued bearing interest at a rate of 6 per cent. In the residential section the assessment commission held that a corner lot received no more benefit than an inside lot, even though there might be lots on the side; but in the business district the corner lots stood the cost of the light on both sides.

P. B. Reed.
Lighting Specialist.
General Electric Company,
Minneapolis, Minn.

Careful Inspection Avoided Trouble

Any plans for work involving considerable electrical energy need careful examination by some one who from experience is capable of passing judgment on the installation. Especially does this apply when the conductors carrying alternating current must be placed in a single conduit to prevent excessive heating and choke-coil effects. The following example of how such sources of trouble have been averted may prove instructive to any one encountering this problem.

Three 100-kva. 2,300/230-volt power transformers were to be installed in a substation and connected delta-delta. For uniformity the underfloor ducts in the building were all 3-in. metal conduit. One duct was provided for the primary leads from the oil switches at the rear of the switchboard, and two for the secondary cables from the transformer bank to the power-feeder panel, a running distance of about 25 ft. The secondary full-load current approximated 754 amp., so in order to avoid using the larger sizes of cables two separate sets of leads were planned from the delta through the conduits provided.



HAD NOT TRANSFORMER CONNECTION BEEN CHECKED, EXCESSIVE HEATING AND CHOKE-COIL EFFECTS WOULD HAVE OCCURRED

Fig. 1—Wrong connection in splitting delta loop through conduit. Fig. 2—Proper connection, avoiding this trouble. Fig. 3—Means of analyzing current unbalance. Fig. 4—Graphical solution of unbalanced currents in each wire.

The installation foreman, finding the space restricted for making the secondary delta, proposed to connect the two sets of leads as shown in illustration No. 1, thus forming two of the loops at the transformers and the third at the power-feeder panel. Before his proposed connections were installed, however, it was evident that trouble was in store because of the separation of the loops, and the entire delta was installed above the transformers, thus giving both sets of leads a balanced three-phase loading, as shown in illustration No. 2.

The unbalanced conditions which would have resulted had the proposed unsymmetrical arrangement of cables been adopted are indicated by an inspection of illustrations Nos. 3 and 4.

The coil current I_{CA} passes to the bus A' by one conduit and the coil current I_{AB} by way of the other. They are 120 deg. out of phase and should unite at A by a short loop similar to those at B and C; otherwise these two coil currents if run separately without such a local loop, would cause a heavy self-inductance in the two metal conduits. Stated another way, each of the leads from B or C carries one-half of the line current from these loops, while the cables from A to bus A' separately carry the whole of the coil currents I_{CA} and I_{AB}.

The instantaneous inequality of these currents and their phase relations are graphically shown in illustration No. 4. Here the secondary voltages, E_{AB}, E_{BC} and E_{CA}, are laid off symmetrically 120 deg. apart. The coil currents I_{AB}, I_{BC} and I_{CA} are also plotted 37 deg. lagging for an assumed load of 80 per cent power factor. The line currents $I_{AA'}$, $I_{BB'}$ and $I_{CC'}$ taken from the loops at A, B and C, with assumed symmetrical connections, are then plotted from the three vector equations:

$$I_{AA'} = I_{CA} + I_{BA} = I_{CA} - I_{AB},$$
$$I_{BB'} = I_{AB} + I_{CB} = I_{AB} - I_{BC},$$
$$I_{CC'} = I_{BC} + I_{AC} = I_{BC} - I_{CA}.$$

The sum of these for symmetrical loading equals zero, and there is no unbalanced flux. But with the wrong connections of illustration No. 1, the line currents $I_{BB'}$ and $I_{CC'}$ combine vectorially to give $I_{A'A}$; one-half of this, $\frac{1}{2}I_{A'A}$, combines vectorially with I_{AB} at one instant, to give the unbalanced current $I_{A''A}$, and with I_{CA}, simultaneously, to give the unbalanced current $I_{C'B'}$. $I_{A''A}$ scales 785 amp., while $I_{C'B'}$ is $\frac{1}{2}I_{CB}$, or 217 amp.

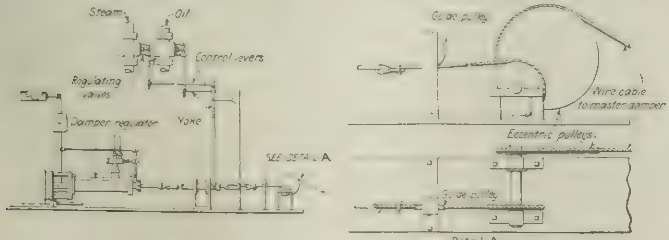
Such unbalanced currents are of sufficient magnitude to induce a considerable reactance in the divided circuit, and besides the resulting heating effect of the metal conduits, would appreciably unbalance the three-phase circuits taken from the power panel. This example of possible wrong cable connections emphasizes the importance of carefully inspecting all field construction, and especially of having men in the field who know how to execute office plans.

Thomas M. Roberts,
Power Plant Engineer.
Bureau of Yards and Docks,
Navy Department,
Washington, D. C.

Easily Rigged-Up Regulator for Oil Boilers

Where firemen were forced to change burner settings quite often on oil-burning boilers because of variable railway load, the Northern Texas Traction Company rigged up an unused Mason damper regulator with two regulating valves to govern the oil supply automatically. The plant had been installed with no automatic devices other than an oil-pump governor, and owing to the commercial depression following the war expensive automatic boiler-equipment was not felt to be justified.

The regulator and valves were assembled as shown in the accompanying illustration, except that the cable pulleys were both concentric. In operation it was found that the master damper was too sluggish in opening at times when fires had been reduced to a minimum with sudden demands for steam coming on. Under these conditions the furnace smoked badly for a few seconds or until the gases attained sufficient velocity to enable air to be drawn into the furnace. To overcome this trouble the pulley carrying the cable to the master damper was made eccentric and assembled as shown in order to get a quick movement of the damper when the regulator turned on oil and steam. This arrangement entirely prevented smoke and reduced the CO_2. Some little experimenting had to be done in order to find the right position of this eccentric pulley on the shaft. Very satisfactory service is now being given from this apparatus. The CO_2 charts show very close regulation of air from boiler ratings of 40 to 200 per cent.



Detail A
MASTER DAMPER CONTROL BY ECCENTRIC PULLEY

SIMPLE AUTOMATIC DAMPER REGULATOR TAKES CARE OF VARIABLE RAILWAY LOAD SATISFACTORILY

At first the steam line to the regulator was taken from the main steam header, but it was found that the regulator responded to every variation in load on the plant, which kept the regulator in constant motion. This was caused by variations of pressure in the header. A great improvement was obtained by taking steam for the regulator from the drums of the boilers, the pressure not varying nearly so much in the drums as in the header with changes of load on the station.

This apparatus cost practically nothing as it was made up of old material.

E. L. White,
Chief Engineer.
Northern Texas Traction Company,
Handley, Tex.

Regulating Hydro-Plant Reservoirs

When a number of hydro-electric power plants are on a stream at various distances from a storage reservoir it is important to so operate the reservoir that the maximum benefit to the power developments on the stream as a whole will result. Owing to the inflow of tributary streams below the reservoir, equal regulation cannot be obtained at all plants, consequently each reservoir must be so operated as to produce as far as possible a certain degree of regulation at some definite point on the stream. Under ordinary conditions the greatest benefit due to storage will result from taking the point of regulation near the middle of the power section of the river.

There are two methods of operating storage reservoirs. The first is the insurance method and is in general use for the operation of reservoirs for regulating the flow of water for water supply for domestic purposes, where it is necessary that a predetermined minimum flow be maintained, the aim being to utilize the available storage to increase the dependable flow. In carrying out the "insurance" method studies would be made to determine what flow could be maintained by use of the reservoir in question in the driest year. After the amount of this flow has been determined no water would be released from storage until the stream flow at the point of regulation had fallen below the determined amount. An objection to this method of operation, from the water-power point of view, is that in all years except the driest the benefit obtained from the reservoirs would not be so great as might be possible, and in some years little or no water would be released from storage.

The second method, sometimes known as the utilization method, aims to utilize practically all the available storage each year without special regard for maintaining a certain minimum regulated flow. In carrying out this latter method water would be released from the reservoir just as soon as the natural flow of the stream fell below the amount which would run the plants at full capacity, and this flow would be maintained continuously until the reservoir had been completely emptied. The objection to this method of operation is that in extremely dry years the reservoir might be emptied before the end of the drought and only the natural low flow would be available until the succeeding spring floods.

It is entirely feasible to so operate storage reservoirs as to obtain the good features of both of these two methods of operation, and a method of operation can be deduced providing for a rate of release of the storage so as to produce as nearly as possible a uniform flow at the point of regulation. In this way the assurance of a certain minimum flow would not be unduly sacrificed, yet practically the entire volume of stored water could be used every year, excepting the extremely wet years, which are of very infrequent occurrence. As a foreknowledge of the stream-flow conditions is assumed, it might be thought that this method is impracticable. However, it is thought entirely feasible to approximate closely this assumed method of regulation where reliable stream-gaging records are available for a considerable length of time, say over a period of ten years.

The above information was taken from the report on the water power and storage possibilities of the Hudson River made under the direction of the New York Water Power Commission.

Field Editor Electrical World.
New York, N. Y.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

What a Store-Lighting Survey Shows*

Only 25 per Cent of Chicago's Retail Stores Have Adequate Illumination—How a Definite Sales Program Increases Revenue of Lighting Department

By Oliver R. Hogue† and James J. Kirk‡
Commonwealth Edison Company, Chicago, Ill.

IT HAS been said that a good sales manager is a man who decides quickly and who is sometimes right. Probably 90 per cent of the answers "yes" or "no" given by the central-station sales manager are based upon opinion rather than on fact. He is usually forced to decide quickly, and his one hope is that he will "guess right." The reason he has to "guess" is that he hasn't heretofore had available data upon which to form a correct opinion quickly. This was demonstrated conclusively during the period of depression from which we are now emerging.

With the industrial slump of May, 1920, the Commonwealth Edison Company found that it had to have more lighting business. Other central stations found themselves in like situations.

Following a survey of its commercial lighting business, we found that we did not know our market thoroughly. This investigation not only revealed the possibilities in the way of new business along the lines we had been following, but at the same time showed us where we could develop new fields.

We had been concentrating our effort on selling better lighting to the merchants who we thought needed it, with indifferent results. When we completed our second investigation, we found that we could, with less effort, do more business with the merchant who already had good lighting. The result has been a pronounced increase in our business.

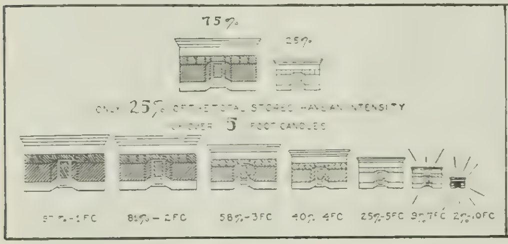

75%
25%
ONLY 25% OF THE TOTAL STORES HAVE AN INTENSITY OF OVER 5 FOOT CANDLES
-1FC
81% - 2FC
58%-3FC
40% 4FC
25%-5FC
9% 7FC
2% 10FC

FIG. 1 —EXTENT OF UNDEVELOPED FIELD

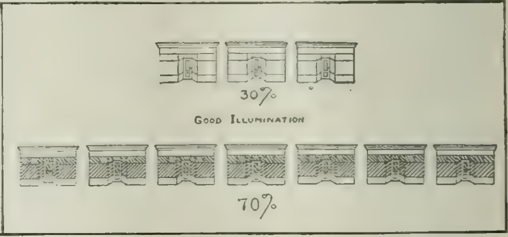


FIG. 2—SEVENTY PER CENT OF STORES HAVE POOR LIGHTING

The First Survey

In the 1921 survey of store-lighting conditions in Chicago, we obtained positive information of the enormous lighting possibilities. In Chicago there are 23,000 retail stores on the ground level. In order that we might get at average conditions, stores of like character in similar locations—in business sections on the North, West and South Sides of the city were decided upon. An equal percentage of stores of each class in each locality were visited. An engineer was assigned to each section. The data were obtained by the use of a foot-candle meter and by observation, and a questionnaire was submitted to the owner of the store. It was necessary to visit more than a thousand establishments before satisfactory data were obtained.

The following list shows the kind of stores that were visited: Dry goods stores, candy stores, bakeries, tailors, meat markets, restaurants, groceries, furniture stores, drug stores and cigar shops.

The same percentage of stores of a given classification of the total number of stores of that classification were visited. Of the twenty-three thousand retail stores in Chicago, 25 per cent are grocery stores, of which only 9 per cent have proper lighting. Forgetting the lighting engineer's view of this inadequacy, and approaching it from the customer's interest, is 5 foot-candles enough? It certainly is not even enough for an outlying grocery that closes at 6 p.m. five nights in the week. On the sixth, Saturday night, the light will draw new customers. We don't even need to mention the stormy winter nights, when it becomes dark about 5 p.m. Then, why do we find so many grocery stores with less than 5 foot-candles? It is evident that the real truth has not yet been presented to the grocery merchant in such a way as to cause him to think and reason along the right lines.

Although drug stores are better lighted than any of the others classified, yet but 30 per cent of them have an intensity over 5 foot-candles. The druggist has a better idea of what good lighting means than the average store owner. The drug store is a long-hour user of electricity and for that reason has a better opportunity to judge the results obtained by improved lighting.

The survey shows that only 25 per cent of the retail stores of Chicago have an intensity of 5 foot-candles or better, and only 2 per cent have intensities of 10 foot-candles, as shown in Fig. 1. It is indeed regrettable to think that only 2 per cent of the retail stores may be classed as progressive and meet the present-day standards of good lighting. This means that seven out of ten stores are prospective customers for better lighting. We do not mean by a "prospect" one that is "sold" on the value of better lighting, but rather a prospect is considered as one who has such poor light that his customers, he himself and all with whom he comes in contact would be benefited by its improvement. The enormous field is furnished by the six out of seven prospects that can be won by patience and tactful selling.

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*From a paper presented before the second annual meeting of the Great Lakes Division of the N. E. L. A. at French Lick Springs, Ind., Sept. 28-30.

†Head lighting agent.

‡Illuminating engineer.

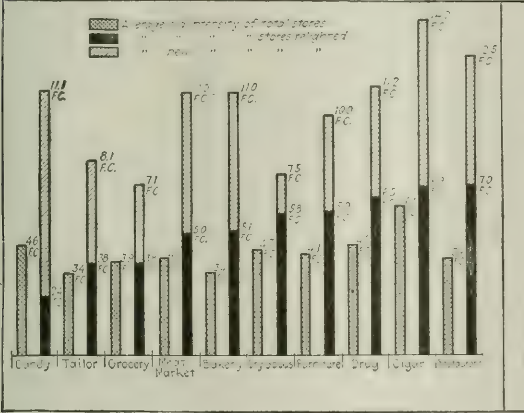


CHART 1—COMPARISON OF INTENSITIES BEFORE AND AFTER STORES WERE RELIGHTED

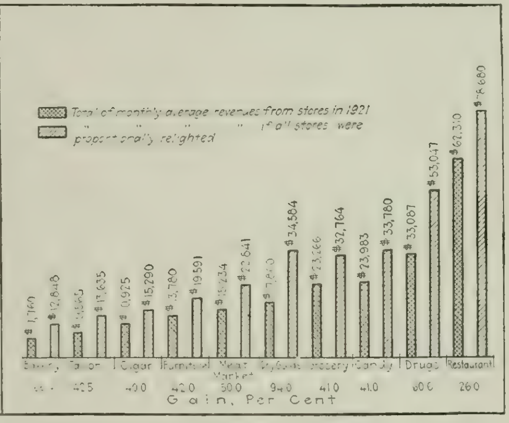


CHART 2—SHOWING INCREASE IN REVENUE IF ALL STORES WERE PROPERLY LIGHTED

The 1921 survey also showed that the stores had an average of 8.4 fixtures. It is a very conservative estimate to assume that one-half of the present equipment is in reasonably good condition. Granting this, 108,560 bare lamps, drop cords and obsolete fixtures should be replaced by modern fixtures.

Nearly one-half of all the stores—41 per cent, to be exact—are using the latest-type high-intensity "C" lamps, while few of them have proper fixtures.

Many good lighting installations are rendered inadequate and inefficient because of the accumulation of dirt. Few merchants realize that from 35 to 40 per cent of the illumination is absorbed by the accumulation of dust on the fixtures. Dirt and dust collect in a comparatively short time. To meet this situation it is necessary for the central station to maintain a cleaning service, as the average business man is so busy thinking of his own line of work that he usually neglects the lighting system. Fixtures should be taken care of at least every thirty days.

THE SECOND SURVEY

Following the first survey, an intensive store-lighting campaign was conducted, and in the early part of 1922 a new survey was made of the stores that were included in the former survey. As the former survey gave us a very definite check on the re-survey, it was comparatively easy to ascertain just what had been accomplished by our store-lighting campaign.

The lighting salesman was told that we expected him to work for installations of at least 10 foot-candles. How well he succeeded is evident from a study of Chart No. 1. Of the ten classifications surveyed all but three equaled or exceeded 10 foot-candles, with a minimum of 7.1 foot-candles, a maximum of 14 foot-candles and an average of 10.1 foot-candles.

This latter survey revealed a startling thing, viz., that it was not the poorly lighted store that was relighted, but rather the store which already had intensities well above the average as shown in chart No. 1. In other words, the merchant who had been using good lighting had a real appreciation of its value to his business and was only too willing to better his installation.

It is interesting to analyze what it would mean if all of the store owners in Chicago realized what good lighting means. If the stores that have an intensity of less than 5 foot-candles would bring their intensities up to that standard there would be an increase of 31,747 kw. in lighting load and an increase in revenue of $99,350 per month, or an annual increase of $1,192,220, would be brought to the Commonwealth Edison Company.

The lighting salesman devoted most of his time to the merchant whose lighting was poor. His usual answer was, "Business is no good." This is the man that is difficult of conviction.

Often aggressive merchants come into the Edison Building and ask what is new in lighting or how they can improve their lighting. These are the merchants that have good lighting and want better lighting. This proves that the commercial lighting business does not follow the "line of hope," but instead varies approximately as the square of the "line of hope" toward saturation, and we are far from saturation.

What do these data obtained from the second survey point out to the central-station company? Just this: That the increased revenue ranged from a minimum of 26 per cent in restaurants up to a maximum of 94 per cent in dry goods stores, or an average increase of store-lighting income of 45.7 per cent from stores that already had fairly good lighting. (See chart No. 2.) There is nothing spectacular about thoroughness, but if store-lighting intensities approached thoroughness — approximately 10 foot-candles—the lighting income of this central station would be more than $2,500,000 per year.

Must Eradicate Idea That Utilities are Soulless

THE idea that public utility companies are soulless corporations must be eradicated from the public mind if public relations are to be improved, declared H. W. Bell, director of service, Utica Savings Bank, before the convention of the Empire State Gas & Electric Association at Lake Placid, N. Y. The public must be imbued with the fact that utilities are created for service, that they have honest aspirations the same as individuals, and that their interests and the public's are mutual.

Too many corporations have cold exteriors and colder interiors, the speaker went on to say. Frequently the officials are inaccessible and hold themselves aloof from the public. This condition can be corrected by establishing a department which will serve as a personal, intimate contact between the public and the utility.

Indicating what can be done with such a department, Mr. Bell referred to the experiences of the Utica Savings Bank, which hired a man to find out the reason for its lack of cordial relations with the public. He reported to the president that the fault lay with the bank. After hearing the facts the president addressed an open letter to the public announcing that he had found a most surprising and regrettable condition and that he intended to establish a department which would represent the public and which would apprise him of conditions that should not exist. This department has the privilege of telling the president of the bank when things are wrong. What is more, he listens and corrects the trouble.

The purpose of the department is to arouse such a social conscience in the bank officials and the employees that they cannot exist unto themselves alone.

All of the activities of this department are not directly connected with banking practice. Still, they redound to the profit of the bank. For example, there is a home economics bureau. In addition, the director of the service department speaks before clubs and schools and elsewhere on economic problems.

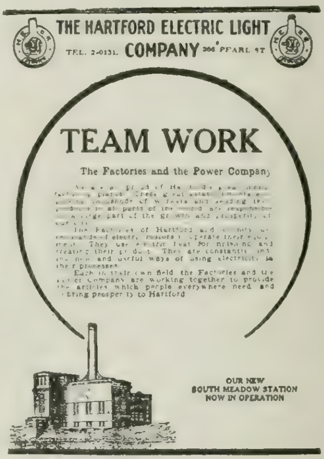
As a result of this department's activities there has been an increase in warmth and cordiality. Mr. Bell did not contend that such a department can operate effectively without proper publicity; the two things must be carried on together.

Public utility companies which are sincerely interested in improving public relations can obtain like results, Mr. Bell asserted. The man in charge of the department must be carefully chosen and of broad caliber. He must represent the public rather than the company. Furthermore, he must have access to all officers of the company, the privilege of taking up complaints with the executives and the right to demand quality and quantity of service from every employee.

◆

Tying in a New Station with Industrial Opportunities

SINCE the recent establishment of service from the new South Meadow generating plant of the Hartford (Conn.) Electric Light Company, the latter has been carrying a weekly advertising message in the local press emphasizing the value of power service to various industries in the territory and the mutual interest of manufacturers and the public in the provision of these increased facilities. One of these advertisements, reproduced herewith, points out the benefits the great manufacturing plants of the city are rendering to the community and shows how the central-station company and these power-using establishments working together are performing a real service in their respective fields. Other displays feature opportunities in particular industries for the use of central-station service or emphasize installations already completed in these fields.



THE HARTFORD ELECTRIC LIGHT COMPANY

TEL. 2-0131. 266 PEARL ST

TEAM WORK

The Factories and the Power Company

OUR NEW SOUTH MEADOW STATION NOW IN OPERATION

ADVERTISEMENT TELLS VALUE OF POWER SERVICE TO THE COMMUNITY

Narragansett Lighting Rates Reduced

THE Narragansett Electric Lighting Company, Providence, R. I., recently established a new lighting rate with the object of promoting increased use of electricity through the combination of a service charge and an energy charge. Under the provisions of the new rate the former clause, which specified that no bills should net less than 9 cents per kilowatt-hour, is eliminated, so that the rate now consists of a service charge of 50 cents per month per customer and a charge of 7 cents per kilowatt-hour for all electricity used. The energy charge is based upon a fuel cost of $8 per gross ton and is subject to increase or decrease at the rate of 1 mill per dollar variation above or below such cost. Under the provisions of this clause electricity used during September was billed at the rate of 6.9 cents per kilowatt-hour plus the service charge of 50 cents per month.

◆

What Other Companies Are Doing

Louisville, Ky.—The Kentucky Utilities Company recently closed a contract with a local coal-mining company to supply electric power for five mining operations. Under this contract the customer is to advance $30,000 to cover the cost of the line extension and guarantees a minimum power bill of $20,000 per annum.

Oklahoma.—By a combined vote of 230 to 4, the towns of Boswell and Soper have voted to sell their municipal distribution systems to the Oklahoma Power Company. In these two communities are nearly 400 electric customers who have had only five-hour service from the municipal plants and will now receive twenty-four-hour service from the company's transmission system.

Chicago.—Electrical energy output at the operated properties of the Standard Gas & Electric Company for the week ended Sept. 16 increased 14.5 per cent over the corresponding week of 1921. Applications were received for 2,566 new electric services, covering 1,265 kw. of lighting and 1,289 hp. in motors. Electric connected load reports show a net gain of 906 customers, with 749 kw. of lighting and 743 hp. in motors.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

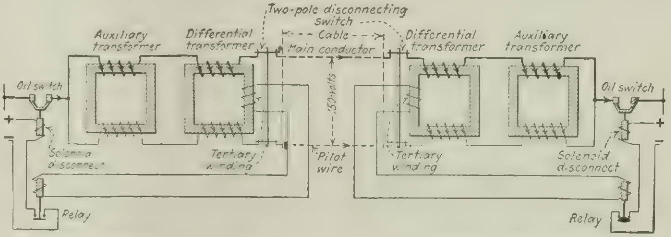
Heat Balances of Blast Furnace and Steel Plants.—W. TRINKS.—Interesting charts showing heat balances for an uneconomical steel plant, an average steel plant, an economical steam-operated steel plant and an ideally operated steel plant are given. Methods of applying the charts to actual conditions are explained.—*Blast Furnace and Steel Plant*, September, 1922.

Systems of Ash Discharge as Applied to Underfeed Stoker Practice.—D. C. SPENCER.—Where widely fluctuating loads are encountered in boiler operation the power dump for ash disposal gives the operator absolute control over the fire, and he may increase the rate of coal to meet almost any contingency that may arise. In case of a fairly constant load in the boiler there is little need for provision to clean fires instantaneously. Clean fires at all times are of utmost importance, however, and to maintain them the discharging of ash as rapidly as it is formed is the best method. The rotary ash discharge system accomplishes this and provides a space in which combustibles may be consumed very completely. It continuously crushes and discharges ash and insures constant furnace conditions.—*The Central Station*, September, 1922.

Present-Day Construction of Electrical Machinery.—L. FLEISCHMANN.—A review of the progress made in design and construction, with a discussion of the main problems encountered. The two chief problems in waterwheels and turbo-generators are the dissipation of the heat from relatively small surfaces and the rotor construction to withstand the great centrifugal forces. The discussion covers rotor construction, improvements in stator design, precaution with deep slots, parallel operation and the heating problem. Other types of apparatus discussed are induction motors, variable-speed alternating-current motors, rotary converters, direct-current motors, mercury rectifiers, transformers and induction regulators.—*Electrician*, Sept. 1, 1922.

Generation, Control and Switching

Cable Protection System.—W. ESTORFF.—A selective cable protection system is described which quickly disconnects a punctured cable from the rest of the system. It is applicable to all interconnected cable networks, and the author claims that it does not react upon overloads. A special cable is required with a central pilot wire which is insulated from the other strands of the cable. At both ends the main and the pilot wires are connected to a small differential transformer, as shown in the accompanying illustration, with such a number of turns as to compensate fully the magnetic fluxes in its iron core if the cable is without a fault. In a tertiary winding upon the core of these transformers no voltage will be induced under normal conditions. This third winding governs the relays, which in turn actuate the oil switches at both ends of the cable. In case of a puncture between the phases of the cable, the previous magnetic balance will be disturbed, a current will be induced in the tertiary winding, and the oil switches will instantly disconnect the disabled cable. To be safeguarded against the rare case of a metallic connection between the main strands of the cable and the pilot wire, an additional small transformer is provided for at both ends. This maintains a constant voltage of about 150 between the main and the pilot wire. If the pilot becomes connected to the main strands, this voltage flows through the differential transformers, disturbs their equilibrium and causes the disconnection of the cable. The actual construction of the apparatus, the cable and the junction boxes used is shown in a number of photographs.—*Elektrotechnische Zeitschrift*, Aug. 11, 1922.



CABLE PROTECTION SYSTEM APPLICABLE TO ALL INTERCONNECTED NETWORKS

Sheet-Steel Cubicles and Truck-Type Switching Equipment in Steel Mills.—G. P. WILSON.—There is no greater field of application for the sheet-steel cubicle, truck-type switchboard and truck-mounted oil circuit breaker than in the steel industry. Their application results in a great saving of labor cost due to the "safety-first" feature, which permits the employment of unskilled labor, improves operating conditions and betters general conditions in any mill by providing a very reliable installation. The author discusses the non-interlocked and interlocked cubicle, outdoor type of sheet-steel cubicle and various kinds of truck-type switchboards.—*Electric Journal*, September, 1922.

Transmission, Substations and Distribution

Possibilities of the Transmission of Large Energies.—J. OSSANNA.—This paper contains a very complete analysis of the advantages and disadvantages of energy transmission with alternating currents of low and standard frequencies and with direct current of high potential. The increased voltage drop due to the inductance of transmission lines may be avoided by the proper use of reactors and rotary condensers. No advantage may be expected from a low-frequency (16⅔-cycle) system or even from a direct-current transmission. A great number of examples have been calculated, and the results tabulated or shown in graphs and curves, to show the different operating conditions of transmission lines if operated by 50 cycles or 16⅔ cycles, or by direct current. In general, a 50-cycle, three-phase system, with as heavy and as few conductors as possible, will result in the most economical and most efficient transmission.—*Elektrotechnische Zeitschrift*, Aug. 11 and 17, 1922.

Present State of Power Transmission.—M. SHIBUZAWA.—The author reviews the progress that has been made in high-tension transmission as observed during his travels through Europe and North America. In Europe the Petersen coil is used for protection and any sort of lightning arrester is regarded of but little value. In regard to oil switches in North America, the double breaker without resistance is generally used, while in Europe the multiple breaker with resistance is popular. Insulator and high-tension underground cable practice is reviewed.—*Journal of the Institute of Electrical Engineers of Japan*, August, 1922.

Units, Measurements and Instruments

Use of Spectrophotometric Data.—F. A. BENFORD.—With the development of new types of aluminum and accessories for modifying light, it is necessary to analyze the light by means of the spectrophotometer if accurate comparisons are desired. This device breaks up the light into its component parts and measures the intensity of each individual part. Various methods of plotting the results have been employed. These are analyzed with a discussion of the limits which should be applied to such tests, the boundary which should be assigned to various spectral colors and the choice of wave length units.—*I. E. S. paper, Swampscott, Mass.*, Sept. 25-28, 1922.

Ignition Temperature of Coal.—Ray W. Arms.—In connection with the storing of coal in piles the ignition temperature takes on a real significance. Coal is actually burning at all times and even at low temperatures. If the heat thus produced is sufficiently confined and air is supplied to the coal at the proper rate, the temperature of the mass will rise. A study is made of this problem with the object of determining the influence of the temperature of ignition of the various coals upon the liability to fire while in storage. A discussion is given of what point may actually be designated as the ignition temperature and what factors influence that point, the methods for determining the ignition temperature of different coals and the results of tests upon the various coals used in the investigation. —*Bulletin* 128, *Engineering Experiment Station, University of Illinois.*

Illumination

Lighting of Public Eating Places.—J. L. Stair.—Practically no field of lighting offers as many opportunities for originality and special effects as the restaurant. Owing to the variety of eating places it is apparent that the demands for lighting are different. These requirements are very skillfully handled in the paper under notice. The author points out that neatness combined with efficiency demands primary consideration in a commercial or industrial cafeteria. There is an extremely wide latitude in the treatment of the more decorative types of lighting. The paper is illustrated by a large number of photographs, showing installations that have proved successful in service from the standpoint of comfort.—*I. E. S. paper, Swampscott, Mass.*, Sept. 25-28, 1922.

Lighting of the Milwaukee Art Institute.—H. W. Bogner and A. J. Sweet. —The paper is a study of the lighting problem of the Milwaukee Art Institute, and the solution presented by the authors is an interesting treatment of the various phases of lighting as encountered in a building of this type. Illustrations of various rooms, floor plans and types of lighting units are shown.—*Transactions of the I. E. S.*, September, 1922.

Motors and Control

Control Apparatus for Rolling-Mill Motors. — W. R. Wickerham. The correct design of control apparatus for alternating-current rolling-mill motors cannot be undertaken without a knowledge of the power-plant conditions and the type of transmission line which will be used to supply power to the equipment. The variable factors in their relation to the parts of the control apparatus are covered by the author. These factors include the power plant kva., voltage and frequency, power-plant equivalent impedance characteristics, synchronous machinery on system, transmission-line characteristics, method of operating primary control, meter combinations, electrical characteristics of motor secondary, accelerating torques and bare motor or flywheel combination drive.—*Electrical Journal*, September, 1922.

Considerations in Laying Out Motor Circuits.—Marin Phillips.—The author shows how to lay out and make a motor installation that is safe and reliable and explains the construction of a motor panelboard. Tables for sizes of wires, switches, fuses and conduits are given.—*Power*, Aug. 29, 1922.

Additional Copper Losses in Electric Machines.—H. Rickli.—Based upon work of Rogowski in the "Archiv für Elektrotechnik," 1913, third issue, the author develops a number of formulas for the simple calculation of additional losses in windings of electrical machines, especially for generators, motors and transformers. It is shown how the height of the copper or aluminum rod, embedded in an open or closed slot, affects the losses and how to arrive at the most advantageous dimensions for the conductors. The new formulas are tested in accordance with the winding data and losses of actually built machines and show a very close appoximation. —*Bulletin of Association Suisse des Electriciens*, August, 1922.

Size of Fuses for Motors.—L. W. Going.—A method is devised for determining the size of fuse necessary for a group of induction motors. Special reference is made to those cases where large motors are included in the group the starting current of which really determines the size of fuse needed for the group. Curves are included that can be used for a wide range of factory work in wiring motors. These will save time in making calculations or referring to other wiring tables.—*Industrial Engineer*, September, 1922.

Heat Applications and Material Handling

Use of Electric Heat in the Railroad Shop.—E. F. Collins.—A brief outline of some of the possibilities of electric heating appliances in the railroad shop is given with the intent to induce engineers to investigate the economic advantages of electric heating as compared with those afforded by fuel-heated apparatus. Among the various applications of electric heat described are sherardizing, core-baking ovens, shrinking furnaces, japanning ovens, heat-treating furnaces, rivet heaters, etc. — *Railway Electrical Engineer*, August, 1922.

Design of Steel Coal Bins.—R. Fleming.—The principal type of structure concerned is the overhead bin or bunker for the boiler room of a power house. After reviewing the present practice in this regard, the author considers weight and friction angle, hopper bottoms, plate thickness and lining, pressure calculations and bending moments. Too much attention cannot be given the importance of proper detailing for obtaining good work. — *Engineering News-Record*, Aug. 31, 1922.

Electrophysics, Electrochemistry and Batteries

Electrical Characteristics of Dry Cells.—G. W. Vinal and L. M. Ritchie. —Two articles taken from the forthcoming Circular 79 of the Bureau of Standards of "Electrical Characteristics and Testing of Dry Cells." The first gives the effect of temperature on voltage, amperage, shelf life, and tests of cells. Tables and curves of discharge at constant resistance and constant current show capacities to different end points at different rates. The second article explains the behavior of a dry cell in a circuit and the effect of internal resistance, illustrated with equations and curves. Grouping the cells is also discussed.—*Chemical and Metallurgical Engineering*, Sept. 13 and 20, 1922.

Dezincification of Brass.—R. B. Abrams.—Experiments are recorded the results of which indicate that the mechanism of dezincification involves the dissolving of the brass as a whole, the copper in solution being redeposited, replacing brass as a unit. This redeposition does not take place unless there is something holding the dissolved copper in contact with the brass, which may be accomplished by the presence either of a membrane or of a large excess of dissolved copper.—*American Electrochemical Society paper, Montreal*, Sept. 21, 1922.

Traction

Electrification of Railroads with High-Frequency Alternating Currents. —Maurice Leblanc.—This paper describes the possibilities of a system of railroad electrification using 20,000-cycle, single-phase current. The most unusual feature of this system is the lack of any metallic connection between the overhead power supply and the train. Instead of an overhead trolley wire, a specially built-up condenser is used consisting of partly telescoped copper tubes of smaller and larger diameters which are slid half way into each other, the interstice being filled out with a dielectric of good insulating properties. Two such "overhead condensers," building a loop, are laid out above the track and are energized by single-phase, 5,542-volt, 20,000-cycle alternating current. Along the roofs of the cars on the track is carried a wire loop, placed about 3 ft. under the "overhead condenser." In this loop an alternating current, likewise of 20,000-cycles frequency, will be induced. The author shows how by means of a special arrangement containing a set of electron tubes, two triple-winding transformers and a motor-driven commutator the high-frequency current can be transformed into low-frequency and low-voltage three-phase current.—*Revue Générale de l'Electricité*, Aug. 26, 1922.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

Standard Handbook for Electrical Engineers

By Frank F. Fowle, editor-in-chief. Fifth edition, revised. New York: McGraw-Hill Book Company, Inc. 2,137 pages, illustrated.

The reputation of the Standard Handbook for accuracy and thoroughness is well maintained in this new edition. The production of a revised edition of such a handbook is a tremendous task, and Mr. Fowle and his corps of editors are to be congratulated on their production. Nearly every section has been completely revised and new names appear on the list of contributors. At the same time, the former editorial staff was able to profit by the comments of the users of the book and to revise previous contributions to insure their being in the most convenient form. More than fifty names appear on the editorial list —a group assembled from the factory, college and utility company who are recognized authorities in their respective fields. To the section entitled "Industrial Motor Applications" material was contributed by twenty-three specialists.

The book has twenty-five sections, each of which contains up-to-date data, well grouped in charts or curves, together with a real discussion of the technical and operating features of the subject. A large number of bibliographies add materially to the value of the new edition.

Every electrical engineer can use the Standard Handbook with profit and read it with pleasure, for it is filled with interesting material from cover to cover. One of the greatest improvements in the new edition from the standpoint of the user is the new index. The value of a handbook is greatly enhanced by a good index, and that furnished with the book just issued is excellent. L. W. W. MORROW.

Modern Methods of Welding as Applied to Workshop Practices

By J. H. Davies 263 pages, illustrated. New York: D. Van Nostrand Company.

This is a rather complete book in that the subjects treated cover a wide variety of practice and much attention is given to apparatus of various kinds. Chapters on pre-heating, on the preparation of welds, on handling cast iron, aluminum, brass and other metals, including lead burning, are included. Various kinds of welding are described, such as oxy-acetylene, oxy-hydrogen, thermit and electric welding of the different types. Spot welding, butt welding and other methods are discussed in considerable detail. The illustrations are very complete and aid appreciably in clarifying the text. Examples are given of welding in inaccessible places by the use of mirrors. Attention is also paid to the protection of the welder by the use of shields and suitable goggles. While this book is by an English author and naturally gives much attention to British practice, it also devotes considerable space to American methods and American apparatus. The combination should be of value to all users of welding apparatus. FRED COLVIN.

Principles of Alternating Currents

By Ralph R. Lawrence. New York: McGraw-Hill Book Company, Inc. 432 pages, 121 illustrations.

This book presents the subject of alternating currents entirely from the analytical standpoint. Little attempt is made to give the student a physical picture of what is going on in the circuit. The book is very comprehensive and goes into great detail in regard to certain phenomena met with in alternating-current circuits. It should be added, however, that there is apparently nothing superfluous contained in it. The practical engineer concerned with alternating-current circuits will doubtless have occasion at times to use all the material presented.

On first opening the book the practical engineer, as well as the teacher, is favorably impressed by the fact that the notation used throughout the text is clearly indicated. As a textbook the material and the method of presentation are better suited for students who already have a considerable knowledge of the subject than for beginners. In the opinion of the writer, the book should be preceded by a simpler text. Even then it would be necessary in the average course given to college seniors to omit considerable of the material presented.

The section on the power factor of unbalanced polyphase circuits is very well presented. This is a matter that is usually either touched upon lightly or entirely omitted. The two-wattmeter method of measuring three-phase power, always a stumbling block to the student, is well explained. One is also favorably impressed by the thorough treatment of non-sinusoidal alternating-current waves and harmonics in polyphase circuits. More space might well be given to a discussion of the method of superposition. This method is used throughout the text and is, of course, a powerful means of attack. Some discussion of its justification and the conditions under which it can or cannot be used might well be included in all our textbooks.

This book should prove an excellent text for advanced students if the matter is presented by a skillful teacher. It should also make an excellent reference book for those who have to deal practically with alternating-current phenomena. BENJ. F. BAILEY.

Invention

By Rear Admiral Bradley A. Fiske, LL.D. New York: E. P. Dutton & Company. 356 pages.

While he holds that beyond any question inventions have increased prosperity and wellbeing, the brilliant author of this pregnant study of human achievement in the mechanic and other arts will not undertake to say that they add to human happiness. Yet, since civilization is by the common agreement of mankind a happier state than savagery, "there seems no escape from the conclusion that it is to invention mainly that we must look for increase of happiness in the future." Offsetting this, we have the recent gloomy pronouncement of Guglielmo Ferrero that we have become the slaves of our own tyrant inventions and that it is the great duty of this epoch not to multiply them blindly any longer. And as if that lugubrious injunction were not enough, other authorities warn us that inventions are making arms and legs useless. Human bodies are but bundles of atrophied organs, and in say ten thousand years man will lack both his prehensile and his locomotive appliances, supplanted by those of mere iron and steel. So there you are! Meantime, it is sure that the creative inventive faculty itself will not be atrophied. Admiral Fiske's clever historical survey gives an excellent idea of the process in which humanity is enveloped and by which it is committed to rise on the stepping stones of its old less refined self to higher, better things.

One cannot find fault with this useful compendium and analysis of scientific and mechanical uplift and onlook. Himself no mean electrical engineer and inventor, the good sailor does generous justice to his coworkers in the electrical field and all their gifts to mankind, and little in any field seems to have escaped his observation or scrutiny. But why, that being so, is he negligent of water power and wind power? Perhaps he is of the opinion that in neither of these most ancient utilizations of nature's forces lies real invention. Still, he does mention the hydraulic dredge and jack—why not the vastly more important turbine, or even its humble predecessor, the plain waterwheel? T. C. MARTIN.

Books Received

Machines Electriques. By A. Mauduit. Paris: Dunod. 1,180 pages, illustrated.

Trade Mark Laws of the World. By John H. Ruege and W. B. Graham. New York: Trade Mark Law Publishing Company. 1,002 pages.

Elementary Determinants for Electrical Engineers. By H. P. Few, New York: D. Van Nostrand Company, 95 pages, illustrated.

Six-Place Tables. New York: McGraw-Hill Book Company, Inc. 124 pages.

Letters of a Radio Engineer to His Son. By John Mills. New York: Harcourt, Brace & Company. 261 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Investment Bankers Meet

W. E. Creed Tells of the Power Industry in California—Water and Power Act Is Condemned

MEETING at Del Monte, Cal., this week, the Investment Bankers' Association of America discussed the public utility situation in various aspects. Provision for lean years, "junior" financing under proper conditions and customer ownership of securities were favored by prominent speakers. The California water and power act was strongly condemned.

Wiggington E. Creed, president of the Pacific Gas & Electric Company, in his address on Wednesday said in part:

"It will interest you to know that the investment in the power industry in America today has grown to fabulous proportions. In the State of California alone there is invested in this type of security nearly $600,000,000, and the program of construction to meet the needs of this state requires the expenditure of an additional $600,000,000 to $800,000,000 within the next ten-year period. Not only does the power industry stand out from others in the amount of money invested, but it is deeply interwoven with every phase of our national economic development. To handle the properties represented by the great investment in California above alluded to there are 21,000 employees receiving annual pay of $31,000,000, and this industry is paying a little more than $7,000,000 a year in state taxes, in addition to those imposed by counties, cities and the federal government.

"The demands of the industry for capital are being met not only willingly but in a competitive way. In other words, the record of the power industry is such that its securities are eagerly sought for by investment bankers the country over. Of course, the only reason the investment banker seeks securities of this type is because he knows that the big investment markets in Boston, Pittsburgh, Chicago and New York will readily take them because wise investors want them."

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Pittsfield Laboratory Now Produces 1,500,000 Volts

Further advances in the generation of extremely high electric potentials have been announced by the high-voltage engineering laboratory of the Pittsfield works of the General Electric Company. Several combinations of voltages have been obtained and studied for the first time, the highest being 1,500,000 volts, which is half again as much as that recorded in this laboratory a year ago. In this combination one terminal with 1,000,000 volts was connected above ground and the other with 500,000 volts below ground.

One million two hundred and fifty thousand volts, single-phase, was also produced, as was 1,000,000 volts, three-phase, with neutral grounded. A million and a half volts arced between needle points 14 ft. apart. One million volts, three-phase, formed a blazing triangle, 9 ft. on a side, between needle points.

Such advances, the Pittsfield laboratory said, are not only of importance in electrical research and the design of apparatus for the more economical transmission of electric power over long distances, but also open up new fields of research for the physicist, astronomer and physician.

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Direct Current at 1,500 Volts for Illinois Central

Adoption of a 1,500-volt direct-current system with overhead contact has been recommended for the electrification of the Illinois Central Railroad by the railroad's engineering commission, composed of eminent heavy-traction electrification engineers. The commission discarded three possible systems, namely, three-phase, alternating-current; storage-battery locomotive and Diesel engine locomotive, as out of the question. This left four systems for final consideration—750 volts, direct current, with third-rail; 1,500 volts, direct current, with overhead contact; 3,000 volts, direct current, with overhead contact, and 11,000 volts, alternating current, single-phase, with overhead contact.

Estimates on first cost, maintenance and operation were made covering all of these systems. Although the 750-volt system did not differ materially in first and operating cost from the other systems, it was eliminated because it required too large a network of third rails and because of climatic conditions. Of the three systems using an overhead contact, the 1,500-volt system was thought best for the particular problem involved—a heavy suburban passenger service, freight transfer switching in congested yards and eventually through passenger movements. It is said to be quite different from any electrification now in operation either in Europe or America.

Executive Optimism Shown

Outlook of Edison Association Roseate—Alternating Current Grows in Favor—New Edisonia

THAT a spirit of optimism pervades the larger electric light and power companies of the country was evidenced at the convention of the Association of Edison Illuminating Companies held at White Sulphur Springs, W. Va., on Tuesday, Wednesday, Thursday and Friday of this week. This tone was reflected in the address of the president and in most of the committee reports. The construction of hydro-electric and steam stations with their attendant transmission and distribution systems is proceeding on a scale hitherto unknown in the industry. Attention was called to the readiness with which funds can be obtained for new enterprises and to the preparations being made by the engineering and operating staffs for handling greatly increased loads more economically and efficiently.

Alternating current is being considered seriously for use in future extensions of Edison systems owing to the greater expense involved in direct-current substation distribution as loads increase in density. W. C. L. Eglin of Philadelphia recommended that four-wire, three-phase distribution, star-connected, be the method adopted for use in all parts of the system, including generation, transmission, primary distribution and secondary distribution, both in densely loaded business districts and in residence districts, and that all new business be connected to this system. He suggested also that wherever practicable existing business be transferred to this system, in that way fulfilling the fundamental principle enunciated by Edison of a single distribution system in which all of the advantages of diversity factor may be obtained.

ADDRESS OF PRESIDENT SLOAN

The president, M. S. Sloan, in his address dwelt on the economic condition of the country and the degree to which electric utilization affects it, the coal strike and the necessity of greater water-power development and wider interconnection of electric generating systems in the interests of a cheaper, dependable and more abundant power supply.

The desirability of a wider market for public utility securities was emphasized by making the bonds of utilities legal investment for savings banks and through the sale of securities to customers. Touching the latter President Sloan sounded a note of warning. He said: "If the members of our industry decide to use this method and source for funds, the industry must be very careful to see that only safe and profitable issues are offered to the public. The bad effect on the public of a flood of weak and unprofitable stocks is too obvious to state, and it would be well if we took the first step and organized a board of investigation among ourselves to examine carefully and review proposed issues for many reasons—principally to prevent poor ones being offered, but also to co-ordinate them to market conditions, to prevent excessive offerings, to forecast favorable and unfavorable periods and in every way to preserve our market in the best condition."

Reference was made to the recent Supreme Court decision in the New York Consolidated Gas case, and particularly to the pertinent statement of the court that "when it became clear that the prescribed rate had yielded no fair return for more than a year, and that this condition would most certainly continue for many months, the company was clearly entitled to relief." This pronouncement of the highest court of the land, President Sloan maintained, was most reassuring, relieving companies of the danger of greatly prolonged periods of unfair returns and enabling them to get on with smaller reserves, which more closely represent the funds required for renewals, replacements and contingencies.

While the courts had thus clearly defined the issue, it was pointed out that threatened measures like the Bacharach bill would only act as stumbling blocks to impede and delay final judgment, very often to the detriment of the public utility.

An Early Edison Discovery

Before the advent of the telephone and a dozen years before the classic work of Hertz with electrical waves Thomas A. Edison, according to notes unearthed by E. W. Hammer, discovered some puzzling phenomena while experimenting with an electromagnetic vibrator. Edison could not explain them, Mr. Hammer said in his paper, by any known theory of the electric circuit, the consequence being that he considered them the manifestation of a new force. He found that the strange influence could be detected at a distance through the use of loop receiving circuits of various kinds containing capacitance, inductance and an imperfect contact receiver. Without having available the theoretical equipment possessed by Hertz in 1886-1888, Mr. Edison had the same fundamental basis for wireless in 1875, according to the author, which Hertz subsequently established. Etheric force was the prophetic name for those ether waves now so widely employed.

That the advocates of direct-current low-tension distribution are constantly on the alert to perfect the system was shown in a paper by C. W. Wilder and C. H. Shaw of New York. By the method of equalizing feeder loads the New York Edison Company has succeeded in increasing the possible maximum loading of its feeders about 10 per cent. This has resulted in a number of the substations being able to operate on two buses instead of three, thereby enabling the stations to utilize more fully the available capacity of the rotary converters. In addition, two stations are now under construction which will have two buses instead of three, thus eliminating the cost of one bus and the necessary switches with their attendant complications. Distribution efficiency has also been increased owing to the more uniform current density on the feeders.

One of the most interesting reports of the convention was that of the committee on steam turbines and generators, which treated of several important advances in the art of steam-turbine design and of the evolution of auxiliary systems and heat balance in power plants. The important report of the lamp committee was delivered as usual by John W. Lieb.

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Detroit Preparing to Build Municipal Plant

Plans and specifications for an electric power plant which will provide for all municipal requirements, such as lighting public buildings and streets, waterworks and sewage pumping stations and energy for the street-railway system, are being prepared under instructions from the Public Lighting Commission of Detroit. The plant is to be designed for an ultimate rating of 150,000 kva., and four units of 25,000 kva. each are to be installed in the immediate future. A 17-acre site in the southwestern part of the city has been selected. A complete transmission system will be installed.

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New York Electrical Show Attracts Thousands

Opening last Saturday and continuing all through this week, the Electrical and Industrial Exposition attracted many thousands of citizens as well as those specially interested in electricity and its adaptations to the Grand Central Palace in New York City. The Museum of Edisonia was one of the features that drew the greatest crowds. The model electrified home exhibited by the United Electric Light & Power Company and the transferable luminaires, which can be moved from room to room or from house to house, were also objects of keen interest. Among some of the notable exhibits in the booths were new types of automatic lifts for handling materials in warehouses, woodworking apparatus, soda-bottling machinery and water purifiers, soap-manufacturing machinery, an improved telephone switchboard, a model cigar factory run along electrical lines, an automatic machine for the manufacture of screws, one for the control of heat in radiators and another for the manufacture of envelopes.

The parade of electric vehicles on Tuesday morning brought out 125 trucks and delivery vans, despite unfavorable weather.

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Civil Engineers' President on Water Power

John R. Freeman, president of the American Society of Civil Engineers, which has just held a water-power convention at San Francisco, speaking last week at the ceremonies held on putting into service the Pit River power plant No. 1 of the Pacific Gas & Electric Company, 15 miles east of Mount Shasta, Cal., said that the cities of Lowell and Lawrence, Mass., in the days when the development of the old direct water power was at its height, had 150 units in operation, requiring three men on a shift for each unit. "The Pit River power plant," continued Mr. Freeman, "contains two units of 35,000 kw. capacity each, and it is interesting to note that one of these units alone will turn out more water power in the form of electricity than all the 150 units which ran the textile mills of Lowell and Lawrence. Not only is there a distinction in quantity of output per unit, but there is another great distinction between water power in the form of electricity and water power in the direct form, and that is that the water power in the form of electricity is portable. It can be removed from the mountain fastnesses, where it is useless, to turn the wheels of industry and be carried down to the valleys and to the cities to supply the needs of man."

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Stone & Webster Managers Hold Discussion

A nation-wide "experience meeting" upon public relations and commercial problems was conducted this week at Boston, when about 175 executives of Stone & Webster, Inc., assembled at the home office for a five-day convention of managers of utilities under the administration of that organization. On Monday Edwin S. Webster gave a brief address upon "The General Financial Situation," followed by Peter O. Knight, Tampa, Fla., upon "Everyday Problems of the Utility Manager," and W. Cameron Forbes, former Governor-General of the Philippine Islands.

In place of numerous individual papers, this year's convention confined itself to the presentation and discussion of topical papers prepared by a committee consisting of H. T. Edgar, A. S. Pratt, C. W. Kellogg, C. F. W. Wetterer, M. L. Sperry and H. A. Lemmon. These subjects included "Internal Relations and Welfare," "Our Sales Department," "Simplified Rates," "The Street-Railway Situation," "Complaints," "Important Developments in the Gas Field" and "Local Security Sales." H. H. Hunt presided, and on Wednesday an outing was held at the Belmont Springs Country Club. Managers of thirty-five utilities operated by Stone & Webster, Inc., were present, representing many districts.

Contractors and Dealers Meet in Cincinnati

The twenty-second annual convention of the National Association of Electrical Contractors and Dealers opened at Cincinnati on Wednesday of this week.

"Yesterday, Today and Tomorrow" was the topic of George M. Verity of Middletown, Ohio, on the opening day. W. R. Herstein of Memphis discussed "The Supply Jobber and the Electragist," and Frank E. Watts, editor of the *Electrical Record*, spoke for the Joint Committee for Business Development. A motion picture, a play and a reception and dance diversified the program.

On Thursday the program included discussions of the following papers: "The New Manual of Estimating," by Arthur L. Abbott of St. Paul; "Electrifying America—Getting the Job Done," by F. M. Feiker of the McGraw-Hill Company; "The Manufacturers' Problems," by Gerard Swope, president General Electric Company; "How an Employers' Association Functions," by Edward T. Miller of Chicago, and "Specific Specifications," by E. H. Eardley of Salt Lake City. The annual outing took place in the afternoon.

"How the National Can Improve the Electragist's Business," by Laurence W. Davis, New York; "Benefits of Organization," by W. C. Culkins, Cincinnati; a code discussion led by A. Penn Denton, Kansas City, and followed by a talk on recodification by Dana Pierce, chairman of the National Fire Protection Association's electrical committee; "A Central Station's Wiring Campaign," by W. W. Freeman, Cincinnati; "Selling the Electric Idea to the Ladies," by Miss Alice Carroll, New York, and "Insurance for Electragists," by Lynton T. Block, St. Louis, were the chief items that were scheduled for Friday.

Wisconsin Consolidations May Bring Legislation

Numerous consolidations of Wisconsin power companies which have become operative in the last twelve months may, according to the recently expressed opinion of L. E. Gettle, a member of the State Railroad Commission, bring corrective legislation in the session of 1923.

"There can be little question," he declared, "that there is an ever-growing tendency in Wisconsin toward the consolidation of public utilities, especially those based on power. It is only recently that we have seen the expansion of the Wisconsin-Minnesota Light & Power Company in the northern part of the state, the control of the Milwaukee Northern stock by the Milwaukee Electric Railway & Light Company, the interchangeable mileage book affecting all electric roads in eastern Wisconsin, the merger into the Wisconsin Securities Company of the electric railway, gas and power systems of Green Bay, Oshkosh, Sheboygan, Marinette, Menominee, Mich., Sturgeon Bay, Kewaunee and Algoma, and the present proposal of a supply of electric power to a score of cities in the Baraboo valley. The real basis for this consolidation is the development of water power."

Mr. Gettle contends that the Railroad Commission, organized for the purpose of protecting the consumers, is in reality able to do little in these consolidation and inter-contract cases. "Practically the only way we have of regulation," he says, "is through the approval of stock sales or the issuance of new stock necessary. This is especially true in inter-contracts between companies. Actually we are but protecting the buyer of stocks in some of these companies instead of safeguarding the consumer of the utility's products."

There will, in Mr. Gettle's opinion, be a continuance of the tendency to consolidate that will eventually link the main cities by chain systems. The problem presented is, he says, comparatively a new one for the commission, and the rules and precedents set will have an important place in future regulation of public utilities.

Utility Advertising Men to Complete Organization

No dissent from the proposal to organize a Public Utility Advertising Association which will apply for membership in the National Advertising Commission and the Advertising Clubs of the World was expressed when the report of the committee on organization was presented at the round-table discussion of the public relations and advertising men at the American Electric Railway Association at Chicago on Wednesday of last week. The organization committee, under the chairmanship of W. P. Strandborg of the Portland Railway, Light & Power Company, was appointed at a meeting in Milwaukee on June 13, 1922, at which the light and power, railway, gas and telephone utilities were represented. A tentative draft of the constitution and standards of practice were presented at the Chicago discussion, and the organization committee recommended that a time be set for the next meeting, at which the constitution and standards of practice should be adopted and officers elected, preliminary to applying for membership in the bodies already mentioned.

West Penn Power Company to Make Large Extensions

An extension to the Springdale plant of the West Penn Power Company which will accommodate two new 35,000-kw. turbo-generators is to be undertaken at once, according to a statement authorized by A. M. Lynn, president of the company. Contracts have already been let for the additions to the plant, which will more than double its present capacity of 42,000 kw.

Work also is to start at once on a steel-tower line from Springdale to Charleroi. This will carry two 132,000-volt circuits and at Charleroi will connect with a line from the Windsor plant on the Ohio River. Other improvements and extensions are planned by the company, the total cost of the work now under way and about to be started being put at $15,000,000.

Stringent Electrical Code Adopted in Wisconsin

A new electrical code has just been adopted jointly by the Wisconsin Industrial and Railroad Commissions. Following are a few of its provisions, some of which are of a stringent character.

The wiring of all schools, theaters, halls, hotels, hospitals and service garages must be metal conduit. Circuits in any building carrying more than 300 volts also must be placed in conduit. Entrance wires to all buildings shall be in conduit from the point where the overhead service attaches to the building to the service switch. This conduit must have a condulet where the service wire is attached to the building which is moisture-proof, has a separate outlet for each wire and is so arranged that water cannot run into the conduit. The conduit for entrance wires may, however, be omitted where the service wires can be brought in directly to the back of the cabinet containing the service switch.

An unusual requirement is that the ground wire and grounded neutral in house wiring must have a designated color. Other rules are that each building shall have a separate service and that the entrance switch shall be inclosed in a metal box and be externally operated and sealed or made inaccessible to other than qualified persons.

Philadelphia Safety-Switch Congress on Nov. 4

A safety-switch congress and exhibit has been planned by the Philadelphia Section of the Association of Iron and Steel Electrical Engineers to be held at the Hotel Majestic, Philadelphia, on Saturday, Nov. 4. About twenty-five manufacturers of safety switches for 600-volt service and below, including motor-starting switches of the "across-the-line" type only and limit switches for cranes, will exhibit their products.

The exhibit will open at 1 p.m., and at 6.30 p.m. a dinner will be served. Following the dinner, P. T. Vanderwaart, electrical engineer of the New Jersey Zinc Company, Palmerton, Pa., will read a paper, to be followed by a general discussion by electrical engineers of the iron and steel and other industries, central-station men, jobbers and contractors and representatives from the underwriters' societies. The proper design and application of the safety switch, both as a means for disconnection of power and lighting service and as a means for manually starting squirrel-cage motors which can be directly connected to the line, will be considered.

Managerial Problems Theme at Lake Placid

Empire State Association Discusses Improvement of Public Relations, Rural Service, Simplification of Demand Billing, the Fuel Situation and Other Practical Topics

THE importance of establishing better public relations and methods of accomplishing this end, the necessity of giving rural service before farmers are roused to drastic action in order to obtain it, the benefit of reducing the number of forms of demand billing, and a method of handling the fuel situation were the outstanding subjects discussed before the eighteenth annual convention of the Empire State Gas and Electric Association at Lake Placid, N. Y., last week. In addition, attention was directed to the amount of business available through an "Electrify America" campaign, the possibility of helping small companies in their sales development by lending them power sales engineers, and the advisability of adopting the N. E. L. A. uniform system of accounting. Engineering problems and practices were dealt with in the reports of the electrical and meter committees.

A relatively optimistic view of the prospects of electric service companies was expressed by President E. H. Rosenquest, who declared that the continually increasing revenue of these companies is the best sign of returning business prosperity. Reduced cost of materials and equipment as well as of money has made plant development and extension possible again. Another favorable sign is contained in recent court decisions regarding property valuations, depreciation and service charges. Electricity will be demanded this winter as never before, President Rosenquest asserted, owing to the fuel situation. Referring to the all too frequent misunderstandings between the public and utilities, he contended that the fault resides chiefly in the utilities' failure to give out more information. This failure will be largely overcome by public utility information bureaus.

Analyzing the fuel situation, W. M. Carpenter, assistant secretary of the association, urged utilities to store enough coal to prevent "hand-to-mouth" existence. Service interruption due to lack of coal will not occur, Mr. Carpenter declared, if every company will co-operate by informing the coal-distributing authorities regarding the amount of coal which it has on hand each week.

IMPORTANCE OF GOOD PUBLIC RELATIONS

Establishment of harmonious public relations is one of the most important tasks before public utilities now, in the view of M. S. Sloan, chairman of the New York State Committee on Public Utility Information, who addressed the convention. The problem is to convince the public that the public utility industry is owned by it and operated to serve it. If the facts are made known, the majority of the people will give utilities a fair deal. So far the financial support for this work has not been what it should be, but more than money is needed. Companies must co-operate by giving the best service for the lowest rates and by cultivating the good will of newspaper editors and reporters.

A résumé of what the New York Public Utility Information Committee is trying to do, how it is doing it and the results which have been obtained was presented by F. W. Crone, director of the work.

An analysis of central-station advertising made by W. J. Reagan, chairman of the Commercial Section's sub-committee on advertising, shows that about 60 per cent refers to appliances and 25 per cent to securities and that information fostering good will is almost entirely neglected.

H. W. Bell, director of service for the Utica Savings Bank, told how public relations in that institution had been improved, suggesting that the same methods could be applied by public utility companies.

FORESTALLING THE FARMERS

Farmers want electric service and utilities must supply it, Bert H. Shepard, chairman of the committee on rural lines, declared. Failure to supply this need will bring about the same objectionable condition that arose in the early days of telephone development. Strenuous efforts must be made to educate farmers regarding the cost of such service and the convenience and economy of using electricity.

E. P. Peck, superintendent electrical department, Utica Gas & Electric Company, referred to the aggressive action of farmers in the Middle West and urged that central-station companies get in line and serve farmers before the farmers force them to do so under conditions which will not pay for cost of rendering service. The demand should be based on the equipment installed to serve a customer.

The committee on demand rates, of which F. W. Smith was chairman, expressed the view that there existed entirely too great a diversity in these rates. This view was supported by J. T. Hutchings and E. P. Peck. The latter thought kilovolt-ampere demand rather than kilowatt demand to be the important factor. C. G. M. Thomas opposed the establishment of rates or minimum guarantees for the express purpose of attracting business.

W. C. Pearce, Syracuse Lighting Company, expressed the belief that one standard of demand billing is not necessary, but that the number of demand intervals and methods of billing can be reduced. The chief difficulty will be with small companies.

C. A. Barton, New York & Queens Electric Light & Power Company, contended that demand should be on a yearly basis because equipment required is permanent. On railroad loads the integrated demand for one hour will be satisfactory, he believed.

F. B. Steele, Utica Gas & Electric Company, pointed out that the Ohio Electric Light Association found very little difference in registration at different time intervals on average loads and has adopted a thirty-minute interval as standard for such conditions. Utica has done likewise, but uses a different interval for fluctuating or intermittent loads.

H. A. Lane of the Joint Committee on Business Development asserted that only 8 per cent of the available business in this country is served.

To assist small companies to solicit power business more successfully it was suggested by the Commercial Section chairman, H. A. Doering, that large companies might arrange to lend their power sales engineers at a definite rate. It was also recommended that advertising and other publicity effort be extended to include utility problems and service to the public.

The Public Service Commission of the State of New York has been petitioned to adopt the uniform system of accounting prescribed by the National Electric Light Association, H. O. Palmer, chairman of the accounting committee, reported.

Several engineering or technical practices that need investigation were emphasized in the reports of the electrical and meter committees, of which L. C. Smith and E. E. Hill respectively were chairmen.

PRACTICES NEEDING ATTENTION

Mr. Smith directed particular attention to a set of tables which have been prepared by a sub-committee of which E. P. Peck is chairman to facilitate selection and building of transmission lines. They give recommended wire spacings and clearances, details of construction and costs. Recommended boiler-room control and banking practices were also outlined, and attention was called to the variances in transformer fusing practice and the need of investigating the relative merits of tree wires and thermal-type load indicators.

Mr. Hill reviewed the work which has been done to formulate demand-meter acceptance tests and emphasized the great variety of demand intervals used. He suggested studies of demand-meter troubles, remedies and maintenance, demand-meter rates with a view toward standardizing, meter installation practices, and maintenance methods and records.

Widely opposite opinions exist regarding the transmission-line recommendations made by the sub-committee on transmission lines, said E. P. Peck, chairman. Some think they are too drastic, others that they are too lenient. Mr. Peck called attention to the lack of satisfactory fuses for voltages of 2,300 and above.

M. J. Brayton, vice-president Utica Gas & Electric Company, was elected president of the association for the ensuing year. The next convention of the Empire State Gas and Electric Association will also be held at Lake Placid.

Tribute Paid to C. L. Edgar

Boston Edison Officials and Employees Celebrate His Thirty-five Years With the Company

IN HONOR of the thirty-fifth anniversary of President C. L. Edgar's connection with the Edison Electric Illuminating Company of Boston, virtually all the bureau and department heads of the company and their principal assistants, together with numerous employees, tendered a complimentary luncheon to their chief executive at the Massachusetts Avenue Service Buildings on Sept. 29. E. S. Mansfield officiated as toastmaster and addresses of congratulation were made by William H. Atkins, general superintendent of the company; John W. Lieb, vice-president of the New York Edison Company; L. H. Howe, Jr., president Boston Edison Employees' Club, and others.

A FEW OF THE OFFICIALS AND EMPLOYEES WHO MET TO CONGRATULATE MR. EDGAR
Mr. Edgar and Mr. Lieb in front row, center

At the luncheon the gathering was composed entirely of Edison employees, the food being cooked by Edison service and the floral displays raised in company gardens, while young women employees served the guests and hosts. In greeting Mr. Edgar Mr. Mansfield said that the employees and officers of the company considered themselves fortunate in being associated with an administration so unusual in length of service and remarkable in accomplishment, the company having grown from a small organization to one of magnificent proportions under Mr. Edgar's leadership. Mr. Lieb offered the felicitations of the sister Edison companies of the country. "It has been my good fortune," he said, "to be associated with Mr. Edgar in many things that had to do with the formulation of general policies. This association has resulted in a deep attachment to the guest of honor, a deep feeling of regard for his personality and for his high ideals of company management and service to the public." Mr. Lieb touched upon the indebtedness of the central-station industry to Mr. Edgar's broad insight and liberal thinking, his judgment and influence.

On behalf of the employees, Mr. Howe presented Mr. Edgar with a share of the company's capital stock, suitably inscribed, as a tribute to his leadership and concern in their welfare and also with a well-stocked humidor. An unusual gift from Mr. Edgar's official associates took the form of a pair of book ends designed to represent the façade of the L Street station in South Boston and made of copper tubing which had transmitted energy in regular Edison service for from thirty to thirty-six years. Walter C. Baylies, vice-president, spoke for the stockholders and directors. In a feeling response Mr. Edgar paid high tribute to the loyalty and abilities of the company's personnel throughout his administration.

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Staten Island Company Under New Management

Through the purchase of the interest of the H. H. Rogers estate in the Richmond Light & Railroad Company, which furnishes light and power and owns the trolley system on Staten Island, N. Y., by a syndicate headed by J. H. Pardee, president of the J. G. White Management Corporation, the way has been prepared for the reorganization of the company, which is now in the hands of a receiver. Mr. Pardee has been elected its president. No details of the purchase price were made public, but it is said to have been between $12,000,000 and $15,000,000. Staten Island, as the Borough of Richmond, forms part of Greater New York.

Code for Electricity Meters Approved by A. E. S. C.

The code for electricity meters submitted by the National Electric Light Association and the Association of Edison Illuminating Companies has received the unanimous approval of the main committee of the American Engineering Standards Committee as "American standard." It is expected that the approval of this code by the A. E. S. C. will bring it into even more general use and will have the effect of greatly reducing the possibility of controversies concerning the installation and performance of electricity meters between meter manufacturers and electric service companies, between service companies and electricity consumers, and between utility commissions and electric service companies.

The Association of Edison Illuminating Companies and the N. E. L. A. have been appointed joint sponsors for the future revision of the code.

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The S. P. E. E. Advances Its Program of Education

The development committee of the Society for the Promotion of Engineering Education has reported plans for the future, their execution being contingent on the provision of the required funds. The committee, which consists of F. W. McNair, M. E. Cooley, D. C. Jackson, J. H. Dunlap, F. L. Bishop and Charles F. Scott, believes the two chief questions in engineering education to be, first, what the engineer graduate should be, and, second, what the training of the engineering student and the influence surrounding him should be.

In its consideration of the first of these questions the committee holds that the past, present and future should be studied; to answer the second, it says, it will be necessary to express definitely the ideals of service and training. There is a necessity to study the needs of civilization, of the profession of engineering and of industry in order to arrive at right conclusions as to the training of the student and the machinery of education.

The committee recommends the establishment of a board of investigation and co-ordination, to consist of a staff of investigators with a director and, in addition, a body of counselors embracing representatives from the several fields concerned in the investigation. The work of the board would be to ascertain facts as regards (a) teachers, their origin, training, experience and effectiveness; (b) teaching facilities; (c) curricula; (d) students and graduates, their origin, training, experience and effectiveness. The board would, in addition, study the future requirements in engineering education, co-operate and establish points of contact with schools and raise funds for these purposes. Dean M. E. Cooley of the University of Michigan, has been proposed as the director of the board.

President Smith on Great Lakes Division

Chief Executive of the National Electric Light Association Pays Tribute to the Electrical Achievements of the Middle West and Its Work in Promoting Good Public Relations

A FEATURE of the geographic division conventions of the National Electric Light Association held in the last few months has been the presence of Frank W. Smith, the national president, and his addresses in appreciation and encouragement of divisional enterprise. At the Great Lakes Division convention at French Lick Springs, Ind., Mr. Smith was the chief speaker at the banquet held on Sept. 28. On this occasion he said in part:

"I should fall short of my duty if I did not say something with particular reference to the large and important interests operating within the territory comprised in the Great Lakes Division. In this territory, made up of the four great states of Illinois, Indiana, Michigan and Wisconsin, you will find exemplified all of the great advances made in the electric light and power business since its foundation forty years ago. Particularly in the more recent phases of the work does this section shine. Here you have recognized your primary duty of mutual help. You occupy a dominating position in the economical production of electrical energy from steam. The remarkable degree of efficiency displayed by the great central-station companies—among the largest in the world—has resulted in a very low average rate for electrical energy, of which the consuming public is receiving the benefit.

"In the development of water power the states within this section have likewise shown commendable energy and foresight. Wisconsin and Michigan abound with modern hydro-electric developments, while to the south, where flows the Father of Waters, there is found the world-famed development of the Mississippi Power Company at Keokuk.

"You have grasped the value and meaning of interdependence. From St. Paul and Minneapolis on the north to St. Louis on the south, and from Keokuk on the west to Terre Haute on the east, there is a general flow and interchange of energy partly obtained from water power, partly from stations at coal mines and partly from superpower stations strategically located as regards coal, water supply and load.

"The use made of electricity in this territory is also as diversified in extent as are its ramifications in area, and the diversity of the demand is such as to cause almost full use of the investment at all times.

PROGRESSIVE PUBLIC RELATIONS

"In the matter of public relations your section occupies a position in the front rank. Here was started the first committee on public utility information, the one in Illinois. Here customer ownership of stock was adopted as a policy almost from its inception and is being pursued energetically by the large interests as well as the relatively small companies.

"In this matter of customer ownership a recent announcement is of great interest, that telling of the formation of the Utilities Securities Company in Chicago, intended to succeed the investment department of the Commonwealth Edison Company, the Public Service Company of Northern Illinois and the Middle West Utilities Company.

"Right now extensions into rural communities are a vital issue with our member companies. We recognize how necessary it is for growing cities to be surrounded by prosperous rural communities and to what extent our wellbeing is wrapped up with the welfare of the farmer. For an enlightened solution of the problem incident to rural service we naturally look in a large degree to the power companies in this section.

"This question of rural-line extension is one of very great importance to a vast group of our member companies and is receiving attention in a national way from our association. There are many problems involved, the questions of financing, adequate rates and so forth, and as a result of the intensive study that is being made by our national committee, tied in, as it is, with all the committees in the geographic divisions, this subject will find a proper solution.

PRIDE IN THE INDUSTRY

"On a recent trip through the Far West I was amazed at the large number of sparsely settled communities, without streets, sewers, water supply or any other public service, yet enjoying all the civilizing advantages that electricity can give. Amazement gave way to pride when I pondered on the significance of that achievement of the electrical industry of which I was a part. In this matter of pride in the industry, which I am sure we all feel so greatly, I was struck by remarks recently made by Past-president Martin J. Insull. He said: 'One of the attractive things to me in the utility business is the fact that we are in a business where we really are doing something for the other person. He may not know it, but we are doing it nevertheless. I have often thought that possibly I might have procured a far greater financial return in some other business than the utility business during the many years I have been in it. However, I have never thought once of leaving it for some other business. I do not want to be in a business where I am just trading dollars. I want to be in a business where I am creating something, so that when the end comes I shall feel I have done something while I was here.'

"I pay tribute to the Great Lakes Division and the four great states within it and to the great organizations within this territory which have contributed so much to the industry and have been such loyal supporters of the work which the National Electric Light Association is seeking to do for the upbuilding of the electric light and power business."

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Indiana Electric Corporation Suit Before Higher Court

The Indiana State Supreme Court has just heard oral arguments on the validity of the consolidation of seven Indiana light and traction companies into the Indiana Electric Corporation. This consolidation was authorized by the Indiana Public Service Commission last January and was later, at the instance of Indianapolis and Kokomo, declared by Judge Linn D. Hay of Indianapolis to be unlawful. Attorneys for these cities declared that the law did not give the commission the right to authorize utilities to sell their own property to themselves through the agencies of their own companies or to issue stocks and bonds on such property to the extent of $7,200,000 more than the fair present value of the property. Attorneys for the corporation maintained that the law permitted any corporation to buy another corporation, regardless of whether they furnished similar service valuations of the property for the purposes of the sale. The issuance of securities beyond a certain valuation was not an evidence of fraud, they said, because opinions did not agree on the correctness of the valuation.

The companies united by order of the commission are the Merchants' Heat & Light Company of Indianapolis, the Elkhart Gas & Fuel Company, the Valparaiso Lighting Company, the Indiana Railways & Light Company of Kokomo, the Putnam Electric Company of Greencastle, the Cayuga Electric Company and the Wabash Valley Electric Company of Clinton.

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Tenney Service Convention Hears Practical Talks

More than 250 officials of utilities under the management of Charles H. Tenney & Company, Boston, assembled Oct. 4 and 5 at the New Ocean House, Swampscott, Mass., for the thirteenth annual convention of the organization, the program being based upon current economic and regulative conditions in the central-station and gas industries. An address was given by Senator Lodge. The speakers at the business sessions were: Col. Charles H. Tenney, opening address; Prof. J. J. Mahoney, Harvard University, "Industry and Non-English-Speaking Employees"; Gen. A. E. Bliss, Malden Electric Company, "Inspection"; B. F. Griffin, associate editor Boston News Bureau, "Business, Finance and the Public Utilities"; Dana D. Barnum, Boston, "The Gas Industry Today"; Everett W. Burdett, Boston, "Steps in Regulation of Public Utilities," and Walter Camp, New Haven, "Keeping the Business Man Fit." At a dinner on Wednesday evening Alvin T. Simonds, president Simonds Manufacturing Company, Fitchburg, Mass., addressed the convention upon "Conditions in Europe and How They Affect Us," and H. C. Attwill, chairman Massachusetts Department of Public Utilities, spoke upon "Regulation." A program of recreation and sports occupied the second day.

Brief News Notes

Interconnection in Texas.—The Dallas Power & Light Company is just completing the construction of a 60,000-volt steel-tower transmission line to connect with the Texas Power & Light Company's transmission system at Trinity Heights. With this new line in service it will be possible to transmit power from Waco and Fort Worth to Dallas over two entirely different routes, thus making a suspension of service almost impossible under normal conditions.

New Company Takes Over Spartanburg Utility.—The South Carolina Gas & Electric Company, succeeding the South Carolina Light, Power & Railways Company, began service in Spartanburg on Oct. 1. All the business and property of the old company were taken over by the new one, which announces that the sum of $300,000 will be expended in improving its facilities. The South Carolina Light, Power & Railways Company was sold at auction to the bondholders of the company several weeks ago.

Southern Power Company to Build Two Steam Plants.—Two large reserve steam-electric plants are to be built very soon by the Southern Power Company to supplement its service in seasons of dry weather or other emergency. One of these plants, to be rated at 40,000 hp., will be built at Mountain Island, N. C., where the company is also building a great hydro-electric plant, and the other one, rated at 20,000 hp., will be built at Eno, N. C., where the company already has a steam plant. The new installations will more than double the capacity of the company's existing steam generating stations. They will cost, it is said, about $2,000,000.

How Tacoma and Seattle Plan to Exchange Power. — Arrangements have been completed whereby the municipal plants of the cities of Tacoma and Seattle, Wash., will exchange power in case of high demand or emergency conditions on the generating system of either city, as previously announced in the *Electrical World*. The scheme of connections, which was designed by engineers of the Westinghouse Electric & Manufacturing Company, although somewhat elaborate in design, is very simple in operation. The generating plant of each of the cities transmits power at approximately 50,000 volts. The maximum amount of power to be exchanged is 15,000 kva., and a 15,000-kva., three-phase water-cooled transformer having approximately a one-to-one ratio will be used to tie the two generating systems together. One side of the transformer will be provided with a number of taps, and a tap-changing device will be supplied to vary the ratio of transformation by means of the taps so that it will be possible to equalize the voltages of the systems one with the other and also to control the amount of the regulation. Instead of transferring abruptly from tap to tap, a small induction regulator will be used to give any intermediate voltage between the taps. The induction regulator will be excited from an auxiliary winding on the main transformer and will vary the voltage of a small series transformer having two secondary windings per phase. These windings will be transferred from tap to tap of the main transformer in such a way that it will be possible to obtain any voltage from the maximum to the minimum. The regulator will be operated by a small motor, and the various switches will be positively geared to the regulator mechanism so that the entire range in voltage will be controlled by operating two push-buttons, one to raise and the other to lower the voltage.

Federal Government Extends Power Plant.—Extension of the United States Capitol power plant so as to furnish steam heat and electric light and power to the Government Printing Office and the Botanic Garden in addition to the buildings previously served, which included the Capitol, the Library of Congress and the House and Senate office buildings, is expected to effect economies of operation of more than $100,000 a year. Coincident with abandonment of its independent steam plant, the Government Printing Office is installing an electric substation with transformers capable of taking care of much more than the immediate power needs of the establishment. The Washington Post Office, which has received heat, light and power from the Government Printing Office, also will be linked to the Capitol power plant when the change is made. Contracts for all the work and equipment, with the exception of the transformers, have been awarded, and work is in progress.

Only 6 per Cent of Accidents in Electric Plants Due to Shock.—An analysis of 5,582 accidents to employees of electric plants in Pennsylvania during the last five years, made by the accident prevention and safety rules committee of the Pennsylvania Electric Association and embodied in the report of that committee to the recent convention at Bedford Springs, shows that only 327 casualties, or 6 per cent of the total, were due to electric shock. These, however, were responsible for 53 of the 101 fatalities. The most prolific source of accidents is listed as "moving and unloading material," 1,297 casualties falling under this head. The other sources of accident giving rise to more than 100 injuries were: Hand labor, 606; falls other than from ladders or poles, 450; injuries from falling materials, 439; burns other than electrical, 357; eye injuries, miscellaneous, 349; moving and assembling material, 246; falls from ladders, 219; injuries from self-propelled vehicles, 196; injuries from nails, 152; injuries from machine tools peculiar to industry, 136; infection from cuts, etc., 116; injury from miscellaneous vehicles, 103; falls from poles, 101. There were thirty-nine injuries from short circuits, twenty-eight received in operating motors and generators, twenty-one eye injuries from electric flash and fifteen from explosions.

Associations and Societies

Southwestern Division, N. E. L. A.—The executive committee of the Southwestern Geographic Division of the National Electric Light Association at a recent meeting in Dallas selected Oklahoma City as the meeting place for the 1923 convention, to be held in connection with the annual convention of the Oklahoma State Utilities Association. The joint convention will be held during March or April, the exact date to be fixed later.

Section Meetings of the Institute.—C. F. Hood of the American Steel & Wire Company, Worcester, Mass., will read a paper on the manufacture of wire before a meeting of the Worcester Section, A. I. E. E., on Oct. 19. On Oct. 24 a demonstration of the portable oscillograph will be made before the Akron (Ohio) Section by J. W. Legg of the Westinghouse Electric & Manufacturing Company. The Philadelphia Section will meet on Nov. 13, when a paper on the trackless trolley, by J. A. Queeney and J. F. Collins, will be presented.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Society of Industrial Engineers — New York, Oct. 18-20.

Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 20-21. A. Bliss McCrum, Charleston, W. Va.

Electric Power Club—Asheville, N. C., Oct. 30-Nov. 2. S. N. Clarkson, Kirby Bldg., Cleveland, Ohio.

Arkansas Utilities Association—Hot Springs, Ark., Nov. 7 and 9. R. P. Brown, Little Rock Ry. & Electric Co., Little Rock

Electrical Credit Association (interstate convention)—Philadelphia, Nov. 10. J. W. Crum, 1328 Land Title Bldg., Philadelphia.

Ontario Association of Electrical Contractors and Dealers—Toronto, Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.

National Association of Railway and Utilities Commissioners—Detroit, Nov. 14-17. J. B. Walker, New York Transit Commission, New York.

Electrical Credit Association, Central Division—St. Louis, Nov. 16-17. F. P. Vose, 1347 Marquette Bldg., Chicago.

Electrical Supply Jobbers' Association—Cleveland, Nov. 20-24. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Society of Mechanical Engineers—New York, Dec. 7-13.

Commission Rulings

Income Tax Chargeable Against Profits.—Income tax was deducted from the operating expense account of the Colorado Power Company by the Colorado Public Utilities Commission as not a proper charge against revenue, it being properly chargeable against profits.

No Excuse Can Palliate Dangerous Construction.—In a complaint brought by the municipality of New Cambria against the Bucklin Light & Power Company inadequate rates were urged as a reason for the improper construction of a transmission line and electrical distribution system. The Missouri Public Service Commission emphatically refused to entertain the plea, declaring: "Inadequacy of rates is no justification for construction that is not only unserviceable but eminently dangerous to human life, which is the condition disclosed by the testimony before the commission."

Securities of Overcapitalized Utility.—That overcapitalization does not justify the refusal of authority to issue necessary bonds for extensions and additions was maintained by the Missouri Public Service Commission in a case recently before it affecting the City Light & Traction Company of Sedalia. The commission also held that it has authority to authorize stock and bond issues to acquire funds to make replacements to an electric plant even where the security issues were made necessary because of the failure of the company to maintain an adequate depreciation reserve in spite of earnings sufficient for that purpose.

Customer Neglecting to Avail Himself of Most Advantageous Rate Schedule Cannot Allege Overcharge.—Complaint was made in Munn vs. the Commonwealth Edison Company of Chicago because the schedule under which the complainant was billed was not so advantageous to him as another one where a change had been made in the minimum charge. The Illinois Commerce Commission dismissed the complaint, saying: "The issue is whether a utility, after having notified a consumer of a more advantageous rate under which he may receive service, is under obligation to make reparation when the consumer has not taken advantage of the opportunity offered him to enter into a more advantageous contract. It is the opinion of the commission that the Commonwealth Edison Company, through its notification to the complainant's agent of a possible saving and through its offer to make changes in its contract which would reflect to the advantage of the consumer, fulfilled its reasonable obligation, and any loss which the consumer experienced as a result of the failure to take advantage of the more favorable rate should not be charged to delinquency on the part of the utility."

Flat Rate Abolished.—The Public Utilities Commission of Utah has authorized the Clark Electric Power Company to discontinue its former flat rate for lighting service in Tooele and required it to publish and file with the commission a meter rate covering the furnishing of electrical energy for water heating. The company reported that of approximately 600 customers for lighting in Tooele, the only place where the flat rate for lighting obtained, only ninety-five were actually paying the flat rate. It was sought to remove this form of service entirely, on the grounds of discrimination and of waste. The power company also asked permission to cancel its present rates for water heating, but the commission found that this could not reasonably be done because in that event customers would be without such service.

Occupied Territory Inadequately Served May Be Allotted to Others.—In granting a certificate of convenience and necessity to one Charles L. Ward to build and operate an electric plant at Greenfield, Mo., notwithstanding that the Greenfield Light & Power Company owns and operates a plant in that city, the Missouri Public Service Commission expressed its conviction that a new electric utility may be authorized to operate in a community where it appears that the existing company has failed to render adequate service and, on account of lack of means and ability to procure means and because of other conditions surrounding the utility, is unable to furnish the service to which the public is entitled. The owner of the new utility was directed to purchase the plant and equipment of the existing company as a condition of obtaining the desired certificate of convenience and necessity.

Why No Value Attaches to Franchises.—In explanation of why it allowed only sums that had been actually and lawfully expended for franchises to be charged to capital the Public Service Commission of Montana recently observed: "A franchise as such ordinarily has no value for rate-making purposes. This is not because, as is sometimes stated, a franchise is a 'gift of the people,' for there is no element of gift or donation therein. A reading of almost any franchise manifests this fact, and particularly of franchises granted to and held by public service corporations. In return for the right of occupancy the city or other political agency exacts from the grantee or its successors obligations whose proper performance is of great importance to the public and fraught with heavy responsibilities to the corporation. Far from issuing as gratuities, franchises are bartered for a *quid pro quo*. The true ground for refusing any valuation to franchises is found in the fact that they no longer confer any immunity from regulation."

Recent Court Decisions

Contract Giving License to Use Reservoirs Does Not Create Easement.—In McLeod vs. Colorado Power Company the plaintiff claimed an easement in certain lands which the defendant company had acquired from the Electric & Hydraulic Company. The last-named company had granted to the plaintiff the right to use for boating, fishing and resort purposes reservoirs to be constructed by the company and the lands adjoining them under restrictions which guarded against interference with the company's use of the stored water for power or other purposes. The projected reservoirs were never built, and the defendant denied that the agreement gave the plaintiff any ownership or license in the land, inasmuch as such an interest was contingent on the creation of the reservoirs. This contention the Supreme Court of Colorado, affirming the judgment of the lower court, has sustained. (208 Pac. 463.)*

Statute Fixing Confiscatory Rates for a Foreign Corporation Held Invalid.—The United States District Court for the Eastern District of South Carolina has, in Southern Bell Telephone & Telegraph Company vs. Railroad Commission, granted to the plaintiff a permanent injunction against the enforcement of rates fixed by the commission under the terms of a statute which provided that no telephone or telegraph company should charge a higher rate than was legally in effect on Jan. 1, 1921. The federal court said: "While it may be conceded that no right in perpetuity exists on the part of any foreign corporation to carry on business and remain within the state, yet equally it must be denied that the state has the right by a sudden and arbitrary exclusion practically to sacrifice and confiscate the property of any such corporation. If it should exercise that power of exclusion under the guise of regulation, it can do so by giving to the corporation which has been allowed to establish itself legally within the limits of the state such a reasonable time for realization upon its property and securities and retirement from the state as would as a judicial question equitably meet the situation. So, conversely, a public service corporation exercising its right to cease carrying on its business because of its inability to earn a reasonable return from its operation might be restrained from doing so for such a reasonable time as would permit the state to meet the situation and endeavor to provide for the service of the public." (280 Fed. 901.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

J. F. Dostal Elected President Rocky Mountain Division, N. E. L. A.

J. F. Dostal, general manager of the Colorado Springs (Col.) Light, Heat & Power Company, is the newly elected president of the Rocky Mountain Division of the National Electric Light Association. He was graduated from Purdue University in 1902 and in the same year entered the engineering department of the Denver Gas & Electric Company. After several years in charge of distribution he became electrical superintendent. He has been general manager of the Colorado Springs company since 1911 and has been prominently identified with organized effort in the electrical industry since 1902. Mr. Dostal served a term as president of the Colorado Public Service Association, is now a member of the Rocky Mountain Committee on Public Utility Information and is prominent in the affairs of the Rotary and Engineers' clubs of Colorado Springs.

J. F. DOSTAL

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W. A. Baehr has been elected president of the St. Cloud (Minn.) Public Service Company, succeeding A. G. Whitney.

R. F. Burkhart, formerly engineer with the Luzerne County Gas & Electric Company, has joined the American Gas Company, Philadelphia.

H. Baker, formerly associated with the West Penn Power Company, has taken a position in the service department of the Duquesne Light Company.

H. E. Dawson has been appointed secretary of the Rhode Island Electrical League, with headquarters at Providence.

C. Voetsch, formerly hydraulic and electrical engineer with the Utica Gas & Electric Company, is now connected with the Adirondack Power & Light Corporation in the same capacity.

W. W. Hill, formerly connected with the Alabama Power Company as electrical material engineer, has joined the staff of the Alabama Polytechnic Institute as instructor.

H. B. Zimmerman, secretary of the Atlas Crucible Steel Company, Dunkirk, N. Y., for the past four years, recently resigned his position to become general manager of the Western New York Electric Company of Jamestown, N. Y.

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W. P. Schwabe Committeeman of New England N. E. L. A.

At a convention held recently in New London Walter P. Schwabe, vice-president and general manager of the Northern Connecticut Light & Power Company, was elected a member of the executive committee of the New England Division of the National Electric Light Association.

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F. G. McRae has severed his connection with the Willys Light Systems, where he was engineer, secretary and treasurer, to become sales engineer for Electric Service Supplies, 610 Monadnock Building, Chicago.

A. D. Holmes, formerly with the New England Power Company, has resigned his position as superintendent of the Uxbridge steam plant to become associated with the Central Maine Power Company at Gardiner, Me.

Milo Smith Ketchum was recently appointed dean of the College of Engineering and director of the Engineering Experiment Station of the University of Illinois. The new dean and director brings to this administrative office a wealth of experience in the engineering field, gained through association in various capacities with the Michigan College of Mines, University of Illinois, University of Colorado and the University of Pennsylvania. In addition, Dean Ketchum was at one time connected with the Gillette-Herzog Manufacturing Company as contracting and designing engineer and later with the American Bridge Company as contracting manager in charge of the Kansas City (Mo.) office. He has carried on a consulting practice for twenty years and has had considerable experience in valuation work and in giving expert testimony. He has written several books on designing and structural engineering and has contributed many articles to the technical press.

Samuel Ferguson, vice-president of the Hartford Electric Light Company has been elected a director of the Hartford Steam Boiler Inspection & Insurance Company.

D. E. Byerley, formerly connected with the Montgomery Light & Water Power Company, Montgomery, Ala., in the capacity of general superintendent, is now associated with the Hattiesburg Traction Company as general manager.

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J. B. Black General Manager Great Western Company

J. B. Black, formerly general sales manager of the Great Western Power Company of San Francisco, has been appointed general manager of the company. He became associated with the Great Western Power Company immediately following his graduation from the University of California in 1912, rising rapidly from one position to another. Mr. Black is one of the active figures in the electrical industry in the West, having been chosen president of the Pacific Coast Electrical Association for the coming year at the recent convention of that organization at Los Angeles in June. He is a member of the advisory committee of the California Electrical Co-operative Campaign and has been instrumental in the success of that organization.

J. B. BLACK

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Changes in Personnel of San Joaquin Company

A. M. Frost, formerly manager of the Fresno district of the San Joaquin Light & Power Corporation, has been appointed manager of sales of the same company and the Midland Counties Public Service Corporation. Paul Wilson, formerly manager of the Madera district, has been appointed manager of the Fresno district, and F. V. Boller, formerly manager of the Santa Maria district of the Midland Counties Public Service Corporation and recently head of the right-of-way department of the San Joaquin Light & Power Corporation, has been appointed manager of the Madera district.

W. F. Brown Elected President of the Colorado P. S. A.

Walter F. Brown, general traffic manager of the Mountain States Telephone & Telegraph Company, Denver, was elected president of the Colorado Public Service Association at its recent Glenwood Springs convention. After his graduation from Yale Mr. Brown became identified with the Bell Telephone System in New York City in 1893. Several years later he was transferred to Colorado, and since 1900 he has successively held the positions of manager of operating department, superintendent of traffic, assistant general manager, division general manager, traffic superintendent and general traffic manager. He was prominent in the affairs of the former Colorado Electric Light, Power and Railway Association and during 1920-1921 was chairman of the electrical bureau of the Denver Civic and Commercial Association. Mr. Brown has the distinction of being the first telephone man in many years to head the Colorado Public Service Association.

W F. BROWN

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Harold Calvert has terminated his work with the Philadelphia Electric Company to accept the position of president of the Baird-Osterhout Company, Philadelphia.

Frank E. Dyson, assistant general agent Universal Winding Company, Providence, R. I., a position he held for seventeen years, has resigned to devote his entire attention to the affairs of the Electrical Products Manufacturing Company of that city, of which he is president.

M. H. Sarben, who was recently appointed vice-president of the Bleadon Dun Company, Chicago, joined the organization in March, 1921, to establish its New York sales office. Previous to his connection with the Bleadon Dun Company he was associated with the Theodore Stove Company, engineer and exporter.

W. H. Price, formerly electrical engineer with the General Machinery Company, Birmingham, Ala., is now connected with the Midvale Steel & Ordnance Company in the capacity of electrical foreman.

Laurence E. Frost has resigned from the Western Electric Company and has taken a position with the Brooklyn Edison Company, where he will be technical assistant to the electrical engineer.

W. W. Miller, formerly of the engineering department of the Cutler-Hammer Manufacturing Company, has been appointed head of the engineering department of the Lewis Electric Company, switches and control equipment, Minerva, Ohio.

W. J. Sanger has been appointed chief engineer of the Winnipeg Hydro-Electric System in succession to E. V. Caton, who has resigned, to join the engineering staff of the Manitoba Power Company, Winnipeg.

Howard Cole Hakes, formerly associated with the Charles R. Ablett Company of New York City, has joined the Betts & Betts Corporation as special sales representative and will work in the State of New York, including New York City.

T. M. Feder has been appointed special representative of the Illinois Electric Porcelain Company, Macomb, Ill. He will be chiefly interested in the development of the high-tension business of the company. Mr. Feder is a graduate of the Brooklyn Polytechnic Institute, where he was later an instructor. He was previously connected with the New York office of the Esterline-Angus Company.

E. F. Irlbacker has been appointed head of the fixture department of the Hartford (Conn.) Electrical Supply Company. Mr. Irlbacker spent the past four years in similar work with Hitt & Brown, Norfolk, Va., and prior to the war was on the staff of Mitchell, Vance & Company, New York, for about fifteen years. In his new post he will have charge of both wholesale and retail sales.

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W. H. Rolinson Manager of Westinghouse Interior Lighting

W. H. Rolinson has been appointed manager of the interior lighting section of the merchandising department of the Westinghouse Electric & Manufacturing Company. Mr. Rolinson is a graduate of Cooper Institute, New York City, and of Columbia University. For ten years, from 1902 to 1912, he was in charge of the incandescent-lamp inspection of the Association of Edison Illuminating Companies, under the direction of the Electrical Testing Laboratories, New York City. From 1912 to 1921 he was with the Westinghouse Lamp Company as commercial engineer, having charge of the commercial engineering department, and in 1921 he was made assistant to the sales manager of that company, a post he held until his present appointment. Mr. Rolinson is a member of several engineering associations among which are the N. E. L. A. and the I. E. S.

R. C. Cole Sales Manager of the Johns-Pratt Electrical Division

Robert Charles Cole, who was recently appointed sales manager of the electrical division of the Johns-Pratt Company, Hartford, Conn., is widely known in Eastern electrical manufacturing circles and has frequently been consulted as an expert upon electrical protection problems by utilities in different parts of the country. Mr. Cole was born at New Haven in 1881 and as early as 1892 became associated with Ralph W. Pope, secretary of the A. I. E. E., assisting him in connection with the World's Columbian Exposition in Chicago in 1893. His acquaintance at that time with prominent electrical men influenced him to enter into the electrical industry, and about 1900 he entered the engineering department of the Johns-Pratt Company. In 1905 he was appointed electrical engineer, and has continued in that post until his recent appointment as sales manager of the electrical division. Mr. Cole is a member of the A. I. E. E., the N. E. L. A., the Hartford Electrical Club and other societies. He has been active in the Fuse Section of the Associated Manufacturers of Electrical Supplies and in the general standards committee of that association.

R. C. COLE

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G. A. Reinhard has been placed in charge of the Cleveland office which the Industrial Controller Company, Milwaukee, has recently opened.

Prof. I. W. Gill, head of the department of mechanical and electrical engineering at the University of British Columbia, Vancouver, has been appointed principal of the Hamilton Technical School. He will assume his new duties on Nov. 1.

P. C. Idell was recently appointed manager of the New England office of the Babcock & Wilcox Company with headquarters in Boston. Mr. Idell has been connected with the company's engineering and sales departments for a period of twenty-three years.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

An Interview with W. A. Layman

President of the Wagner Electric Manufacturing Company Outlines Business Conditions in the Electrical Industry and the Reorganization Plan of His Company

By Daniel H. Braymer
Editor *Industrial Engineer*

BETWEEN the time of the peak demands before and during 1919 and a part of 1920 and the present date electrical and all other manufacturers have devoted some terse thinking to matters of ordinary economies of "housekeeping," with the result that they are richer in experience and better fitted to develop their business of production and distribution without waste and with profits that are more closely in proportion to the demands which they supply in competing with all comers the world around.

Costs Being Studied

This thinking has included a thorough analysis of the economic proportions of the cost of materials and labor in the manufacture of any product and the balance that must be maintained in manufacturing and executive overhead expenses. It has also brought about new considerations in the economic use of materials and an elimination of waste in production that will play a part in unit production costs of the future. Just how these developments will be reflected in the development of electrical manufacturing as a business, time with its attendant demands from all lines of industry will reveal. Just what the future holds as a normal business for electrical manufacturers is a grave problem of speculation, but there are basic indications which furnish significant indexes.

In discussing these topics with the writer, W. A. Layman, president of the Wagner Electric Manufacturing Company, St. Louis, has given the following interview expressing his views and experience in the management of the company during the war and the period of adjustment following it and its financial reorganization on a new and larger plan of operation, together with comments on business conditions in general. Mr. Layman said:

Industry Is Not Seriously Overbuilt

"I am very strongly of the opinion that the general public is under an entire misapprehension as to the degree of industrial expansion of the nation during the war. Although arrangements were completed and manufacturing operations created for a vast war business along new and unparalleled lines in kind or volume, I am convinced the manufacturing floor space of the country as a whole was not permanently increased to anything like the degree popularly imagined. A careful analysis would, I think, disclose that the assumed tremendous industrial expansion of the nation was apparent rather than actual, and the 'large production' reached was in reality a combination of, first, high unit prices; second, the double-time basis of war operations, and, third, the wide employment of temporary facilities through the conversion of space used normally for peace requirements into the manufacturing of products essential to war. Insufficient labor supply alone prevented a large overbuilding of industry.

"The popular opinion seems to be that our own company made a very large expansion of facilities as a result of our war operations, but the actual fact is that our permanent floor space available for electrical manufacture was not increased to exceed 10 per cent. The Wagner company's experience in this regard is typical of the entire industrial city of St. Louis. I, therefore, believe that it will not be long until the industrial expansion of this country is resumed, and the real limit to this expansion will not be our trade opportunities, both internal and external, but the transportation capacity of the railroads and the labor supply available.

"Figures published from time to time have shown that the public utilities of this country furnishing light and power double their output every five years, but during the past three or four years they have been able only to handle existing demands of industrial and residential customers already connected. The practical fact is, therefore, that our electrical public utilities of the country are now inadequate to our immediate industrial output and must expand with the least possible delay. Financial conditions alone have held back large construction programs that might have been executed under normal conditions and will certainly be taken care of in the early future. The financial relaxation of the country makes possible the expansion of public utility organizations through immediate orders for equipment that will be placed in operation during the next twenty-four months. As public utilities are prepared to supply the service, there will be resumed the rapid expansion and also conversion of miscellaneous industrial power requirements which prevailed immediately prior to the entrance of the United States into the war.

An Encouraging Outlook

"If the rate at which electrical service has expanded in the past can be taken as a guide, we have an interesting and encouraging outlook for renewed demand for electrical equipment in all lines of industrial production, and a brief interval only of reawakened industrial activity will be required to exhaust such stock accumulations of electrical equipment as have been carried forward to the present date.

"Data published in the *Electrical World* of Aug. 19, based upon the 1919 census of manufactures, showed that the number of motors and their horsepower in industries practically doubled during the five years between 1914 and 1919 and that the energy for motor service supplied by central stations was increasing at a rate indicating a renewed expansion of all industries during that period. If I am correct in the statement that the country was not overbuilt industrially during the war, then this normal expansion of demand for electrical service and motor supply will shortly be resumed.

Liquidation Without Dumping

"The industrial collapse of the latter part of 1920 found the Wagner company, as it did most companies, operating at a high rate of production with large inventories and heavy commitments on raw material. The only avoidance of this condition would have been to make no effort to take care of long-established business, but to pursue a dormant policy throughout the readjustment interval, a policy which, seemingly, comparatively few, if any, American industries pursued. The experience of our company throughout the readjustment interval has been very much the same as that of the majority of large companies. At the end of June, 1922, we had liquidated approximately 45 per cent of all inventories and outstanding obligations without the usual dumping process by asking fair values for all products sold. In dealing with this proposition we adopted the policy of facing the facts and readjusting inventories to the inevitable future market situation with which we were confronted. We also aggressively faced the problem of future keen competition by projecting into our business, through the readjustment interval, the best electrical, mechanical and production engineering ever employed by us, with the result that we think we are ready for the immediate future with the best quality of product, the most economical employment of material and the best shop practice we have ever had. A new design of heavy-duty 40 deg. motors is one of the products of this period of aggressive internal activity.

"There is probably no line of American industry more highly developed than the electrical, from the standpoint of excellence of apparatus designed, technical skill of sales, engineering and production organization and technical training of the purchasing public. The natural result of this situation is that the electrical manufacturer has no siesta period on his program, and the electrical consumer gets the best electrical product produced anywhere in the world at a price very low in comparison with the profits of numerous lines of industry less highly developed. The electrical manufacturer of America must progress or quickly fall behind and pass out.

"As to the condition of current business, my observation is that the entire electrical industry is returning to a healthy plane of production. In our own company we have produced during the last quarter more motors than at any time in our history. In industrial sizes the production has been running about 75 per cent of previous maximum in numbers of motors, while in the smaller sizes our output has exceeded any previous rates of production."

W. A. LAYMAN

In reference to business-getting methods Mr. Layman said that no particular plan had been adopted, except to forget the methods of the order-taking days of war time and revive fundamental distribution methods and accurate, sound salesmanship. Boiled down, he said, this has meant just going out and getting the share of business that the Wagner company should expect by reason of the quality of its products and the service that it can guarantee to those who are buying to meet their actual current production needs. In the distribution of products Mr. Layman stated that improved results had been attained by building up the esprit de corps of the complete organization and in bringing the company's field men as well as the factory organization to see that no achievements of the past were a sufficient criterion of what the organization could and would have to do today. The company's policy has been to ask of its men consistent and steady self-development, just as they in turn look to the company to progress rather than to stand still.

With respect to credit conditions Mr. Layman said that throughout the interval of reorganization the electrical trade had maintained its long-standing reputation for financial soundness. There have been remarkably few electrical concerns unable to meet their obligations throughout the readjustment period, with the extension of reasonable co-operation and leniency in the matter of credit. Collections at the present time are satisfactory, and losses on current accounts receivable are negligible.

Community Electrical Co-operation

In the matter of co-operative effort for the development of the electrical industry Mr. Layman expressed the deepest interest and enthusiasm in the progress evident over the entire country. He referred to the splendid organization and effective co-operation of the St. Louis Electrical Board of Trade as a typical illustration and expressed the keenest interest in the plans for collective self-development of the electrical men of St. Louis contemplated in the proposed co-operative university extension work between the Washington University of that city and the St. Louis Electrical Board of Trade. It is planned to have during the ensuing year—thus perhaps establishing a precedent for the future—a carefully arranged series of instructive lectures given by the faculty of Washington University to the electrical men of St. Louis, the purpose in view being to keep these men abreast of the times in the progress and development not only of electrical science, but in the broad field of general science and industrial engineering.

Financial Plan of Reorganization

In reference to the reorganization of the Wagner Electric Manufacturing Company and its plan for future operation and expansion Mr. Layman made the following statement:

"In accordance with a plan of financial reorganization of the Wagner Electric Manufacturing Company which was officially approved by holders of 90 per cent of the capital stock and indorsed by its directors on Aug. 11, 1922, a new company known as the Wagner Electric Corporation has taken over the operation of the former corporation and assumed all of its assets and liabilities. The new company starts with no indebtedness to the banks and with a board of directors unusually ong in members identified with gnally successful, important indus-es. The new board is made up as llows: V. W. Bergenthal, assistant easurer of the company; James M. uick, vice-president American Car & Foundry Company; Guilford Duncan, president Ludlow-Saylor Wire Company; James H. Grover, vice-president St. Louis Union Trust Company; John F. Lee, attorney; W. A. Layman, president of the company; Joseph W. Lewis, attorney; Stewart McDonald, president Moon Motor Car Company; E. J. Miller, president St. Louis Screw Company; J. Herndon Smith of Smith, Moore & Company; Harry J. Steinbreder, president Fulton Iron Works Company.

The directors of the new corporation have elected the following officers:

President, W. A. Layman; vice-president, A. H. Timmerman; treasurer, V. W. Bergenthal; auditor, G. L. Evans; secretary, J. W. Westcott; assistant secretary and assistant treasurer, A. K. Bahret.

The reorganization plan is entirely a financial one, having for its purpose the funding of the company's floating indebtedness and the creation of a legal skeleton making possible a larger production and sales program in the future as the natural evolution of the company may require it, including: (1) The sale of first-mortgage 7 per cent bonds to the amount of $2,500,000 by the Wagner Electric Manufacturing Company (the old company); (2) the sale of 7 per cent cumulative preferred stock to the amount of $1,500,000 (out of an authorized issue of $3,000,000) by the Wagner Electric Corporation (the new company); (3) the issuance by the new company of 20,000 shares of its no-par-value common stock, to accomplish the refinancing and reorganization of the company.

PRESENT BUSINESS AND OUTLOOK

"Our electrical business as a whole is showing a very satisfactory volume, considering the general trade and industrial situation," Mr. Layman said. "Our production operations at the present time are on the basis of approximately 65 per cent of the maximum capacity of our plant facilities. The incoming rate of business for the second quarter of the year was at the rate of approximately 70 per cent of plant capacity. If the improvement of business which has been experienced since Jan. 1 continues, within a few months the entire manufacturing facilities of the company will be occupied.

"On the basis of the company's present volume of operations, the payment of bond interest and preferred stock dividends is assured, with a reasonable return for the common stock. With the restoration of normal national industrial conditions the outlook for the Wagner company is that its future will exceed its best achievements in the past. The company hopes to continue to constitute itself a vital and useful part of the electrical productive facilities of America and to justify by its service the support of the electrical consuming public."

Survey of Business Conditions

Holiday Buying Is Active

Holiday buying is now active and is marked with a large number of very small orders. Dealers' stocks are low, and apparently they intend to keep them down as jobbers' stocks are in excellent condition. It is the idea of one large jobber that this year's business will be better than last year's but will be slower coming, the bulk of the buying being right before the holidays. Curling irons are selling rapidly, sales being about 400 per cent of those this time last year. Flatiron sales are about the same as a year ago. Air-heater business is good but has suffered this week from the very warm weather prevailing.

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Manufacturers Showed Large 1920 Incomes

The corporations engaged in the manufacture of certain electrical products, machine tools, gages, firearms, hardware and cutlery, had net incomes aggregating $53,250,232 in 1920, according to a compilation just completed by the Bureau of Internal Revenue. During that year there were 1,004 corporations engaged in this type of manufacture. Of that number 370 had no net income, but on the other hand reported deficits aggregating $7,413,469. The 634 companies reporting net incomes paid taxes totaling $11,799,859.

The compilation shows that 15,131 corporations were engaged in some type of metal manufacture in 1920. The tax paid by that industry reached the large total of $293,857,794. The net income of this entire group was $1,411,647,483. The companies engaged in metal manufacture were subdivided as follows: Iron and steel smelting, 110 companies; foundries and rolling mills, 2,719 companies; agricultural machinery, steam appliances, construction machinery, 1,750 companies; metal-working and paper-making machinery, heavy ordnance and rolling stock, 801 companies; general electric machinery, refrigerating machinery, stationary and marine engines, 703 companies; motor vehicles and airplanes, 858 companies; boot and shoe machinery, typewriters, gas and electrical fixtures, 816 companies; metal furniture, ornamental ironwork, sewing machines, 208 companies; machine tools, gages, firearms, hardware and cutlery, 1,004 companies; all other metal products, 4,786 companies; base-metal smelting, 711 companies; precious-metal smelting and refining, 665 companies.

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Steam Consumer Staying Out of Coal Market

The advent of cold weather and the usual seasonal household demand will increase the need for domestic fuels. According to *Coal Age*, this market is not yet in full swing, but domestic quotations for Oct. 4 have all the earmarks of further increases as the short supply will be accentuated by orders placed as a substitute for hard coal. This demand will fall largely on producing districts not usually called upon to furnish coal for domestic use, but will doubtless also lead to emergency shipments eastward of high-grade domestic from fields west of the Alleghenies.

The steam consumer is purposely staying out of the market and is taking little coal aside from current needs. In the Middle West he is able to obtain this tonnage by picking up bargain lots which are still sent in on consignment, often being sold under pressure of heavy demurrage. Screenings have been selling on a par with mine-run, but with the apathetic steam market and the better domestic call more operators are screening their output, and this is fast softening the resultant sizes.

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Estimates Copper in Building Totaled 150,000,000 Lb.

The Copper and Brass Research Association estimates the total consumption of copper in the building industry this year at 150,000,000 lb., comprising copper, brass and bronze in the form of sheets, piping, hardware, lighting fixtures, wire, etc.

This is an increase of 100,000,000 lb. as compared with 1921, of 96,000,000 lb. as compared with 1920, and of 73,000,000 lb. as compared with 1919, in which years the amount of copper used in the building industry varied between 4 and 6 per cent of the total copper consumption of the United States.

The association also estimates that 118,000,000 lb. of copper will be used this year in roofing and sheet metal work, 17,000,000 lb. in plumbing, 11,000,000 lb. for lighting fixtures, etc., and 4,000,000 lb. in hardware.

The potential market for copper and brass in the building industry on the basis of this year's construction is estimated at 650,000,000 lb.

Fixture Thread Hearings to Be Held in Near Future

Public hearings by the National Screw Thread Commission in the matter of threads for electric fittings and fixtures will be held in the near future at Pittsburgh and Chicago. It is hoped that these hearings can be called before the end of October. A third hearing is contemplated at which those concerned with pipe-casing threads may acquaint the commission with their views. That hearing will be held at some point in the oil region. Neither the place nor the date has been determined upon as yet.

Loose-Leaf Commerce Reports Wanted as Aid to Sales

Loose-leaf publications of commerce reports are finding much favor from those carrying on foreign trade in electrical products. That the industry is desirous of having its circulars of information in this form is seen in a recent survey made by an association of New York City. It is said that the first suggestion was made to the Department of Commerce by J. Walter Drake and G. F. Bauer, chairman and secretary of the foreign trade committee, and Gordon Lee, chief of the United States Automobile Division.

"The change, if made," said Mr. Drake, "will be of great advantage to business men. Valuable information, now perishable in many instances, could readily be stored for future use in devising foreign sales campaigns that, based on facts, would be directly reflected in domestic prosperity."

Prevailing Conditions Affecting Cost and Volume

Volume of Business Shows Large Gain.—Settlement of end-of-quarter and end-of-month obligations during the week ended Oct. 4 accounts largely for the increase in the volume of business from $8,220,000,000 for the week ended Sept. 27 to $9,697,000,000 for the week under review. Larger figures are reported for all the leading centers except Detroit.

Business Continues Upward Trend.—The general trend of business in the United States during the last week, with few exceptions, continued in the direction of improvement, according to *Dun's Review*. "Recent weeks have brought practically an advance, following a seasonal lull in different trades and a setback in some industries through labor troubles, and sentiment is unmistakably stronger."

Coal Shipments Improve Quickly.—Loading of anthracite coal on Tuesday, Oct. 3, totaled 6,056 cars, according to reports received from the rail carriers by the Car Service Division of the American Railway Association. This was an increase of 224 cars over the day before. It also exceeded the daily average for October last year by 203 cars and the daily average for October, 1920, by 146 cars.

Greatest Car Loading in History.—The number of cars loaded with revenue freight on American railroads during the week which ended on Sept. 23 was 96 per cent of the greatest loading in history, which was during the week of Oct. 1, 1920 according to reports just received by the Car Service Division of the American Railway Association.

Failures Increase in South. — Last week a large increase in the South and a smaller one in the Pacific section have more than offset the decreases in the other two sections of the United States. Failures reported to R. G. Dun & Company totaled 383, compared with 380 for the week before last. A year ago the total was 353. A decline, however, is shown in the number of defaults with liabilities of more than $5,000 in each case. Last week's figure is 209, which is 54.5 per cent of the total, while in the preceding week the number was 214 and the proportion 56.3 per cent, the same proportion held by the 199 similar insolvencies in the week a year ago.

Expects Peak Car Shortage Will Come Next Month

Opinions in the industries regarding the imminence of a shortage of coal because of a lack of transportation vary. One large coal dealer has been quoted as believing that the peak of the car shortage will be reached in the middle of November. He explained that precedence has been given to coal shipments since the resumption of mining and that this condition could not be maintained indefinitely.

Electrical Exports Declined During August

A further decline in the exports of electrical machinery and apparatus was registered during August, the returns to the Bureau of Foreign and Domestic Commerce show. In that month the value of electrical exports was $3,928,344. This is a falling off of more than $400,000 as compared with July and a decline of over $2,000,000 as compared with the value of exports in August, 1921. The detailed figures are as follows:

ELECTRICAL EXPORTS FOR AUGUST, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

	August, 1921	August, 1922
	Value	
Electrical glassware, except for lighting		$14,051
Electrical porcelain		87,171
Carbons for electric lighting, electrodes and batteries	$27,110	130,802
Insulated wire and cable (iron and steel)		27,508
Other manufactures of aluminum	183,065	105,411
Copper wire (bare)	35,918	99,423
Insulated copper wire and cable	305,829	117,841
Generators:		
Direct-current—		
Under 500 kw.		45,670
500 kw. and over		280,402
Alternating-current—		
Under 2,000 kw.		1,339
2,000 kw. and over		86,430
Accessories and parts of generators		15,836
Self-contained lighting outfits		52,622
Batteries—		
Primary—dry		79,787
Primary—wet		1,862
Storage		122,799
Transforming or converting apparatus:		
Power transformers		334,931
Other transformers		25,777
Rectifiers		4,777
Condensers, double-current and motor generators, dynamotors, synchronous and other converters		279,139
Transmission and distribution apparatus:		
Switchboards and panelboards, except telephone		222,222
Switches and circuit breakers		212,886
Fuses and fuse plugs		11,315
Watt-hour and other measuring meters		23,916
Volt, watt and ampere meters and other recording, indicating and testing apparatus		55,008
Lightning arresters, choke coils, reactors and other protective devices		69,665
Motors, starters and controllers:		
Motors, under 1 hp.		62,238
Stationary motors—		
1 to 200 hp.		114,123
Over 200 hp.		24,253
Railway motors		33,505
Electric locomotives	242,362	
Railway		
Mining and industrial		62
Other motors	959,773	38
Rheostats, controllers and other starting and controlling equipment	64,456	89,626
Accessories and parts for motors		88,248
Electric appliances:		
Electric fans	32,233	36,036
Electric lamps—		
Arc	184	3,363
Incandescent—		
Carbon-filament	8,051	1,959
Metal-filament	86,746	80,367
Other electric lamps		8,339
Flashlights		17,568
Searchlights and projectors		8,660
Motor-driven household devices		38,963
Domestic heating and cooking devices	69,660	30,164
Industrial electric furnaces and ovens		25,914
Therapeutic apparatus, x-ray machines, galvanic and faradic batteries, etc.		43,981
Signal and communication devices:		
Radio and wireless apparatus		188,670
Telegraph apparatus		20,839
Telephone apparatus, including switchboards		261,385
Police, fire and burglar alarms		1,432
Railway signals, switches and attachments		20,274
Bells, buzzers and annunciators		6,258
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	71,145	92,732
Insulating material		
Metal conduit, outlet and switch boxes		26,579
Sockets, outlets and receptacles		51,338
Other wiring supplies and fixtures	69,386	105,091
Other electrical apparatus not elsewhere specified	2,098,969	425,178
Electrical machinery and apparatus (total	$5,966,912	$3,928,344

The Metal Market

Copper Firm—Trade Would Not Have Been Strong if Production Had Been Normal

A firm tone prevails in the copper market. The price is unchanged at 14 cents per pound for electrolytic, delivered, throughout the remainder of the year and through January of 1922. It is said in the trade that buying would not have proved strong enough to have maintained prices had the supply of labor been normal. There would have been overproduction and the market could not have held. In former times three-quarters of the workmen in mines and smelters were foreigners, but so strict have the immigration laws become that now the percentage lies the other way and only one-quarter are foreigners.

Demand remains high from both wire and brass mills, and consumers continue insistent upon prompt shipments on contracts. As soon as the rail congestion begins to be straightened out better buying is expected. In the meantime consumers are waiting for improvement in fuel stocks before buying very much in advance of requirements. Stocks of metal at the mills are reported as small.

The antimony market continues quiet, there being only a limited demand for odd-lot quantities at attractive prices. Seven cents per pound continues to be quoted by the larger interests in carload lots. This price, however, can be shaded in the outside market by at least ¼ cent a pound.

No new business has been reported in manganese ore. Most buyers readily admit that the tariff will not stop large importations of manganese ore, which is absolutely necessary to make a high-grade ferro-manganese, as the domestic ore is of too low grade for that purpose. Considerable business has been done in ferro-manganese.

Prior to and immediately following the passage of the tariff bill very considerable business in tungsten ores was done, causing the price to go up to $7.50 and $7.75 per unit for good-grade ore. Profit taking on the part of those who have bought the tungsten in at low figures caused, however, a slight recession, and prices again temporarily touched $7 to $7.50 per unit, according to the quality of the ore. It would appear that profit taking has now come to an end, and it is doubtful whether any large quantity of ore can be picked up today under $7.50 to $8 per unit. The statistical situation of tungsten ore seems to be favorable for higher prices.

Steel mills and furnaces are receiving a larger percentage of coal by barge, and preparations are being made to forward heavy shipments to the south by water. Carnegie Steel is operating thirty-six of its forty-eight blast furnaces. A number of plants are on an 80-per cent basis. Sheet and tin plate mills are close to normal. In the Wheeling district schedules were advanced slightly last week.

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

IMPROVEMENT in the electrical trade continues, according to reports received from all important centers of the United States. Broadcasting of the "world series" baseball games has caused increased interest in radio apparatus, and sales for the week show an improvement. Spotty stocks of conduit are noted, and prices are continuing upward in the Eastern districts. Holiday buying of appliances has started, and extensive sales are reported by the jobbers.

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New York

Fixture Demand Increasing—Motor Prices Steady—Stocks of Smaller Size Conduit Uneven

Jobbers report appliances to be moving in better volume than for some months past. Heater stocks are being rapidly used up, and there is some talk in the market of further stiffening of prices. Schedule material is selling actively and construction material sales remain steady.

Fixtures.—Increasing demand for all grades. Stocks are fair and prices steady. Some activity in glass-decorated types was reported last week.

Motors.—Smaller sizes are selling best at the present time. Prices are steady and stocks are much lower than three weeks ago.

Conduit.—Stocks of the smaller sizes are uneven. Some deliveries are longer than normal. Prices are on the upward trend.

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Chicago

Lighting Fixtures Active—Cleaners and Washers Moving Well—Wiring-Material Demand Steady

Electrical trade is continuing its steady movement. The call for lighting fixtures is quite active. Jobbers attribute this to the people's desire to complete and rehabilitate their lighting system before the evenings grow much longer. Demand for wiring materials is a little varied, but the amount sold is encouraging. Conduit is still spotted. Dealers report good sales on washing machines and vacuum cleaners.

Conduit.—The conduit situation has changed but slightly, since the demand is active and stocks are varied. The freight embargo from the East on conduit, effective Oct. 12, will not help the situation. The ½-in. black pipe sells around $55 per 1,000-ft. in 5,000-ft. lots.

Wire.—Movement on rubber-covered wire is still steady. The No. 14 is available is 5,000-ft. lots for $6.25 and $6.30 per 1,000 ft. Stocks are normal. The demand for bare and weatherproof remains unchanged.

High-Tension Equipment — Healthy action on this material is reported by manufacturers. One company shipped an order for 300 25,000-volt fuses to New Zealand and an order for 69,000-volt fuse mountings and fuses to a utility in Pensylvania.

Cleaners and Washers. — Sales on these appliances are greater than this time last year. One dealer reports an active volume of business which is due to his sales campaigns. Stocks are normal.

Lighting Fixtures. — Business on household lighting fixtures has been very satisfactory to most dealers. The medium-priced grade of fixture is moving the best. Prices increased about 10 per cent Oct. 1 on glassware and fixtures.

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Boston

World Series Broadcasting Stimulates Radio Sales—Heater Buying Is Record-Breaking

Improvement in trade continues, demand being well distributed. Building contracts in New England for the week ended Oct. 3 totaled $8,210,500 against $3,696,300 for the same week last year. The Boston Edison company has decided to begin its new Weymouth station, with an initial installation of 60,000 kw. General business is better throughout New England, though textiles have not become normal and manufacturing in general is slowly returning to prosperity. Jobbers of electrical supplies are very busy and shortages in steel products are marked.

Radio Apparatus.—The public is back in the market, and the baseball "world series" broadcasting stimulated demand sharply last week. Stocks are ample and prices are weak in some quarters owing to overaccumulation.

Wire.—Rubber-covered No. 14 is active at $6.25 per 1,000 ft. in 5,000-ft. lots. Weatherproof is moving well on a 16.5-cent to 17-cent base. Six to seven weeks' delivery is quoted by a large New England manufacturer, but jobbers' stocks are satisfactory for the present.

Rigid Conduit.—Stocks are spotty, with local gaps in ½-in. and ¾-in. sizes. Fittings are plentiful. The embargo in the Pittsfield district is greatly hampering deliveries. Prices are firm.

Motors. — Gradual improvement is evident in both inquiries and sales. The recent trend toward fuel-oil installations has resulted in placing many ¼-hp. alternating-current motors.

Market Conditions for Four Weeks Ended Oct. 7

	New York	Chicago	Boston	Atlanta	Cleveland	St. Louis	San Francisco	Salt Lake City-Denver	Portland-Seattle
Conduit	Active	Active	Steady	Active	Active	Steady	Steady	Steady	Active
Armored cable	Steady	Active	Steady	Steady	Steady	Steady	Active	Steady	Active
Wire	Steady	Steady	Active	Active	Active	Active	Steady	Active	Steady
Sockets	Steady	Steady	Steady	Steady	Steady	Steady	Steady	Slow	Active
Knobs	Steady	Active	Steady	Steady	Steady	Active	Active	Steady	Active
Switches	Active	Active	Steady	Active	Steady	Steady	Steady	Slow	Steady
Hollow ware	Steady	Steady	Steady	Steady	Steady	Steady	Active	Active	Active
Lamps	Active	Active	Active	Steady	Active	Active	Steady	Active	Steady
Motors	Steady	Active	Active	Steady	Steady	Steady	Active	Steady	Steady
Refrigerators	Steady	Steady	Slow	Active	Slow	Steady	Steady	Steady	Steady
Soldering sets	Steady	Steady	Steady	Active	Steady	Steady	Steady	Steady	Steady
Washing machines	Slow	Steady	Active	Active	Active	Active	Slow	Active	Active
Vacuum cleaners	Steady	Steady	Active	Steady	Active	Steady	Slow	Active	Steady
Radio equipment	Active	Active	Active	Active	Active	Steady	Steady	Steady	Steady
Trend of prices	Up	Up	Up	Up	Up	Up	Firm	Up	Firm

Heaters.—The demand is so active that it is practically impossible to maintain stocks. Manufacturing facilities are still hard pressed, and the public is buying on a record-breaking scale.

Appliances.—Flatirons and cleaners are moving well. Portable lamps are selling somewhat better. Vigorous appliance sales effort by central stations is reacting to create a larger demand for house wiring.

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Atlanta

Pole Movement Is Only Fair—Lamp Supplies Ample—Glass Insulators in Demand

A steady improvement of general conditions is apparent both in the cities and rural districts. Building continues very active with all previous records in Atlanta smashed by the month of August, when permits totaled $2,320,000. This brings a grand total of eight months up to $14,052,000 and reflects accurately the building activities in this city. Merchants report that marketing of crops is improving collections in country districts, but rural clients are still not inclined to take care of old indebtedness.

Poles.—Only fair movement is reported, with deliveries not so good as they might be. Prices continue to remain steady.

Pole-Line Hardware. — Satisfactory volume of sales is reported on the entire line in face of the 10 per cent price advance. Good stocks are on hand, but deliveries are somewhat slow.

Lamps.—The fall demand is in full swing, with retailers purchasing quite respectable stocks for fall trade. Ample supplies are in the territory.

Panelboards. — Building construction is stimulating this line and sales are brisk. Some delay is being experienced in receipt of factory shipments, due to rail conditions.

Insulators.—A continued fair movement of the porcelain types is to be noted, while glass types are in steady demand. Local stocks are in good shape and a noticeable improvement is apparent in deliveries.

Radio Equipment.—Sales in this line hold up excellently, while jobbers have good stocks on hand and report shipments satisfactory. Deliveries, however, are still somewhat delayed.

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Salt Lake City

Warm Weather Retards Heater Demand—Lamp Sales Show Healthy Increase—Washers Slow

Retail selling is brightening in nearly all lines. Harvest money is circulating freely and farmers are better able this year to liquidate their obligations. Collections show a corresponding improvement.

Government statistics show that labor conditions are practically normal in the Intermountain region. Non-employment has totally disappeared, and there is an actual labor shortage in certain lines. Building projects of all kinds are moving forward satisfactorily, the weather favoring outdoor construction.

Air Heaters—Retailers are stocking well, but consumer activity has scarcely begun. The weather continues warm, retarding demand. Jobbers' stocks are normal. An effort will be made to clean up old stocks. Selling price is 20 per cent below last year's quotations.

Lamps—Reductions amounting to 15 per cent apply to all popular sizes. Sales show a healthy increase, especially since the beginning of the fall school term.

Washing Machines—There is a decided let-down in demand. This is not considered the washer season. Stocks are good.

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St. Louis

Radio Demand Is for Complete Sets—Further Increase in Conduit Is Reported

New construction of small houses, hospitals, schools, churches and society buildings, holiday purchasing and radio sales constitute the principal elements of demand. Business is characterized by gradually increasing prices, a large number of small orders and a very conservative buying policy. Dealers are becoming more appreciative of the jobbers' function of maintaining a reservoir of goods upon which they may draw, and jobbers are encouraging conservative buying and faster turnovers.

Radio.—Trade is picking up very encouragingly, and the dullness during the summer enabled jobbers to build up their stocks so that immediate delivery on most items can be given. Demand is shifting toward complete outfits, and the principal requirement is the set selling for $130 to $160.

Conduit. — A further increase in price was announced this week, the new quotations made by one jobber in 5,000-ft. lots being; ½-in. black, $55 per 1,000 ft.; ½-in. galvanized, $62 per 1,000 ft.; ¾-in. black, $70 per 1,000 ft.; ¾-in. galvanized, $76 per 1,000 ft. Demand is holding up well, but stocks are quite short. Deliveries have been made more difficult by freight embargoes.

Porcelain.—Prices continue upward. Knobs are now selling for around $15 per 1,000 in barrel lots. Stocks are in good condition to meet the demand, which is comparatively active.

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Denver

Washing-Machine Business Spotty—Flatirons Selling Actively—Conduit Stock Depleted Materially

Increased bank clearings and a continued building boom reflect improvement in business in spite of transportation difficulties. The labor situation shows marked improvement, according to the government report. Electric business continues in good volume with increasing demand from outside territory, all jobbers reporting satisfactory business.

Radio.—Movement of high-priced sets and parts, especially amplifiers and loud speakers, is picking up. Distributors feel that the increase in the past few weeks evidences returning interest, and if broadcasting programs are stabilized holiday business in this line will prove good.

Washing Machines.—Spotty business is found throughout this territory. One of the largest jobbers reports a volume twice that of last year. September campaign by central stations has stimulated interest materially, according to dealers.

Appliances.—Flatirons, curling irons, radiant heaters and waffle irons in their respective order lead in the volume of sales.

Conduit.—The extensive local building program has depleted stocks materially. All jobbers report slow deliveries, presumably due to transportation difficulties. Prices on available stock have strengthened. All reserve stocks have been released.

Pole-line Hardware.—Two jobbers report increasing demand for materials on new transmission lines with business to date nearly double that anticipated earlier in the year. Continued extensions will absorb all surplus stocks if new shipments are not received in time.

San Francisco

Stocks in Good Shape—Improvement in Appliance Selling—Competition Affecting Marine Business

Local stocks are in good shape and show steady proportionate movement. These stock figures are kept comparatively high by reason of service competition. The usual fall shows are well attended, but the rank and file of electrical dealers are not so well represented as specialty appliance stores. Store business is reported to be in a fair condition.

Household Appliances.—Increasing importance of neighborhood stores and their more intelligent merchandising show better appliance results, especially when they divorce the dealer from the contractor. This seems to be the second stage of appliance merchandising.

Marine Material.—Nearly all work is carried on by special firms. These without exception report that business is concentrated at times but decreasing from its previous volume. The reason generally given is that fierce competition has caused steamer companies to instruct their crews to cut out all except "life and death" repairs. However, ambitious plans insure future excellent business.

Schedule Material.—Manufacturers show tendency to eliminate protection and future delivery orders so that unfilled balances will be billed at the prices effective on date of shipment. Some manufacturers are urging better anticipation of demands to counter a threatened decrease in production.

Portland—Seattle

Jobbers Report Business in Excellent Shape—Advances Reported for Rubber-Covered Wire

Business for the past week in the Northwest continues to show improvement. Exports for September from Portland were greater than any month this year with the exception of June, and October promises to exceed the September record. Building throughout the Northwest is still active. For the first nine months of this year the valuation will exceed that for the same period of 1921 by at least 35 per cent.

Electrical jobbers report business to be in excellent shape. Building construction work and new development projects are both creating a heavy demand for material. Conduit shortage continues to be serious. Collections are very slow. The Portland district, however, reports a material improvement during the past month. Prices are stiffening, slight advances being reported on rubber-covered wire and porcelain products.

Convenience Outlet Boxes—The demand has been and continues to be very good. Galvanized boxes are largely replacing the black boxes. Octagonal boxes, in standard packages, are quoted at $18.20 per 100.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

General Electric Orders Gain 42 per Cent

Orders received by the General Electric Company for the three months ended Sept. 30 have amounted to $58,914,620, an increase of 42 per cent over the similar period in 1921, according to a statement just made by President Gerard Swope.

For the nine months ended Sept. 30 orders were $176,171,194, or an increase of 30 per cent over the same period in 1921.

Ohio Electric & Controller Makes Sales Appointments

Mark C. Smith, formerly associated with the Westinghouse Electric & Manufacturing Company, Cleveland, has been appointed district sales manager of the motor department of the Ohio Electric & Controller Company, effective Oct. 1 Mr. Smith's office will be at 53 West Jackson Boulevard, Chicago.

Chicago Fixture Company Increases Force

The Chicago Lighting Fixture Company, 28 West Lake Street, Chicago, has been obliged to double its assembling force owing to the active demand for household fixtures. R. L. Groome, sales manager, stated to a representative of the *Electrical World* that sales on good-grade fixtures both in Chicago and the suburbs have proved very satisfactory. With the rush of orders for the past weeks Mr. Groome declared that his rest periods have been infrequent.

Although prices increased about 10 per cent Oct. 1 on glass and brassware, the demand for artistic and serviceable features has been very active. This is the natural result of the biggest building boom Chicago has ever known.

Apex Electrical Distributing Announces Changes

The Apex Electrical Distributing Company, Cleveland, has appointed the North Coast Electric Company as distributor for its products in the States of Oregon and Washington. The North Coast Company maintains houses at Seattle, Spokane and Portland, and it will distribute the complete line of the Apex company, consisting of the "Apex" electric suction cleaner, "Rotarex" electric clothes washer and "Rotarex" home double-roll ironer.

The company also announces that it has moved its Philadelphia office from the Perry Building to 204 Empire Building.

The H. C. Roberts Electric Supply Company, Philadelphia, has been appointed distributor for the products of the Apex company in the territory of eastern Pennsylvania, Delaware and southern New Jersey.

Binghamton Washing Machine Acquires 1900 Washer

The controlling interest in the 1900 Washer Company, Binghamton, N. Y., manufacturer of electrically operated washing machines, has been acquired by the Binghamton Washing Machine Corporation, organized under state laws with a capital of $800,000. The new owner will take immediate possession of the plant and purposes to increase the output. The purchasing firm is controlled by the Maynard H. Murch Company, Union National Bank Building, Cleveland, dealer in investment securities, and Walter S. Quinlan vice-president and secretary of this company, will be president of the new organization. T. W. Behan, formerly general manager of the 1900 Washer Company, will be vice-president, and Paul J. Bickel secretary.

English Radio Manufacturers Form Broadcasting Company

Formation of a broadcasting company by the six principal manufacturers of radio equipment in Great Britain in order to promote sales was announced last week by Frank Gill of London, European chief engineer of the International Western Electric Company and president-elect of the British Institution of Electrical Engineers, who has just arrived in this country. He said that stock ownership in the company will be available to any manufacturer of radio equipment in the British Isles. The company, he said, would have a capital of £100,000, and present plans call for the erection of stations at London, Birmingham, Manchester, Newcastle, Cardiff, Glasgow, Plymouth and Aberdeen.

Los Angeles Firm Puts M. F. Size in Charge of Appliance Sales

The Edison Electric Appliance Company, Los Angeles, announces the appointment of Mires F. Size, formerly with the Martin Electric Company, Denver, Colo., agent-jobber for the Edison Electric Appliance Company in Colorado, as a heavy-duty specialist and in charge of the heating-appliance campaign in southern California.

Radio Corporation Purchases $1,000,000 Home

Officials of the Radio Corporation of America announced last week that a contract had been entered into for the purchase of the White Oil Building in New York City for approximately $1,000,000. The building, in which already are some of the offices of the corporation, will be known as Radio House and will be the point from which all messages from and to the United States will be sent and received. In its announcement the company stated:

"No 64 Broad Street has come to be known in the radio world as the 'heart of worldwide wireless.' The building is within two blocks of the principal cable and telegraph forwarding offices and particularly near the Postal Telegraph Company's office, with which the Radio Corporation has recently entered into an traffic arrangement whereby the Postal company collects and distributes transatlantic radiograms from and to all points in the United States."

Cutler-Hammer Company Opens Sales Office in Buffalo

In order to give greater attention to business in western New York and the Province of Ontario, a branch office has been opened by the New York office of the Cutler-Hammer Manufacturing Company, manufacturer of electric motor controllers, clutches, brakes and other electrical equipment. This office is at 358 Ellicott Square, Buffalo, N. Y., B. A. Hansen, formerly in New York, has been placed in charge.

Slogan Contest for $1,000 Started by Electric Truck Association

The electric truck industry is asking for a slogan with a reason. Men in that industry want a slogan not longer than ten words and have appropriated $1,000 to be paid in prizes as follows for the best slogans with reasons which are suggested: First prize, $500; second prize, $200; third prize, $100, and forty other prizes of $5 each.

According to the publicity literature which the Electric Motor Truck Association, New York City, is putting out, among the 4,362 electric trucks that were in use in New York City, Jan. 1, 1921, there were five trucks over twenty-three years old, seven over twenty years, twenty-five over eighteen years, thirty-three over seventeen years, 106 over fifteen years, 221 over twelve years, 980 over ten years, 1,580 over eight years, 2,448 over six years and 2,899 over five years. One of its bulletins further states: "Obnoxious odors are eliminated; there are 500 fewer parts to wear out; automatic panels make charging simple; 'electrics' reduce insurance costs 25 to 50 per cent; there is 2,000 miles greater guarantee on tires; there is no starting trouble or complicated mechanism; no frozen radiators with storage-battery trucks; the vehicle will deliver more packages at lower cost for each package; uses no energy when standing still; it is cleaner, and its cost for each mile, ton-mile or ton hauled is the lowest for any known motor truck."

Westinghouse Opens New Service Station at Johnstown, Pa.

Representatives of many industries and the Johnstown Chamber of Commerce attended the official opening of the Westinghouse Electric & Manufacturing Company's new service station at Johnstown, Pa., recently.

The guests were received by H. R. Larson, manager of the new station and, after an inspection tour of the plant, were entertained at a buffet luncheon. Addresses at the meeting following the luncheon were made by Mr. Larson, who presided; P. L. Carpenter, president of the Johnstown Chamber of Commerce, and H. H. Johnston, mining engineer of the Westinghouse company.

Mr. Carpenter, speaking in behalf of the Chamber of Commerce and business interests of Johnstown, thanked the Westinghouse officials for the establishment of the station. Mr. Johnston discussed the advantages in recent developments in the manufacture of electrical equipment for use in mines and industrial plants.

The station is housed in a two-story brick building and contains approximately 9,000 sq.ft. of floor space. The first floor contains all equipment necessary for repairs to electrical equipment and the second floor is to be used for storage purposes.

The establishment of the service station, which brings the Westinghouse company in closer contact with its customers in the large mining and industrial area centering in Johnstown, is considered a tribute to the rapid progress of industry in that district.

The Beacon Lamp Company, Peabody, Mass., has leased a building at Lowell and Foster Streets, heretofore occupied by the Peabody Thermometer Company, and will equip the structure for the manufacture of incandescent electric lamps.

The King Electric Manufacturing Company, Tonawanda, N. Y., will soon commence operations at its new plant at 1,671-5 Fillmore Avenue, Buffalo, N. Y., recently acquired from the Linde Air Products Company and used by that organization during the war as an experimental works. The King company will remove its Tonawanda factory to the new location, where a complete line of battery-charging equipment and automatic electric devices will be manufactured. A considerably increased working force will be employed.

The Westinghouse Lamp Company, Watsessing district, Bloomfield, N. J., will soon commence the construction of the first unit of its proposed plant additions, near Arlington Avenue, estimated to cost close to $70,000. Other units will be constructed in the near future.

The Wood-Reinecke Electric Company, Inc., 512 West Main Street, Louisville, distributor and jobber, has been changed to the Ohio Valley Electric Company, Inc. The address of the company remains the same. Since the death of Harry I. Wood, former president of the firm, and the acquiring of his interests by the present stockholders, the following officers have been elected: William Reinecke, president, and J. Louis Daeuble, vice-president and treasurer.

The Baldwin Locomotive Works, Philadelphia, announces that it has an order from the New York, New Haven & Hartford Railroad for five large electric locomotives.

The Safety Insulated Wire & Cable Company, 114 Liberty Street, New York City, has moved its offices in Boston from Post Office Square to 185 Devonshire Street.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is reported to be negotiating for the purchase of the plant of the Savage Arms Company at Sharon, Pa., to be used as a new branch plant.

The Wills Storage Battery Manufacturing Company, San Marcos, Tex., recently organized, has plans nearing completion for the erection of a new plant, 50 ft. x 100 ft., for the manufacture of batteries and battery parts.

The Electric Motor & Engineering Company, Canton, Ohio, switchboards, panelboards, steel switch boxes and motors, has recently booked a large order from the General Motors Company, Detroit, covering some lighting and power panels and main switchboards.

The Western Electric Company has awarded a contract to Barclay White & Company, 1713 Sansom Street, Philadelphia, for the erection of a five-story building, 60 ft. x 148 ft., at 910-14 Cherry Street, Philadelphia, estimated to cost about $200,000, to be used for a local headquarters and factory branch.

The United States Lighting & Heating Corporation, Niagara Falls, N. Y., manufacturer of lighting equipment, batteries, etc., has taken title to a tract of land at Oakland, Cal., totaling about two acres, to be used as a site for the construction of a branch plant. Plans will be prepared at an early date.

The Electric Gift Shop, 115 East Ohio Street, Indianapolis, distributor of labor-saving appliances, has changed its name to the Edison Electric Company, Inc. V. L. Jones is president.

The E. W. Ham Electric Company, Worcester, Mass., wholesaler of supplies, will be in its new quarters on Burnside Court after Nov. 1.

The Parr Electric Company, Inc. New York City, wholesaler and exporter of supplies, has recently filled several large marine orders.

Foreign Trade Notes

PROPOSED DEVELOPMENT ON THE RIVER BLAVET IN FRANCE.—A concession has been asked by the Société Générale d'Enterprises, Paris, the *Commerce Reports* states, for the construction of a hydro-electric plant in the Department of Morbihan, about 30 miles up the River Blavet from the city of Lorient. The total cost of the project is estimated at 28,000,000 francs. It is proposed that the sum of 2,000,000 francs each be contributed to the enterprise by the two departments (Morbihan and Côtes-du-Nord) which are primarily interested in seeing this source of power developed.

PROPOSED IMROVEMENTS TO THE HYDRO-ELECTRIC PLANT AT NAPLES, ITALY.—Improvements to the water supply and hydro-electric plant of Naples, Italy, are under consideration, according to *Commerce Reports*, involving the utilization of the fountain of Acellica, which has a capacity of 320 liters and 1,200 liters per second and which is to supply water for domestic purposes and electricity for the provinces of Avellino and Benevento. The cost is estimated at 600,000 lire, but as yet no authorization for the work has been obtained.

HYDRO-ELECTRIC PLANT IN PHILIPPINE ISLANDS UNDER CONSIDERATION.—In connection with plans to secure water for Manila from the Angat irrigation system, investigations are being made by officials and engineers looking into the possibility of utilizing the falls of the irrigation dam on the Angat River in Bulacan to generate electricity. The minimum cost is estimated at $7,500,000.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Australia (No. 3,809 for motors and generators, power circuit 230-460 volts, 50 cycles, alternating current; motors and generators, car lighting and starting; accumulators and parts.

Correspondence is desired in Indo-China (No. 3,849) with manufacturers of portable and stationary ceiling electric fans for alternating current (single phase), 120 volts, 50 cycles, and for direct current, 220 volts.

An agency is desired in India (No. 3,863) for electrical goods and accessories.

An agency is desired in New Zealand (No. 3,865) for motor accessories, electrical gear (general).

New Apparatus and Publications

LOUD SPEAKER AND VARIOMETER.—The Missouri Radio Corporation, St. Louis, is distributing descriptive circulars of its new loud speaker and variometer.

AUTOMATIC TEMPERATURE CONTROL.—The Brown Instrument Company, Philadelphia, has issued catalog 85 on the automatic control of temperatures through Brown indicating and recording instruments.

RADIO EQUIPMENT.—The Automatic Electric Company, 945 West Van Buren Street, Chicago, has added a new radio head set to its regular line of telephone equipment.

ELECTRO-MEDICAL APPARATUS.—The Bleadon-Dun Company, 213-17 South Peoria Street, Chicago, is manufacturing a new type C "Violetta."

ELECTRIC HUMIDIFIER.—The Ingersol Electrical Products Company, 109 West Austin Avenue, Chicago, is distributing a circular describing an electric humidifier which operates on either alternating or direct current.

STOKERS.—The Green Engineering Company, East Chicago, Ind., has issued a seventy-one-page book which gives a history of its stokers and also contains engineering data.

DEMAND METER.—Bulletin No. 46.108 issued by the General Electric Company, Schenectady, N. Y., describes its type M-4 demand meter, designed for use in combination with a watt-hour meter to indicate maximum demand.

OIL REFINERY APPARATUS.—The Griscom-Russell Company, 90 West Street, New York City, is distributing bulletin No. 910, covering its "Multiwhirl" and "G-R Vaneflo" coolers, exchangers and condensers for oil refineries.

MECHANICAL STOKERS.—"Cutting the Cost of Producing Steam" is the title of bulletin No. 230 issued by the Detroit Stoker Company, Detroit, which describes the Detroit single-retort underfeed stokers

RESISTANCE MEASURING INSTRUMENTS.—Herman H. Sticht & Company, 15 Park Row, New York City, has issued Bulletin No. 115, covering the "Standco" megohmer, model "D," for measuring and testing voltages.

SAFETY SWITCHES.—The Trumbull Electric Manufacturing Company, Plainville, Conn., is distributing bulletin No. 4, covering its entire line of safety and externally operated switches. This bulletin is published in two forms, one a pocket edition and the other a loose-leaf form punched to fit jobbers' data book.

DRY BATTERY.—The National Carbon Company, Thompson Avenue and Orton Street, Long Island City, has recently brought out a new steel-case "Columbia" hot-shot battery, No. 1,461.

OIL CIRCUIT BREAKERS.—The Condit Electrical Manufacturing Company, South Boston, Mass., is distributing bulletins No. 450 and No. 452, describing its two new oil circuit breakers, known as types D-18 and D-22, for central-station and industrial use.

OUTLET BOXES AND COVERS.—The National Metal Molding Company has issued catalog No. 250, covering the "National" outlet boxes and covers, concrete boxes, switch boxes, cast cable boxes, etc.

RADIO TRANSFORMERS.—The Standard Transformer Company, Warren, Ohio, has developed several new types of radio transformers, including audio frequency amplifier, filament heating, power and two bell-ringing types.

LINE-SHAFTING EQUIPMENT.—The Medart Company, Potomac and De Kalb Streets, St. Louis, has issued catalog No. 43, covering its line-shafting equipment.

SMALL STEAM TURBINES.—The Kerr Turbine Company, Wellsville, N. Y., has developed a new small steam turbine for either generator or mechanical drive. It is made in capacities to generate from 500 watts to 2,000 watts or to furnish from 1 hp. to 5 hp. for mechanical drive.

SWITCHES AND FITTINGS.—Bulletin No. 60 issued by the Square D Company, Detroit, describes and illustrates its various types of standardized switches and fittings.

SMALL MOTORS.—The Bodine Electric Company, Ohio Street and Oakley Avenue, Chicago, has issued a small booklet covering the various types of the "Bodine" fractional-horsepower motors.

PRECISION INSTRUMENT.—The Norma Company of America, Anable Avenue, Long Island City, N. Y., is distributing a booklet describing its "minimeter," a precision measuring instrument, which makes possible measurements to one ten-thousandt of an inch in the manufacture of machines.

New Incorporations

THE SYLVATUS (VA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $10,000. G. W. Lewis is president and I. Lee Gray secretary.

THE FRANKLIN (MO.) ELECTRIC COMPANY has been incorporated with a capital stock of $20,000 by B. E. Perkinson, John Rogers and R. E. Boon.

THE AMHERST (WIS.) ELECTRIC COMPANY has been incorporated by A. G. Kernin, W. H. Knodler and Charles Simpson, Mosinee, Wis. The company is capitalized at $35,000 and proposes to furnish electricity for lamps and motors in Amherst.

THE STRATFORD (WIS.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $12,000 to supply electricity in Stratford. The incorporators are Herman Langer, F. A. Semmulhack and Theodore W. Hoffman.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

AUBURN, ME.—The Board of Water Commissioners is planning to install an electrically operated pumping plant, to cost about $125,000.

MACHIAS, ME.—The Eastern Development Company, recently organized, will take over the property and holdings of the Washington County Light & Power Company. E. C. Ryder, Bangor, is president.

BOSTON, MASS.—The Board of Works will build a power plant at 750 Albany Street for municipal service, to cost about $25,000.

BOSTON, MASS.—Work will begin at once by the Edison Electric Illuminating Company of Boston on the erection of a new electric generating station in Weymouth. The initial installation, it is understood, will include two generating units of 30,000 kw. each. Stone & Webster, Inc., Boston, will design and build the plant in collaboration with the company's engineers. The work will be under the supervision of E. I. Moultrop of the Edison company.

Middle Atlantic States

COHOES, N. Y.—Contract has been let by the Board of Public Works, Albany, to the Brown-Lowe-Law Company, Schenectady, for the construction of a power house at Cohoes, to be used in connection with the State Barge Canal.

NEW YORK, N. Y.—The New York Edison Company has awarded a general contract to Charles K. Hedden, 342 Madison Avenue, for the construction of a three-story and basement substation, 44 ft. x 120 ft., at 27-29 Bridge Street.

NEW YORK, N. Y.—The New York Edison Company will erect a transformer station, 20 ft. x 100 ft., at 227 East Fifty-first Street, to cost about $200,000.

WHITE PLAINS, N. Y.—The New York Telephone Company will erect an automobile service and repair works on White Plains Avenue, to cost about $200,000. McKenzie, Voorhees & Gmelin, 432 Madison Avenue, New York City, are architects.

CAMDEN, N. J.—The lighting committee of the City Council has recommended substituting new street lamps for the arc lamps now in use. The Public Service Electric Company furnishes the street-lighting service.

EAST MILLSTONE, N. J.—Frederick Bascom contemplates the rebuilding of the power house and a portion of his milling plant, destroyed by fire, Oct. 1, causing a loss of about $50,000.

MORRISTOWN, N. J.—The Morris & Somerset Electric Company has been granted permission to erect a transmission line to Livingston and Millburn Townships, to cost $30,000.

TRENTON, N. J.—The Chamber of Commerce is considering plans for the installation of an improved street-lighting system in the business district.

CHAMBERSBURG, PA.—J. Crowe, Hartman Building, York, architect, is preparing plans for the construction of a power house and cold-storage plant here. The owner's name will be announced at an early date, when bids will be called.

McKEE'S ROCKS, PA.—A one-story power house, 30 ft. x 40 ft., will be erected in connection with the proposed new plant of the Cheseborough Manufacturing Company, 17 State Street, New York City, to cost about $750,000.

MINERSVILLE, PA.—The Pine Hill Collieries Company contemplates improvements to its properties, including the installation of electrical and mechanical equipment.

MOUNT CARMEL, PA.—The Council has approved plans for the installation of an ornamental lighting system on Fifth, Oak and Third Streets.

OAKS, PA.—Steps have been taken by the Oaks Improvement Association to secure an electric street-lighting system for Oaks. It is proposed to ask the Counties

Gas & Electric Company, Norristown, to furnish the service.

BALTIMORE, MD.—Bids will be received by the Board of Awards, City Hall, until Oct. 18 for 200,000 duct-feet of four-way and 100,000 duct-feet of six-way, multiple vitrified-clay conduit for the city electrical commission. Charles F. Goob is chief engineer.

HAGERSTOWN, MD.—Plans for the proposed municipal electric light plant have been submitted to the City Council by Millard Osborne, Philadelphia, consulting engineer. The plant will be erected on the Antietam Creek, near Grossnickle's Mill. The cost is estimated at about $400,000. A bond issue of $300,000 which has been approved by the voters is available.

KITZMILLERSVILLE, MD.—The Public Service Commission has authorized the West Maryland Power Company to furnish electricity in Kitzmillersville.

FAIRMONT, W. VA. — Arrangements have been made by the Brady-Warner Coal Corporation for a bond issue of $1,000,000, the proceeds to be used for extensions, including the installation of new mining machinery, electric equipment, etc.

NORFOLK, VA.—Steps have been taken by the Monticello Avenue Improvement League for the installation of an ornamental lighting system on that thoroughfare.

PORTSMOUTH, VA.—Isaac Fass, Inc., plans for the complete electrification of its ice and cold-storage plant. A substation will be erected.

RADFORD, VA.—Improvements are contemplated to the municipal electric light plant, to cost about $20,000.

RICHMOND, VA.—The Virginia Railway & Power Company has issued $1,250,000 in bonds, part of the proceeds to be used for extensions and improvements.

WASHINGTON, D. C.—Bids will be received by the purchasing agent, Post Office Department, until Oct. 16 for 4,000 sets commutator wire assemblies.

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North Central States

DETROIT, MICH.—The Public Lighting Commission has engaged Smith, Hinchman & Grylls, architects and engineers, Washington Arcade, Detroit, to prepare plans for a municipal electric power plant to have an ultimate capacity of 150,000 kva. The initial installation will include four units of 25,000 kva. each. The proposed plant will supply electricity for lighting the public buildings, streets, waterworks and sewage-pumping stations and the street railway system. Bids will be taken on equipment, including boilers, stokers, turbines and condensers and economizers, as soon as specifications are prepared.

GIRARD, OHIO.—Negotiations are under way between the City Council and the Pennsylvania-Ohio Power & Light Company for the installation of a new street-lighting system.

STEUBENVILLE, OHIO. — Plans are under way, it is reported, by the Pennsylvania-Ohio Power & Light Company, Youngstown, for the construction of a large power station on the Ohio River, near Steubenville, to supply electricity to the Youngstown industrial district, running as far north as Warren. The cost of the plant and transmission system is estimated at $15,000,000.

TOLEDO, OHIO.—The National Supply Company, 136 Huron Street, will build a one-story addition to its power plant, 24 ft x 70 ft.

ZANESVILLE, OHIO.—The Ohio Power Company, Newark, a subsidiary of the American Gas & Electric Company, is reported to be contemplating the construction of a large power plant near Zanesville, to cost between $15,000,000 and $20,000,000. It will be connected up with the Newark and Windsor plants.

NEWPORT, KY.—Bids will be received by the Board of Commissioners, City Hall, until Nov. 14 for furnishing and erecting steam and electrically driven deep-well pumping machinery of 6,000,000 gal. capacity in the pumping station of the Newport waterworks. George Hornung, Wool-Sack Building, Newport, is consulting engineer.

PIKEVILLE, KY.—The Pike Light & Power Company contemplates extensions and improvements to its plant.

SOMERSET, KY.—The Parker Electric Mills, Ann Arbor, Mich., will build a hydro-electric plant in connection with a flour mill to be erected here, to cost about $500,000. The Associated Engineering Company, Somerset, is engineer.

HOPE, IND.—The Hope Light & Power Company, recently organized, is negotiating for the purchase of the local lines of the Porter Light & Power Company. Extensions and improvements will be made.

INDIANAPOLIS, IND.—The Merchants' Heat & Light Company has petitioned the Public Service Commission for authority to issue $118,000 in capital stock and $356,500 in bonds. Of the proceeds $91,333 will be used for extensions to the distribution system, $85,000 for new turbines, $70,000 for new transmission lines, and from $19,000 to $31,000 for equipment for increasing voltages, etc.

LAPORTE, IND.—Extensions and improvements are contemplated to the municipal waterworks system, including the installation of pumping equipment, etc., to cost about $125,000.

LAKE BLUFF, ILL.—The Public Service Company of Northern Illinois will build a transmission line from Evanston to Lake Bluff.

EAGLE RIVER, WIS. — Arrangements have been completed to erect a 4-mile extension to the municipal transmission line to furnish electrical service to the nearby summer resorts near Eagle River. Plans are also under consideration to erect an extension west of the power dam in the spring.

MILWAUKEE, WIS.—The Mullaney Fuel Company, 139 Sixth Street, will build a one-story addition to its power house.

MILWAUKEE, WIS.—The property of the Oostburg (Wis.) Heat & Power Company, the light and power lines of the Cedar Grove (Wis.) Telephone Company and the plant and property of the Belgium (Wis.) Electric Light & Power Company have been sold to the Badger Public Service Company, 1127 First Wisconsin National Bank Building, Milwaukee. The company will erect a transmission between the above towns and will be in the market for material and supplies for same. W. N. Albertson is president and general manager of the Badger company.

OSHKOSH, WIS.—The Wisconsin Public Service Company has issued $5,495,000 in bonds, part of the proceeds to be used for extensions and improvements.

PLATTEVILLE, WIS.—Construction will be commenced at once on a one-story addition, 48 ft. x 62 ft., to the municipal power plant.

PLYMOUTH, WIS.—The Phenix Cheese Company contemplates the purchase of a 30-ton artificial ice machine, a steam generating unit, two 150-hp. boilers and other equipment for its cold-storage warehouse. The Singer-Perlstein Company, 9 South Clinton Street, Chicago, is engineer.

RHINELANDER, WIS.—A new electric light plant will be installed in the local amusement park to replace the present plant.

WAUKESHA, WIS.—The installation of an ornamental lighting system in the downtown section is under consideration by the Council.

WEST ALLIS, WIS.—The City Council has authorized the installation of 100-cp. lamps at the principal street intersections throughout the city. The lamps will be installed by the Milwaukee Electric Railway & Light Company.

ELKADER, IOWA.—The electric plant of the Elkader Light & Power Company has been purchased by business men of Elkader, Garnavillo, Guttenberg, Littleporti, St. Olaf and Colesburg and will hereafter be known as the Turkey River Development Company. The new company proposes to raise the present dam 4 ft. and will also build another dam to double the output of the plant, which will be distributed in neighboring towns.

ORANGE CITY, IOWA.—Bonds to the amount of $45,000 have been voted for the construction of a municipal electric light plant.

CAPE GIRARDEAU, MO. — Plans are under consideration by the Missouri Public Utilities Company to erect a transmission system to supply electricity from its central power plants in Cape Girardeau and Poplar Bluff to towns in southeast Missouri. The first lines to be erected will connect the system at Poplar Bluff with the local plant. Both of the power plants will be enlarged.

HIGGINSVILLE, MO.—The Council is considering the installation of an ornamental lighting system in the business district.

KANSAS CITY, MO.—The City Council is planning to install electric lamps in Swope Park and the main boulevard approaches.

KLONDIKE, MO.—The Tavern Rock Mining Company plans to rebuild its power house, recently destroyed by fire.

NEWBURG, MO.—F. W. Shaw, Rolla, plans for the construction of an electric plant to furnish electricity in Newburg.

ST. LOUIS, MO. — The McKelvey Construction Company will install an electric street-lighting system in Pennsylvania Park section, which is being developed for residential purposes.

SEWARD, NEB. — Contract has been awarded to the Central Bridge & Construction Company, Wahoo, Neb., for the construction of a new power house for the municipal electric plant, and for an ornamental lighting system on principal thoroughfares.

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Southern States

CHARLOTTE, N. C. — The Southern Power Company will build two new large steam-driven electric generating plants. One of the stations (of 40,000 hp. capacity) will be located at Mountain Island, where the company is now building a large hydro-electric plant, and the other (of 20,000 hp. capacity) at Eno, where it already has a steam plant. Contracts for machinery, it is understood, have been awarded. The cost of the combined plants is estimated at about $2,000,000.

MOUNT AIRY, N. C.—The Appalachian Power Company, Bluefield, W. Va., is reported to be considering the erection of a transmission line from Bluefield to Mount Airy.

WILMINGTON, N. C.—The City Council has entered into a contract with the Tidewater Power Company to furnish electricity to operate the pumping plant of the waterworks system.

HICKORY GROVE, S. C.—Steps have been taken by local business men to erect an electric transmission line from Ninety-six Islands to Hickory Grove. The cost is estimated at $20,000.

ADEL, GA.—C. W. Carter contemplates rebuilding his lumber mill and power house, recently destroyed by fire, causing a loss of about $35,000.

COMMERCE, GA.—The City Council has granted the Georgia Railway & Light Company, Atlanta, a franchise to supply electricity for light, heat, power, etc., in excess of 50 hp. in Commerce.

DAYTONA, FLA.—The Daytona Public Service Company has issued $600,000 in bonds, part of the proceeds to be used for extensions and improvements.

JACKSONVILLE, FLA.—The municipal transmission system will be extended to Norwood and Panama Park.

JACKSONVILLE, FLA.—Plans are being considered for the construction of a hydro-electric plant on the St. Mary's River for service at the waterworks. A transmission line, 25 miles in length, will also be erected.

YBOR CITY, FLA.—The Business Men's Association is considering extensions to the ornamental lighting system.

KNOXVILLE, TENN. — The Knoxville Railway & Light Company has appropriated $250,000 for extensions and improvements to its system.

BIRMINGHAM, ALA.—Plans are under way for extensions and improvements in the municipal electric plant at North Birmingham.

NEWTON, ALA. — The Houston Power Company, Dothan, has been granted a preliminary permit for a water-power development on the Choctawhatchie River, near Newton.

LITTLE ROCK, ARK.—The electric system of the Light and Water District No. 1, comprising the Park Hill Addition, will be purchased by the city.

MOUNTAIN HOME, ARK. — The local light and power plant has recently been purchased by W. H. McShane, Kansas City, Mo. Extensions and improvements to the system are reported to be under consideration.

CROSSETT, LA.—The Crossett Lumber Company contemplates the construction of a power house in connection with a new lumber mill, to cost about $500,000.

OKLAHOMA CITY, OKLA.—The Hydro-Electric Company has preliminary plans in progress for the construction of a hydro-electric power plant on the Grand River, with extensive transmission system. It will cost in excess of $5,000,000.

TIPTON, OKLA.—The Tipton Power & Light Company contemplates the installation of new equipment, including a new generating set.

TULSA, OKLA.—The National Refining Company contemplates the installation of two new electrically operated plants in connection with the extension of its oil pipe line from Coffeyville, Kan.

WANN, OKLA.—The C. R. Long Electric Company will build a power plant in Wann to furnish light and power service.

CUERO, TEX.—The Cuero Light & Power Company contemplates extensions and improvements to its system, to cost $75,000, including a transmission line to Yorktown and Nordheim.

DE QUINCY, LA.—Bonds to the amount of $120,000 have been voted for the installation of a municipal electric light plant and waterworks system.

MANSFIELD, LA.—The Mansfield Light & Power Company has plans under way for the installation of a 250-kw. generator-set, Corliss engine, etc., at its power plant, for which, it is understood, bids will soon be asked.

DALLAS, TEX.—The City Council has accepted the proposal submitted by the Missouri, Kansas & Texas Railroad Company for the electrification of its railway from Dallas to Denton. The cost is estimated at about $4,000,000 and will include the erection of new power plants, transmission lines, etc.

EL PASO, TEX.—The El Paso Brick Company will build a substation and install motors, controlling equipment, etc., in connection with the proposed electrification of its plant.

FABENS, TEX.—A street-lighting system will be installed on all main thoroughfares in the town.

HOUSTON, TEX.—Plans are being prepared by the Sinclair Pipe Line Company, Houston, for new pipe lines from Mexia to Houston, a distance of 165 miles, to cost about $500,000. The work will include the installation of three new electrically operated pumping plants, with additions to several of the present pumping plants.

ORANGE, TEX.—The Orange Ice, Light & Water Company plans for extensions in its transmission and distributing lines.

VALLEY MILLS, TEX.—Plans have been completed for the installation of a municipal electric light and power plant.

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Pacific and Mountain States

SOUTH BEND, WASH.—The Nettleton Power Company, South Bend, has applied for a permit to appropriate the water in the Nasel River in Pacific County to generate electricity. The company proposes to develop 10,000 hp. for distribution in South Bend, Ilwaco, Chinook and other cities. The cost of the project is estimated at $250,000.

SPOKANE, WASH.—New equipment will be installed by the Spokane Valley Irrigation District, including a hydraulic turbine and auxiliary apparatus, two centrifugal pumps, electrical and other power machinery, in connection with a new irrigation project, to cost about $500,000. R. K. Tiffany, Old National Bank Building, is engineer.

BEND, ORE.—The Brooks-Scanlon Lumber Company contemplates extensions to its power house in connection with proposed extensions to its mill, to cost about $250,000. All machinery will be electrically operated.

EUGENE, ORE.—The Eugene Heat & Power Company will make extensions and improvements in its plant.

NEWBERG, ORE.—The electric plants at Willamina, Amity and Sheridan have been acquired by the Yamhill Electric Company, Newberg. Improvements are now being made to the systems, which will be connected up with the transmission system of the Yamhill company. About 13 miles of 11,000-volt transmission line will be erected and 5 miles of the present lines will be rebuilt.

PORTLAND, ORE.—The Peninsula Lumber Company contemplates the construction of a power house in connection with its proposed sawmill on the Willamette River, to cost about $500,000.

LOMPOC, CAL.—Arrangements are being made for the purchase of the local light and power system, to be operated as municipal property at a cost of about $30,000. Extensions and improvements will be made.

LOS ANGELES, CAL.—Bids will be received by the Public Service Commission until Oct. 17 for 20,000-volt cable, as called for in Specification P-289. James P. Vroman is secretary.

LOS ANGELES, CAL.—An ordinance has been approved for the installation of an ornamental lighting system on Sunset Boulevard, between Vista and Stanley Streets.

LOS ANGELES, CAL.—The Pacific Ready-Built Homes, Inc., is planning an addition to its plant, to cost about $150,000. The equipment will include several electrically operated loading cranes.

MARICOPA, CAL.—Bids will be received by the Maricopa Irrigation District until Oct. 27 for the construction of an 11,000-volt transmission line, 51 miles, to be used in connection with a new irrigation district, to include transformer stations, lighting arresters, switches, etc., complete. D. H. Smith is secretary.

MODESTO, CAL.—Plans have been approved by the board of directors of the Modesto Irrigation District for the erection of a transmission line from the Don Pedro dam to the Modesto district. The line will be about 37 miles long. The specifications call for 111 miles of copper-strand wire, 37 miles of iron or steel wire, stranded; 670 red-cedar poles, 80 galvanized-iron or steel cross-arms and 2,400 insulators.

MONROVIA, CAL.—Plans are being considered for the installation of an ornamental lighting system on White Oak Avenue and on Orange Street, about 2½ miles.

TURLOCK, CAL.—Plans are under consideration for a municipal electric distributing system. Power will be purchased from the Turlock Irrigation District plant.

TUCSON, ARIZ.—Electrical District No. 1, Casa Grande, Ariz., is arranging a bond issue of $200,000 for the installation of transmission and distributing lines, with substations, etc., for irrigation work in the Gila River Valley.

BASIN, WYO.—A municipal electric light and power plant will be constructed at once. Prince & Nixon, Peters Trust Building, Omaha, Neb., are engineers.

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Canada

POINT GREY, B. C.—A bylaw to establish a municipal street-lighting system, to cost about $135,000, will be submitted to the ratepayers.

HARTVILLE, N. S.—The Premier Paper & Power Company is planning to develop an additional 5,000 hp. to supply power for its local plant.

KENORA, ONT.—Bylaws have been passed by the Town Council for raising $7,433 for extensions to the telephone system and $4,610 for extensions to the electric lighting system.

PORT DALHOUSIE, ONT.—The Council has passed a bylaw providing $5,000 for extensions and improvements to the hydro-electric system.

Electrical Patents

Announced by U. S. Patent Office

(Issued Sept. 19, 1922)

1,429,909. Method of Preparing Furnace Linings; M. Unger, Pittsfield, Mass. App. filed Oct. 13, 1920. Green furnace lining in desired shape baked out by heater consisting of metal rings of different melting points.

1,429,914. Oil-Seal Insulator; G. R. Lewers, Brooklyn, N. Y. App. filed Nov. 8, 1918. Electric precipitator of closed-chamber type safely insulated from high-tension conductor.

(Issued Sept. 26, 1922)

1,429,931. Signaling Circuits for Toll Lines; J. Davidson, Jr., Montclair, N. J. App. filed Dec. 12, 1918. Two-way toll line so designed that connections may be established in either direction.

1,429,948. Electrical Apparatus; G. E. Hulse, Newark, N. J. App. filed Feb. 16, 1917. Storage-battery-charging relay.

1,429,972. Desk Operator's Circuits; W. A. Rhodes, New York, N. Y. App. filed Dec. 5, 1918. Equipped with a single-ended cord for either talking or monitoring.

1,430,007. Compressible Rheostat; A. W. Donop, Niagara Falls, N. Y. App. filed April 17, 1914. Pressure on carbon-resistance pile varied by solenoid.

1,430,042. Hauling Cable; W. von Raczynski, Bismarckshohe, Germany. App. filed Aug. 1, 1918. Traction system for agricultural machines.

1,430,082. Telephone Reproducer; F. Holmstrom, Jr., Chicago, Ill. App. filed Nov. 3, 1917. Relieves magnet pull during time magnet is not responding to voice currents.

1,430,095. Therapeutic Apparatus; W. Meyer, Chicago, Ill. App. filed Dec. 18, 1918. Table for taking X-ray photographs and for administering electric treatment.

1,430,096. X-Ray Apparatus; W. Meyer, Chicago, Ill. App. filed Nov. 17, 1920. Milliammeter connected through commutating device operating synchronously with rectifier in secondary winding.

1,430,104. Automatic Control of Electrical Furnaces; T. E. Niblock, Great Falls, Mont. App. filed Feb. 8, 1921. Automatic control of furnace electrodes.

1,430,106. Means for Charging Storage Batteries; C. E. Ogden, Cincinnati, Ohio. App. filed Feb. 18, 1920. Batteries in series automatically disconnected from circuit when fully charged and resistance inserted for each.

1,430,107. Means for Charging Storage Batteries; C. E. Ogden, Cincinnati, Ohio. App. filed July 26, 1920. Regulating rate at which battery is charged.

1,430,110. Rail Bond; C. A. Parker, Haugan, Mont. App. filed May 8, 1921. Incased by joint plates of rails.

1,430,118. Process and Apparatus for Sealing Lamps; R. Le Rossignol, Harrow, England. App. filed July 8, 1920. Apparatus for exhausting electrical glow lamps and glass receptacles.

1,430,130. Armature Winding; W. J. Warder, Jr., Chicago, Ill. App. filed Jan. 17, 1918. Heavy-current generators used to supply current for electrolytic work.

1,430,167. Method of Treating and Restoring Used Storage Batteries; M. E. Hunt, Belle Plains, Iowa. App. filed Nov. 4, 1921. By heating plates sufficiently to dry them.

1,430,188. Trolley Shoe; H. A. Rhoads, Leetonia, Ohio. App. filed April 1, 1922. Elliptical sliding shoe with four wearing surfaces.

1,430,245. Central Circulating Dehydrator for Petroleum Oils; W. Meredith, Alameda, Cal. App. filed March 14, 1921. Oils subjected to action of electric field, causing water particles to agglomerate and form large masses.

1,430,246. Stratifying Dehydrator; W. Meredith, Alameda, Cal. App. filed April 30, 1921. Treats oils of widely different characteristics.

1,430,256. Method of and Apparatus for Telephonically Transmitting Speech; E. S. Pridham and P. L. Jensen, San Francisco, Cal. App. filed Aug. 21, 1917. Transmitter for aëroplane communication.

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1,430,294. Dehydrator; H. C. Eddy, Los Angeles, and J. T. Worthington, Whittier, Cal. App. filed March 2, 1921. Water particles agglomerated by electric current.

1,430,295. Adjustable Field Dehydrator; H. C. Eddy, Los Angeles, Cal. App. filed June 25, 1921. Prevents the persistence of water chains.

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1,430,364. Annunciator; C. P. Evans, St. Louis, M. L. Greenstreet and W. Day, Maplewood, Mo. App. filed Nov. 15, 1921. Signal sounded or flashed at predetermined periods.

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The Human Side of Economics

WORDS run through the conversation of the world like other fads. One year some thought is front in everybody's mind and the name of it on everybody's tongue. Next year some other idea is ascendant or some other name for the old interest.

Right now all men are talking of economics. The word "efficiency" has given way to the plainer truer term—"elimination of waste." The old admonition "Know your costs!" is linked with it. But today we boil it all down into four convenient syllables and call it "economics." But "economics" has an academic sound and many people are afraid of it.

ECONOMICS means just facts about the cost of doing things. It's not a theoretical study, a matter for professors and financiers to worry about. Rather it is the practical application of prudence, thrift and forward thinking, with the judgment based on facts instead of fancy. For example:

There are today electrical contractors who when they estimate take out an envelope and pencil and virtually figure thus: "Nothing from nothing leaves nothing. Two from one won't come. I'll wire your house for fifty dollars." Economics in this case would mean an estimating sheet suggesting every item, a schedule of material costs, a record of labor experience to aid the guessing.

There are jobbers who encourage or permit their salesmen to devote most of their time to taking orders for the lines that are most easily and quickly sold. Economics for these men would point to the interesting fact that harder-to-sell specialties will often pay higher profits for the same amount of work when linked intelligently with more creative development of the staple market.

There are manufacturers who persist in turning out a vast array of excess varieties. Economics here could show some sensible reasons why it would be better to concentrate on a line of essentials.

There are central-station men who are forgetful of the burden on the central-station dollar and sell capacity for low-profit business that with effort could be marketed for better earnings. And a little economic thinking here would help.

MEN hasten on and use what they call their "judgment" without facts to base true judgment on. But they can lose more time and waste more money this way on unwise decisions than would ever be expended in securing facts that would guide them safe through. The use of facts on cost, facts on price, facts on market, facts on experience from which a man may tell just what to do—this is the human side of it, the actual thought in this word "economics" that we are using so much nowadays.

Economics is not just a study. It is a principle. It says, "Be frank and fair and sure and don't waste"—this in the interest of yourself, your stockholders and your industry.

Samuel Wesley Stratton

Builder of the Bureau of Standards and a foremost exponent of the advantages of research.

SAMUEL WESLEY STRATTON, who was elected president of the Massachusetts Institute of Technology on Oct. 11, was for twenty-one years director of the Bureau of Standards, Washington. During that time Dr. Stratton built up from a small office of weights and measures, employing three or four persons, a bureau which occupies a dozen buildings, has a staff of more than nine hundred employees and is the largest government laboratory in the world.

Coming from the University of Chicago in 1901, where he was professor of physics, Dr. Stratton immediately began the establishment of the Bureau of Standards as a center of scientific research. American industry during these twenty years has seen many changes. At least four industries in the United States may be said to have been created in that period—the automotive industry, the chemical industry, the electrical industry and the motion-picture industry. Dr. Stratton, as the head of the Bureau of Standards, built it up during this period of intensive industrial development not only with a remarkable grasp of the fundamental scientific work that underlay the development of certain features of this industrial growth, but with a many-sided, intimate knowledge of processes, a knowledge which is a continuing source of pleasure to those in industry who have come in contact with the breadth of his knowledge. The bureau under his direction has developed two broad functions aside from its limited start as a repository of the legal standards of weights and measures. First, it has gradually become the research testing laboratory for a great many of the government purchasing departments, and, second, it has gained the function of research for industry. In the second capacity the bureau has a remarkable record of achievement, and in the fields of industry where rule of thumb has been the order it has made many converts to the fundamental soundness of scientific research as a basis for the development of better industrial processes and better products. To facilitate this work four complete manufacturing establishments in miniature were set up at the Bureau of Standards—in textiles, in ceramics, in glass and in paper. One of the outgrowths of the intensive studies in ceramics was of inestimable value to this country during the world war, when the Bureau of Standards furnished from its plant the optical glass for which up to that time this country had been depending on Germany. This is but one instance of Dr. Stratton's practical ability.

Dr. Stratton was born at Litchfield, Ill., July 18. 1861. From his Alma Mater, the University of Illinois, from which he was graduated in 1884, he received the honorary degree of doctor of engineering in 1903, and in the same year he received the degree of doctor of science from the University of Pittsburgh, then called the Western University of Pennsylvania. The same degree in 1909 was conferred upon him by the University of Cambridge and in 1919 by Yale University. He is a member of many learned societies. He was made a chevalier of the Legion of Honor in 1909 and is a recipient of the Elliott Cresson medal from the Franklin Institute and of the welfare medal of the National Academy of Sciences.

During the war with Spain Dr. Stratton served as a lieutenant in the navy, and from 1904 to 1912 he was a commander of the District of Columbia Naval Militia. During the world war he was a member of the interdepartmental board of the Council of National Defense and of the National Advisory Committee for Aëronautics.

The Massachusetts Institute of Technology will gain in Dr. Stratton as its head a scientist with deep and wide knowledge of industry and a man who has eminently succeeded in dealing with men and conditions under government administration.

Editorial Comment

Electrical World, October 21, 1922

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Number 17

Will Gates Once Closed Be Thoughtlessly Opened?

THERE is a lesson for many who, unfortunately, will not see it in the address of P. S. Arkwright delivered before the Association of Edison Illuminating Companies last week. Stated in a few words, the point he made was this: Many states in early days used their credit freely to construct public works, principally railroads. Subsequent hard, cold experience with government operation of these works, with the attendant political influences, accompanied by actual repudiation of their debts by eleven states, led the citizens of all but four of the states to place constitutional prohibition upon any use of state credit for construction of public works or for any purpose not actually governmental in nature. Now, apparently unmindful of that history, attempts are being made, notably in California, to remove the restrictions so that that which experience taught should not be done may again be done. They are pounding at gates once judiciously closed.

There are many arguments, many facts, many opinions quoted in connection with the present move in California to amend the constitution so that the state may control the water powers. But stronger than all of these, it seems, should be the plain experiences of our own predecessors in connection with similar state ownership of public works. That fact is that it just didn't work. There is no reason to believe that human nature or our governmental organization and methods have undergone any revolution which will permit such things now to be done. A study of the facts as put forth by Mr. Arkwright ought to have an effect upon intelligent voters in California if they can be made available to them for study. Citizens and politicians of other states where the subject is under consideration should also ponder the question with care and study the history of their forefathers.

Waterpower Resources of France Hardly Tapped

AS THE World knows, France has few coal mines in her own territory, and in the war Germany thoughtfully destroyed every coal mine on which she could lay her hands. A certain amount of fuel has been wrung from Germany in reparation for her iniquities. but, with all that, power supply in France is difficult. The available waterpower is considerable, reaching nearly 2,500,000 hp. in the main river basins. A very much larger amount could be obtained from mountain streams, mostly rather small. Some 800,000 hp. was in use before the war. While France is unusually rich in small developments for local use throughout the country, the big waterpowers have not yet been developed, although the Rhone with a full capacity of 1,700,000 hp. is on the way to reasonably prompt development. A project is now on foot for a corporation privately owned, but with the government as a responsible partner, which will undertake the very serious cost of the total development.

Most of the power of the Rhone lies in its upper reaches, and, as our readers are well aware, the development here considered, especially for the supply of Paris, has been several times investigated with a good deal of care. It was in behalf of the long transmission which would be involved that rather elaborate experiments were undertaken some years ago with the constant-current system, utilizing ground return in a pinch, the project at that time being directed toward an underground transmission line. What form the present project will take is as yet uncertain, but this much is clear, that the Rhone, especially in its proper reaches, has available power to a very large amount, a considerable portion of which can be utilized without forbidding expense.

The project as now outlined implies a more complete development than has been considered in previous stages of investigation, including considerable expense for navigable waterways and irrigation. It would, in fact, open up a barge canal from the Mediterranean to the Lake of Geneva, and from Marseilles to Strasbourg. The scheme is far from being fully under way, but it has reached the stage where there seems to be a strong probability that the splendid resources of the Rhone will ere long be turned to something like full account.

Reckoning the Cost of Daylight

THE Illuminating Engineering Society convention paper by Luckiesh and Holladay dealing with the cost of daylight stirs up a question which is of real importance in modern city planning. It extends in fact not only to large industrial or office buildings, but even to hotels and residences. In its larger aspect the problem is this: Given ground space for a substantial skyscraper, say 20,000 square feet, how much of such space does it pay to reserve for light wells or their equivalent, looking at the matter in all its aspects and reckoning the full cost of daylight lighting and also of artificial lighting at current rates? Of course, it will readily be granted that to the degree in which outside lighting can conveniently be obtained without sacrificing of ground space it is always worth obtaining; but in the inner portions of the available space the loss of floor area due to a light well is serious, and the effectiveness of such a well in the case of very tall buildings becomes dubious unless considerable area be sacrificed. Therefore is it not wise to depend more upon artificial light than we have of late been in the habit of doing?

Few people realize that window space costs in dollars and cents more than wall space. This is true not only in the case of an industrial building with highly specialized steel window frames, but as regards a common frame house. Moreover, the amount of heat required in our climate during a considerable part of the year is greatly increased when very liberal window space is provided. Heat is lost through the windows much more rapidly than through the walls, and consequently more must be furnished. Repairs, renewals and cleaning of windows also rise to a very perceptible figure, so that, including the interest on the investment, the authors find that, speaking in general terms, the total annual costs of lighting by window spaces and by artificial light are usually not widely different, while in not a few instances artificial lighting carried to the point indicated by good modern illuminating practice is actually cheaper than natural light.

This is not at all to offer the suggestion that we had better do without windows entirely unless they are needed for ventilating purposes, but to show that in cases where ground space is valuable and the uses of a building are such as permit of effective artificial lighting such light may be not only economical, but on the whole quite as desirable as natural lighting. If a building is to be used for industrial purposes, experience shows that without great sacrifice of ground area it is extremely difficult to get good natural lighting, and it is also a well-known fact that first-class artificial light keeps production up to at least the point reached by the average daylight conditions. It is a curious turn of affairs that has brought about a profit balance on the side of artificial light, a result perhaps of our insistence on crowding together in cities and putting our buildings on end and in contact with each other instead of spreading them out for the maximum benefit of light and air. Society is penalized by this sort of crowding in many ways, but it is a condition and not a theory with which we have to deal, and from present data it looks very much as though the future architect and contractor would have to consider the economic factor of artificial lighting as one bearing somewhat heavily on the utilization of the space at hand.

Analyzing Costs in the Interests of Scientific Rates

IN SPITE of all the past efforts toward computing rates on a rigidly scientific basis, it is hardly mere speculation to assert that a large majority of the published electric rate schedules would, upon investigation, be proved to rest upon tradition or expediency. In relatively few instances could it be demonstrated that the classification of consumers is at the same time fairly complete and completely fair. The cases are not yet the rule where each consumer contributes equitably with the others to the expenses and fair profits of the producers. The measure of inequity which still exists is attributable, ordinarily, to a multiplicity of factors that culminate in a "let-well-enough-alone" attitude on the part of the management. Nor can the attitude or even the results be categorically condemned—in some instances the cost of charging scientifically could easily transcend the benefits, in others the rigidly correct charge would be more than a desirable group of consumers could bear.

Books are kept primarily for the purpose of exhibiting the extent to which the enterprise is solvent and profitable, but they can as well reflect the costs of financing and operating in such form as to permit ready and appropriate allocation among classifications. Three members of the Iowa Railway & Light Company staff begin in this issue and will continue in a later one their analysis of the costs of serving various users and the necessary modification of the accounting system to facilitate the segregation of costs. Those who have striven for a means of crediting the off-peak consumer without resort to individual treatment will appreciate the ingenious employment of the "peak-responsibility factor." Others may justly question the propriety of dealing with the simple arithmetical difference between kilovolt-amperes of capacity and kilowatts of load as a measure of unused capacity. But all should welcome the impetus to the movement to place, as far as feasible, the assessments more generally in proportion to the benefits. The authors are to be commended for their suggestion that the utilities exchange through the press more data on the factors that affect rates. Much is now known, but inaccessible, that would contribute immeasurably to the determination of demand factors, diversity factors and the more recent "peak-responsibility factor" and to their proper application in the precise fixing of rates.

The Breakdown of Insulation

INSULATION is the weakest element in every electric machine or system. Short-radius curvature, sharp bends and mechanical vibration impose severe mechanical burdens on substances which demand by their nature and function the gentlest treatment possible. Nor is this the worst of it. For it may be said with almost equal truth that this is also the element that we know least about. Perhaps this ignorance is the cause of the trouble, and in some far future day we may know the nature of dielectric properties and the mechanism of breakdown and be able to control the structure of insulation and predict its life.

For the present, however, insulation is the greatest problem of the manufacturer and the greatest challenge to the investigator. What happens when voltage is applied to an insulator? A slow soaking in of charge, a conduction current, dielectric hysteresis, a change in insulation resistance, the generation of hot spots, and finally failure. But all these things are working together in a relation entirely unknown and apparently varying from point to point. The investigation of each is complicated by the presence of the other. For a long time it has been known that temperature has a most important influence on insulation. Even below the values at which it threatens carbonization or oxidation, temperature variation causes wide changes in insulation resistance and dielectric loss. Hot spots in insulation have long been recognized as precursors of breakdown.

The trend of expert opinion is now apparently to the feeling that conductivity, as affected by temperature, is the cause of breakdown, or at least the method in which the final stages occur. This position was taken by Dr. K. W. Wagner in his A. I. E. E. address last spring, and Messrs. Hayden and Steinmetz develop it still further in this issue, with the aid of several illuminating experimental tests. Their observation is that, owing to the non-homogeneity of insulation, the conductivity current is unevenly distributed, so that if the heat generated is not readily liberated the current will become excessive in spots, because of the negative temperature coefficient, and eventually cause breakdown due to the pyroelectric effect.

While this observation is very interesting and is valuable information, it does not tell us much of the ultimate nature of dielectrics and their failure. Before we can hope to understand and control their properties we must go much deeper. Water within even the dryest insulation has a most important influence, and H. Evershed has developed an ingenious theory, confirmed by experiment, accounting for the influence of temperature by the behavior of water in minute capillary channels within the insulations. But, as already remarked, the answer is not yet, and it is a task, not for one, but for many careful and trained investigators.

An Excellent Chance for a Good Primary Battery

OF LATE the primary battery seems to have been left out in the cold in reckoning up the electrical family, and yet there are times and places where it has very much to recommend it. One such condition, and a really important one, is to be found in the excitation of the tubes used in radio receiving sets. The conventional equipment at the present time, when one gets beyond the crystal detector stage, usually pretty early in his experience, requires the use of a storage battery. This in and of itself does not sound at all formidable to the man who is familiar with the use of this instrument in his car, but nevertheless the situation is different in a very material degree. It is generally recommended that the owner of a radio set should put his battery in the cellar and wire it to his receiving station. This of itself is not altogether a cheerful prospect, but the isolation of the battery from ordinary living rooms is highly desirable on account of the evil odor and more evil occasional spattering of the acid. Batteries of the kind most readily obtainable weigh anywhere from thirty to sixty pounds and have to be recharged at fairly frequent intervals. This is not difficult in the city when the radio "fan" has a car, but in small towns and in the country maintenance of a storage battery is a good deal of a nuisance. Nothing is more admirable within its limitations, but these cannot altogether be forgotten.

Tubes are now available requiring only a very modest current output, but the source must be reliable. There is certainly a good opportunity in this particular field, which is rather a large one, for a primary battery which is thoroughly reliable, holds up its voltage well and neither smells nor has a tendency to spray acid. Some day batteries will drop out of sight altogether in favor of energy taken from the ordinary electricity supply, but even so the radio set can and will go into a good many places not yet served. There are many possibilities in the primary-battery lines—various forms, for instance, of extra durable and efficient dry cells, improved wet cells of the same Leclanché type and other batteries belonging to the old-line equipment in sources of electricity. One of the very best of these is the Grenet, which, if put up in convenient and not too bulky form, would be a most dependable and convenient source of energy, and others there are which probably could equally well be brought to a modern pitch of efficiency. The broad fact that there is a wide field of usefulness open to a battery which does not require the ministrations of an electrical supply circuit and is at once compact, trustworthy and cleanly in use ought to stimulate engineers, particularly those directly interested in radio, to a new period of activity. Too much of the earlier electrical art has been quite forgotten, and opportunities such as this suggest the advisability of bringing it to memory.

Engineering Problems That Must Not Be Overlooked in Interconnection

WITH all the commendation of the policy of interconnection and the vigorous propaganda carried on in behalf of the "superpower system," it may be well to examine closely to discover wherein interconnection is beset with countervailing difficulties. It is in fact apparent that such are rather easily found, particularly in the matter of the greatly increased plant capacity with which the component members of the interconnected system must deal. For example, if three 10,000-kw. plants are interconnected, there may exist circumstances under which any one of the three will have thrust upon it short-circuit possibilities and switch duties considerably greater than those for which the outfit was originally designed. The chance of surging will be increased with some risk to the insulation, and the interconnected stations must have some coherent system of switching and load dispatching. In any given case these possible disadvantages must be weighed. We are inclined to the opinion that they will usualy be found of comparatively small general significance, although now and then there may be striking exceptions to this rule. To offset the greater possibilities of a short circuit one has the chance of a much higher diversity factor, considerably reduced fluctuations in the joint load and so on.

The chance of trouble in interconnecting old-fashioned and ill-designed systems, however, is not one which can be overlooked. There are a good many plants in the country in which the factor of safety on the insulators is decidedly insufficient. If one of these weakly insulated systems is tied in with one equipped on modern lines and a surge does start, rather serious results may follow. This is especially true if the two systems happen to be near together, and it behooves the owners of an old plant which contemplates tying in to remember something of the Scriptural adage, perhaps now outlawed by the Volstead act, about putting new wine into old bottles. In other words, there is under such circumstances real need for a thorough going over of the older system to eliminate all the weak spots which time has left. In interconnecting plants over great areas the cushioning effect of long lines is often a very valuable asset in avoiding trouble, but the potential gradients possible under surge conditions require considerable examination, lest at some branch, very likely connecting a weak plant with a strong line, so to speak, dangerous conditions may exist.

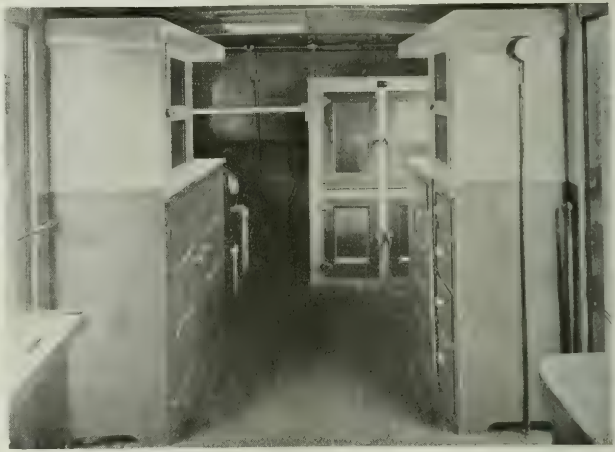
Interconnection is like trying to make two machines do any kind of work harmoniously on the same job; the results are apt to be held within the limitations of the weaker of the two. This is no argument against the principle of interconnection, but it is a clear warning to proceed with care and to regard the engineering as well as the commercial problem as one worthy of study in considerable detail.

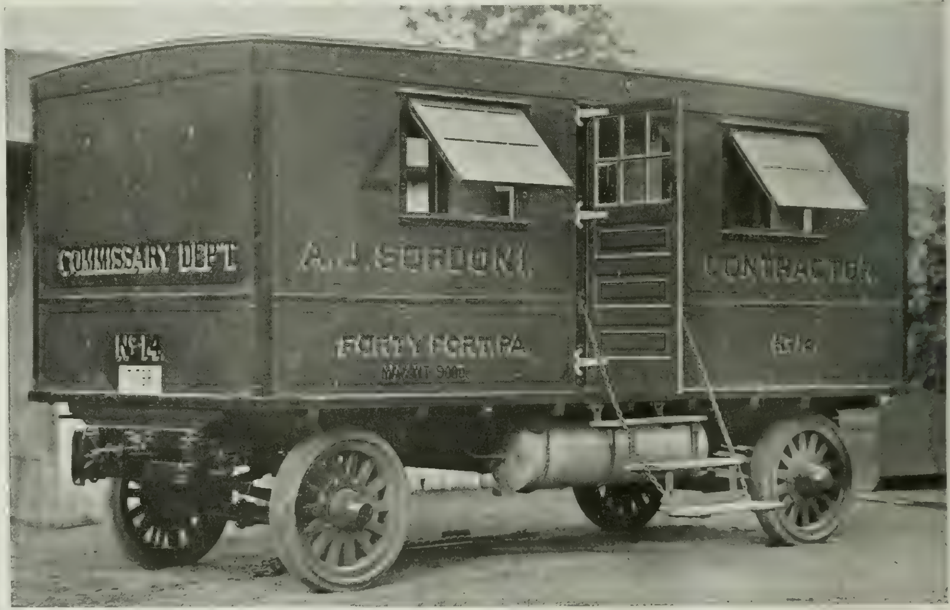
A Portable Camp that Appeals to Construction Men

REALIZING that contented workmen give the best service, A. J. Sordoni, a general contractor in the utility field, has added to the usual construction equipment a portable outfit which serves not only as a kitchen, commissary and refrigerating plant but also as a central utility plant for supplying hot and cold water, electricity and other comforts to the camps of his men. The outfit is mounted on a 5-ton reversible trailer that can be drawn behind one of the trucks used to transport construction equipment. It is shown second in the line of trucks.

In addition to the usual equipment required for a camp kitchen and commissary, the truck is equipped with a 110-volt automatic generator, an electric refrigerating plant and an electric pump for furnishing hot and cold water to the men's tents. These tents as well as the dining tent are lighted by electricity.

Mr. Sordoni says that the men and camp cook appreciate these added conveniences and reflect it in their work. On one transmission-line construction job fifteen men raised and tamped fifty-nine 50-ft. poles in one day.



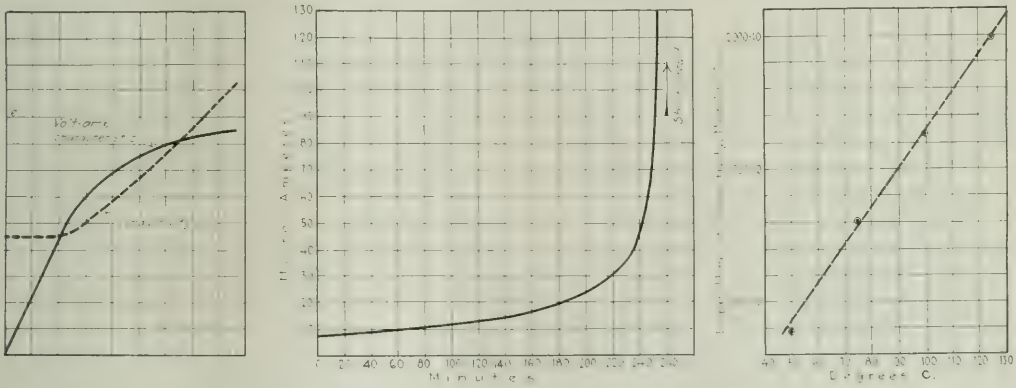


Insulation Failure—A Pyroelectric Effect

Investigation of Mechanism of Breakdown of Solid Insulation Proves that It Depends Upon Relation Between Heat Production and Heat Dissipation — Time Element Involved — When Puncture Occurs

By J. L. R. HAYDEN and CHARLES P. STEINMETZ
General Electric Company

THE mechanism of breakdown of solid insulation is essentially different from that of air. Solid insulators do not have a definite dielectric strength or breakdown gradient at which they change to conductors, as in the case of air. They are really high-resistance conductors with a very high negative temperature coefficient of resistance. One characteristic of a substance having a high negative temperature coefficient resistance is its instability at constant potential above a certain critical voltage or voltage gradient. At and above this voltage the decrease of resistance by the increase of temperature increases the current density and thus the temperature indefinitely, thereby short-circuiting the constant-potential supply and destroying the insulator. Below this critical voltage the decrease of resistivity and increase of temperature limit themselves and the conditions are stable.



FIGS. 1, 2 AND 3—EFFECT OF CONDUCTION CURRENT, ELAPSED TIME AND TEMPERATURE ON CONDUCTIVITY OF THREE SAMPLES OF INSULATION

Fig. 1—The continuous-current voltage impressed upon the insulation was gradually increased, and current measurements were made with the necessary precautions to protect against stray and leakage currents by means of guard rings, ground shields, etc. As may be observed the current first increases proportionally to the voltage, then more than proportionally, and at an increasing rate until finally the current "ran away." That is, it increased without further increase of voltage, and puncture occurred and destroyed the insulation. The approach to puncture is indicated by a gradual and progressive increase of the conductance of the insulation. The material tested was composite high-voltage armature insulation.

Fig. 2—To obtain these data a number of layers of black varnished cloth such as are used in machine insulation were wound on a brass tube and covered with tinfoil. A unidirectional continuous voltage was impressed and kept constant at 57.6 kv., and the current passing through the insulation was read every thirty seconds. At first the current rose slowly, then increased rapidly, and finally ran away, causing breakdown more than four hours after the application of the voltage. This test shows an increase of conductance with time at constant impressed voltage. Fig. 3 refers to black varnished cloth also.

This critical voltage point is called the breakdown point or puncturing gradient. However, it is not a constant of the material like the dielectric strength of air, but depends upon the relation between heat production and heat dissipation in the insulator, and therefore upon many extraneous conditions. If the short-circuiting which occurs at breakdown under constant potential supply is avoided, the insulation can be stressed above the critical gradient without any harm.

Consequently dielectric breakdown of a solid insulation is a temperature effect. It cannot take place instantaneously; some time must elapse during which the temperature at the place of breakdown reaches the critical value. Solid insulation must therefore have a time lag in breakdown, and this time lag is the shorter the more the impressed voltage gradient exceeds the critical voltage or critical gradient respectively—the so-called "puncture voltage." The time lag is of the magnitude of seconds, minutes or hours. Anything that affects the temperature affects the critical or puncture voltage of solid insulation, respectively the critical or disruptive gradient, so that the latter is not a constant of the material, but a function of the electrical and thermal circuit.

As examples of what may affect the time lag of insulator breakdown the following may be cited:

A. In an alternating dielectric field dielectric losses of the nature of hysteresis increase the heating. At the same time, heating due to the conduction current is less in the alternating field than in a direct-current field having a voltage equal to the maximum value of the alternating field. The total heating, therefore, may be more or less, depending upon the relation between dielectric losses and the conduction losses, and thus upon the frequency.

Usually the total loss, and thus the heating, in an alternating field is higher, and the critical voltage therefore lower, than in a direct-current field. However, there are some insulators of low dielectric losses and high conduction loss which break down at a direct-current voltage less than the maximum value of the alternating puncture voltage.

Consequently, the ratio of direct-current to alternating-current puncture voltage with air is $\sqrt{2} = 1.41$; with solid insulation it may depend on the frequency, and usually is higher, though it may be as low as 1.00 in the case of Fig. 3. The ratio may have to be experimentally determined for every material or class of material.

B. Comparing an insulation consisting of *m* layers with one consisting of *n* time *m* layers of the same material: The latter has *n* times the thickness and if there were a definite dielectric strength would require *n* times the voltage for puncture. Not so, however, with the puncture considered as a temperature effect. At moderate thicknesses of the insulation the major portion of the heat is conducted away transversely to the metal terminals. With *nm* sheets the path of heat conduction is *n* times longer than with only *m* sheets, and the heat conduction thereby considerably decreased. As the puncture gradient is determined by the balance of heat production and heat dissipation, it thus follows that the puncture gradient is lowered by the decreased heat conductance; that is *nm* sheets puncture at a voltage materially lower than *n* times the voltage at which *m* sheets puncture. In other words, the disruptive strength of built-up material does not increase proportionally to the number of layers or thickness, but at a materially less rate.

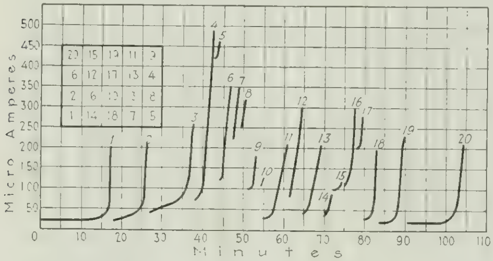


FIG. 4—PROGRESSIVE INCREASE OF CONDUCTANCE IS A LOCALIZED AND POSSIBLY SHIFTING PHENOMENON

The insulation, which consisted of twelve sheets of unimpregnated linen paper, was tested with a constant potential of 5,650 volts between metal plates having an area of 4.20 sq.cm. Then the upper electrode plate was cut into twenty sections, connected by very small fuses, and the test repeated. At first the current increased slowly, then rapidly, and finally ran away, and puncture occurred, just as in Fig. 2. But the blowing of the fuse cut off the section in which the puncture occurred, and the excessive current vanished until a weak spot developed in some of the other sections which had remained under voltage. Then the current increased, puncture resulted, and another section was cut off, etc.

C. In the insulation between concentric cylinders, as in cables, the voltage gradient increases toward the interior, and the inner layers of the insulation may thereby be stressed materially above the gradient found for the same thickness of material as its breakdown gradient in a uniform field. Nevertheless, these "overstressed" inner layers are not damaged but continue to take their share of the voltage. With air under these conditions the overstressed portion would become conducting and filled with corona.

Thus in a non-uniform field with solid insulation puncture occurs not when the maximum gradient at one point or over a finite range has exceeded the critical value, but when a dielectric circuit as a whole, between the terminals, passes the critical voltage or potential at which the temperature "runs away."

The foregoing observations and conclusions were reached as a result of extensive tests conducted with two new "tools" devised especially for the study of solid insulations over the entire voltage range before and after the so-called "breakdown" point. Methods differing from those usually employed were used because applying an alternating-current voltage between metal terminals until puncture occurs shows nothing while the potential is being raised except surface corona, perhaps, whereas after puncture the insulation is destroyed by the energy concentration. With the ordinary tests, therefore, no information is obtained but the voltage gradient at the puncture voltage. This depends greatly on time, temperature, thickness and shape of material, on the amount and nature of surrounding materials, on the heat conductivity of the insulation and the surrounding material, and even on its color and many other features.

HOW OBSERVATIONS WERE MADE

In the method developed especially for testing solid insulations a vacuum-tube rectifier made available constant unidirectional voltages of considerable power up to several hundred thousand volts. This permitted measuring the current passing through the insulation during the gradual voltage rise up to and beyond the breakdown point, and thereby the resistivity or conductivity. As a result characteristic conductivity changes were discovered. These are hidden in alternating-current tests by the much larger capacity current. This method also eliminated the dielectric losses and so permitted the exact determination of the energy input into the insulation.

Various methods were devised to eliminate the energy concentration in the path of puncture, so that the insulation could be studied far beyond its so-called breakdown point. Some of the observations which were made and which are typical of the remainder of the tests are graphically represented in the accompanying illustrations. They show progressive increase in conductivity under constant voltage stress and the effect of elapsed time on insulation breakdown. To determine whether this progressive increase of conductance, which leads to breakdown of the insulation, is uniform throughout the sheet of insulation or localized at a defective spot at which puncture will later occur, tests were conducted with various insulations. The results of one set of tests are shown in Fig. 4.

CURRENT NOT UNIFORMLY DISTRIBUTED

The foregoing test indicated that the gradual increase of current and of conductance which leads to puncture is not uniform throughout the insulation but occurs locally at the spot at which puncture eventually occurs. Whether there is also a gradual increase of conductivity of the entire insulation during the time of voltage application cannot be decided from these tests. If so, it is small compared with the local current rise at the point where the puncture develops.

Another pertinent conclusion follows from Fig. 4: Twelve sheets of linen paper were used, so that the coincidence of four defective spots was entirely improbable. Even if four defective spots coincided and were entirely conducting, it would still leave two-thirds of the sheets of paper, so that the current density could increase locally only 50 per cent. In the total current this would be entirely inappreciable. However, the total current increased several-fold, which proves that the defective spot in the insulation involves all the layers, even the perfect ones.

The explanation of breakdown of build-up insulations, therefore, cannot be that the failure of the defective layers increases the gradient on the other and undefective layers beyond their disruptive strength, thereby breaking them down. The breakdown must be pictured as a deterioration proceeding from a defective spot in one or a few layers and gradually penetrating and damaging the other undefective layers until the whole thickness is deteriorated. The mechanism may consist in the concentration of the voltage gradient at and by the defective spot. For example, a partially conducting spot in one layer of the insulation might cause an electrostatic cutting edge which would penetrate the other layers and thereby produce a conducting path.

Often in such tests as described the increase of current before the breakdown is smaller than shown in Figs. 2 and 4, and sometimes it is hardly appreciable in the total current. Nevertheless, the local current density, and thus the conductivity, may have increased many hundredfold. For instance, in the first breakdown (Fig. 4) the conductivity of the deteriorating spot had increased a hundred-thousandfold, assuming the area of the deteriorating spot as 4 sq.mm. out of a total plate surface of 420 sq.cm.

What is the significance of this increase of conductivity? This may be answered by considering Fig. 3, which shows the temperature conductivity characteristic of black varnished cloth. As may be observed, the conductivity increases or the resistivity decreases about tenfold with every 35 deg. C., indicating that the material has a very high negative temperature coefficient of resistance. This action is typical of all solid insulating materials, at least as far as they are known.

Now, suppose that a sheet of insulation of uniform thickness is subjected to a uniform dielectric field. A leakage current or conduction current passes through this insulation. If the insulation were perfectly uniform, this current would have uniform current density and give a uniform temperature rise of the insulation by its power dissipation (*ei*). As the material cannot be perfectly uniform, the current density and the heating caused by it would not be perfectly uniform. At low voltage, where the temperature rise is very small, the temperature difference within the sheet due to the differences of current density would be so small that the conductivity would be practically uniform and the conditions stable.

If, however, the voltage is gradually raised and the leakage current and temperature thereby augumented, the conductivity, current density and power input to the sheet will in turn be increased, particularly at some one spot which will be the ultimate puncture point. As a result the temperature would rise, and this would still further increase the conductivity. This increases the power and thus the temperature. Unless some compensating influence such as heat radiation equal to increased heat generation comes into play the temperature and current density will run away, destroying the insulation by heat or puncture, as shown in Figs. 2 and 4.

THERMAL CONDITION A VITAL INFLUENCE

The "disruptive voltage," then, is a voltage at which the increase of conductivity and temperature cease to limit themselves at some local spot. This point depends on the heat locally produced (that is, the voltage and conductivity), and the heat carried away (that is, the heat conduction, convection, storage, etc.) thus depends on the shape of the structure, etc. Therefore, the disruptive voltage is not a definite characteristic of the material, and the breakdown value of the insulation is that at which the temperature-voltage characteristic becomes unstable.

Neither is the breakdown gradient a characteristic of the material alone. It, too, depends on the condition of operation, more particularly the relation of the heat production to the heat dissipation. Under one condition, an insulation may be operated without breakdown point at a gradient which would be far above the breakdown gradient under other conditions. It follows that the insulation is not damaged or destroyed by straining it above the breakdown gradient and that nothing particular occurs at the breakdown gradient. Hence the so-called breakdown gradient is a characteristic of the electrical and thermal circuit. Straining solid insulation to and beyond the breakdown gradient will not necessarily damage it. When damage or destruction does occur, it is due to the excessive energy concentration incident to constant potential supply.

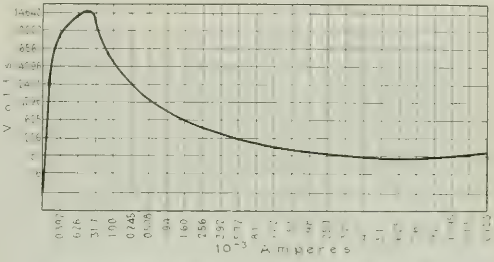


FIG. 5—VOLT-AMPERE CHARACTERISTIC OF NERNST LAMP GLOWER

As may be observed from the characteristic of the Nernst lamp glower, the current increases with increasing voltage, first proportionally to the voltage, then more rapidly (with increasing rapidity), until at about 16,000 volts the current "runs away" and the insulator "breaks down"; in other words, the current indefinitely increases without further increase of voltage. At a constant voltage supply the insulator is destroyed by the current short-circuiting. If, however, the current is limited and gradually increased, the voltage decreases again and gradually comes down to less than 1 per cent of the breakdown voltage. The current may become many times larger than the current at the breakdown point without the insulator being destroyed.

Thus it becomes possible to study the behavior of solid insulation beyond the "breakdown gradient" by limiting the energy concentration, thus observing the insulation, not under constant potential, but under constant current supply. This makes it possible to carry the volt-ampere characteristic of the insulation far beyond the breakdown point and back, without damage to the insulation. [A characteristic similar to that of insulation is exhibited by the electric arc. The arc is unstable at constant potential; that is, the current runs away and short-circuits, and stability is produced by using a sufficiently high series resistance.]

In insulation testing, a series resistance, no matter how high, will not usually limit the current at the spot where, by a local temperature rise, the insulator passes the breakdown gradient, because with the increase of current at this spot the voltage decreases. However, this spot is a small part of the total sheet of insulation, and its current therefore a small part of the total current. A drop of voltage reduces the conduction current through the entire insulation and so makes it available at the critical spot. At this spot the current density may increase many hundredfold and thus destroy the insulation without increasing the total current and

BEHAVIOR OF AIR UNDER DIELECTRIC STRESS IS DIFFERENT FROM THAT OF SOLID INSULATIONS (PEEK, WHITEHEAD AND OTHERS)

(1) Air has a definite *dielectric strength* g_o. This is proportional to the air density and is 30 kv./cm. at 0 deg. C. and 76 cm. barometer.

(2) Air breaks down and becomes conducting when the dielectric gradient g exceeds the dielectric strength g_o over a definite distance, the so-called *energy distance.* This energy distance depends on the shape of the dielectric field.

(3) The maximum gradient g_m therefore must be so large that the breakdown gradient g_o is exceeded over the entire energy distance.

Between spheres of radius r the maximum gradient is at the surface of the spheres, and is:

$$g_m = g_o\delta\left(1 + \frac{0.54}{\sqrt{\delta r}}\right)$$

and between cylinders of radius r:

$$g_m = g_o\delta\left(1 + \frac{0.30}{\sqrt{\delta r}}\right)$$

where δ = air density, referred to 0 deg. C. and 76 cm. barometer.

(4) When the gradient exceeds the dielectric strength g_o over a space equal to or greater than the energy distance, the air breaks down in this space and becomes conducting. If thereby the gradient in the remaining part of the field is not increased, breakdown limits itself and corona takes place in the broken down part of the field. If, however, the gradient is increased in the remaining part of the field, the breakdown progresses until either spark discharge occurs between the terminals, or the gradient does not further increase and the corona limits itself.

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therefore without being limited by the series resistance, because the current through the other part of the insulation correspondingly decreases by the voltage drop. About the same condition exists as if an arc were shunted by a very low resistance. It would then be unstable, even in a constant-current circuit, because the current in the arc could increase without the total current increasing, owing to the current in the shunting resistance decreasing by reason of the decrease in potential drop.

To carry the study of insulation beyond the breakdown point either requires the testing of a piece of insulation so small in section that the temperature throughout the section remains uniform or it requires a local current limitation so that at every point of the insulation the local current density is limited. The latter can be accomplished by placing in series with the insulation another insulation in which the conductivity does not appreciably change within the temperature range in which the first insulation breaks down. For instance, mica is placed in series with black varnished cloth, and then the voltage drop across the mica is segregated from that in the insulator under test, namely, the black varnished cloth.

Using a small section of insulation (a fraction of a square millimeter) is feasible only with insulators which have relatively a very high conductivity, so that the conduction current through the small section is measurable by a sensitive galvanometer. Within this limitation it is the most convenient way. Such insulation is available in the material of the Nernst lamp glower. This affords a convenient means of observing the entire volt-ampere characteristics of an insulator. (See Fig. 5.)

To bring the different parts of the curve within visible range on the same sheet, the fourth roots of e and i are used as co-ordinates in Fig. 1, instead of their first powers. The ratio of the currents at constant conductance, at the breakdown point or maximum voltage point and at the minimum voltage point is of the magnitude 1:6,000:20,0000,000.

From the volt-ampere characteristic of Fig. 1 a temperature conductivity characteristic like Fig. 3 can be calculated. Conversely, from the temperature conductivity characteristic (Fig. 3) a volt-ampere characteristic can be calculated which has the same character as Fig. 1. As may be observed, the breakdown point in current and voltage is not a constant of the material, but can be varied over a wide range by changing the relation between heat production and heat dissipation; this can be done by varying the ambient temperature.

In concluding, the authors wish to say that the experimental investigations made abroad by Dr. Wagner have led him to practically the same conceptions as those outlined above. While it would be premature to claim that all breakdowns of solid insulations are temperature effects, it has been found that this conception is corroborated over a wide range of insulating materials, as is shown by the illustrations.

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The New 105,000-Kw. Generating Station at Birmingham, England

THE new electric station at Nechells, Birmingham, England, of which a view was given in the *Electrical World* for July 29, page 240, has been under construction for nearly ten years. Work upon it was interrupted during the war, but the plant is now virtually completed at a cost of about £1,000,000. The site is near large filter beds which furnish an ample supply of water for condensing purposes. The plant is constructed on reinforced-concrete piles, and the condensing-water reservoir and canal basin are built of the same material. The buildings are of steel with a brick shell. There is coal storage for 80,000 tons, and it is estimated that fuel consumption will amount to 300,000 tons a year.

The completed boiler house will accommodate forty-five boilers. Each section of the house contains six marine-type water-tube boilers, fitted with superheaters, economizers and chain-grate stokers. Each boiler is capable of evaporating 42,000 lb. of water per hour. The turbine house at present contains two 15,000-kw. turbo-alternator sets, each having its own condensing plant, and the completed turbine house will ultimately contain seven such sets, giving a total capacity of 105,000 kw. The operating floor of this house is 23 ft. above the basement, and large open walls are left, in which are installed the condenser pumps and other apparatus. The alternators generate current at 5,500 volts, which is distributed at this pressure to a large section of the city, two 33,000-volt lines running to substations in other parts of Birmingham.

It is believed, says United States Consul John F. Jewell, from whose report this description of the new station is taken, that the plant will have a material effect in reducing the cost of production of electric power in the Birmingham district during the coming year. With cheaper production should come cheaper cost per unit of power, an increased use of electricity, and a diminution in the use of gas, which has heretofore been widely employed for domestic and commercial purposes. All plans for further development are being shaped with a view to co-ordination with the great system of superstations which is being worked out for the whole country.

A New Trend in Our Commercial Thinking

A Little Picture and Interpretation of the Recent Conference of Local Electrical Leagues and the Western New York State Conference and Other Straws that Show the Wind

By EARL E. WHITEHORNE
Commercial Editor Electrical World

THERE seems to be substantial evidence that a distinct trend in commercial thinking is developing among electrical men. The industry has come up through its forty years of rapid evolution. It has worked out of its eras of research, invention and engineering and into its commercial era. Research will continue, invention will proceed apace with progress, engineering problems and achievements will grow steadily greater as the industry expands. But we have passed on beyond the day when every kilowatt ground out found an eager waiting market. We have skimmed off the business that lay like thick, sweet cream upon the surface. We have recognized at last the fundamental need for systematic market development through creative selling. And we are apparently beginning to realize that this selling must be done, not nationally and in great campaigns but locally in towns and cities, everywhere, by continuous, consistent co-operation among the electrical men who live and work there. And if this idea takes hold throughout the industry, it is going to bring some mighty changes in our world of electricity.

THE SIX HUNDRED ELECTRICAL MEN OF WESTERN NEW YORK STATE WHO HELD A CONFERENCE ON COMMERCIAL PLANS IN BUFFALO

I have just come from two very unusual meetings of electrical men. They have impressed me tremendously with the feeling that a new vision is breaking out and a new purpose forming in the industry. They were the conference of local electrical leagues held at Association Island and the Western New York State Electrical Conference at Buffalo. Out of them have converged a lot of impulses and indications that seem to me to carry a meaning and a message which I should like to picture and interpret if I can.

These two meetings may logically be considered direct outgrowths of the general movement for business development which was initiated by the National Electric Light Association and has been under the direction of the Joint Committee on Business Development. The job of developing local co-operative leagues and serving them was put up to the Society for Electrical Development. The society called a conference of existing leagues, and representatives of twenty leagues and fifteen other cities where leagues are in process of organization came to the island and spent three days discussing, in a word, what leagues have done, what leagues can do.

For the first time in all these years, men of the cities—not just jobbers, manufacturers, central-station executives and contractors, but men of the cities speaking and thinking for the electrical families of those communities—were gathered together to talk, not about merchandising, wiring, light and power, jobbing or manufacturing, but about promoting electricity in cities. And they were national in their scope and point of view, for these men were from Los Angeles, San Francisco, Boise, Salt Lake City, Denver, St. Louis, Chicago, Toledo, Cincinnati, Pittsburgh, Cleveland, Buffalo, Philadelphia, New York, Boston and other places in between.

I have sat in on many electrical meetings in the last sixteen years, but here was a new line of talk—all kinds of electrical men from all kinds of places focused on one common purpose and an absolutely fundamental one. They were there to try to find new ways to make electrical men, co-operating in their individual towns, individually more prosperous and to try to influence more towns to organize leagues and do the same thing. There were 125 delegates in camp. They played together, they talked together, they ate together, they sang together, they met together in working sessions under the big elm or over the boathouse and got acquainted and helped each other as men can on "the Island." Camp clothes, soft shirts, open at the throat without neckties, white caps all alike with each man's name in front, the row of tents, the broad parade ground, the lake, the boats, the ducks and swans, the bugle calls, the band playing, the free and friendly comfort and informality of the atmosphere brings men's minds together and gets things started.

I am not going to tell about the meetings. W. W. Freeman was there. E. W. Rockafellow was there. W. F. Robertson was there, and E. W. Lloyd, and Walter Neumuller, and F. M. Feiker, and W. L. Goodwin, and a lot more men who have worked long and earnestly to build this industry. And they all talked, and the men from all the leagues talked, and out of it came a picture of what co-operative electrical organizations have done in different cities and what things they can and ought to do. Under the leadership of different chairmen the story of the leagues was drawn out and certain basic facts were clearly pictured. For instance, there are six different activities in which local electrical leagues have profitably engaged and can profitably engage. And there are at least eleven very definite problems of policy which all leagues must face on organization and should settle with a full knowledge of contemporary experience.

Scope of League Work

The opportunities for useful service to the local electrical family lie along the lines of (1) social activities, such as electrical club rooms, luncheons and meetings, where addresses are made on helpful subjects; (2) coordinated publicity, such as co-operative electrical pages in the newspapers and other advertising; (3) co-operative educational demonstrations and exhibitions, such as electric homes and electric shows; (4) advisory service to home builders and architects, to assist in laying out wiring plans and in raising the standards of electrical equipment; (5) co-operative demonstrations and service in the specific promotion of residence, commercial or industrial illumination, electric power, or vehicles or any other application, and (6) work for harmony among local electrical men, assisting in the adjustment of disputes and the development of closer co-operation and better understanding.

It developed that different leagues in different cities have begun their work in different ways. Some start as lunch clubs, some by organizing co-operative pages in the newspapers, some with a "home electric" or a show. Some devote most of their attention to harmony work. Local conditions have directed their steps. Most of the leagues are only doing two or three things, but it is agreed that all of them could work along all six of these lines and that such co-operative effort could be organized in every city to the great advancement of the industry and the great profit of the local men.

But there are problems to be faced and carried through: (1) Should there be a permanent headquarters? (2) Should a paid secretary be employed? (3) How heavy should the dues be? (4) What kind of speakers should be featured at meetings? (5) How should the expense of league activities be apportioned among the different classes of electrical men? (6) What should be done when the central-station company is unprogressive in lamp policy and merchandising methods? (7) How about non-electric store competition? (8) When there are two antagonistic associations in a town, what should be done? (9) How can bad union conditions be improved? (10) How can the outlying suburban communities be tied into co-operative work?

These questions were all raised at the meetings and discussed. It was shown that some leagues have impoverished themselves with too heavy headquarters expense, and some have failed to function because of lack of organization. Some cities were seen to be practically deadlocked because two groups are contending for leadership. In other towns fine work is being done and far-reaching progress made because their policies are right.

I won't attempt to give the answers here. The abstracted minutes of the conference will be soon published by the society and will tell the story. Enough to say that these men went away pledged to active help in the development of the best possible plan for organizing and financing a local league, and the society was indorsed as the headquarters for league activity to carry on the work of developing more leagues and serving them. Every man present—contractor, dealer, jobber and manufacturer—agreed that the further upbuilding of the electrical industry must rest on the work of local men in the towns and cities and that the central station occupies a naturally dominant position and must give generous leadership and co-operation if local development is to measure up to the waiting opportunity in any creditable degree.

The Buffalo Meeting

So much for the league meeting. These were men come from the towns where they are working to talk about what to do. In Buffalo the industry has just seen the other side of the picture—the most encouraging practical demonstration of how to do it in a big way that has ever been recorded, I believe. For to bring this message home to the electrical men of western New York State and crystallize this opportunity through the great section served by hydro-electric power from Niagara Falls, more than six hundred dealers, contractors, central-station men, jobbers and manufacturers from nearly one hundred communities were in session for two days, trying to get a clearer plan of how to build up business now in western New York.

W. F. Robertson of the Robertson-Cataract Electric Company fathered the project by inviting eighteen men to take lunch with him one day. They all came. They represented these organizations: Niagara Falls Power Company, Buffalo General Electric Company, Niagara, Lockport & Ontario Power Company, Tonawanda Power Company, Niagara Electric Service Corporation, General Electric Company, Westinghouse Electric & Manufacturing Company, Western Electric Company, McCarthy Brothers & Ford, H. I. Sackett Electric Company, Lloyd A. Wooley, Inc., and the Electric Club of Buffalo.

He outlined to them his idea of bringing all the electrical men of western New York State together to meet each other and receive a clear picture of the immediate business opportunity and how to develop it. He suggested a two-day conference and ten thousand dollars to finance it. The plans were formed and the money was pledged right there at the luncheon. The power companies and the transmission company recognized that if the local electrical men of the various communities to which their power flows can be helped to a fuller prosperity, they will benefit with them. The Buffalo jobbers and manufacturers realized that their own market would be increased likewise. They were willing to spend the money. So the invitations went out and everybody came to the party.

Meetings were held two mornings and one afternoon at one of the hotels. There was a banquet with fine singing and good speeches, also a Dutch supper on the roof of the Niagara Falls power station overlooking the rapids below the Falls, followed by a smoker and boxing bouts. There were visits to the Buffalo General Electric steam station and an inspection of the great 36-ft. hydraulic tunnel now nearing completion through solid rock under the city, to lead water to the new station. Everything was paid for by the hosts except your room and your breakfast. Everybody had a good time and showed it.

THESE SNAPSHOTS FROM THE CONFERENCE OF LOCAL ELECTRICAL LEAGUES TAKEN AT ASSOCIATION ISLAND SHOW SOMETHING OF THE NATURE OF THE PARTY

But it was the meetings that impressed you most. During most of the first session more than a hundred men stood silently at the back of the hall. The crowd stuck to the end of each meeting, interested and attentive. The number of new faces was striking to any one who has been about to electrical conventions a good deal. They were for the most part men of small towns who have small organizations and are busy at home and do not go to meetings. They were not conference-weary. They were eager to get advice and new ideas.

The program was well thought out. It opened with a picture of the present and future market. Then three men of three financing companies told how the local man can arrange the financing of wiring and appliance sales on deferred payments. Then two men talked on advertising. Then there were two talks on wiring with a two-act play that told the story of the value of adequate wiring and how the contractor can sell it. Then came talks and demonstrations that covered industrial power, presented by five men, appliances, discussed by three men, and lighting, about which three men talked.

The plan was to picture to these men of western New York the fullness of the opportunity in their own towns. Piece upon piece this picture was put together by men who stand before the industry as knowing these subjects and in position to give counsel. There was implanted in them a new conception of the work which they can do for the electrical industry and for themselves, and of the community of interest between the electrical men of that section of country linked together by that great distribution system.

How do I know that this is so? Well, the Robertson-Cataract company held a conference of its salesmen on the day after, to line up its organization, and sent the men out into the field to see what the result had been and how they could individually serve in putting the idea into action locally. They report throughout the section a keen purpose to go forward and develop business in every direction *now*, and a very large number of letters have come back to Buffalo saying, "Don't worry about the value of the conference. It is going to pay us all, because we are going to work to make it pay here in this town and so in other places." And many men have said that this western New York State group must get together periodically and plan its work.

From the league conference up on Association Island has come the same reaction. Already several cities have sent word that they are organizing leagues, or clubs or electrical boards of trade, for co-operative development work.

It shows, I believe, a new trend of commercial thinking among electrical men. We are beginning to come down to earth and realize that we cannot develop our industry by sending up balloons and shooting rockets and flying flags in national campaigns full of fine plans for what somebody else should do.

What we need is work, steady, persistent, creative, harmonious work, at home by the men of every town, that we may wire more houses and sell more motors and more good lighting and more appliances. For it is in the individual homes, stores, offices and factories along the individual streets of individual towns that the separate sales must be made and the separate jobs done out of which electrical development must be built up. And all this work must be done not by national associations or committees, but by all kinds of electrical men working singly and in co-operating groups in these communities.

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Electrical Characteristics of Steel and Iron Wire

Tests Conducted on Samples of Steel and Iron Strand and Wire Which Are Available for Use as Electrical Conductors Provide Useful Data for the Purposes of the Designer

TESTS on steel strand and galvanized-iron wire were recently carried out at the Electrical Testing Laboratories of New York City for the Indiana Steel & Wire Company to determine (a) the continuous-current resistance and resistivity, (b) the temperature co-efficient of resistance, (c) the alternating-current resistance at 25 cycles and 60 cycles, and (d) the alternating-current inductance at 25 and 60 cycles. A considerable portion of the data obtained follows here.* The alternating-current measurements were made by a Wheatstone bridge method, with the wire suspended in the air in the form of a long and narrow rectangular loop of constant and known dimensions. The resistance and total inductance of the loop were determined in terms of known standard resistors and inductors. The average length of the test loops was approximately 115 ft. (35 m.) and the width 30 in. (75 cm.). The loop was broken in the center for the introduction of test current, and the ends of the wire were dipped in mercury pools for connection to the bridge network.

The results of the tests are given in Table II, which contains the true direct-current resistance, effective alternating-current resistance, skin-effect resistance ratio, internal inductance ratio at unit permeability, effective internal inductance and the internal inductance ratio for all of the samples tested at 25 cycles and 60 cycles. Each value of resistance given in the tables corresponds to the final temperature which the conductor would reach, with the stated value of current, when the air temperature is 20 deg. C. In making the tests the various values of alternating current were maintained until the resistance of the loop had attained final value. Table I, which gives the temperature rise of various wires above air temperature in degrees Centigrade, shows opposite characteristics in ½-in. Siemens-Martin and No. 6 B.W.G. wire.

Comparison between three different grades of ⅜-in. strand (9.5-mm.) is afforded by Fig. 1. The skin-effect resistance ratios in the high-strength and Siemens-Martin strand are of a nominal order and increase but slightly with the current density. (Fig. 2.) The internal-inductance ratios are of relatively small magnitude. The samples evidently had the low magnetic permeability characteristic of medium-hard steel. The sample of standard grade shows pronounced skin effect increasing rapidly with increase of current and much higher internal-inductance ratios, indicating considerably softer steel than the other two samples. Owing to the differences it becomes a question in any specific case which grade of steel should be selected to obtain the smallest permissible conductor from the electrical standpoint. Fig. 1, comparing the actual effective re-

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*These data are abstracted from a report made by Frank F. Fowle, consulting engineer of Chicago, and copyrighted by the Indiana Steel & Wire Company.

TABLE I—TEMPERATURE RISE (DEG. C.) OF VARIOUS SAMPLES ABOVE AIR TEMPERATURE AT DIFFERENT CURRENTS

	Total Circ. mils in Conductor	Ratio of Resistivity to International Annealed Copper Standard (Per Cent)	Ratio of Conductivity to International Annealed Copper Standard (Per Cent)	Resistance Temp. Coefficient per Deg. C. from and at 20 Deg. C.	Current Density at 10 Amperes (Amp. per sq.in.)	Test Frequency	Current in Amperes 5	10	15	20	25
⅜-in. high-strength strand	99,960	10.34	9.67	0.00338	127.4	60	0.2	0.6	1.8	3.0	4.6
						25	0.2	0.8	1.6		
½-in. Siemens-Martin strand..	177,600	10.87	9.20	0.00333	71.67	60	0.2	0.8	1.2	1.8	2.8
						25	0.2	0.8	1.2	1.8	3.0
⅜-in. Siemens-Martin strand	99,960	10.03	9.97	0.00348	127.4	60	0.4	1.4	2.4	4.6	6.6
						25	0.4	1.6	3.0	4.4	6.4
¼-in. Siemens-Martin strand	46,900	10.41	9.61	0.00309	271.5	60	0.6	2.8	5.4	11.8	17.8
						25	0.6	3.2	7.4	12.6	18.2
⅜-in. standard strand	109,400	6.73	14.85	0.00570	116.4	60	0.2	1.0	2.0	2.6	5.0
						25	0.2	1.2	2.0	3.0	5.6
3-ply No. 8 B.W.G. twisted guy wire	78,930	7.66	13.05	0.00445	161.3	60	0.2	1.0	2.6	5.8	9.2
						25	0.2	1.0	3.6	5.4	8.6
No. 6 B.W.G. "BB" telephone and telegraph wire	40,800	6.59	15.18	0.00496	312.0	60	0.2	2.8	7.4	13.2	22.8
						25	0.2	2.6	6.6	10.6	18.4

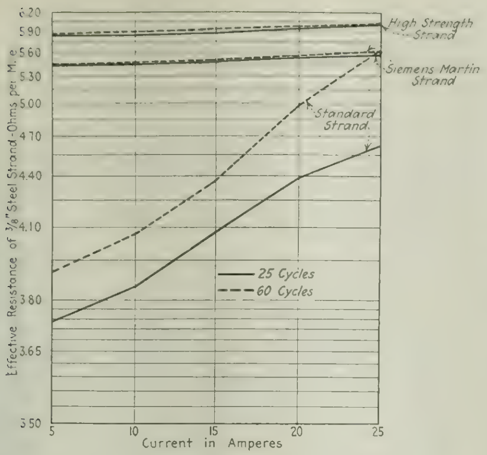

FIG. 1—EFFECTIVE RESISTANCE OF THREE SAMPLES OF IRON WIRE AT 5 AMP. TO 25 AMP.

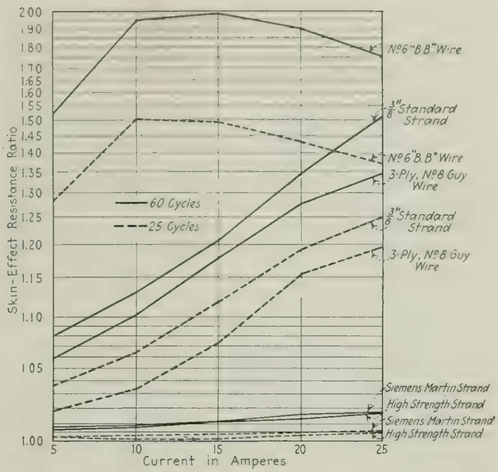

FIG. 2—SKIN-EFFECT RESISTANCE RATIOS OF SEVERAL SAMPLES OF IRON WIRE AT DIFFERENT CURRENT DENSITIES

sistances of the samples, makes this clearer. From this graph it appears that the standard sample has a lower effective alternating-current resistance at 60 cycles up to 25 amp., but for larger currents it is probable that the Siemens-Martin sample would have the lower resistance. At 25 cycles the standard sample shows a lower resistance in every case, although there seems to be a tendency to approach the same resistance at some larger value of current. In every case the internal reactance of the standard sample is several times larger than that of the other two.

The comparisons set up in Fig. 2 show certain characteristic differences, noticeable particularly in the case of BB wire. The skin-effect resistance ratio, making allowance for differences in density at equal values of current, and the internal-inductance ratios are least in the guy wire and maximum in the BB wire, indicating that the degree of hardness is greatest in the guy wire and least in the BB, with the standard strand intermediate. An effect noted only in the BB wire is the decrease of skin-effect resistance ratio and internal-inductance ratio after current values exceed approximately 15 amp. While there might be some question in a particular case whether guy wire or standard strand would be the better, it seems evident that both are superior to BB wire. By applying skin-effect resistance factors to the values of volume resistivity, it seems that BB wire is inferior to Siemens-Martin steel at 60 cycles with equal current densities. At 25 cycles the reverse is probably true.

While no specific investigation of wave distortion was made, it is proper to point out that such distortion will always occur in some degree with iron and steel conductors, being most pronounced with wires of high permeability. All tests were made under conditions

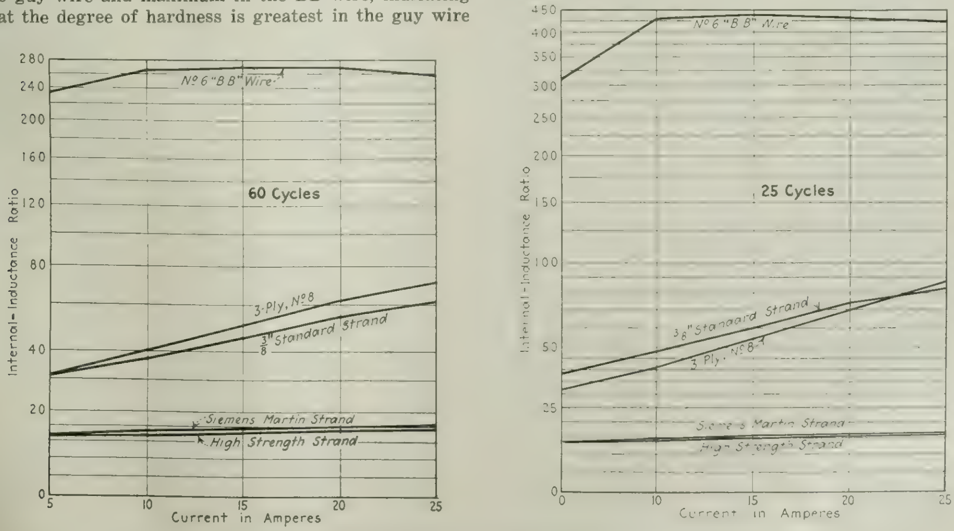

FIG. 3—INTERNAL-INDUCTANCE RATIOS OF FIVE GRADES OF STEEL STRAND

precluding any effect of harmonics that might be circulating in the loops on the test results. The measurements with alternating current were all made with current having a sine-wave shape.

As to possible use of the data it may be pointed out that steel conductors can be used to advantage for lines of short or moderate length where the minimum size of conductor is fixed by corona discharge and the line resistance is a secondary consideration, and for high-tension lines of short or medium length transmitting moderate amounts of energy, such that the line drop and the line loss fall within permissible limits, as, for example, in the case of branch or tap lines of high-tension networks. Other uses are for short lines delivering small amounts of energy at the primary voltages customary in urban and rural distribution, such that the drop and the loss are not excessive, and for long or unusually severe spans requiring greater tensile strength and factor of safety than can be obtained with copper or aluminum. In selecting steel conductors for alternating-current transmission or distribution lines the choice of the harder grades of material will insure minimum skin effect and internal reactance and maximum tensile strength.

TABLE II—SOME ELECTRICAL CHARACTERISTICS OF FIVE TYPES OF STEEL WIRE

Kind of Strand and Frequency	Current (Amp.)	True (D.-C.) Resistance (Ohms per 1,000 Ft.)	Effective (A.-C. Resistance)		Skin Effect Resistance Ratio	True Internal Inductance at Unit Permeability in Millihenries per 1,000 Ft.	Effective Internal Inductance		Internal Inductance Ratio
			Ohms per 1,000 Ft.	Ohms per Mile			Millihenries per 1,000 Ft	Millihenries per Mile	
⅜-in. high-strength steel (single-conductor), 60 cycles	5	1.106	1.112	5.871	1.006	0.01956	0.2565	1.354	13.11
	10	1.106	1.116	5.892	1.007	0.01956	0.2690	1.420	13.75
	15	1.112	1.124	5.935	1.011	0.01956	0.2795	1.476	14.29
	20	1.118	1.132	5.977	1.013	0.01956	0.2920	1.542	14.91
	25	1.124	1.142	6.030	1.016	0.01956	0.3050	1.610	15.59
⅜-in. high-strength steel (single-conductor), 25 cycles	5	1.102	1.105	5.834	1.002	0.01956	0.2580	1.362	13.19
	10	1.105	1.106	5.840	1.001	0.01956	0.2700	1.426	13.80
	15	1.109	1.110	5.861	1.001	0.01956	0.2830	1.494	14.47
	20	1.121	1.124	5.935	1.003	0.01956	0.2960	1.563	15.13
	25	1.129	1.135	5.993	1.005	0.01956	0.3115	1.645	15.92
½-in. Siemens-Martin steel (single-conductor), 60 cycles	5	0.637	0.644	3.400	1.012	0.01956	0.2690	1.420	13.75
	10	0.639	0.648	3.421	1.014	0.01956	0.2805	1.481	14.34
	15	0.640	0.649	3.427	1.015	0.01956	0.2880	1.521	14.72
	20	0.644	0.652	3.443	1.019	0.01956	0.2960	1.563	15.13
	25	0.644	0.658	3.474	1.021	0.01956	0.3085	1.629	15.77
½-in. Siemens-Martin steel (single-conductor), 25 cycles	5	0.636	0.639	3.374	1.004	0.01956	0.2785	1.470	14.24
	10	0.637	0.640	3.379	1.005	0.01956	0.2830	1.494	14.47
	15	0.639	0.642	3.390	1.006	0.01956	0.2940	1.552	15.03
	20	0.640	0.644	3.400	1.007	0.01956	0.3035	1.602	15.51
	25	0.642	0.646	3.411	1.007	0.01956	0.3140	1.658	16.05
⅜-in. Siemens-Martin steel (single-conductor), 60 cycles	5	1.022	1.031	5.444	1.008	0.01956	0.2650	1.399	13.55
	10	1.025	1.035	5.465	1.009	0.01956	0.2820	1.489	14.41
	15	1.030	1.040	5.491	1.011	0.01956	0.2985	1.576	15.26
	20	1.035	1.051	5.549	1.016	0.01956	0.3130	1.653	16.00
	25	1.046	1.065	5.623	1.017	0.01956	0.3270	1.727	16.71
⅜-in. Siemens-Martin steel (single-conductor), 25 cycles	5	1.024	1.027	5.423	1.002	0.01956	0.2645	1.397	13.52
	10	1.027	1.029	5.433	1.003	0.01956	0.2840	1.500	14.52
	15	1.033	1.036	5.470	1.004	0.01956	0.3000	1.584	15.33
	20	1.039	1.044	5.512	1.005	0.01956	0.3150	1.663	16.10
	25	1.048	1.054	5.565	1.006	0.01956	0.3280	1.732	16.77
¼-in. Siemens-Martin steel (single-conductor), 60 cycles	5	2.315	2.320	12.25	1.002	0.01956	0.2765	1.460	14.13
	10	2.335	2.345	12.38	1.003	0.01956	0.2895	1.529	14.80
	15	2.360	2.375	12.54	1.006	0.01956	0.3120	1.647	15.95
	20	2.400	2.415	12.75	1.008	0.01956	0.3260	1.721	16.66
	25	2.445	2.470	13.04	1.009	0.01956	0.3505	1.851	17.92
¼-in. Siemens-Martin steel (single-conductor), 25 cycles	5	2.305	2.310	12.20	1.001	0.01956	0.2780	1.468	14.21
	10	2.330	2.330	12.30	1.001	0.01956	0.2920	1.542	14.92
	15	2.365	2.370	12.51	1.002	0.01956	0.3115	1.645	15.92
	20	2.405	2.410	12.72	1.003	0.01956	0.3280	1.732	16.77
	25	2.450	2.465	13.02	1.006	0.01956	0.3560	1.880	18.20
⅜-in. standard steel (single-conductor), 60 cycles	5	0.686	0.741	3.912	1.080	0.01956	0.614	3.242	31.38
	10	0.686	0.771	4.071	1.130	0.01956	0.743	3.923	37.98
	15	0.686	0.827	4.367	1.207	0.01956	0.889	4.694	45.44
	20	0.696	0.943	4.979	1.346	0.01956	1.067	5.634	54.52
	25	0.707	1.067	5.634	1.512	0.01956	1.198	6.325	61.34
⅜-in. standard steel (single-conductor), 25 cycles	5	0.681	0.707	3.733	1.036	0.01956	0.738	3.897	37.72
	10	0.684	0.728	3.844	1.064	0.01956	0.932	4.921	47.64
	15	0.690	0.771	4.071	1.117	0.01956	1.172	6.188	59.90
	20	0.698	0.830	4.382	1.191	0.01956	1.433	7.566	73.25
	25	0.700	0.875	4.620	1.250	0.01956	1.618	8.543	82.70
Three-ply No. 8 B. W. G. twisted guy wire (single-conductor), 60 cycles	5	1.026	1.086	5.734	1.059	0.02371	0.751	3.965	31.67
	10	1.030	1.134	5.987	1.102	0.02371	0.951	5.020	40.11
	15	1.036	1.217	6.426	1.179	0.02371	1.198	6.325	50.52
	20	1.052	1.343	7.091	1.275	0.02371	1.476	7.793	62.25
	25	1.067	1.435	7.577	1.345	0.02371	1.706	9.008	71.95
Three-ply No. 8 B. W. G. twisted guy wire (single-conductor), 25 cycles	5	1.024	1.044	5.512	1.018	0.02371	0.745	3.934	31.42
	10	1.028	1.063	5.613	1.034	0.02371	0.951	5.020	40.11
	15	1.040	1.115	5.887	1.073	0.02371	1.286	6.790	54.24
	20	1.045	1.205	6.362	1.152	0.02371	1.649	8.707	69.54
	25	1.062	1.270	6.706	1.195	0.02371	2.045	10.800	86.24
No. 6 B. W. G. "BB." telephone and telegraph wire (single-conductor), 60 cycles	5	1.670	2.540	13.41	1.525	0.01525	3.585	18.93	235.1
	10	1.675	3.260	17.21	1.950	0.01525	4.035	21.30	264.7
	15	1.695	3.375	17.82	1.990	0.01525	4.125	21.78	270.6
	20	1.750	3.325	17.56	1.900	0.01525	4.100	21.65	268.9
	25	1.840	3.220	17.00	1.760	0.01525	3.920	20.70	257.1
No. 6 B. W. G. "BB." telephone and telegraph wire (single-conductor), 25 cycles	5	1.670	2.140	11.30	1.281	0.01525	4.735	25.00	310.6
	10	1.695	2.550	13.46	1.508	0.01525	6.555	34.61	429.9
	15	1.720	2.570	13.57	1.494	0.01525	6.675	35.24	437.8
	20	1.755	2.515	13.28	1.433	0.01525	6.595	34.82	432.6
	25	1.820	2.495	13.17	1.373	0.01525	6.450	34.06	423.1

Threatened State Control of Water Powers[*]

Present Attempts to Authorize State Ownership of Water Powers Are Made Directly in the Face of Earlier Experiences of the States Which Resulted in Existing Constitutional Prohibitions Against Such Use of Public Credit

By PRESTON S. ARKWRIGHT
President Georgia Railway & Power Company, Atlanta, Ga.

THE first electric light I ever saw was exhibited in a circus, and they showed it, in connection with other wild animals that had been subdued and tamed by man, as a curiosity. Soon after that in the town where I lived a few individuals got together and formed a company, got up a crude central station and put some arc lights on towers high up in the sky, to shine in the night when the moon was not shining. The developments in the electrical industry have been big and fast since the old days, but these developments have not been brought about by governments, or by states, or by municipalities, or by socialists, or by communists, or by any other organization for the betterment of mankind. They have been brought to pass by the ingenuity, initiative and courage of individuals, and there has been no other industry that has shown the marvelous growth that the electrical industry has displayed.

There were a great many difficulties in the early days in the starting of this business. Nobody heralded us with any voice of acclaim when we started the business, nobody has fondled the electrical industry since it started; on the contrary, it seems to me, it has been necessary to fight almost every step of the way. But we have had constant reduction in price, constant improvements in service, constant improvements in the devices with which electricity is used, and practically all the benefits of economies and efficiencies in improved devices for the utilization of electrical energy have gone to the consumer.

INITIATIVE HAS DEVELOPED THE WATER POWERS

We have passed beyond the confines of the municipality and are hearing very little of the proposition for municipal ownership of electric light and power plants. We have reached the point where the electric light is not the only important factor in our work, for the greatest proportion of our output at the present time is used not for lighting purposes but for power purposes. The electric light industry brought to the fingertips of the people the energy which had been deposited in coal during the ages, and brought them a service on tiptoe to answer their summons for every known work or use that they could call this power to perform for them.

Among other things that the electrical industry is responsible for is the development of the usefulness of the water powers, those rivers which we hear so much about nowadays, which have been running to waste during the centuries and would have continued to run to waste through all eternity but for the development of the electrical industry, thus enabling us to bring the energy produced by these water powers to the centers of population.

It has not been very many years that it has been possible to transmit electrical energy developed from the water powers to the far-scattered centers of population, and yet we are having today a constant agitation in several sections of the country with regard to municipal ownership or state ownership of the water powers. The question has been agitated in New York every year since 1912, and yet New York stands first among all the states of the Union in the development of water power. It has been agitated in Maine year after year and defeated each year in the Legislature of Maine, and yet the State of Maine stands fourth in the development of water powers in the United States. It has been agitated for eight years in Idaho and defeated each time before the Legislature of Idaho, yet, in 1920, the first recognition that state ownership of water powers has gained in any of the states where it has been agitated was brought about by the insertion of a clause in the Constitution of the State of Idaho permitting the state to use its own resources to promote or develop the use of water powers.

State ownership of water powers has been agitated in the State of Georgia for the last four years. A bill was first introduced in the Legislature of 1919. It was defeated in committee. It was again introduced in the year 1920. It then received a majority vote of the committee. It was introduced again, but was defeated in committee, in the year 1921. It was introduced again in the year 1922 and defeated by a vote of thirty to one.

It has been proposed in the State of California year after year in the Legislature and defeated each and every time, and now we have in California a measure submitting to a vote of the people the amendment of the constitution and the creation of a water and power commission for the state ownership of water powers. California stands second among all the states in the Union in the development of water powers electrically and exceedingly low in the scale of rates charged.

In Nebraska the subject of the control of water powers has been agitated for some time, but it has never got beyond the stage of agitation in that state. It was suggested that a provision for state ownership of the water powers in Nebraska be inserted in a new state constitution, but it was defeated. The same thing has been proposed in Michigan for a great number of years, brought before the successive legislatures and defeated each time.

POPULAR IMAGINATION, NOT INTELLIGENCE, APPEALED TO

There is a lot of imagination and romance about this water-power business. A sample of the arguments used by advocates of state ownership in Georgia—and the same arguments are used elsewhere—is that there is enough power in the State of Georgia to light the homes, cook the food, run the dairies, saw the wood, pump the water, heat the homes, thresh the grain, gin the cotton, turn the wheels of every vehicle, run all the trolleys, and run all the trains in the state, bringing the people from darkness into light and lifting the drudgery from their shoulders. They never dreamed that it would take a billion dollars to do it—and it never could be done even if they had the billion dollars. They contend that the water powers have not been developed simply because there are undeveloped water powers. Surely that claim cannot be made in the State of California, where more progress in the development of water powers is going on than in any other state in this whole nation. It cannot be made as to the United States in general, because, although there is in North America only 15 per cent of the potential water power on the globe, there has been more water-power development, in capacity, in North America than in all the rest of the world combined. The development of the United States alone is 41 per cent of the total development of all the water powers in all the wide world, and this development has been brought about by individuals, at their own risk, on business principles, and not as a political scheme.

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[*] Abstract of an address delivered at the convention of the Association of Edison Illuminating Companies, White Sulphur Springs, W. Va., Oct. 10-14, 1922.

The agitation for state ownership of water powers has not sprung up in the states that are lagging in this development, but it has been greatest in the states where the development has been the greatest and the most progressive.

Use of State Credit an Old Story

It is not the first time that efforts have been made to use the credit of the state for improvements of this character. In the early thirties some of the states were greatly interested in the building of railroads. Now, while we claim that an abundance of cheap power is of vast importance to the territory and the people within it, I think we will admit that the question of transportation is of even greater importance to the progress of the country. So, in order to obtain railroads many of the states of the Union built railroads themselves. Originally there were no limitations in the constitutions of any of the states regarding the creating of a debt by the state, and it was held that the state had a right to do that in the absence of a prohibition.

So a great many of the states, in order to obtain railroads, built railroads themselves. It was a disastrous proposition for them. In some cases they finally sold the roads and in other cases leased the roads which the state had built at a very substantial financial loss.

The State of Georgia itself built a railroad from Atlanta to Chattanooga, a distance of about 132 miles, and tried to operate it by appointed officers. They could not operate it, and so they leased it to a company composed of individuals, and this company operated it successfully.

In addition to the building of railroads by state's credit, they loaned the credit of the states to many private corporations to induce building of railroads. These had the power to create debts, and the legislatures of all the states of the Union went wild piling up debt on debt. It is the same old story of spending somebody else's money, and they spent it with both hands, until the states of the Union were burdened with such an expense that eleven of them at one time or another repudiated these debts incurred on the faith and credit of the state itself.

So, out of that situation grew amendments to the constitutions or new constitutions. This movement included practically every state in the United States with the exception of Connecticut, Vermont, New Hampshire and Massachusetts, so that most of the constitutions of the states today provide that no debt shall be incurred by the state except to pay existing debts, to suppress insurrection, repel invasion, or defend the state in time of war. Thus nothing can be financed with the state's money. No matter how important the project may seem to be, no matter what the demand of the agitators may be, no matter what the desires of uninformed voters may be, the state's money and the state's credit shall not be used for any matter whatever except of a strictly governmental character.

Now, we have passed beyond the days of building railroads—we have found other game. It is not these little electric light companies that only furnish light over a comparatively small area, but the great power companies which serve widely extended areas, and we want to do for them exactly what the constitution, on account of the experience had with the building of railroads and other internal improvements, made it impossible ever to do again. So that the advocates of every one of these suggested laws in all of the states have proposed amendments to the constitution. They want to do exactly what formerly got the states into trouble, but in order to do it they must remove the precaution that was put into the constitution to prevent a recurrence of that very trouble, and thus every one of these propositions involves an amendment to the constitution of the state.

These agitations are not made by people who are interested in using power. In not a single one of the states where the matter has been agitated has it been sponsored by a power user or by any other considerable element of the population. It has been done by politicians, by some one who might have a particular grudge against a particular company, and by people who believe in the socialistic doctrine. That is true in our state, and it is certainly true in California, and my information is that it is true in all of the other states.

One of the arguments used most frequently with reference to the installation of water powers by the state is to point to the Ontario Hydro-Electric Commission. But the situation of Ontario is misrepresented in all of these states. I want to call your attention to how the expense rose. They started up in Ontario with seven towns lying near to Niagara Falls—they estimated they could develop the water power at Niagara Falls so as to deliver it at a cost of $4.95 per horsepower per year. Instead of what they estimated, it was $9.40 per horsepower per year, and while last year there was distributed 337,000 hp., the commission had itself developed only 46,000 hp., and of this 46,000 hp. which the commission had developed, it had actually only constructed the generative stations for 11,500 hp., the rest of it being simply additions in the form of stations which the commission had taken over and which had been built on individual initiative and enterprise.

They have spent on the project something like $175,000,000 or $200,000,000. Now, having got the water powers and involved the municipalities and the province in a debt of $200,000,000, they want to build electric railways and hydro-radials, at an estimated cost of $100,000,000 more. There is no limit to the ambitions of people in political office, with the unlimited credit of the state or government behind them, and they will spend money hand over fist, so that they may say, "We have the biggest water-power development," or "the longest miles of transmission line," or "the greatest railway mileage," etc.

The question regarding prices for electricity generated by waterpower are misleading in the form in which they are generally stated. I want to call your attention to the fact that they have in Toronto, so far as I know, the lowest rate for residential lighting in North America, a maximum of 2.5 cents per kilowatt-hour. You know and I know that is below cost. You know and I know that if the energy costs nothing you cannot deliver it at any such rate. But it is done intentionally and it is done deliberately, because it serves to interest directly the greatest number of voters, and it is the argument that is used in the United States with the greatest possible effect.

In our city we furnish residential lighting at a maximum of 8 cents, and I suppose that, taking the country as a whole, the average would be something like 7 cents as a maximum rate. The comparison is made in various parts of the country between that rate and the 2.5-cent rate in Toronto. You can get up statistics and data about the average rate and show that the average rate received in Buffalo, or Montreal, or Quebec, or the average rate received in California, is much less than the average rate of the Ontario Hydro-Electric Commission, but the ordinary voter and householder cannot see beyond the difference in his residential lighting rate.

No Real Reason for State Ownership

For my own part, there is less reason for government ownership of water powers than for almost anything else I know of. The water powers were not designed by God for lighting purposes—they were designed by Nature for power uses. And unless you can get the power loads they will not justify their development; unless you can get power loads from customers with a good demand, water-power development of considerable size can hardly be undertaken. And that business is strictly competitive.

I do not think that any of these agitations for state ownership of water power will succeed. They have never made any headway in Georgia. They have made very little headway in any of these other states, and my opinion is that the proposition will be defeated in November in California. The agitation will tend constantly to recur; but I hope that its decided defeat by a vote of the people of California may help to silence it in all the other states.

Don't you think for one minute that what these people want is to develop more water power by the state—they want to drive out private ownership and individual initiative, and to do that is a dangerous thing. Sir Adam Beck, chairman of the Ontario Hydro-Electric Commission, in his testimony before the United States Congress in 1918, said that the ultimate aim of the plan is the elimination of the private or independent companies. At that time they had bought out eighty private companies, and since then I think that they have bought them all out.

One of his associates visited Georgia during this agitation, and he said that they believed in the monopoly of the power business and their aim was to place these monopolies in the hands of the government. The man who led the agitation in Georgia, particularly against us, against our interests, stated on one occasion that if this business had to be in private hands, he would rather that it should be in the hands of the people in whose hands it then was in Georgia than in anybody else's hands, but that they were violently opposed to private ownership. So it is not a proposition to develop additional water power. The agitation is born of a prejudice against individual reward for individual energy, enterprise, initiative and effort.

It is contrary to the very principles on which we have carried forward the administration of this country since its formation. It is a substitution of socialistic ownership for individual company rights—and don't think that it ends with water powers. If this movement succeeds in the case of water powers, it is simply the beginning of the suffocation of enterprise and the death knell to prosperity in this country.

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Development of Incandescent Lamp for Street Lighting

By A. D. Cameron
Supply Department General Electric Company

The commercial introduction of the incandescent lamp was started in 1880, current being distributed by a constant-potential, multiple system of wiring. The series system was being successfully used for street lighting with the carbon open-arc lamp, and as a demand came for a smaller street-lighting unit a series incandescent lamp was developed. The first lamps made were for about 1¾ amp. and in two sizes, 16-cp. and 32-cp. A special high-voltage direct-current dynamo was developed, generating about 500 volts, and the lamps were burned in series on this voltage, this being known as the "Municipal" system.

Series open-arc lamps were designed to operate at about 10 amp. It was not possible to make a good incandescent lamp for this high current as it required too thick and short a carbon filament. Later, when the series inclosed-arc lamp was developed for 6.6 amp. and 7.5 amp., a few carbon incandescent lamps were made to operate on these circuits, but they were not entirely successful. By this time larger sizes of lamps were being used, so that incandescent lamps of 16, 20, 25, 32, 40 and 50 cp. were available.

About 1905 the "Gem" series incandescent lamp became available. This had a metallized carbon filament and was 25 per cent more efficient than the previous carbon lamp. It was made in the same sizes, but was soon supplanted by the tungsten-filament lamp, which appeared in the latter part of 1907. This lamp was four times as efficient as the carbon lamp and soon drove the carbon and "Gem" series lamps out of the market. Tungsten-filament series lamps could be made for the higher amperages, and soon the 6.6-amp. became the standard series circuit with these lamps. They could also be made in even larger sizes, up to 400 cp., and were much more efficient than the inclosed carbon arc lamp, which gave only about 200 cp. and which, therefore, soon disappeared from use.

About 1913 the "Mazda C" lamp, with its tungsten filament operating in an inert gas, was put on the market, it being 50 per cent more efficient than the vacuum lamp. This made it economically possible to make even larger sizes, 600-cp. and 1,000-cp. and later 1,500 cp. and 2,500 cp.

Even further progress must be made to satisfy the demands of the people for brighter, lighter streets.

The Cost of Electric Service

A Method of Analyzing the Costs of Central-Station Service to the Consumer Devised by an Iowa Company—The Plan, Based on Regular Accounting System, Reduces Book Accounts to Unit Consumer, Capacity and Energy Costs

By W. J. GREENE, C. F. SCHOONMAKER and C. B. GORTON

THE cost of service to the various classes of consumers of an electric light and power system has been a debated question on which different authorities making an analysis of the same property are quite likely to disagree. Frequently the disagreements will exhibit serious differences. This is due largely to the fact that no method generally accepted for utility cost allocation has been developed. A large amount of effort in this direction has been expended in the industrial field, and in the modern quantity-production factory very accurate methods of determining costs have been developed and the executives in charge know at all times where any department, or the business as a whole, stands. There seems to be no logical reason why the same thing cannot be done for any utility if a careful study of the conditions is made, the proper plan of handling the records developed and cost allocation made a matter of routine accounting.

A PLAN DEVELOPED

Several years ago the Iowa Railway & Light Company made an agreement with a large consumer to supply high-pressure steam and electrical energy on a cost-plus basis. This required a plan of accurately determining and allocating the costs of steam and electric service each month. The method adopted proved so satisfactory that it has been developed and extended to cover all classes of consumers supplied by the company. The territory served by the company covers a large portion of the central part of Iowa from east to west, service being given to towns and cities the largest of which is Cedar Rapids with a population of 45,556. The majority of the towns are small, and the problems involved in the distribution of costs are typical of those encountered on any widespread transmission and distribution system. In some ways there are more complications than are to be found on many systems as central-station heating is supplied from some of the plants, making an additional complication in cost allocation.

In describing the method the term "cost" is used to cover all costs, including operating expenses, taxes, depreciation and amortization. To these is added a factor termed "money costs." This term is used in place of the term "interest," and the term "money rate" in place of "interest rate." The usual method of handling money costs is to treat them as the return on the fair value of the property. It is believed that any statement of costs that is correct must include all the above items. These items are therefore included in the costs that are allocated by routine cost accounting.

The foundation of the manual for the determination of unit costs developed by the Iowa Railway & Light Company is the uniform system of accounts for electric corporations recommended for adoption by state commissions at the annual meeting of the National Association of Railway and Utilities Comissioners in Washington, Nov. 12, 1920. For purposes of cost accounting this system of accounts is not entirely satisfactory. Some of the fixed capital and operating expense accounts do not represent natural divisions from the standpoint of the use of the property, materials and supplies, and labor. An ideal classification would be one in which each division or subdivision could be used in the cost accounting without further subdivision. However, by providing certain sub-accounts or by keeping details of certain accounts, the classification referred to, or any other classification by a proper reconstruction of the reference numbers, will give the desired results.

The ratios developed for the allocation of the major portion of the costs are based on data established within accuracy of the meters and the records of the consumers. It has been necessary to develop a few ratios based on a careful study of the conditions, but even if given the widest possible variance, the maximum error in results would be a very small percentage. They may not be numerically correct for all properties, and they may, on further study, be modified for the property for which they were developed. It is believed, however, that the method as a whole is fundamentally correct and commercially accurate, although it is expected that a more extended study and further experience with some of the details will result in a somewhat closer accuracy.

OUTLINE OF THE METHOD

Starting with the standard accounts, the fixed-capital items are grouped. The main plant-investment cost items are grouped under the general heads of "steam electric," "hydro-electric," "gas electric" and "storage battery," with the subdivisions of land, structures and equipment under each. The transmission system investment costs are handled in the same way. The distribution system accounts are "land," "structures," "distribution substation equipment," "distribution lines," "transformers," "service" and "meters." The distribution lines are sub-grouped as "underground conduit," "underground conductors," "poles" and "overhead conductors." The miscellaneous items are "commercial lamps," "municipal street lighting equipment" and "electric appliances." Each group is subdivided as far as its service will permit into sub-groups covering the general light and power system, municipal street-lighting system, special power customers and rural service system. The general property accounts are grouped under the headings of "lands," "structures," "equipment" and "miscellaneous tangible capital." Provisions are made for introducing in the cost accounting items of investment expenses covering insurance, taxes, depreciation, amortization and money costs, and for accurately determining these rates and charges entering into the investment expenses. The net result of the grouping is to finally set up a total investment cost for each subdivision of the fixed-capital accounts which represents the fixed charges that are part of the cost of service.

The handling of the steam-plant investment and operating expense is more complicated in the case of the property under consideration than would be the usual case, as it has been necessary to provide for the segregation of the expenses between the electric service, the exhaust or steam-heating service and the live-steam service. The total expense of the steam plant is first grouped into "energy," "capacity" and "indeterminate expense." These are in turn distributed to the electric, the exhaust and the live steam uses on a basis determined by the actual steam used by each system, the responsibility of each system in creating the demand for steam, and a combination of both respectively, a small portion of the expenses being arbitrarily apportioned 50 per cent by responsibility and 50 per cent by quantity used. One item that is set out in the cost analysis is that of ineffective and effective fuel. It is believed that a record of these items will assist materially in improving plant efficiency. The ineffective fuel is the fuel used in banking boilers and bringing banked boilers to working condition.

TRANSMISSION LINES TREATED AS BUS EXTENSIONS

Up to this point the plan has dealt with only the plant investment or fixed charges and operating expenses. In introducing the transmission investment or fixed charges and operating expenses the transmission lines, including transmission substations, have been treated as extensions of the central-station bus and are grouped with generating-plant costs. The combined result is a total expense that is allocated to transmission centers. This expense is grouped under the headings of "electrical energy," "electric capacity" and "electric indeterminate expenses." The electrical energy is subgrouped as ineffective and effective energy expenses. The groups are allocated to the transmission centers on a basis determined by the electricity used, by the responsibility of each center in the creation of load on the generation and transmission system, and by a combination of use and responsibility.

The distribution centers in turn receive their allocated portion of expense from the transmission centers, which with the distribution substation expenses, grouped as operating and investment expenses, comprise the distribution centers' expenses. The distribution centers are carried as class A and class B. The class A are those for which it is thought desirable, because of size or other special reasons, to determine costs monthly. In general, the costs for the smaller centers are determined on an annual basis. To the costs allocated to the distribution centers are added the costs incurred in each center for the expense of distribution. These expenses are then allocated to what are termed the systems of the distribution center. These systems are "general light and power," "municipal street lighting," "special power," and "rural."

The commercial office expense for the electric department and the general office expenses are still to be added to the cost figures for each distribution center. The total operating expense of the commercial electric department plus the investment or fixed charges of the electric department are assembled and in turn apportioned to the distribution centers on the basis of the number of consumers served. In case a consumer is served from a transmission center he is treated in this allocation as an independent center of distribution. The expenses classed as commercial office are those incurred in reading meters, billing and the other expenses involved in handling the consumer records. The general expense items are assembled and divided into two factors, one an expense and the other a consumer element factor. This is done because certain parts of general expense are incurred in handling consumers and should be considered in the final determination as consumer expense. The consumer element part of general expense is allocated to the distribution centers on the basis of the number of consumers, and the expense element is distributed on an expense ratio basis to the distribution centers.

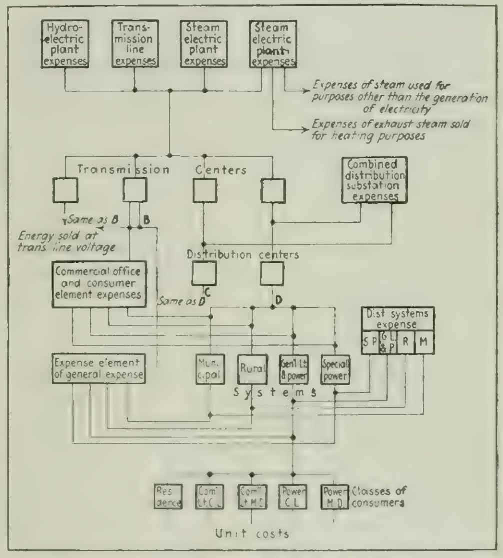
Hydro-electric plant expenses
Trans-mission line expenses
Steam electric plant expenses
Steam electric plant expenses
Expenses of steam used for purposes other than the generation of electricity
Expenses of exhaust steam sold for heating purposes
Transmission Centers
Combined distribution substation expenses
Same as B
B
Energy sold at trans. line voltage
Distribution centers
Commercial office and consumer element expenses
C
Same as D
D
Dist systems expense
S P
G L & P
R
M
Expense element of general expense
Mun. c.pal
Rural
Gen'l Lt & power
Special power
Systems
Residence
Com'l Lt. C. L.
Com'l Lt M. D.
Power C. L.
Power M. D.
Classes of consumers
Unit costs

CHART OF ACCOUNTING SYSTEM OF A MIDDLE WEST UTILITY

The Iowa Railway & Light Company, Cedar Rapids, Iowa, has developed a method of allocating costs so that the final result is the expression of the usual investment and operating figures contained in the accounting groups of the ordinary central-station books in terms of unit consumer, capacity and energy costs for the various groups of consumers served. The system is designed as an integral part of the accounting work. This illustrates graphically the relation of the various grouped items of expense to each other and the final unit costs to the different classes of service. The general procedure is explained in the accompanying article.

The final result of the series of allocations outlined above is the grouping under the head of each distribution center of a proportion of the total fixed and operating expenses of each system. The expense of meter shunt and line transformer core losses are determined and added to the expense of each of these centers. In each of these groups there is, therefore, a collection of cost data which represent the costs of a general light and power system, a municipal street-lighting system, a special power consumer and a rural system. Except for the rural system, these items represent costs that will probably need no further subdivision, or, at the most, a very slight subdivision that will be determined by the conditions in each case. For the purpose of this discussion the rural system will be ignored, as the distribution of costs in the general light and power system, which represents the major item, is most important and the distribution of the rural service costs, once determined in total, should be comparatively simple. The items of a general light and power system's costs must be properly apportioned to the consumer, capacity and energy elements or costs. Most of the costs are easily apportioned to the proper element or elements. For example, the item of meter loss expense and also that of commercial office expense is clearly a 100 per cent consumer cost. Similarly the effective energy expense which covers the cost of energy actually put on the transmission lines for distribution is clearly 100 per cent energy expense. In passing it is interesting to note that this item is almost the only energy expense, only one other item contributing anything to this element.

To handle the groups that are either indeterminate or contain costs belonging to more than one of the groups, a series of ratios are used to allocate them to their proper element or elements. As an example of the application, the poles and fixtures and overhead conductor groups are equally divided between consumer and capacity expense. With the allocations made the consumer and energy costs can be reduced to a unit-cost basis by dividing the total consumer cost by the number of consumers and the total energy cost by the number of kilowatt-hours sold during the period covered by the expense. It should be noted in the latter case that the cost is in terms of kilowatt-hours measured by the consumers' meters, thus automatically correcting for line losses. The consumer costs will be on an annual or monthly basis, depending on the period covered by the cost figures.

ALLOCATION OF DEMAND COSTS

Allocation of the demand costs is a more complicated process and is carried out as follows: Two factors are used, one being maximum demand and the other a factor that has been named peak responsibility. In determining the value of these factors the consumers are classified. With the residence class the manufacturer's rating of the largest device used is taken as the maximum demand with a minimum of 1 kw. The commercial lighting connected load class is given a minimum of 500 watts. The commercial lighting measured demand class has a maximum demand equal to twice the highest kilovolt-ampere-hours measured in any thirty-minute interval. Corresponding to this is a general power measured-demand class on the same basis and general power connected-load class which has a minimum demand of 1 kw., 1 hp. being taken as the equivalent of 1 kw. The peak responsibility is the demand of a consumer or group of consumers at the time of the combined maximum load on all sources of supply.

It will be seen that this does not necessarily correspond with the individual or group maximum demands. The maximum demand and peak responsibility of the various groups is determined by selecting a number of smaller groups of consumers from each of the major groups and determining the values by measurement. This should be done for a number of small groups of customers in each major group. As will be readily seen, these two factors are not likely to coincide in value. The sum of the demands of the consumers divided by the peak responsibility of any group is the peak responsibility factor of the group. The average of this factor for a number of similar groups is taken as the peak responsibility factor of a class. The sum of the maximum demands of a group divided by the maximum demand of the group is the maximum-demand factor of the group, and the average of a number of these factors for similar groups is taken as the maximum-demand factor of the class. In making these determinations the tests must be extended over a sufficient time and the various groups selected for test to insure representative results.

USE PEAK RESPONSIBILITY FACTOR

In determining the unit-demand costs the sum of the consumers' demands of each class is divided by the class peak responsibility factor. The results of this calculation give the peak responsibility of each class, and the ratio of each of the results to the sum is then calculated. This set of ratios is used to multiply the power-plant and transmission capacity costs allocated to the general light and power system. The results are the peak responsibility costs of each class. The sum of the consumers' maximum demands of each class is divided by the maximum-demand factor of the class, and the ratio of each result to the sum of the results is obtained. These ratios are used as multipliers of the distribution substation and distribution systems demand costs allotted to a general light and power system. This result gives the demand expense of each class. The sum of the peak responsibility expense and the maximum-demand expense of each class is found and divided by the sum of the consumer's demands of the respective class. The result is the unit-demand cost of each class, which will be on a yearly or a monthly basis, depending on the basis on which the cost figures have been taken. It is believed that the greater knowledge obtained from the general use of the method over an extended period will result in a refinement in the classification of consumers.

The allocation of costs of the generation and transmission system to the transmission and distribution centers has been mentioned as being made on a ratio basis. The method of arriving at the ratios in each case is based on measured quantities. In allocating the distribution, commercial office and general expenses concrete data are used, except in a very few cases where necessary data are not available and an estimate is the only possible method. However, the plan is designed with the thought that eventually every important factor will be determined by measurement and that experience in the minor factors will make it possible to place the final result on as definite a basis as the cost accounting of any industry.

The next issue of the *Electrical World* will contain the second part of this article, which will deal with specific applications of the general principles outlined in the first part of the article.

Power Club Publishes Control Handbook

A SIMPLE description of controllers for electric motors and definitions of the terms used in that connection have been compiled by the Electric Power Club and published in a handbook. Words which do not appear in the regular dictionaries are here explained in simple language, and in addition to being a handbook for users of electrical control apparatus, it gives the meaning of terms with which all users of electrical apparatus should be familiar.

The handbooks may be obtained from leading manufacturers of electric power and control apparatus or from the Electric Power Club, Kirby Building, Cleveland, Ohio.

Use of High-Power Vacuum Tubes

Characteristics, Operation and Connections of 20-Kw. Vacuum Tube Used for Transatlantic Radio Service—Description of 1,000-Kw. Power Tube and Its Possibilities—Overcoming Space-Charge Effect and Filament Excitation

By DR. IRVING LANGMUIR

Assistant Director Research Laboratory, General Electric Company

THE engineering development of high-power vacuum tubes for radio has progressed so successfully during the last few years that other uses for such tubes appear as more or less definite future possibilities. Although progress in this direction is more difficult and is apt to be slower than in the direction which has thus far seemed more important, the author believes that it would be rash to predict the limitations of the ultimate use of vacuum tubes in the power field.

THE recent tests at Rocky Point, L. I., using 20-kw. pliotrons as a source of radio-frequency power have demonstrated the practical operation of high-power vacuum tubes. The Alexanderson multiple-tuned antenna was used, supplied by high-frequency current from six 20-kw. pliotrons running in parallel, and during a sixteen-hour test signals were transmitted to Nauen, Germany, and came in from there. These signals were in addition to those usually transmitted with the Alexanderson alternator.

The tubes used in this test, like the ordinary vacuum tubes used for receiving radio signals, contain three electrodes, the filament, the grid and the plate, and to this extent they incorporate the principle first brought forward by De Forest. By the use of a very high vacuum and by special features of construction, ionization due to a gas residue is brought down to negligible value, and in this way it has been possible to develop pliotrons capable of operating at higher and higher powers. The present 20-kw. tube marks simply one step in this development. The original De Forest audion operated with currents of at most a few milliamperes and at voltages of 30 or 40, so that the power which could be controlled was about 0.1 watt or 0.2 watt. By using the new principle of a pure electron discharge, independent of gas ionization, it was possible to develop tubes for transmitting purposes. These were used widely during the war for small radio-telegraph and radio-telephone sets. Gradually tubes of 50 watts and 200 watts were developed, using tungsten filaments as cathodes and with plates of metallic molybdenum capable of operating at such high temperatures that they could dissipate by radiation relatively large amounts of power. During the last few years tubes of this type of 1 kw. and 5 kw. capacity have been developed. The molybdenum anodes in these larger tubes are of cylindrical form and operate at high temperatures so that they can radiate the heat through the transparent glass wall of the bulb.

In going to larger powers it becomes difficult to make an anode of sufficient size to radiate the energy dissipated, and therefore resort has been had to water-cooling the anode. In this way the glass bulb was avoided entirely except as a means of insulating the leads connecting the electrodes to other external circuits. The anode, instead of being inside of the tube, is made to be the envelope of the tube. This introduces several new problems, for it is necessary to make a vacuum-tight seal between the cylindrical anode of relatively large diameter and the glass tube through which the leads are brought. Furthermore, new problems arise in connection with maintaining sufficiently high vacuum in a metal container in which large amounts of energy are being dissipated. These and other similar problems have been worked out largely as a result of several years' work on the part of W. C. White and H. P Nolte.

Fig. 1 is a photograph of the outside of the 20-kw. tube, which has already been manufactured in relatively large numbers and is commonly known by the type number UV207. It is seen that the lower part of the tube consists of a copper cylinder of about 1.9 in. outside diameter and about 8 in. long. This is sealed to a large glass tube of about 2.75 in. diameter by means of a conical thin-metal portion consisting of copper-covered nickel steel, this material acting as a substitute for the very expensive platinum which might otherwise be used. The upper glass portion of the tube is about 10 in. long and serves merely to support and insulate the filament leads from the grid and anode.

Fig. 2 is a photograph illustrating the interior construction of the tube. The cathode is a heavy tungsten filament of about 0.04 in. diameter bent in the form of a "W" supported on stout tungsten rods. It requires about 50 amp. heating current at about 20 volts, thus consuming about 1 kw. The plate or anode operates at about 15,000 volts direct current with respect to the cathode. The outside of the plate cylinder is directly in contact with running water supplied at the rate of about 2 gal. to 3 gal. per minute.

OVERCOMING THE SPACE-CHARGE EFFECT

Because of the possibility of dissipating a large amount of power from the water-cooled anode it is possible to make this anode relatively smaller—in fact, much smaller than is used in the 5-kw. tube. This aids greatly in overcoming the space-charge effect which is a feature limiting the efficiency of electron tubes. These 20-kw. tubes have therefore a rather higher efficiency than the low-power tubes with molybdenum anodes. In the production of radio-frequency power these tubes give an output of 20 kw. in an antenna with a plate efficiency of 75 per cent, the filament loss of 1 kw. reducing the over-all efficiency to about 70 per cent. This is by no means the limit of the efficiency that these tubes can give. If used for lower frequency, considerably higher efficiencies may be obtained.

The particular set-up used in the recent tests is illustrated in the diagram of Fig. 3. The power is supplied from a three-phase, 60-cycle, 22,000-volt line.

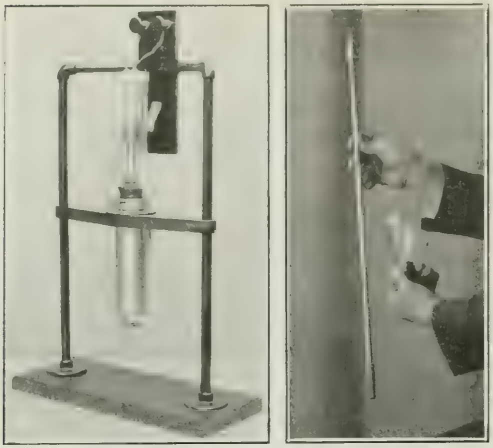

FIG. 1 — LEFT: EXTERIOR VIEW OF 20-KW. TUBE WITH WATER-COOLED PLATE. RIGHT: FILAMENT OF 1,000-KW. TUBE COMPARED TO A 40-WATT LAMP

Each phase is grounded through a reactor and is also connected to the anode of a water-cooled kenotron. These kenotrons are constructed just like the 20-kw pliotrons except that the grid is omitted. The filaments of the kenotrons are excited by an insulated filament transformer fed from 110-volt, 60-cycle current. In the recent Rocky Point tests, carried out by co-operation between E. F. W. Alexanderson, C. W. Hansell of the Radio Corporation of America, W. R. G. Baker of the radio department of the General Electric Company and H. J. Nolte and W. C. White of the research laboratory, three kenotrons were used for rectifying the alternating current supplied. The power from the kenotron outfit was smoothed out by a capacity C_1, shown in the diagram. This direct-current power supply was further smoothed out by the choke coil L_1, or 50 millihenries. This direct-current power, ranging from 10,000 volts to 15,000 volts, was then applied to the plates of six pliotrons operating in parallel. The grids of these pliotrons were excited by a master oscillator giving about 1,250 volts and capable of delivering about 1.5 kw. of high-frequency power. The grids were operated in parallel, each grid being provided with a grid leak and grid condenser. The connection to the antenna from the plate circuit was made by means of the condenser C_2, which was tapped into the antenna circuit at a point in a series of condensers C_3, connecting the antenna with the ground. The antenna itself was connected to the condensers C_3 through the tuning coil L. The antenna was of the multiple-tuned type which has been described by Alexanderson.

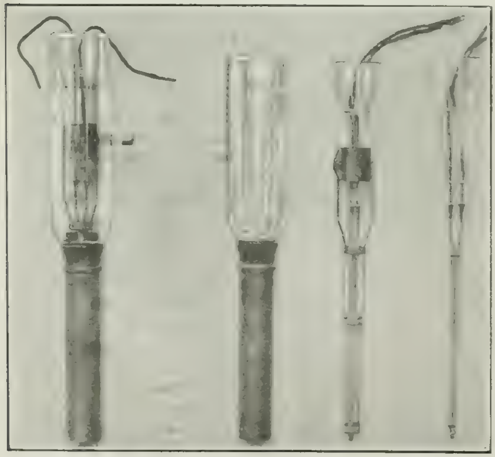

FIG. 2—INTERNAL DETAILS OF THE 20-KW. RADIO-TYPE TUBE

In the tests recently made where signals were transmitted to Nauen the antenna current was about 310 amp., which is about one-half that used ordinarily with the Alexanderson alternator. No particular effort was made to obtain the full output of the tubes in these tests, and undoubtedly more than twice as much power will soon be obtained from a similar number of tubes. The tests have demonstrated on a larger scale what we have already known from laboratory studies of individual tubes, that these tubes are capable of thoroughly satisfactory operation with an output of about 20 kw. The filament design is conservative, so that the life of the tubes should average several thousand hours in actual operation.

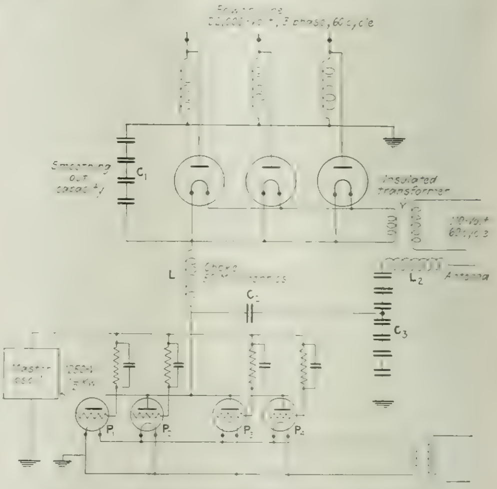

FIG. 3—SET UP FOR TRANSATLANTIC RADIO TESTS, USING 20-KW. TUBES

The practical utilization for radio purposes of these 20-kw. tubes marks merely a step in the application of the basic principle of the pliotron. Since 1912, when this development was first begun, the energy controlled by the three electrode tubes has been increased from the 0.1 watt or 0.2 watt of the original audion up to more than 20,000 watts, an increase more than a hundred-thousandfold.

This has been accomplished as the result of a careful study of the fundamental principles involved in the conduction of electricity through high vacuum. The writer's own work in this field was published in 1913 in the *Physical Review**, and the first work in applying this principle in the construction of vacuum tubes was described before the Institute of Radio Engineers early in 1915.† In order to get large powers, of course, it has been necessary to use both larger currents and higher voltages than were originally used. This has been made possible by an understanding of the harmful effects produced by gas ionization and the discovery of means of avoiding these effects.

**Physical Review*, Vol. II, page 450, 1913.

Larger tubes than those rated at 20 kw. are being constructed. A 100-kw. tube of nearly the same type as the present 20-kw. tube is now being developed by W. C. White and H. J. Nolte and promises to be fully as successful as the present tube, in addition to having the advantage of somewhat higher efficiency.

Another quite different type of tube, involving the principle of magnetic control proposed by Dr. A. W. Hull and called by him the magnetron, has been constructed by J. H. Payne. This tube, of which a photograph is shown in Fig. 4, consists essentially of a water-cooled cylindrical anode 30 in. long and 1¾ in. in diameter. In the axis of the anode is a tungsten filament 0.4 in. in diameter and 22 in. long. This filament is excited by current of 1,800 amp. at 10,000 cycles, the filament excitation requiring about 20 kw. The magnetic field produced by this large heating current is sufficient to "cut off" the electron current from the cathode to the anode during a portion of each half cycle of the current passing through the cathode, this action taking the place of that of the grid in the three-electrode tube. The electron current to the cathode is thus interrupted 20,000 times per second. By the use of properly tuned circuits this can be used for the production of high-frequency power for radio or any other purpose. The particular type shown in Fig. 4 will supply 1,000 kw. of 20,000-cycle power at an efficiency of 70 per cent, operating with an anode voltage of 20,000 volts direct current.

For radio purposes efficiencies of 70 and 80 per cent are eminently satisfactory, but for other engineering purposes they are not so high as would be generally desired. Another line of development is therefore in progress, viz., the production of tubes of higher efficiency as well as tubes of larger output. The progress in this direction is more difficult and is apt to be slower than in the direction which has thus far seemed more important. There are two main causes of loss of power in vacuum tubes: the space-charge effect and the filament excitation. By use of higher voltage and in other ways it is possible to reduce the space-charge loss very materially.

The energy loss in heating the filament can be reduced to one-tenth, or even less than one-twentieth, of that necessary with a pure tungsten cathode by employing a "thoriated" tungsten filament under very special conditions which have been the subject of study during the last few years.

The advantage of the thoriated filament is due to an adsorbed film of metallic thorium on the surface of the filament, this film consisting of a single layer of atoms. The thorium as fast as it evaporates off the surface is supplied by diffusion from the interior of the filament. In utilizing this effect a particularly high degree of vacuum is desirable, or at least the presence of those gases must be avoided which would oxidize or otherwise combine with the very thin film of thorium. For this purpose the vapors of various reducing materials, such as magnesium, or alkali metals, such as potassium substances containing carbon, have been used. Very successful results have been obtained in adopting this thorium filament in power tubes. At present the necessity of using this more efficient cathode is not very pressing, but with a future demand for high efficiency it will be possible not only to cut the energy necessary for filament excitation down to a small fraction of what it now is, but at the same time the life of a cathode can be increased enormously, so that the practical applications of electron tubes of large power will certainly not be limited by an unduly short life.

These developments will come gradually, for the practical construction of powerful tubes giving thoroughly satisfactory operation requires a great deal of development work. It would be rash, however, to predict the limitations of the ultimate use of vacuum tubes in the power field.

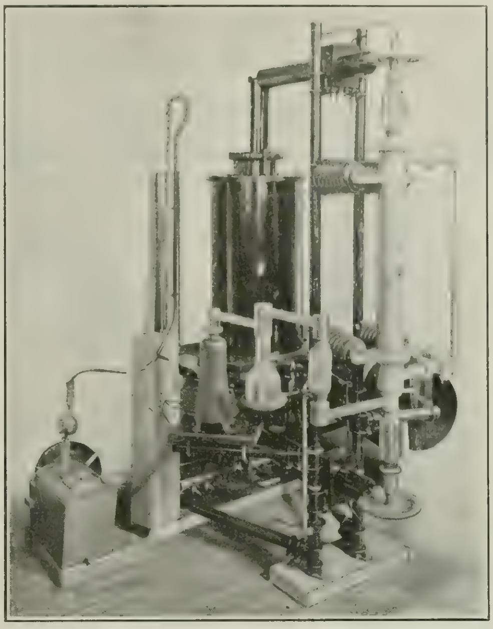

FIG. 4—A 1,000-KW. POWER TUBE OCCUPIES LITTLE SPACE

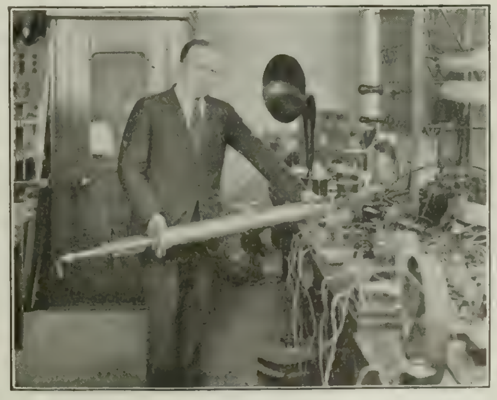

FIG. 5—BUSY DEVELOPING THE 1,000-KW. TUBE IN THE GENERAL ELECTRIC RESEARCH LABORATORY

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†*Proceedings of Institute of Radio Engineers*, September, 1915.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Professor Ryan for A. I. E. E. Presidency

To the Editors of the Electrical World:

The inclosed letter from Mr. Osgood is self-explanatory. I can think of no better way of accomplishing the general knowledge of his position than to ask you to include this letter and his letter in an early issue. I trust that you will find it possible to comply.

Milwaukee, Wis. A. W. BERRESFORD.

A. W. BERRESFORD, Milwaukee, Wis.

DEAR BERRESFORD: I am in receipt of your letter regarding Institute matters and am glad of the conclusion which you and the others have reached. As a matter of fact, I have not at any time seen how any other conclusion was possible. Professor Ryan appeals to me as I am sure he will appeal to every Institute member. Aside from making evident the national character of the Institute and the fact that the choice of its president need not be determined by his contiguity to headquarters, there is the man himself. He has been an outstanding leader in electrical engineering. His work is internationally known and approved. His personal characteristics are such that all men love him, and I know that only his own modesty has prevented his accepting a nomination at an earlier date. The Institute should take advantage of his consent.

Will you transmit to those who voted for me last year and have advanced my name this year the fact that I would appreciate their transferring their support to him? Also, will you make sure that this is so generally known as to prevent misunderstanding? My impulse was to do this directly as soon as I knew there was a possibility of Professor Ryan's consenting to run, but I realized that this would hardly be fair to you and the others who have been good enough to interest yourselves in my behalf. Sincerely yours,

Newark, N. J. FARLEY OSGOOD.

Fusing the Neutral Wire

To the Editors of the Electrical World:

I have noted with interest the comments published in the *Electrical World* regarding the fusing of the neutral wire. In the articles published the facts concerning danger to life have been brought out, but there is the damage caused to appliances and devices, which are costly, to be considered also. I will mention a few such instances which I know of.

One was that of a range where the neutral fuse blew and caused an unbalanced load and voltage enough to burn out all of the top plates which happened to be on the high-voltage side of the line. The customer was put to great inconvenience until repairs could be made. Moreover, the occurrence was expensive to him. There was also a case of the neutral fuse blowing at a church just before the beginning of the evening service. Although the fuse was soon replaced, so many of the lamps had been burned out by the higher unbalanced voltage that the congregation were unable to read the hymnbooks.

Both cases above mentioned had the effect of damaging the reputation of the service for reliability, and certain complaint of the expense and inconvenience was incurred. The occurrences were beyond the control of the utility concerned, because we all know that people in general know enough to put in a new fuse where one is blown, but they do not understand the correct amperage for fuses nor the proper sizes for the several places.

The underwriters have been criticised, but I hope that it was all meant in the constructive spirit. They have a side of the argument which is reasonable. There are several arguments in favor of the solid neutral.

In this day we are all talking and acting "safety." There has been offered to the manufacturers a device which will both solve the underwriters' objection and at the same time make for considerable more "safety" in the various other uses of the current. Now that a solution is offered which will not add to expense, let us take advantage of it and settle the question.

Janesville Electric Company, G. R. BLAKESLEY,
Janesville, Wis. Commercial Manager.

Reports Should Be More Specific

To the Editors of the Electrical World:

I am much interested in the article by Edward Britt in the *Electrical World* of Oct. 7, page 776, entitled "Pulverized Waste Coal Efficiently Burned," which gives a description of a test of low-grade fuel in a French boiler plant.

Similar fuel has been burned in pulverized form quite extensively in this country for the last two or three years, using what is virtually dust and culm, mine dirt, etc., from anthracite coal. The largest equipment, which is supplied by six Fuller pulverizing screen mills, is for twelve 500-hp. and 600-hp. boilers of the water-tube type and operating a 10,000-kw. electric power station. It has been in successful operation over a year and a half, and the owners are so well satisfied that they contemplate building a similar plant in a different locality which will use the same class of fuel. The efficiency of boiler and furnace of 80 per cent and more is maintained regularly, from the B. t. u.'s in the coal as fired, when developing from 150 to 200 per cent of boiler rating.

The details given in the article you print are not altogether consistent, and the statements are rather misleading and need to be clarified to make them more definite. For instance, in the fourth paragraph it is stated that the average evaporation per pound of fuel is 7.38 lb. of steam, which corresponds to an over-all efficiency of 82 per cent, boiler and furnace. Figuring backward, based on the B. t. u.'s in the coal of 10,728 per pound, 82 per cent boiler and furnace efficiency would give an evaporation of 9.06 lb. from and at 212 deg. F. On the other hand, if the evaporation given as 7.38 lb. of steam is from and at 212 deg. F., this would mean only 66 per cent boiler and furnace efficiency. As the feed-water temperature during the test and the boiler pressure are not given, it is difficult to interpret the figures correctly.

This letter is not intended as a criticism of the test in any way, but if the statements could be elaborated in order to bring out the actual facts of the operating conditions, it would add to the value of the information given. FREDERICK A. SCHEFFLER,

Fuller Engineering Company, Manager Power Department.
Allentown, Pa

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Analysis of Costs in Gas-Engine Plants

CONSTRUCTION cost data and itemized operating costs for internal-combustion-engine power plants were given in a paper presented by D. M. Petty, superintendent of the electrical department, Bethlehem (Pa.) Steel Company, at the recent convention of the Association of Iron and Steel Electrical Engineers at Cleveland. The installed cost per kilowatt of a gas-engine power plant made up of three or more 4,000-kw. units is given in Table I. Operating costs per kilowatt-hour are shown in Table II for a similar plant made up of six 3,000-kw. units and one 4,000-kw. unit.

TABLE I—INSTALLED COST PER KILOWATT CAPACITY FOR A GAS-ENGINE POWER STATION WITH 4,000-KW. UNITS

	Cost per Kilowatt	
Building, modern construction, brick and steel, tile floors and crane, including exhaust tunnel and stacks	$7.50 to	$15.00
Foundations for engines, including excavation at $15 per cubic yard	4.50 to	9.00
Engines, including all piping and painting and ready to run	60.00 to	75.00
Gas-cleaning apparatus	6.00 to	8.00
Generators, switchboard, exciters, oil switches for 6,600 volts	13.00 to	20.00
Miscellaneous expense	10.00 to	15.00
Total	$101.00 to	$142.00
Average cost per kilowatt	$121.50	

TABLE II—OPERATING COST OF A GAS-ENGINE POWER PLANT WITH SIX 3,000-KW. UNITS AND ONE 4,000-KW. UNIT

	Cost per Kilowatt-Hour, Cents
Fuel, 1,443,288,000 cu.ft.; average B.t.u., 94 per cu.ft. at $0.0094 per 1,000 cu.ft.	0.00158
Labor, including switchboard operators, engineers, oilers, superintendents, etc.	0.00030
Repairs, including renewals, tools, miscellaneous supplies and labor in repairs	0.00033
Water for cooling, oil, waste, packing and cooling-pond expense	0.00021
Gas cleaning, including water, labor, repairs and power	0.00037
Total operating cost	0.00279
Heating feed water with exhaust gases (installed on four engines only), credit	0.00033
Net operating cost	0.00246

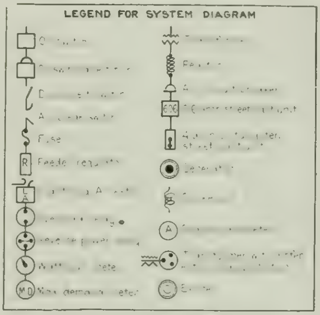
In the matter of operating costs one of the principal items in the past has been the renewal of worn steel parts, such as pistons, cylinders, piston rods, etc. This item has been very materially reduced by the careful application of electric welding. Formerly when the grooves of the piston became worn to such an extent as to cause excessive leakage by the piston ring all that could be done was to remachine them and put on oversized rings. This, of course, could not be carried on indefinitely on account of cutting away the metal. Today the worn places are filled up by electric welding and machined out so that the life of a steel piston is almost infinite. A cast-iron piston cannot be welded.

At times cracks develop in cylinder walls, especially in the vicinity of the exhaust ports. Formerly these cracks would necessitate the scrapping of the cylinder. Today they are welded and seldom open up again; in fact, discarded cylinders have been reclaimed by this process to such an extent in one plant that four extra cylinders which were on order have been canceled. It is seen, therefore, that with the proper application of electric welding a gas engine built of steel should never wear out and would be replaced only because of obsolescence.

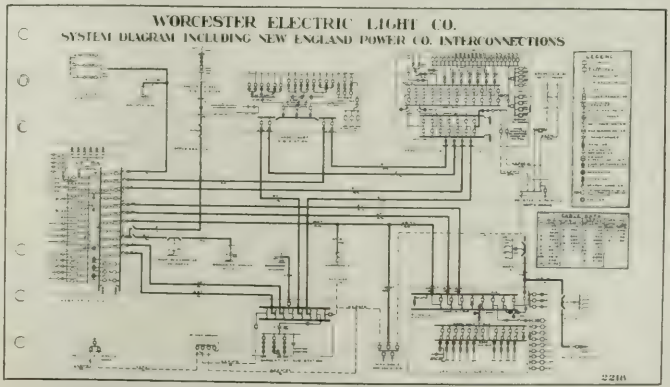
FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Compact System Diagram for Pocket Binder

A FOLDING single-line diagram about 6 in. x 10 in. in size, printed on cloth-backed paper and punched for a Lefax binder, is issued annually by the Worcester (Mass.) Electric Light Company to operating officials, engineers and maintenance foremen to enable them to keep in close touch with the status of the company's 13,200-volt system. Practically this entire system of higher-voltage lines is now underground, and a useful feature of the diagram is a tabulation of circuit sizes and lengths between the generating plant of the company at Webster Street and the various substations.



TYPICAL LEGEND USED WITH SYSTEM DIAGRAM


WORCESTER ELECTRIC LIGHT CO.
SYSTEM DIAGRAM INCLUDING NEW ENGLAND POWER CO. INTERCONNECTIONS
2218

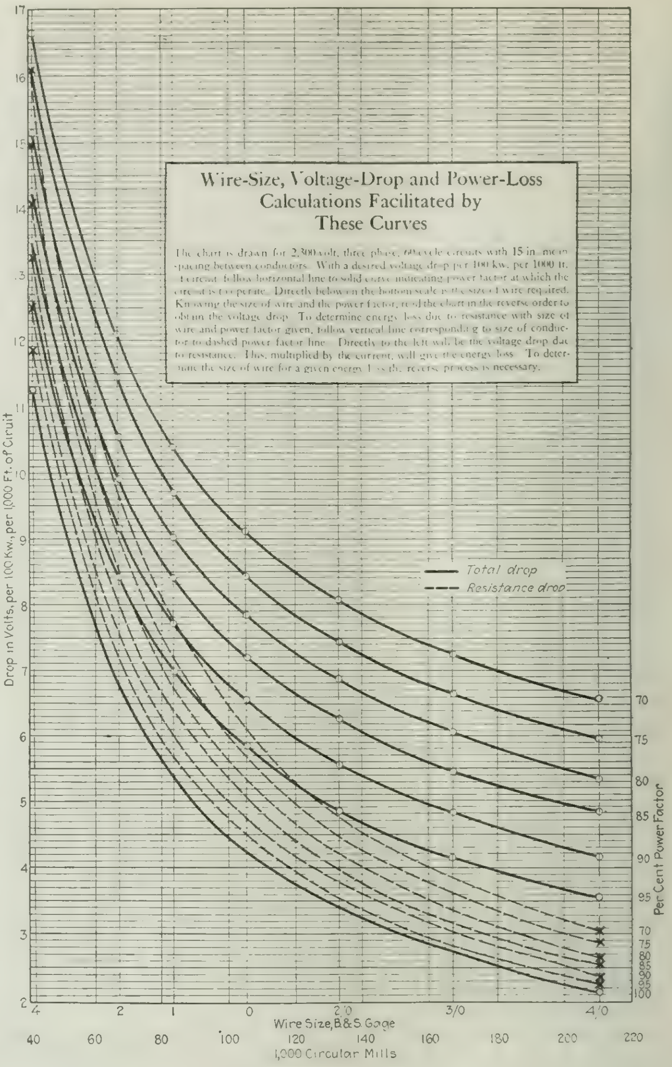
ENTIRE SYSTEM OF 13,200-VOLT LINES SHOWN IN 60-SQ.IN. DIAGRAM

Interconnections with the New England Power Company are also shown on the diagram, with the location of oil circuit breakers, disconnecting switches, transformers, reactors, relays, buses, etc., on the central-station system. In emergencies or construction problems these diagrams are a great convenience, and their compactness well illustrates the value of single-line diagrams. Worcester is a city of about 175,000 population, and the rating of Webster Street is about 55,000 kva. GEORGE M. HARDY,

General Superintendent.
Worcester Electric Light Company,
Worcester, Mass.

◆

Line-Drop Charts Solving 2,300-Volt Problems



Wire-Size, Voltage-Drop and Power-Loss Calculations Facilitated by These Curves

The chart is drawn for 2,300-volt, three-phase, 60-cycle circuits with 15 in. mean spacing between conductors. With a desired voltage drop per 100 kw. per 1000 ft. of circuit follow horizontal line to solid curve indicating power factor at which the circuit is to operate. Directly below on the bottom scale is the size of wire required. Knowing the size of wire and the power factor, read the chart in the reverse order to obtain the voltage drop. To determine energy loss due to resistance with size of wire and power factor given, follow vertical line corresponding to size of conductor to dashed power factor line. Directly to the left will be the voltage drop due to resistance. This, multiplied by the current, will give the energy loss. To determine the size of wire for a given energy loss the reverse process is necessary.

SEVERAL approximate methods for the calculation of transmission and distribution lines have appeared in recent issues of the *Electrical World* covering all the standard voltages in every-day use. However, nearly all electrical companies have only three or four standard voltages, and line-drop charts of the type shown in the accompanying illustration offer a ready solution to every-day problems of wire size, voltage drop and power loss. This chart is for 2,300-volt, three-phase, 60-cycle circuits with 15 in. mean spacing.

In plotting the chart the voltage drop per 100 kw. per 1,000 ft. of circuit for the desired sizes and power factor is calculated by means of a Mershon diagram or by L. A. Herdt's "Chart for the Calculation of Transmission Lines." The latter is more convenient but does not cover wires smaller than No. 2. Capacity has been disregarded.

To find the voltage drop due to resistance only, follow dotted curve corresponding to the power factor of line to its intersection with the vertical through the desired wire size; then follow the horizontal line from this point of intersection to the scale at the left and read the volts drop per 100 kw. per 1,000 ft. of circuit. To find the total drop or that due to both resistance and reactance the full lines are used.

For example: What is the total line drop in transmitting 100 kw. 1,000 ft., three-phase, at 80 per cent power factor, with No. 2 wire?

To solve this: Follow the solid line corresponding to 80 per cent power factor to its intersection with the vertical through No. 2 wire and then follow the horizontal from this point to the scale on the left, which gives 10.53 volts drop. If in the above example single-phase current is used instead of three-phase, the drop will be twice as large, or 21.06 volts. Remembering that load and distance have an equal effect on line drop and losses, the wire size, spacing, frequency, power factor, etc., remaining the same, the chart can be used for solving problems in line drop, wire size, etc.

Problem 1. Required to determine the voltage drop with a load of 300 kw., three-phase, distance 6,000 ft., 95 per cent power factor and No. 2 wire.

From the chart we find that the total drop for 100-kw., 1,000-ft., No. 2 wire, etc., is 8.4 volts. For the conditions of the problem the total drop will be:

$$8.4 \times 300/100 \times 6{,}000/1{,}000 = 8.4 \times 18 = 151 \text{ volts.}$$

From the basis upon which the chart is made a general formula can be deduced:

$$V = d \times \text{kw}/100 \times l/1000$$

where V = final voltage drop.
d = voltage drop per 100 kw. per 1,000 ft. of circuit, read from chart
and l = length of circuit in feet.

Problem 2. Required to find the wire size where the voltage drop is 10 per cent, or 230 volts, with a load of 140 kw., three-phase, distance 5 miles and power factor 80 per cent. From the above equation the drop per 100 kw. per 1,000 ft. is:

$$230 = d \times 140/100 \times (5 \times 5{,}280)/1{,}000$$

$$d = 230 \div (140/100 \times 5 \times 5{,}280/1{,}000) = 6.2 \text{ volts.}$$

Looking on the chart, we see that this drop corresponds to a No. 3/0 wire. ROBERT C. SMITH.

Public Service Department,
Glendale, Cal

◆

Uneven Ice Loading Causes Short Circuit on Line

ABOUT ten years ago we received a trouble call from the load dispatcher on a large hydro-electric system, who said that two 66,000-volt transmission lines were in trouble, the operator being unable to keep them energized. It was found that uneven ice loading on the wires had caused the conductors to come together and short-circuit. Considering the phase wires as *A*, *B* and *C*, from top to bottom respectively it was observed that *A* and *B* each had a deposit of four inches of ice and that *C* had but one inch. This condition was the same for both lines.

As the work of repairing the lines progressed a preliminary report was made to the load dispatcher in which it was stated that *C* and *B* were broken by the ice load and were both lying on the ground, but that *A*, although heavily loaded, remained intact and would need only to have the ice removed before energizing the line.

Since suspension-type insulators were used at this point of the line, which was on the crest of a hill at an elevation of 3,000 ft., *A* and *B*, being equally loaded, drew all the sag from unloaded sections on each side of the trouble zone, and both sagged evenly. As the ice formation of *C* was a great deal less than on the two other wires, when *B* sagged it came into contact with *C*, causing a short circuit and causing each wire to part. Question arose in making out the supplementary report as to the reason for the uneven deposit of ice on the conductors. The answer was that a heavy mist had passed over the mountain top, phases *A* and *B* receiving the full benefit of the dampness, while phase *C* was protected by the trees on the windward side of the right-of-way. Had there been no trees on either side of the right-of-way, or had they been removed during construction, the interruption to service would have been averted. The writer, who inspected this line before placing it in service, recommended that strain insulators should be installed at this point so as to prevent just such an occurrence.

In building transmission lines at high altitudes there are two alternatives: Either use dead-end or strain insulators or widen the right-of-way in places where it may be deemed necessary when passing through wooded sections.

Spencer, Mass. G. S. PHELAN.

◆

Standardization Rules for Electric Drills

WHAT are believed to be the first standards for portable electric drills were adopted by the Electric Power Club on Aug. 20, 1922. These rules are the nucleus of a complete group of electric tool standards and include a definition of what constitutes a portable electric drill, test requirements of the motors, performance specifications for drilling, standard sizes of drills and the information which should be given on electric drill nameplates. Some of the standardization rules are given in the following paragraphs, and they will all be published in the next edition of the Electric Power Club's handbook:

TABLE I—MINIMUM DRILLING REQUIREMENTS OF PORTABLE DRILLS

Twist Drill Diameter, In.	Depth of Drilling per Minute, In.	Twist Drill Diameter, In.	Depth of Drilling per Minute, In.
3/16	1 5/8	7/8	7/8
1/4	1 1/2	29/32	7/8
5/16	1 3/8	1	13/16
3/8	1 5/16	1 1/4	11/16
1/2	1 1/8	1 1/2	5/8
9/16	1 1/16	1 3/4	9/16
5/8	1 1/16	2	1/2
3/4	15/16	. .	. . . .

TABLE II—TEMPERATURE RISE UNDER NORMAL CONDITIONS

Insulation class A. Load, 100 per cent of rated capacity. Time rating, intermittent

	Temperature Rise, Deg. C.
1 Core and windings:	
a. Fully inclosed motors	55
b. All other types	50
2 Commutators.	
a. If class A insulation is employed in the commutator or is adjacent thereto and its life would be affected by the heat from the commutator	65
b. In all other cases	85
3 Bare copper windings	60
3A Bare copper windings, inclosed motors. Provided the thermometer is applied directly to the surface of the bare copper winding	65
4 Mechanical parts	

Temperature rise of all mechanical parts not in contact with insulation may be such as will not be injurious in any respect.

Performance Specifications. — The minimum drilling requirements of portable electric drills shall be based on the drilling of holes in 20-30 carbon steel with carbon steel drills of the full rated capacity of the electric drill, at a cutting speed of approximately 50 ft. per minute, and at the specified minimum rate of speed per minute for the various sizes of drills given in Table I.

Temperature Rise. — Temperature rise in degrees centigrade when operating under normal conditions, as specified on the nameplate, shall be as given in Table II.

S. N. CLARKSON,
Executive Secretary.

Electric Power Club,
Cleveland, Ohio.

◆

Safety Cabinets Reduce Fire Hazards

EVEN though the use of the inclosed switch in meter installations is superior to the open type, it does not represent the safest practice, as may be seen from the following paragraphs.

The average practice where inclosed switches are used is as follows: The entrance conduit is installed and connected direct to the inclosed switch; open wires are then connected to this switch and run to the meter, thence to the branch cut-outs, which in the majority of installations are not inclosed. In analyzing these installations four points should be considered:

First, the contractor installs service wires in conduit and runs open wires to the meter. Why not inclose the meter wires?

Second, it is the practice in a good many cities to install any inclosed switch that has been approved by the fire underwriters, irrespective of whether it has sufficient clearance for the utility to test the meter.

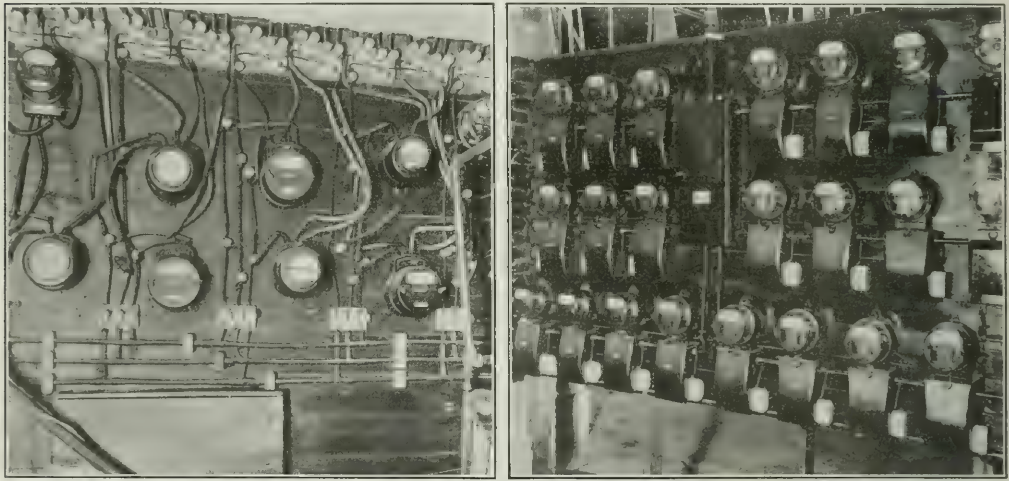
Third, with reference to the average installation, the city electrical inspector and a great many central-station companies are not interested as to whether the switch is sealed and permit the consumer to destroy all of the protection that the city electrical department is endeavoring to give him. From the standpoint of the utility this permits the theft of electrical energy. Now, why should the city electrical department advocate that means be provided to prevent theft? The reason is that the consumer in stealing energy steals from every honest consumer as well as the central station, and in sealing these cabinets the utility is protecting the revenues of all its consumers.

Fourth, a great deal of propaganda has been advanced explaining the danger of the open-knife switch, all of which is a tremendous improvement along safety lines. But if a hazard exists at the switch, why does not a similar condition exist in connection with the branch cut-outs? It is this company's belief that in order to make safe installations the branch cut-outs must be completely inclosed in porcelain or steel.

It has been found by experience that improper use of material in the main-line cut-outs has resulted in fires, and the writer believes that this is one of the greatest electrical hazards that exist today. Sealing these entrance fuses, we believe, results in better protection to our consumers and to ourselves. The present practice seems to be that the electrical inspector, or some one in a position to know the danger, says to the consumer or the contractor, "Please do not plug the fuses as it is dangerous." Is it not a safer and saner method to prevent the tampering of this safety device than to permit the hazard which is considered in a great many localities more or less of a joke? We are advocating the installation of fuses of smaller capacity accessible to the consumer and then, in all cases, the sealing of the entrance fuse. In the majority of trouble cases the smaller fuse will open and can be readily renewed by the consumer; if he then inserts a penny, the main fuses will blow. It would seem that the utility is entitled to know that this has happened so that it can inspect its meter and transforming apparatus, which may become damaged from the short circuit. There was a great deal of discussion a few months ago with reference to electrical fires presumably caused by defective wiring. It is the writer's contention that a fire cannot be started in the ordinary residence installation by actually short-circuting the wiring, provided proper fuses are installed at the entrance service.

The present time is ideal for obtaining "safe and sane" meter installations because the manufacturers and utilities are willing to co-operate. It is the writer's opinion that the safety cabinet should be made by more than one company, which permits the use of the standard end wall and can be produced at a reasonable cost and should be handled through the contractor-dealer in order that an excessive burden shall not be placed upon the consumer. It should be of sufficient dimensions to meet the requirements of the public service company. There is no question that the utilities have a right to make reasonable rules and specifications, especially with reference to installations where they are required to furnish a meter. It is not possible to obtain a 100 per cent safe installation without having the full co-operation of the central station. In reality, the utility should be more interested in the installation of a safety cabinet than the consumer or the contractor, because it is required to furnish proper service through this device and is in most states required by the public service commission to make periodic tests on the meter.

J. C. LANGDELL,
Meter Engineer.
Hodenpyl, Hardy & Company, Inc.,
Jackson, Mich.



COMPACTNESS, SAFETY AND PREVENTION OF THEFT OF ENERGY ARE SOME OF THE RESULTS OBTAINED BY USING SAFETY CABINETS

Left—The fire risk due to the proximity of the gas meter is a horrible example of old-time wiring. Right—Completely inclosing all wiring and mounting customers' fuses in the knockouts practically eliminates all fire hazards.

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Effect of Electrode Size on Metal Deposition

THE size of the electrodes used in arc welding should be such that the current in them is about 8,000 amp. per square inch. If the electrodes are too large, the arc is harder to maintain, the rate of deposition is slower, and the penetration is excessive. If the electrodes are too small, they are fused too rapidly, with the result that the metal is deposited before the parent metal is fused, causing poor penetration and large overlap. In extreme cases the electrode may melt and drops fall on the parent metal, causing beading. The proportions between the size of the electrodes and the current density for most successful results on work of average size is 90 amp. to 125 amp. for $\frac{1}{8}$-in. electrodes and 150 amp. to 200 amp. when $\frac{3}{16}$-in. electrodes are used.

D. N. LOUIS.
San José, Cal.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Power Sales Through Breakdown Service

By Co-operating with Casualty Organizations Central Stations Can Often Gain Permanent Load When Private Power Plants Fail

AN UNDEVELOPED opportunity for increasing central-station power service in industrial plants through closer co-operation with insurance interests was pointed out at the recent New London convention of the New England Division of the N. E. L. A. by R. F. Cavanaugh of the Employers' Liability Assurance Corporation, Ltd., Boston, in an address upon "The Relation Between Industrial Breakdowns and Central-Station Power Development." The speaker emphasized the heavy cost of shutdowns under use-and-occupancy insurance and the importance from all standpoints of resuming productive service as soon as possible. Within the last few years electric motor drive has become extremely reliable, and casualty companies are now willing to write insurance against motor failures and consequent suspension of production. In many cases electrical risks are preferred to risks on mechanical drives from steam engines.

Recently accidents have occurred in industrial plants due to the breakdown of old steam engines. In these cases there is often opportunity for installing partial if not complete electric drive on very short order, and this, of course, reduces losses both to the insurance company and to the plant owner. In one such case at Fall River, Mass., it was possible to save the insurance company $1,800 per day through the rental of 705 hp. in electric motors operated by local central-station service. A temporary condenser was installed in connection with the high-pressure cylinder of a reciprocating engine the low-pressure side of which had failed, and this, with the rented electric power, enabled operations to be resumed in very quick time at the mill.

As industrial steam-power plants depreciate the hazards of operation tend to increase to a point where breakdowns interrupt production, and at such times a well-prepared plan of action on the part of the central-station company brings its own reward.

When boilers reach, say, twenty years of age the steam pressure must be reduced in accordance with state laws. Later many concerns install new boilers designed to operate at higher pressures than were formerly used by the plant equipment, and the resulting strain upon prime movers often leads to accident. "There are a lot of old engines which are playing 'hookey' from the junk pile," said Mr. Cavanaugh, "and when these fail is the psychological time for the central station's power engineer to come to the rescue."

Central-Station Service Does Not Injure the Engineer

One of the chief difficulties in connection with the electrification of an industrial plant by central-station service is the opposition of operating steam engineers in these mills to the purchase of outside energy. Many such engineers are afraid of the entrance of central-station power for fear they may lose their jobs. Mr. Cavanaugh stated that in his ten years' experience in the United States and Canada he had never come across a single case where a competent engineer lost his place because of the introduction of purchased power. Objections by engineers to purchasing energy on the most economical basis brand them as incompetent, and the engineer who objects to outside power coming in is also pretty apt to object to outside inspection of his plant. There are naturally many important tasks for the operating engineer to perform around a plant that has been electrified by central-station service, apart from the time-honored duty of operating and maintaining steam-engine equipment.

Readiness to go to the assistance of industrial plants in case of trouble is a most important phase of obtaining such power business. Mr. Cavanaugh pointed out the value of preliminary analyses of load conditions and ready records showing distances from feeders, the availability of motors for prompt installation, probable course to take in case of a shutdown which can be relieved by running temporary or permanent lines to a plant, and other preparatory steps that the far-sighted central-station power engineer should take if he wishes to obtain this class of business when the opportunity arises.

In some industrial plants the operating engineer suports a policy of piecemeal electrification. Then, when the entire plant is motorized, he goes to his superior with the advice that central-station service be discarded and isolated-plant generating machinery be installed and operated. Central stations can anticipate this sort of a move by studying their loads and striving to furnish the most economical service possible to their customers.

Quick Service Wins Business

When an accident occurs under a use-and-occupancy contract the problem of repairing or replacement immediately comes to the front, and in the interest of getting the plant into operation at the earliest possible moment the question of improvising new parts or installing central-station service is often a live issue. The company has found it saves time in most cases to make up new engine parts, castings, etc., in local machine shops or foundries, as compared with waiting for the builders to supply the missing elements. Where local resources are available a plant can often be got into operation in a week or much less. Here the central station which is prepared promptly to introduce service after equipment failure stands a far better chance of securing additional power business than one which has allowed matters to drift along without preliminary workable plans for running lines into such a plant.

Accidents to equipment are classified under defective material, poor design and faulty management, the last-named being the greatest hazard. Some industries fear that if large motor units are installed by a central station breakdowns will result in heavy losses from the productive standpoint, but the speaker said that he knew of no case where an entire large industry had been shut down by the failure of central-station power. Utility companies carry adequate reserves in general, and interconnections between utilities and between these and industrial plants are helping to maintain service reliability.

CULTIVATE BETTER UNDERSTANDING

Central-station officials should address the organizations of operating engineers as to public policies, economics of utility service and stability of employment. In this way progress will be less retarded by the obstructions put in the way of utility service by engineers of stationary power plants. Power companies should be ready to extend their lines for the complete electrification of industrial plants with guarantee of permanent service. The casualty engineer stands ready to co-operate with the utility in this direction.

C. B. Burleigh, General Electric Company, Boston, declared that every central-station company of any magnitude should be represented in the membership of the National Association of Stationary Engineers, in order that the ideas of utilities may be spread among the individuals of that organization. This should be done, he said, even if the central-station company pays the dues of its representative.

Great Benefit If Number of Demand Rates Is Reduced

That entirely too great a diversity exists in demand rates was emphasized in the report of the committee on this subject, F. W. Smith chairman, at the Lake Placid meeting of the Empire State Gas & Electric Association. Greater uniformity is necessary, although no definite conclusions were given. As a result of the survey which stimulated this observation it was found that several questions arose. For example, should demand charges be on a monthly or yearly basis? Should they be based on yearly, monthly or weekly peaks? Should they apply to the calendar or the contract year? And when should different demand intervals be used? In this connection attention was called to the bearing which load factor and diversity factor have on the interval to select. It was pointed out that demand meter development would be greatly hastened by more uniform practice.

Emphasizing this point, J. T. Hutchings declared that the diversity of demand intervals makes instruments costly, development expensive, stock more costly to keep and deliveries more difficult than if there were fewer demand intervals used. Two or three intervals should be adopted, he contended. Because of their smaller effect on the service system, small consumers are entitled to longer demand intervals than large companies. Steam-plant service, which can be used to handle fluctuating loads, should be rendered on a short-interval basis, whereas water-power plants can sell on long-interval basis.

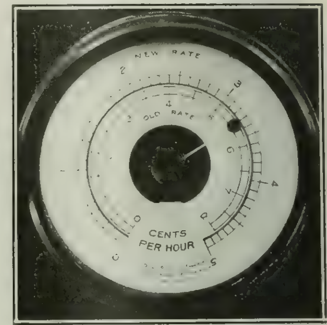
The chief trouble with demand instruments, declared E. P. Peck, is their improper functioning. He maintained that the problem of bringing about the use of fewer demand intervals would be greatly facilitated by the collection of data comparing the registration of different demand meters with different demand intervals on various types of loads—fluctuating and uniform. It will probably be found that the difference is not great and that one interval can be used for fluctuating or intermittent loads and another for average loads.

Mr. Peck also raised the question: "Are we measuring the right demand?" In his opinion kilovolt-ampere demand and not kilowatt-demand is the important factor, since its purpose is to determine the portion of the standby equipment which must be kept in readiness. A study of the relative effects of kva. demand on different parts of a system would, Mr. Peck thought, be very enlightening.

The important problem, said C. G. M. Thomas, is how demand shall be determined. Whatever the method, service must be rendered on a basis that will be attractive to the customer and profitable to the company. Rates or minimum guarantees must never be established to attract business.

Demonstrating New Rates in Appliance Department

Since establishing a reduced rate for electricity early this year the Hartford (Conn.) Electric Light Company has sought to capitalize the reduction by means of various window displays, advertisements, etc., some of which have been illustrated in the *Electrical World.* Recently an indicating wattmeter showing the cost of operating appliances per hour on both old and new rates has been installed on the appliance exchange floor of the company's main office, and this has proved effective in interesting visitors in the lowered costs of service. In the illustrated view shown the hourly cost of operating an electric radiator of recent design with the old and the new rates is indicated.



EACH READING OF METER CONTRASTS OLD AND NEW RATES

Public Utility Safety Work in Public Schools

Courses of study in safety are receiving increasing attention in the public schools, and in many cases utility companies have interested themselves directly in the courses and taken an active part in conducting the work. Comparatively little has as yet been done toward preparing a textbook on this subject, and most of the effort has been confined to talks and illustrations calculated to reach the children.

Definite action is being taken in some cities toward the formulation of logical courses of study that will become a part of the school routine.

Typical of this sort of work is that done in Toledo, where the school authorities are co-operating with the

Community Traction Company, the Toledo Edison Company and the Toledo Automobile Club. A course of study outline has been prepared which covers eight headings. These are: "How to Avoid Accidents in School," "How to Make the Common Experiences of the Street Safe," "Safety in the Home," "A Study of Fires in the Home," "Ways in Which People Are Burned," "How Can Fires Be Prevented," "Other Forms of Accidents or Unsafe Conditions in the Home," and "How to Prevent Accidents in Public Places."

Some material regarding the dangers of defective wiring and ways in which electric appliances can be misused and create fire hazards is included. In addition to the outline for safety studies an outline of methods of presentation to the primary, middle and upper grades is given in very complete form. In the course in Toledo the subject of electrical hazards is not overemphasized but is included as a part of the general subject. Public utilities, particularly the central-station and electric railway companies, are taking active part in the promotion of such work in the public schools in a number of places. Among the notable movements to include safety in the course of study is that in Chicago, where a complete textbook for use in the city schools is being prepared and it is expected that it will be used actively during the present year.

◆

An Effective "Contrast" Window

AN EFFECTIVE "contrast window" designed to exhibit old and new methods of house cleaning was recently featured by the Worcester (Mass.) Electric Light Company under the direction of O. R. Underhill, superintendent of the appliance department. The accompanying photograph shows how the company's window space was used to tell the story to passers-by.

◆

Courteous Service Mark of Notice to Customers

By A. C. McMicken

Sales Manager Portland Railway, Light & Power Company, Portland, Ore.

IN ITS campaign to impress the public with the fact that service and courtesy are the prime motives of the power company, the Portland Railway, Light & Power Company has made a simple change in the wording of cards which are left on the premises of new tenants by the company's inspectors. This company follows the practice of leaving the service connected when a tenant moves out, in order to save the new occupant the inconvenience of being without lights for several days. When the meter reader on his regular monthly rounds finds the premises unoccupied and consumption shown on the meter since the final reading of the previous tenant, he notifies the commercial department and an inspector calls and leaves a card which reads:

> Our electric service has been left connected, ready to use, for your convenience. No one likes to wait for the electricity to be connected—particularly after "moving in." Will you not help us by telephoning our commercial department within the next five days whether or not you desire the electric service left connected or call at our office and sign the necessary application? We will gladly send a representative for your application if it is not convenient for you to call at our office. Just use the telephone. If you do not telephone our commercial department or call in person within the next five days, we shall understand that you do not want electric service and will disconnect same without further notice.

A WORCESTER WINDOW THAT TOLD THE STORY OF ELECTRIC CLEANING

The card formerly in use frequently created a wrong impression as the wording was decidedly terse and carried a certain note of command. It read:

> In order to save you the inconvenience of an interruption in service, we are leaving your electric lights temporarily connected, with the understanding that within the next five days you will call at our office and sign the required application for service.
>
> If the above conditions are not complied with, we shall be obliged to discontinue service without further notice.

In the redrafted notice the idea of convenience and service has been emphasized, and the customer is made to feel that the company's first desire is to render courteous service.

◆

What Other Companies Are Doing

Ohio.—Two more municipal electric light plants in this state have kicked the proverbial bucket. In Blanchester residents of the village voted four to one to abandon their municipal plant because it was proving too costly a proposition. Energy will be purchased from a privately owned plant. "Expenditures exceeded the income," says the village clerk of Williamsburg in explaining why the municipal plant has been sold and will be operated by a private company.

Utah. — Approximately 95 per cent of all homes in this state within 300 ft. of distribution lines are wired and have electric service. How this has influenced the sale of electric appliances is shown by the following figures: In Utah there are now being used 4,200 ranges, 20,000 washing machines, 60,000 flatirons, 7,500 vacuum cleaners, 1,500 sewing machines, 85 bake ovens and 20,000 other electrical devices such as grills, toasters, percolators and miscellaneous items.

Portland, Ore.—With a total twenty-four-hour generation of 1,028,000 kw.-hr. on Sept. 20, the Portland Railway Light & Power Company broke all former records. The daily generation is now 20 per cent above that of a year ago. As the winter peak is still three months ahead, it is expected that records will continue to be smashed. Unfortunately the fall rains have been delayed and the mountain streams feeding the hydro-electric plants are at extreme low levels. This has taxed the steam plants to capacity.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

The Power Plant in a Modern Sugar Refinery.—ROGER B. STEVENS.—The factors determining the selection of prime movers and the relative advantages and disadvantages of direct-current and alternating-current equipment as applied in the American Sugar Refinery Company of Baltimore are pointed out. After an exhaustive investigation reciprocating engines as prime movers were selected. The chief reason for this choice was that a large part of the steam generated in the plant is expended in closed-coil heaters immersed directly in the sugar solution, and upon the development of a slight leak in any one coil sugar is allowed to go into the boiler water, where, under the influence of heat, it breaks down and forms complex organic acids. These acids, or in some cases the excessive amount of boiler compound which is introduced to neutralize them, are the cause of much deterioration of turbine blades.—*Power*, Sept. 19, 1922.

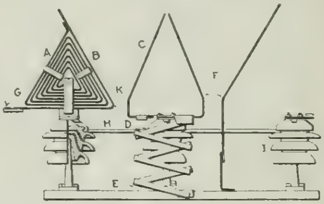
The Hydraulic Turbine in Evolution.—H. B. TAYLOR and L. F. MOODY.—Notable work has been accomplished in the extension of the range of available speeds, so that extremely high specific speeds are now obtainable with satisfactory efficiency. The authors describe some of the lines of development which have been followed and some of the problems involved in applying the new turbine forms.—*Mechanical Engineering*, October, 1921.

Great Falls Development of Manitoba Power Company.—F. H. MARTIN.—An ultimate development of 168,000 hp. is planned for this section of the Winnipeg River. The power house is being built for an initial installation of three 28,000-hp. units operating under a 56-ft head. Concrete centercone draft tubes are to be used. Three-phase, 60-cycle, 11,000-volt, 138.5-r.p.m. generators are provided with 150-kw. direct-connected exciters. A résumé is given of the governors, draft tubes, transformers, thrust bearings and switching equipment.—*Canadian Engineer*, Sept. 12, 1922.

Generation, Control and Switching

Transient Phenomena in a Short-Circuited Alternator.—TARO OTAKE.—A study starting with the generally accepted fundamental equations for a short-circuited alternator and using no questionable assumptions. The solution of these is effected by means of an integral equation, and the results thus obtained are compared with other studies made on this problem.—*Journal of the Institute of Electrical Engineers of Japan*, September, 1922.

High-Voltage Switchgear Developments.—W. A. COATES.—The previous experience of American and European engineers in high-voltage transmission is being used to advantage by English engineers who are just facing this problem. High-voltage switchgear in Continental plants has up to the present been placed indoors, while even the earliest American practice embraced the use of outdoor structures. The most important item in outdoor construction is the oil circuit breaker. The form of lightning arrester shown in the accompanying illustration, which has been widely used in America, is beginning to be used in Englinad.—*Engineer*, Aug. 25, 1922.



HORN ARRESTER FINDING FAVOR IN ENGLAND

In this arrester any impulse coming from the line enters at *G* and, meeting its first impedance at the upward turn *K*, flashes over to the ground horn. A high-frequency discharge will prefer to take the lower resistance path through both main gap *K* and auxiliary gap *F*, while at lower frequencies the path selected would be through the main gap *K* and the resistances *D*, the latter limiting the possible flow of dynamic current.

Transmission, Substations and Distribution

Aspects of the Most Economical Transmission-Line Design.—WILLIAM T. TAYLOR.—In designing a transmission line, the principal independent variables to be taken into account are distance, amount and nature of load, cost of generating energy, spacing of poles or towers, voltage and spacing of conductors. After discussing the various factors that must be considered, the author outlines the steps that must be taken to determine the most economical line.—*Electrical Review*, Sept. 1, 1922.

Steel-Aluminum Overhead Lines.—H. SCHENKEL.—Basing his study on theoretical considerations, the author explains how the stresses due to changes in temperature are distributed between the two metals in a steel-aluminum cable. It is impossible to support such a cable so as to avoid all stresses under all conditions in the aluminum. The calculations show that by proper dimensioning of a bimetallic cable a smaller sag may be obtained and higher towers may be used than with an equivalent copper cable.—*Elektrotechnische Zeitschrift*, Sept. 14, 1922.

Noiseless Automatic Substation for Los Angeles Railway.—CLARK E. BAKER.—The Los Angeles Railway Corporation has solved the problem of building substations in the residential part of the city in a satisfactory manner by utilizing automatic substation equipment housed in an ingeniously constructed sound-proof building of architectural beauty.—*General Electric Review*, October, 1922.

Units, Measurements and Instruments

Direct Reading and Computing Attachment for Sphere Photometers.—B. S. WILLIS.—A very ingenious mechanical arrangement for obtaining direct readings from integrating spheres is described. The device, which was developed by the Bureau of Standards, converts into logarithmic motion the inverse square motion of the comparison lamp of the sphere photometer. Tests show that it has a high degree of precision.—*I. E. S. paper, Swampscott, Mass., Sept.* 25-28, 1922.

Differential Ionometer for the Measurement of Dust in the Air.—H. GREINACHER.—The author has devised an apparatus for the measurement of the ionization of air by X-rays or radium rays and developed formulas for the sensitiveness and the time of indication of the apparatus. An elaborate theoretical analysis of the instrument is given.—*Bulletin of Association Suisse des Electriciens*, August, 1922.

Carbon-Dioxide Meter.—M. WALDHAUSEN.—An entirely new principle is used in the apparatus described in this paper. A small motor pumps the flue gases into a measuring chamber and rotates the same rapidly. Within the chamber is a measuring wheel which is taken along by friction. Air is pumped at the same time into a second identical chamber, with a measuring wheel, but rotated in the reverse direction. The respective rotations of the two wheels oppose each other, and any difference between their torque can be indicated, reading, after proper calibration, directly in per cent of carbon dioxide.—*A. E. G. Mitteilungen*, August, 1922.

Proper Handling, Care and Testing of Insulating Oils.—Nearly all transformers, compensators and oil switches that are used for lighting, power, etc., employ an insulating oil of some grade or other. According to a committee report made at the Huntington convention of the West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers, Sept. 22, special mineral oils of high insulating value, free from acid, alkali and moisture, are used. The danger from absorption of moisture and the formation of sludge can be avoided by testing the transformer oil samples twice a year.—*Coal Age*, Sept. 28, 1922.

Illumination

Lighting the Motion-Picture Studio. —F. F. MILLS.—Lighting requirements for the motion-picture studio are visualized by the author, who points out the field of various illuminants. High-intensity arc lamps are used for special effects, mercury-vapor lamps for general actinic lighting and the high wattage tungsten-filament gas-filled lamps fill their individual place in this industry.—*I. E. S. paper, Swampscott, Mass.*, Sept. 25-28, 1922.

Skylight Illumination on horizontal and Vertical Surfaces.—Sky brightness and daylight illumination measurements were summarized in a report by the committee on sky brightness, H. H. Kimball chairman, at the annual convention of the I. E. S. The measurements were taken in Washington and Chicago during the year ended April 6, 1922. With the sun at different altitudes the intensity for horizontal and vertical surfaces over eight points of the compass was found.—*I. E. S. paper, Swampscott, Mass.*, Sept. 25-28, 1922.

Heat Applications and Material Handling

Manufacture of Carbon Bisulphide. —G. A. RICHTER. — A comparatively recent process is described for the manufacture of carbon bisulphide in an electric furnace. Actual plant data indicate that these furnace units operate with a reasonably fair thermal efficiency. An approximation of the thermal losses is included.—*American Electrochemical Society paper, Montreal*, Sept. 21, 1922.

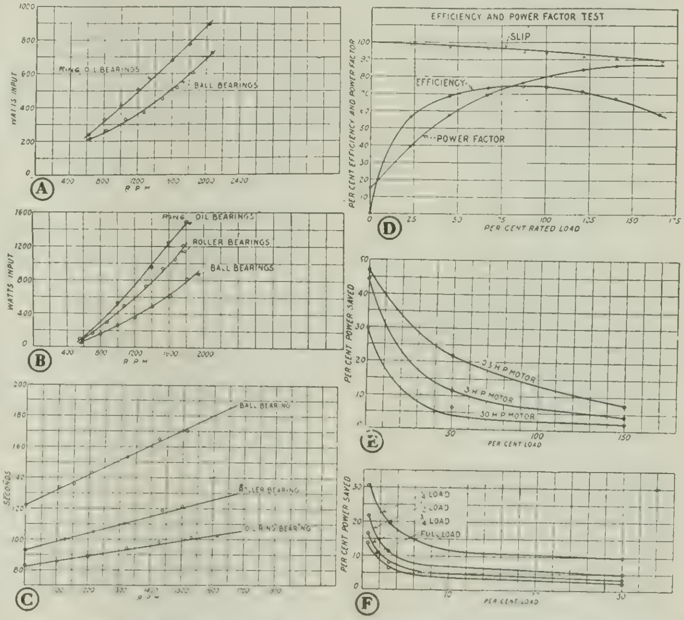
Progress of Electric Welding Processes. — O. WUNDRAM. — A review is given of the development of the arc-welding and resistance-welding methods. It is claimed that too much attention has been paid to the development of special welding generators and transformers with a deplorable lack of research into the welding process itself. Detailed data are needed about the exact current and voltage requirements, the nature of the metal transportation in the arc, the physical and chemical changes of the welded metals, the effect of different fluxes, etc. The latest chemical methods, the microscope and the X-ray should aid in such investigations. — *Elektrische Kraftbetriebe und Bahnen*, Aug. 22, 1922.

Bread-Baking Ovens with Fuel and Electric Heating.—F. GRAF.—Large baking ovens are described which can be heated at will by coal or other fuel or by electric heating units. Most of the ovens were equipped with the second heat supply after they had been installed, and in every case the alteration was done without interruption. The electric capacity of these ovens varies between 3 kw. and 5 kw. per square meter of baking surface. The energy consumed in these ovens amounts to about 0.5 kw.-hr. to 1 kw.-hr. per 1 kg. of bread.—*Bulletin Association Suisse des Electriciens*, August, 1922.

The Electric Range.—F. H. MCCORMICK.—The advantages of the electric range to the household user and to the power supply company are outlined, and a description is given of the manually controlled range, the range which is automatic with respect to temperature control and the range which is super-automatic with respect to both time and temperature control.—*General Electric Review*, August, 1922.

Motors and Control

Ball and Roller Bearings.—G. A. VAN BRUNT.—By properly aligning shafting and providing the bearings and pulleys best suited to the requirements of the machines driven, a marked saving in friction-load shafting installations can be effected. Various designs of ball and roller bearings are described and directions given for installing them on lineshafts and machines. Many illustrations of typical installations are included and the accompanying curves are reproduced to show the comparative tests made on motors equipped with different types of bearings.—*Industrial Engineer*, September, 1922.



COMPARATIVE TESTS ON MOTORS EQUIPPED WITH PLAIN, ROLLER AND BALL BEARINGS

A—Two identical motors except as regards bearings, each driven separately by a third motor. The input represents the windage and friction losses of both driven and driving motors. The difference in the losses represents the saving in power with ball bearings.

B—Windage and friction losses on three motors of similar rating and identical except for the bearings.

C—Curves obtained from the three motors used in B to determine the number of seconds each rotated after the power was cut off.

D—Efficiency and power factor tests made on a 1-hp. ball-bearing induction motor.

E—Percentage of power saved through the use of ball bearings as compared with plain bearings.

F—Saving in power which may be expected with any motor up to 30 hp. equipped with ball bearings instead of plain bearings.

Electrophysics, Electrochemistry and Batteries

Waterproofing by Electricity.—In the perfected type of machine used for waterproofing silk and woolen fabrics two sets of electrodes are employed, the cloth being caused to reverse in the interval between the two electrodes so that both the top and the bottom of the cloth receive a waterproofing treatment. For cotton material four sets of electrodes are used, the cloth being reversed between each set. The method of applying the waterproofing material electrically is described.—*Electrical Times*, Sept. 14, 1922.

The Effect of Impurities in Nickel Salts Used for Electrodeposition. — M. R. THOMPSON and C. T. THOMAS.— Investigations were conducted by the authors to determine the effect of the principal impurities present in nickel salts upon the character of the deposited nickel. It was found that of the impurities likely to be present copper and zinc are especially objectionable. Analyses were made of a considerable number of samples of commercial salts, and specifications for the purity of these materials are suggested. — *American Electrochemical Society paper, Montreal*, Sept. 21, 1922.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University Ithaca N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Arc, Carbon, Temperature of.

By using rotatory dispersion through Nicol prisms, data obtained upon the crater of the carbon arc indicate a color temperature of about 3,780 deg. K. for solid carbons and 3,420 deg. K. for cored carbons. —*Irwin G. Priest, Bureau of Standards, Washington, D. C.*

Alternators, Short-Circuit Tests on.

In some severe short-circuit tests on large alternators a mechanical recording arrangement was attached to the free ends of the stator coils for ascertaining any possible deformations or displacements. On the field coil of one of the pole pieces strips of paper were pasted, partly stretched and partly loose, in order to find out if there were any mechanical results of a sudden short circuit. No measurable deformations were found anywhere.—*F. Wuethrich, Baden, Switzerland.*

Capacitance or Inductance, Extremely Small, Measurement of.

With a hot-cathode Braun tube it is possible to determine very small deviations in frequency. Changes in a capacitance or inductance may be made proportional to those in a standard frequency, and thus measured. Theoretically, a change of inductance of the order of one part in 10^6 can be detected.—*H. G. Tasker and L. T. Jones, University of California, Berkeley, Cal.*

Dynamometer, Electric, for Testing Chassis.

The well-known electric dynamometer has been applied to testing automobile engines assembled on the chassis. The rear wheels of the car stand on and drive the traction drums of the dynamometer, while the car itself is held stationary by being attached to an anchor. The dynamometer can be regulated from the driver's seat.—*Sprague Electric Works, New York City.*

Frequency, Measurement of, by Hot-Cathode Braun Tube.

Two oscillating circuits are made to deflect a cathode beam in two directions at right angles to each other. The combined deflections produce one of the well-known Lissajous figures. If the two circuits are of exactly the same frequency, say 500,000 cycles, the resulting figure will in general be an ellipse. A frequency change of 5 cycles per second will cause the ellipse to revolve five times per second.—*L. M. Hull, Bureau of Standards, Washington, D. C.*

Instruments, Recording, Damping of.

In recording instruments in which oil is used for damping the character of the record may be modified at will by changing the viscosity of the oil. Tests were made on two identical wattmeters connected to a rapidly fluctuating load. One, filled with very light oil gave a record showing minute fluctuations of the load; the other, filled with the heaviest cylinder oil, gave only general variations of the average load. Careful planimetering of the two curves showed the areas to be equal.—*J. W. Esterline, Indianapolis, Ind.*

Mercury Rectifier, High-Tension, High-Power.

A large mercury rectifier was recently built and operated continually at 5,400 volts, 300 amp. (1,620 kw.). It worked without a mishap for a long time, during which tests were made on switching, overloads, short circuits, etc. This type of rectifier should prove useful for automatic substations in the coming extensive electrification of steam railroads.—*Brown, Boveri & Company, Baden, Switzerland.*

Motors, Direct-Current, Synchronous Running of.

In some industrial applications two or more identical shunt-wound direct-current motors must be run in parallel at exactly the same speed. This can be accomplished by providing each armature with three taps connected to slip rings, as in a rotary converter. The corresponding alternating-current brushes of the two machines are connected together. Actual tests have shown that the motors are then forced to run at exactly the same speed because of synchronizing currents. The motor fields can be provided with compound windings; the series coils of motor 1 are connected in series with the armature of motor 2, and vice versa. A similar arrangement works satisfactorily with two motors in series. A one-to-one ratio transformer is used between the two machines on the alternating-current side.—*Cladius Shenfer, Technical High School, Moscow, Russia.*

Nitric Oxides and Ozone, Production of.

An extended investigation has been made of the various factors which enter into the production of oxides of nitrogen and ozone, during corona discharge, particularly with the view of securing higher concentrations of the above products and higher yields per kilowatt-hour. Various types of tubes in which electrical discharges are confined have been tested. For details see Bulletin No. 9 of our Engineering Experiment Station.—*K. B. McEachron, Purdue University, Lafayette, Ind.*

Quartz Lamp, Silica-to-Metal Joint for.

In order to obtain a vacuum-tight quartz-to-metal seal which can stand relatively high temperatures, a homogeneous graded joint has been developed in which fused quartz is connected through intermediate steps of glasses of increasing coefficients of expansion to a glass fused directly to a metal lead-in wire.—*L. J. Buttolph, Hoboken, N. J.*

Sound Intensity, Measurement of.

An electrostatic transmitter combined with a vacuum-tube amplifier is well adapted for the measurement of intensities of complex tones and for use with an oscillograph for recording sound waves. The arrangement can be made either uniformly sensitive over a wide range of frequencies or highly selective for a definite pitch. For details see *Physical Review*, Vol. 19, 1922, page 498.—*E. C. Wente, New York City.*

Ultra-Violet Arc for Testing Materials.

A mercury-arc lamp in a fused-quartz chamber, with suitable filters, has been developed as a source of powerful ultra-violet rays. This lamp has been applied to the testing of dyes, inks, textiles, leather, paints, paper, rubber, etc., for the fading or deteriorating effect of sunlight. Because of the intensity of ultra-violet rays in the arc, a rate of fading which would require about thirty days of June sunlight can be accomplished in a single working day. This light causes fluorescence of some substances and can be used for many practical tests. Thus certain paint pigments instantly show their instability by a visible fluorescence. Fraudulent work and alterations in paintings or manuscripts are easily detected by the dissimilar fluorescence. In the reduction of zinc ores a brilliant fluorescence of the residual willemite in the tailings indicates the amount unextracted.—*L. J. Buttolph, Hoboken, N. J.*

Watt-Hour Meters, Effect of Unsymmetrical Current Wave on.

Four typical commercial induction-type watt-hour meters have been investigated to determine the effect of a load with a symmetrical emf. wave but a non-symmetrical current wave. The meters were tested (1) at three voltages and at unity power factor and (2) at three power factors at the normal voltage, each test for six current values. In no case did the error exceed usual commercial limits, and the greatest observed difference due to changing the load from symmetrical to unsymmetrical was about 2 per cent. At very light loads a somewhat greater variation was observed. A 6-amp. "tungar" rectifier was used to obtain non-symmetrical current waves.—*W. F. Davidson, University of Michigan, Ann Arbor, Mich.*

Suggestions for Research

Cables, Copper, Elasticity of.

It is desired to investigate the effective modulus of elasticity of copper in the form of a standard cable, as compared with a solid conductor of same cross-section. This value is important in determining the stress developed in an overhead cable. — *M. G. Lloyd, Bureau of Standards, Washington, D. C.*

Cables, Insulation of, Represented by Equivalent Leaky Condensers.

For purposes of computation an imperfect cable insulation may be replaced by a perfect condenser shunted by a high resistance. For a more detailed study of the internal phenomena in the insulation it seems better to replace it by two or more leaky condensers in various combinations. A beginning of such a study will be found in a paper by DelMar and Hanson, *A. I. E. E. Journal*, 1922, page 439. Other combinations of leaky condensers should be tried and the results checked on flat samples of impregnated paper and on actual cables.

Furnace, Arc, for Melting Gray Iron.

One of the most promising fields for the electric furnace is where strong gray castings of thin section are required. The sulphur content in scrap iron is often too high to permit of satisfactory thin-section castings being poured from the cupola.—*B. C. Gibson and E. L. Crosby in the N. E. L. A. Bulletin.*

Hysteresis Loop.

While the general hysteresis loop is known, very little is known about the way in which a loop changes with frequency or when one or more of the required harmonics to support it are missing.—*F. S. Dellenbaugh, Jr., Massachusetts Institute of Technology, Cambridge, Mass.*

Insulators, Wet Flashover Test of.

Some recent German tests (*Electrical World*, Sept. 23, page 674) indicate large differences in the flashover voltage, depending upon the conductivity of water used. Systematic tests should be made to determine the quantitative relationship between the two. Either water of standard conductivity should be specified for wet tests on insulators or else a curve should be agreed upon for correction to some agreed standard conductivity of water.

Tanning of Hides by Electricity.

It is imperative that some means be found whereby extract tanning processes for hides can be accelerated, because the amount of capital invested in pelts laid away to tan is far greater today than in times previous. So-called electric tanning, possibly through an adaption of the phenomenon of electric osmose, may eventually solve this problem. Electric tanning processes of this nature have been experimented with in Germany and England of late, and a considerable degree of success has been attained.—*W. E. Broughton and J. J. Brophy, in the A. I. E. E. Journal, September,* 1922.

Watt-Hour-Meter Jewels, Oil for.

Actual tests show that fish oils do not merit confidence for lubricating pivots of watt-hour meters since organic acids are formed in contact with air and brass which attack brass and nickel. Iron oxide of high abrasive properties is also formed, allowing the pivot to grind the jewel. It is believed that more satisfactory oils of petroleum or asphaltic base are available.—*F. C. Holtz, Springfield, Ill.*

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Stratton Head of M. I. T.

Praising Him, Secretary Hoover Deplores the Inadequacy of Government Emoluments

DR. S. W. STRATTON, head of the United States Bureau of Standards, Washington, was elected president of the Massachusetts Institute of Technology on Oct. 11 at a meeting of the corporation and will assume office at Cambridge on Jan. 1, 1923.

In connection with Dr. Stratton's election Secretary Hoover of the Department of Commerce gave out the following statement:

"The loss of Dr. Stratton as head of the Bureau of Standards is a real national loss. He has built up that service from a bureau devoted to scientific determination of weights and measurements to a great physical laboratory co-operating with American industry and commerce in the solution of many problems of enormous value to industry which the commercial laboratories of the country, from lack of equipment and personnel, have been unable to undertake.

"While the Massachusetts Institute of Technology is to be congratulated on securing Dr. Stratton, one cannot overlook the fact that the desperately poor pay which our government gives to great experts makes it impossible for us to retain men capable of performing the tasks which are placed upon them.

"The Massachusetts Institute of Technology, an educational institution, finds no difficulty in paying a man of Dr. Stratton's caliber three times the salary the government is able to pay him.

"Dr. Stratton has repeatedly refused large offers before, but the inability of the scientific men in the government to support themselves and their families properly under the living conditions in Washington, and to make any provision for old age, makes it impossible for any responsible department head to obtain such men for public service at government salaries."

Work Begun on Illinois Plant to Cost $12,000,000

The Middle West Power Company, a subsidiary of the Middle West Utilities Company, announces that ground has been broken for its new plant on the east bank of the Mississippi River at Grand Tower, Jackson County, in the southern Illinois coal fields. Building plans call for a total generating capacity of 100,000 kw., representing an ultimate investment of $12,000,000, with provision for still further extension in the future. The first unit to be installed will be rated at 25,000 kw., and there will be room for another unit of this size in the section of the station first completed, which will be of the highest type of modern construction. The turbine, boilers, stokers and other equipment for the first unit have been contracted for, and the plant is expected to be in operation early in the fall of next year.

The Grand Tower plant will furnish electrical energy to another Middle West Utilities Company subsidiary, the Central Illinois Public Service Company, which serves 187 central and southern Illinois cities and towns and has a plant at Muddy, near Harrisburg, Ill. The two plants will be tied together by a 66,000-volt steel-tower transmission line, thus insuring continuous service to the bituminous fields which lie between them.

Will Not Rehear Loop Case

Wisconsin Supreme Court Reaffirms Its Finding in Eau Claire Suit Against Unit Charges

THAT municipalities must be treated as separate units by the Wisconsin Railroad Commission in making electric rates was reiterated by the Wisconsin Supreme Court last week in denying the motion of the state for a rehearing in the case of the city of Eau Claire against the commission. Unless a change in the statute is made by the Legislature, the commission will be required to rearrange the schedule of charges of virtually all electric utility companies in the state as a result of the Supreme Court's decision.

In a recent order the Railroad Commission fixed one rate on electric service for the cities of Eau Claire, Menomonie and Chippewa Falls, all supplied by the Wisconsin-Minnesota Light & Power Company and forming part of the territory served by the company's "loop" system. The city of Eau Claire appealed to the Supreme Court from the commission's ruling, contending that the state board could not legally fix a uniform charge for utility service for a whole district in one order. When the case came before the Supreme Court in July it held the commission's action to be illegal on the ground that it had no power to make equal rates where the expense of service differed. (See *Electrical World* for July 29, page 219.)

Shoals Lease Renewed

Government Plant Will Be Operated by Alabama Power Company for Another Year

RENEWAL for another year of the lease under which the Alabama Power Company operates the government's steam-electric plant at Muscle Shoals, Ala., has been announced by Secretary Weeks. The company will pay the government the same rental as heretofore, amounting to $10,000 a month for the use of the plant, plus a charge of 2 mills a kilowatt-hour for all the energy developed. During 1922 the rental to the government is expected to exceed $200,000. Renewal of the lease, Secretary Weeks said, will enable Southern industries served by the Alabama Power Company through its interconnections to plan against possible recurrence of drought and coal shortage next year.

MR. MARTIN ON COMPANY'S ACHIEVEMENTS

Discussing the renewal of the lease, Thomas W. Martin, president of the Alabama Power Company, said:

"Our present lease with the government for the Sheffield steam plant expires Dec. 1, and it had been evident for some time that our company would be unable to supply the demand of power in this state during the coming winter without the assistance of the Sheffield plant. The Mitchell Dam will be completed during the early part of the spring of next year, but even with that plant the company will probably be unable to meet the demands for power during the low-water seasons of next year without the government plant at Sheffield. In addition, the present demand of the power companies in the other Southern states is much in excess of their capacities, and they will require assistance during the coming winter and for a considerable part of next year. We are now and have for some time been supplying power generated at the Sheffield plant to the companies in Georgia and North and South Carolina. This has been of great assistance in their districts in keeping numerous industries and utilities operating."

Several thousand miles of high-voltage transmission lines are now being used by the Alabama Power Company, and with its various interconnections in Alabama, Tennessee, Georgia, North and South Carolina, the system now, according to President Martin, is the largest in the whole country.

Edison Visits Schenectady

Sees General Electric Plant for First Time in Quarter Century and Views New Inventions

FOR the first time in twenty-five years Thomas A. Edison visited the General Electric Comany's plant at Schenectady, N. Y., on Wednesday of this week, his visit making a red-letter day for the great establishment. He was received by the president and other high officers of the company and escorted over the plant, where he saw the newest inventions and developments and met a number of former associates and employees of his own who were connected with the industry in its pioneer days. Among the objects of special interest that Mr. Edison inspected were the new high-powered vacuum tubes, the recently perfected mercury boiler and the machine for registering the voice by photographic means on motion-picture films in order to produce the long-looked-for "talking movies." Dr. Steinmetz gave an exhibition of his artificial lightning-making machine for Mr. Edison's benefit, and in the accompanying illustration he is showing the visiting inventor broken porcelain insulators and a piece of a tree limb which he had shattered a few minutes before in a mimic lightning storm.

Courtesy of General Electric Company

STEINMETZ ENTERTAINING EDISON AT SCHENECTADY PLANT

President Appoints Coal Commission

President Harding has announced the appointment of the Fact-Finding Coal Commission of seven men to study the coal industry and the problems developed by the recent strikes and to make recommendations to Congress which may serve to bring about legislation to prevent recurrent labor troubles in the coal fields. The appointment of the commission was authorized by Congress.

The commission consists of John Hays Hammond, engineer; Thomas Riley Marshall, former Vice-President of the United States; Judge Samuel Alschuler of Chicago, a United States Circuit Judge, who has acted as an arbitrator in recent labor disputes; Clark Howell, editor of the *Atlanta Constitution;* George Otis Smith, director of the United States Geological Survey; Dr. Edward T. Devine of New York, a writer on social and economical questions, and Charles P. Neill of Illinois, former Federal Commissioner of Labor.

John Hays Hammond was elected chairman of the commission by his fellow-members at the first meeting, which was held in Washington on Wednesday of this week.

Federal Power Commission Expedites Work

The staff of the Federal Power Commission is engaged in an active endeavor to hurry action on all pending applications. Of the 349 applications which have been filed with it, 201 have been acted on. Sixty-four preliminary permits have been issued, sixty-four licenses have been issued, twenty-five applications have been rejected, and forty-eight applications have been withdrawn or canceled. Of the remaining 148, there are thirty-five applications on which action has been suspended indefinitely because the commission must await the action of some other agency before it will be in a position to consider the case. In this category come the St. Lawrence and Colorado River applications and those on the Columbia River which affect the Columbia basin project in the state of Washington.

Of the remaining 113 applications, thirty are so incomplete that the commission cannot act on them. When the act was passed a flood of applications poured in before rules could be drawn or forms prepared. So as not to work an injustice or to cause unnecessary delay in prospective developments, the commission accepted any informal application or declaration of intention.

When applications now are received, it is the policy of the commission to require the applicant to proceed actively with his undertaking or to throw out the application. The purpose is to save the commission the burden of correspondence, of investigation and of public hearings which can have no immediate result. There is also the matter of preventing "blue-sky" promoting based on the false claim that the applicant enjoys certain rights.

Edison Association Officers

At the concluding session of the convention of the Association of Edison Illuminating Companies at White Sulphur Springs, West Va., last week, Matthew S. Sloan of the Brooklyn Edison Company was re-elected president and John F. Gilchrist of the Commonwealth Edison Company of Chicago was re-elected vice-president. Samuel Ferguson of the Hartford (Conn.) Electric Light Company was elected treasurer, and Preston S. Millar of the Electric Testing Laboratories of New York was re-elected secretary and assistant treasurer.

The executive committee comprises the officers and the following members: Samuel Insull, Commonwealth Edison Company, Chicago; W. W. Freeman, Union Gas & Electric Company, Cincinnati; Charles L. Edgar, Edison Electric Illuminating Company of Boston; J. B. McCall, Philadelphia Electric Company, and John W. Lieb, New York Edison Company.

A most interesting symposium of European impressions was given on the evening of Oct. 11, at which time John W. Lieb spoke of the opportunities which are available for hydro-electric development in Italy, where market conditions and stability of enterprise warrant generous encouragement from American investors. W. H. Patchell, vice-chairman of the Institution of Mechanical Engineers of Great Britain and an eminent consulting engineer, reviewed briefly advanced steam and electric practice followed in recent British and French installations, and K. Yamaguchi of Tokio spoke of the marvelous growth of hydro-electric development in Japan.

As a part of the report of the lamp committee an exhibit was given of a heterogeneous group of incandescent lamps purchased in various sections of the country from contractor-dealers, drug stores, hardware stores and other places. This exhibit indicated to what extent the average user is imposed upon by the seller of inferior lamps and in contrast showed the marked uniformity and superiority of the "Mazda" lamps.

Civil Engineers Discuss Water Power

San Francisco Meeting Given Over Largely to This Subject—Problems and Developments in West Create Lively Interest—Hetch Hetchy Project Inspected

THE fall meeting of the American Society of Civil Engineers, held in San Francisco from Oct. 4 to Oct. 8, was given over almost entirely to a discussion of water-power development, a problem in which the West is so vitally interested. The marked interest in the discussion of this subject was evidenced by the large attendance and close interest at all sessions. Each morning session was attended by about 350.

After the opening address of President John R. Freeman, noted in last week's issue, an illustrated talk on the Colorado River development was given by A. P. Davis, director of the United States Reclamation Service, who said that the river can be made to develop 6,000,000 hp. and to irrigate 6,000,000 acres. Its complete and efficient use for power requires large storage, though the most urgent need is the control of the destructive floods poured over the lower valleys every year. J. B. Lippincott of Los Angeles, in discussing Mr. Davis' paper, said that if federal development of storage and power could not be begun soon, the federal authorities should at least allow private enterprises, which stood ready, to undertake it.

O. C. Merrill, the executive secretary of the Federal Power Commission, said that in the two years since the water-power act was passed 348 applications for permits, aggregating more than 20,000,000 hp., have been filed with the commission. Fifteen licensed developments, involving an estimated installation of 1,880,000 hp. and an investment of $220,000,000, are either completed or under construction, or one and a half times as much as was constructed under federal authorization in the twenty years preceding the passage of the act.

PACIFIC COAST DEVELOPMENT

F. H. Fowler, district engineer United States Forest Service, San Francisco, in a paper on "Water-Power Potentialities of the Pacific Coast," showed that practically all the Western coast is within a 500-mile radius of the two great sources of power on the Colorado and Columbia Rivers. The enormous power possibilities here, however, cannot be developed economically except in large blocks, and consequently markets for the power must be found before development will be feasible. In the long run oil cannot be a competitor of hydro-electric power. The entire Western region, he said, could be supplied from developments on the Colorado and Columbia if this power could be successfully transmitted over distances of 500 miles.

John D. Galloway, consulting engineer, San Francisco, presented a paper on "Hydro-Electric Developments on the Pacific Coast." He discussed the necessity for avoiding a conflict of irrigation and power interests in water storage. Power demand in California, he said, has been increasing three to four times as fast as the population. By 1930, he estimated, the annual energy output will exceed 10,000,000,000 kw.-hr.

M. M. O'Shaughnessy, city engineer of San Francisco, expressed a view favorable to state ownership of power development only when the entire power resources of an extensive area can be tied together and controlled as one system, and when the state shall have the right to condemn all of the present power companies' holdings, as at present all of the good developments have been taken by the power companies and the state would have to content itself with projects of second class. Such developments, he said, must be on a sound basis, very unlike the impracticable scheme of the California water and power act now proposed.

HIGH-VOLTAGE TRANSMISSION

F. W. Peek, Jr., consulting engineer, General Electric Company, Pittsfield, Mass., in his paper on "High-Voltage Power Transmission," showed that the ultimate voltage of transmission lines would not be limited by engineering difficulties, but rather by sources and markets for power. In his opinion it will be necessary to have a minimum of 100,000 kw. of power per circuit to be transmitted before 1,000,000-volt transmission will be economically feasible, in view of the great cost of lines at very high voltages. A 1,000,000-volt transmission line, for example, should have tubular conductors 6 in. in diameter, spaced 30 ft. apart on 20-ft. insulators, or towers probably about 200 ft. high. Prof. Harris J. Ryan, Stanford University, who presented a paper on "High-Voltage Phenomena Encountered in Power Transmission," agreed with Mr. Peek that 100,000 kw. per circuit is the minimum power that can be economically transmitted at 1,000,000 volts.

H. W. Dennis, consulting engineer of Southern California Edison Company, co-author with H. A. Barre, executive engineer of the same company, of a paper on electric power in southern California, said that in the territory served by the Southern California Edison Company the population had increased over 300 per cent between 1910 and 1920 and that during that time the company had increased its output from 379,900,000 kw.-hr. to 1,079,000,000 kw.-hr. During the next six years 322,000 hp. will be developed and a distribution system provided at a total cost of about $125,000,000. In 1922 the company is expending $27,000,000 for new water-power plants and additional distribution facilities.

The conclusion arrived at in the paper presented by C. F. Loweth, chief engineer Chicago, Milwaukee & St. Paul Railway, on "Hydro-Electric Power Development as Related to Electrification of Railroads," was that it is reasonably safe to assume that hydro-electric power will be a large factor in steam-railway electrification under the following conditions: (1) When it is available over such an extended area as will include a large main track mileage for the individual railroad under construction, (2) when the several sources are tied in together so as to insure reliability, (3) when it can be contracted for extending over long periods, and (4) when its cost reduced to terms of locomotive tractive effort is cheaper than that of steam-generated power."

Following the Thursday evening meeting, the delegates went by train to inspect the Hetch Hetchy combined municipal water supply and hydro-electric project of the city of San Francisco. Here an opportunity was afforded to study in detail a typical Western development of large proportions. In its present stage work is under way on a concrete and an earthen dam, an 18-mile tunnel, forebay, penstock, power house and other construction work incidental to a combined water and power development served by its own 68-mile railroad.

Weymouth Plant to Afford Interconnection Facilities

The new generating plant about to be built at Weymouth, Mass., by the Edison Electric Illuminating Company of Boston, as announced in the *Electrical World* for Oct. 7, page 788, had its origin in the fact that the 30,000-kw. unit now being installed by the company at its L Street station in South Boston will make further expansion at that site impossible without radical changes. The Weymouth plant will be about 2 miles from the harbor at tidewater, and coal barges can reach it by ship canal.

The company is at present supplying Weymouth and the adjacent city of Quincy with electrical energy, and the main cables which pass by the new site will conveniently serve as an initial tie line between the new plant and the L Street station, 8 miles distant. It will also be easy to take energy from this plant for any electrification scheme of the steam railways or to tie into the proposed superpower line along the Atlantic Coast.

The property when filled to the bulkhead lines established by the government will consist of about 60 acres. The plans will be prepared for a station that will ultimately have a capacity of approximately 300,000 kw., together with the necessary outdoor switching, transformer stations and administration buildings and storage capacity for at least 300,000 tons of coal. Tentative preliminary plans have been based upon an initial installation of two 30,000-kw., 60-cycle turbines with boiler plant sufficient for one unit.

Putting Pit River No. 1 Into Service

The formal opening of Pit River No. 1 power plant of the Pacific Gas & Electric Company, in northern California, on Sept. 30, brought together 200 bankers, business men and engineers, invited guests of the power company, who journeyed from San Francisco on a special train, and representatives of many northern California communities. The ceremonies at the plant as well as at the Vaca substation, 28 miles from Sacramento, the terminus of the 200-mile, 220,000-volt transmission line from the Pit River plant, were under the direction of the civic organizations of northern California. To the accompaniment of rousing cheers, a switch was closed at the Pit River plant at 4:30 p.m. by Miss Isabel Creed, daughter of President W. E. Creed of the Pacific Gas & Electric Company, and at the same moment an answering cheer arose from the Vaca substation, where flashing of lights, increasing in brilliancy as the current reached its maximum, and an American flag slowly rising as a motor to which the ropes of the banner were attached began to operate, told several thousand waiting persons that the great undertaking had been achieved.

GREAT CROWD CHEERS OPENING OF PIT RIVER PLANT NO. 1

Middle West Utilities Gets Syndicate Holdings

The Middle West Utilities Company announces that it has acquired the entire holdings of the syndicate formed late in 1921 which obtained a controlling interest in the Ironwood & Bessemer Railway & Light Company, the Ashland Light, Power & Street Railway Company and the Big Falls Water Power Company. After the acquiring of control in the three companies, the name of the Big Falls Water Power Company was changed to Lake Superior District Power Company, and under that name they were merged a few months ago. By the transaction just consummated the Middle West Utilities Company, which was a participant in the syndicate, obtains for itself all of the common stock of the Lake Superior District Power Company together with certain preferred holdings.

The Lake Superior District Power Company serves Ashland, Hurley and Ladysmith, Wis., and Ironwood, Bessemer and Wakefield, Mich., together with fifteen other communities and a large number of iron mines in the Gogebic iron range in Wisconsin and Michigan. The company is now constructing a large hydro-electric plant on the Flambeau River at Big Falls, Wis. The possibilities for the development of electric power business in the territory served are very great.

New Ohio Plant to Operate at 530 Lb. Pressure

The Ohio Power Company, a subsidiary of the American Gas & Electric Company, is preparing plans for a new power station to be erected on the Muskingum River at Philo, Ohio, about 9 miles south of Zanesville, and contract has been placed for two 35,000-kw. General Electric turbines, which will be operated at 530 lb. steam pressure and a total temperature of 725 deg. F. at the turbine throttle. A contract has also been placed with the Babcock & Wilcox Company for the boilers, which will be built for 650 lb. working pressure, although they will be operated at 550 lb. pressure. The boiler units will consist of boilers, superheaters and economizers of the same design as those being installed for the Waukegan Generating Company. It is understood that many new features will be embodied in the design of this station. Sargent & Lundy, Chicago, are the consulting engineers.

National Radio Chamber to Investigate Broadcasting

It is officially announced that the newly organized National Radio Chamber of Commerce, with headquarters at New York, has virtually completed the selection of its executive personnel and will at once through a committee of investigation turn its attention to the broadcasting problem. William H. Davis, New York, is the president of the chamber, and its declared purposes are these:

"To aid the government and the American people in peace or war, to eliminate the confusion of rapid development, to work with the federal departments in devising a rational scheme of broadcasting for the nation, to promote on a universal scale effective organization of all radio instrumentalities, and in general to undertake at once the solution of the pressing problems of the industry now leading to conflict."

Power Club Will Discuss Temperature Ratings

At the fall meeting of the Electric Power Club, to be held from Oct. 30 to Nov. 2 at Grove Park Inn, Asheville, N. C., an important feature will be the report of the temperature rating committee of the Motor and Generator Section, which will concern a proposal to substitute as a standard of the club a 40-deg. single rating for the present 40-degree double rating and 50-degree single rating. The sentiment for the 40-degree single rating is said to be growing, but no final vote can be taken at this meeting, because to change or rescind a standard requires three months' notice. An agreement to take a letter ballot on the matter or even to settle it at the next meeting may possibly be reached.

Other features of the program will be as follows:

MONDAY, OCT. 30

Morning.—Section and committee meetings.

Afternoon.—Meeting of the board of governors.

Evening.—President's address, R. J. Russell; reports of officers: "Advantages and Limitations of Different Advertising Mediums," C. H. Clark, advertising manager Robbins & Myers Company; report on activities of Electrical Manufacturers' Council, S. L. Nicholson

TUESDAY, OCT. 31

Morning.—Section and committee meetings.

Afternoon.—Sports.

Evening.—Committee reports: "Neglected Possibilities of Publicity for Member Companies," H. W. Young; "Extent of Foreign Competition at Home," S. L. Nicholson.

WEDNESDAY, NOV. 1

Morning.—Section meetings.

Afternoon.—Meeting of the board of governors

Evening.—Dinner: "First-Hand Observations of Conditions in Europe Today," James Burke; "Opportunities for Electrical Apparatus Manufacturers in the Orient," S. Glen Vinson.

THURSDAY, NOV. 2

Morning.—Committee reports; "Cancellation of Orders and Business Morality," Alfred E. Waller; "Repair and Replacement Policies and Proper Marking of Nameplates," B. Lester.

Contractor-Dealer Body Changes Name

It Will Hereafter Be the "International Association of Electragists"—Parallel Sections Are Set Up to Solve Difficulties That Arise in Connection with the Labor Problem

CHANGES in the constitution making its new name "The International Association of Electragists," separating individual memberships from state association, affiliation, limiting to its own members only the right to use the new copyrighted term for contractor-dealers ("electragists"), and setting up separate sections for union and open-shop employers, were among the steps taken by the former National Association of Electrical Contractors and Dealers at its Cincinnati convention Oct. 11 to 14.

National Chairman James R. Strong in his official address on Wednesday spoke of the problems of the association in helping both large and small contractor-dealers, as well—those employing union labor as those employing non-union labor, and made a plea for good-fellowship in approaching all association problems.

George M. Verity, president of the American Rolling Mills Company, Middletown, Ohio, read a paper on "Business Today and Tomorrow," outlining the sweeping changes which have taken place in business and industrial relations. "Yesterday," he said, "the great problem was production. The problem of the future is efficiency in distribution in every line of human endeavor."

W. R. Herstein, Electrical Supply Company, Memphis, Tenn., spoke on the relations between the electrical supply jobber and the "electragist," indicating how the wholesaler can be of service to the electrical contractor-dealer through the following out of business policies of constructive value to each. Frank E. Watts of the *Electrical Record* followed with a talk on the aims of the Joint Committee for Business Development.

Merchandising Lessons in a Play

"The Awakening of Mr. Moss" was the title of a four-act comedy presented by employees of the Union Gas & Electric Company, under the direction of T. L. Phillips. It recounted the business transformation of a discouraged electrical contractor—with the aid of a local central-station wiring campaign—into a hustling "electragist" with an attractive store, an electrically equipped home of his own and a keen eye for business.

On Thursday Arthur L. Abbott of St. Paul discussed the new "Manual for Estimating" prepared by the committee of which he is chairman. F. M. Feiker, vice-president McGraw-Hill Company, New York, sent a message to the convention emphasizing the point that national associations and national movements will be effective only as they stimulate individual action in getting after business. Edward T. Miller, Chicago, explained how the United Typothetæ of employing printers functions with its parallel union and open-shop sections. E. H. Eardley, Salt Lake City, in his report as chairman of the engineers' committee, dwelt upon the need for more specific specifications for electrical work.

Eight Geographical Divisions

Friday morning's session took up the ratification of changes in the constitution as recommended by the association's executive committee. By vote of the convention, the name of the association was changed to "The International Association of Electragists" in recognition, first, of the membership on both sides of the boundary between the United States and Canada and, second, to give wider currency to the coined word "electragist." It is planned to hold meetings or "regional" conventions of members in various sections of the country. For organization purposes the membership is divided into eight geographical divisions, each of which elects a member of the executive committee. A "closed-shop" section and an "open-shop" section of the association were also authorized and were later formed by their respective adherents, L. K. Comstock, New York, being elected to head the section of union employers and Arthur L. Abbott the open-shop advocates.

Lawrence W. Davis, special representative of the association, told how membership in the association benefits the individual electrical man.

"The National Electrical Code—Its Past, Present and Future" was discussed by Dana Pierce, chairman of the electrical committee of the National Fire Protection Association and vice-president of the Underwriters' Laboratories. A. Penn Denton, the association's representative on the code committee, told of the trend of the committee's opinion toward abolishment of the "660-watt rule" and placing dependence on limiting the number of outlets on a circuit to be supplied through a branch fuse. Approval of the 15-amp. fusing of circuits where the No. 14 circuit wire is carried directly into the outlet or socket wired to is also under consideration.

Cincinnati's Sales Campaign

W. W. Freeman, president of the Union Gas & Electric Company, told how 20,000 houses are now being wired each year in Cincinnati because of an aggressive sales campaign. Of the total number, 53 per cent are handled on the company's own books, while the remaining 47 per cent have been taken and handled by non-affiliated contractors.

John F. Gilchrist, vice-president Commonwealth Edison Company, Chicago, referred to the close relationship existing between all groups in the industry and declared that lack of prosperity in any branch tends to drag the whole industry down. Assuming that an installation can be sold to the average customer costing as much as the $200 investment per kilowatt behind the central station's service line, Mr. Gilchrist pointed out that the $300,000,000 needed in the near future to finance central-station extensions will be duplicated in the sales of equipment and merchandise passing through electrical trade channels.

William L. Goodwin of the Society for Electrical Development described briefly the work of that organization and was followed by Miss Alice Carroll of the society's staff, who gave a talk on "How to Sell the Electrical Idea to the Ladies."

The 1923 convention of the International Association of Electragists will be held at Washington, D. C., probably about the middle of September.

Permits for the Deschutes

Federal Commission Issues Them to Two Oregon Companies—Colorado River Permit Extended

THE Federal Power Commission at a meeting on Oct. 10 authorized the issuance of a preliminary permit to the Pacific Power & Light Company of Portland, Ore., covering a project on the Deschutes River at the reclamation site, 20 miles above the mouth of the river. H. S. McGowan of McGowan, Wash., was also an applicant for this permit.

The commission authorized the issuance of a preliminary permit to the Columbia Valley Power Company covering two sites on the Deschutes River. The company applied for a permit to cover five sites on a 34-mile stretch of the river just below the junction with the Metolius River. It was held, however, that the company should demonstrate what it could do with the two upper sites before the permit was extended to include the other three. A conflicting application by H. S. McGowan was rejected.

The preliminary permit of James B. Girand covering a development on the Colorado River was again extended until March 19, 1923. The extensions have been necessary because of objection on the part of the Reclamation Service.

The application of the late William Park Mills covering a project on the Vermilion River in the Cabinet National Forest was rejected. Preliminary permits to E. Fletcher of San Diego were authorized covering a 3,600-hp. development on Santa Isabel Creek in the Cleveland National Forest and a 900-hp. development on Boulder Creek in the same forest.

The commission has received an application from Frank I. Reed of Anchorage, Alaska, for a preliminary permit covering the construction of a dam and a power house in connection with a project on Eklutna River and Lake in the Knik region of Alaska.

Dr. Kennelly's Impressions

Favors the Interchange of Graduate Students in Science Between America and France

THAT both the United States and France would benefit by an interchange of graduate students in engineering and the sciences is one of the conclusions of Dr. A. E. Kennelly of Harvard University, who recently returned to this country after a year's absence in France, where he represented seven American universities as exchange professor in applied science. Dr. Kennelly was the first exchange professor to go to France to give instruction in applied science or engineering. He exchanged with Prof. Jacques Cavalier, rector of the University of Toulouse, and during his visit gave eighty-four lectures in French upon power transmission, telephony, radio and the skin effect, besides publishing a book on hyperbolic functions for his overseas students. These lectures were delivered at Grenoble, Lyons, Marseilles, Toulouse, Bordeaux, Nancy, Lille and Paris, including the École Supérieure d'Électricité of the last-named city.

Dr. Kennelly received the honorary degree of doctor from the University of Toulouse, this being the first honorary degree in science granted by that institution since its founding in 1229. He also received an honorary membership in the Société Française des Électriciens and was made a Chevalier of the Legion of Honor.

French Thoroughness Praised

"Thoroughness is the keynote of French higher education in science and almost all else," said Dr. Kennelly to a representative of the *Electrical World*. "The average man in France is better prepared in fundamentals, whereas in America students are more experienced in what might be called the craftsmanship side of technical training. The foregoing is also the case in French secondary schools. Athletic life and student co-operation are less developed than here. In mathematics, physics and chemistry French students, on the average, are distinctly ahead of those in this country, the latter excelling in laboratory and shop activities. All French education from early ages upward is focused on the 'concours,' or competitive examinations. Instead of so-called 'passing marks' being established, a stated number of students receiving the highest marks are accepted for admission or promotion, the remainder being obliged to drop out, repeat or seek other lines of activity. This gives a selected body of students, who work like intellectual beavers from the beginning to the end of their courses. The graduate in science is a highly trained specialist, but has had little contact with industry and practice. This comes later."

At the age of twenty-three or twenty-four, when the average man completes his scientific courses, the necessity for eighteen months' military service confronts him. Dr. Kennelly said that the French nation is at one in its conviction of the absolute necessity of continual preparedness for defense against possible future German aggression; that the warmest friendship for the United States is country-wide, and that French opinion is universally to the effect that charges of militarism brought against France in certain quarters are unjust in the extreme. In the devastated areas the appreciation of Mr. Hoover's remarkable relief work during the war is still intense.

Financial conditions in France are in a perilous state, Dr. Kennelly said, but the economic salvation of the country, as always, lies with the peasant. The cost of living is about four and one-half times the pre-war cost, while the compensation of teachers has roughly doubled. Under present conditions there appears no possibility of modifying French educational methods to parallel closely those of this country, or vice versa. The interchange of graduate students, however, for say one year's resident study, would be the means of a closer understanding between the French and American universities and would give the educational world on each side of the Atlantic great benefits, besides broadening the training of individuals participating in such a transfer.

A. E. KENNELLY

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New England N. E. L. A. Section Chairmen Named

These chairmen of the major sections of the New England Geographic Division of the National Electric Light Association have been appointed for 1922-23 by President E. A. Barrows: Commercial, H. W. Derry, Hartford Electric Light Company; Technical, Samuel B. Swan, Narragansett Electric Lighting Company, Providence; Accounting, I. S. Hall, Charles N. Tenney & Company, Boston; Public Relations, E. L. Milliken, Blackstone Valley Gas & Electric Company, Woonsocket, R. I.

Federal Engineer Sees West

Finds the Public in Earnest About Full Use of Water Power and Expects Markets to Grow in Size

AFTER a visit to a number of the power-producing streams of the West, Col. William Kelly, the chief engineer of the Federal Power Commission, has returned to Washington more thoroughly impressed than ever with the opportunities in that section offered industries in which power is a relatively large factor. While he realizes that the distance of these power sources from some markets offers an obstacle which cannot be overcome in many cases and does not expect to see any marked exodus of Eastern industries to the West, he does believe that there will be an increasing transition as the cost of power increases in the East and as the demand grows more insistent that the public utilities shall have the first call on hydro-electric power in the more congested regions. That the people in the West favor the utilization of the maximum amount of its water power is indicated, Colonel Kelly points out, by the very general response when the Southern California Edison undertook the financing of its great development program. He saw many other indications that the public is determined to utillze this resource which has lain dormant so long.

Many Projects Under Way

Colonel Kelly visited the work being done by the Southern California Edison Company along Big Creek and on the Upper San Joaquin. He visited the two plants now in operation on the Feather River and Pit River plant No. 1 of the Pacific Gas & Electric Company, as well as the Clackamas River project of the Portland Railway & Light Company. His trip also included visits to the Northwestern Power Company's site on the Lewis River and the Priest Rapids site and Kettle Falls on the Columbia River. On his return to the East he stopped at Flathead Lake and visited also the site of the development proposed by the city of St. Paul on the St. Croix River. In Illinois he went down the Desplaines River and looked over the work being done on the Illinois waterway.

In some areas of the West, Colonel Kelly believes, hydro-electric development is progressing more rapidly than is justified by the probable amount of power that the region can absorb. An important factor in stimulating water-power development was the high price and scarcity of fuel oil at the time the water-power act was passed. Since that time the fuel-oil situation has become fairly satisfactory, and many of the plants which expected to be forced to resort to other power have been able to continue the use of their oil-burning equipment. Colonel Kelly finds, however, that there is general uneasiness on the part of the users of fuel oil, partly because of prices and partly because of early probable limitations of supply.

A. E. S. C. Is Now Handling 106 Projects

The growing interest in standardization on the part of almost every American industry is emphasized by the quarterly report of the activities of the American Engineering Standards Committee issued from the headquarters of the committee at 29 West Thirty-ninth Street, New York City.

Of the projects which have official status before the committee, twenty are concerned with mechanical engineering, seventeen are civil-engineering projects, fifteen are electrical, three are automotive, ten are concerned with transportation, ten with ferrous metals, eleven with chemistry, five with non-ferrous metals, four with mining, two with textiles, one with shipbuilding, and eight projects are of general interest.

Twenty-four standards or safety codes have been approved and thirty-six are up for approval. The remaining forty-six projects represent codes and standards which are either in the process of formulation or which are now being considered by committees of representatives designated by the various bodies, industrial, technical and governmental, interested in each particular subject. In this way more than two hundred such bodies are officially participating in the work of the committees through their accredited representatives.

A regular interchange of information as to the status of work under way is maintained by the American Engineering Standards Committee with the national standardizing bodies of Austria, Belgium, Canada, Czechoslovakia, France, Germany, Great Britain, Holland, Italy, Japan, Norway, Sweden and Switzerland. This information is issued in the form of quarterly reports and includes a statement of the status of each project on which work is actively under way.

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Reciprocal Registration Rules Prepared by Council

Rules for reciprocal registration of professional engineers were drawn up by the Council of State Boards of Engineering Examiners, representing sixteen states, at their Chicago conference on Oct. 2 and 3. The rules provide that an engineer registered in one state may be permitted to practice in other states which have accepted this reciprocal registration. These articles of agreement will be sent to the various state boards of engineering examiners for final ratification.

The council also passed a resolution urging the necessary change in state laws so that an engineer registered in one state may be granted reciprocal registration in another state without being required to pay a second registration fee. An investigating committee was appointed to consider reciprocal registration with Canada and Mexico.

Chicago was chosen for the council's 1923 October meeting place. The new officers elected were: President, John T. Cox, Ann Arbor, Mich.; vice-president, O. Lauxgaard, Portland, Ore.; secretary, P. H. Daggett, Chapel Hill, N. C.

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California Rate Reduction

People Will Save $6.000.000 a Year on Electric Rates. According to Commission's Estimate

AN ANNUAL saving to the people of California of $20,350,000 in rates and fares has been figured out by the California Railroad Commission as the result of reductions in public utility charges. Of this amount $6,000,000 is estimated as the saving in electric rates, $10,450,000 being credited to lower railroad rates and the rest to reduced gas rates and express charges.

"This saving to consumers," said Harley W. Brundige, president of the commission, "has been effected notwithstanding the fact that utility rates have been maintained at all times at levels distinctly below the 'cost of living' figures compiled by the federal government and the commodity price indices of Dun and Bradstreet. While living costs are given today by the United States Bureau of Labor Statistics as 66⅔ per cent above the 1913 base, electric prices are only 16 to 20 per cent above pre-war levels. In the peak of 1920 living costs went to 219 from a base of 97 in 1913. In the same period the average increase in electric rates did not exceed 130 to 143 from a base of 100. In other words, cost of living went up 122 per cent and is still up 66⅔ per cent, while electric increases ranged from 30 to 43 per cent at the peak and present rates are only 16 to 20 per cent above the normal base of 100.

COMMISSION CLAIMS THE CREDIT

"To me," Mr. Brundige continued, "this showing is very significant as completely justifying regulation. The figures show that during the peak of prices the utilities were not permitted to profiteer and at the same time they received reasonable increases so that they could function properly. As was said at the public utilities session of the recent meeting of the American Bar Association, 'A starved horse cannot pull a full load.' The utilities were enabled to pull a full load. It was recognized that a period of advancing prices put a severe strain upon regulation, but it met the test. It is equally obvious that regulation would fail if it were not vigilant to take advantage, promptly and boldly, of every opportunity to keep utility prices in line, even a little ahead, of a declining commodity market."

The reduction in electric rates from peak prices, as allocated to the principal companies, indicates a sectional distribution as follows: Pacific Gas & Electric Company, $2,000,000; Great Western Power Company, $500,000; Southern California Edison Company, $3,000,000; San Joaquin Light & Power Corporation, $500.000.

Brief News Notes

Detroit Edison Has New Plant Ready.—Fires have been started under the boilers of the new Bunch Creek steam plant of the Detroit Edison Company in Marysville, Mich., which will furnish power for Port Huron and other St. Clair River towns. The plant cost $2,500,000.

Maximum Rate Cut at Springfield, Mass.—The United Electric Light Company, Springfield, Mass., has announced a reduction of price from 10 to 9 cents per kilowatt-hour as the maximum rate for residential lighting, effective Nov. 1. The 10-cent rate has been in force since 1918. No other reduction of rates is to be made by the company at present.

Texas University Establishes Course in Public Utility Economics.—A course in public utility economics, covering lectures on light and power companies, street and interurban railways, franchises, accounting and eight other topics, is being given at the Southern Methodist University at Dallas, Tex., under the auspices of the Texas Public Service Information Bureau.

Fifteen California Towns Ask Lower Rates.—The California Railroad Commission has recently heard evidence on the plea made by fifteen municipalities for a further reduction in the electric lighting rates of the Southern California Edison Company. The cities concerned are Alhambra, Anaheim, Arcadia, Chino, Colton, El Monte, La Verne, Lindsay, Long Beach, Monrovia, Newport Beach, Pasadena, Porterville, Ventura and South Pasadena. Decision is not expected for some time.

Supreme Court's Views on Valuation.—A brief prepared by Victor E. Wilson of Lincoln, Neb., and recently filed with the Nebraska State Railway Commission in connection with valuation proceedings of the Omaha & Council Bluffs Street Railway Company, has been issued in available form. The significant feature of the brief is a review of United States Supreme Court decisions as to what are relevant facts to prove value. Mr. Wilson's conclusion is that facts as to the cost of reproduction now constitute the only evidence considered by the court when they are present in the record.

California Chambers of Commerce Oppose Water and Power Act.—Upon the leadership of the California Development Association, the only state-wide civic body in California, resolutions against the proposed water and power act have been passed by the chambers of commerce in Berkeley, Lassen County, Pittsburg, Red Bluff, Sebastopol, San Francisco, San Jose, Redwood City, San Benito County, Santa Rosa, Livingston and Vallejo. The Los Angeles chamber also is on record against the measure. All these bodies are carrying on a fight in their respective communities to aid in its defeat.

Noblesville Company Seeks to Dam White River.—The Noblesville (Ind.) Heat, Light & Power Company is meeting with opposition in its plan to build a dam across White River 4 miles north of the city. Difficulties with the Indianapolis Water Company, which feared interference with its supply of water, had just been compromised and a contract between the two companies approved by the Indiana Public Service Commission when an injunction was asked by a private landowner who fears the backwater from the dam will injure his property. This action was filed in the circuit court last week.

Lakeside's New Unit Placed in Service. — Another unit was placed in service at the Lakeside plant of the Milwaukee Electric Railway & Light Company on Oct. 6, when the company began the operation of its new 30,000-kw. turbo-generator. The new unit represents an investment of $1,500,000 and brings the rating of the station up to 70,000 kw., two units rated at 20,000 kw. each having been installed last year. The ultimate rating of the plant, which is said to be the only large station in the world using only pulverized fuel for steam generation, is 200,000 kw. The work of designing the turbine began last winter and the field work started this spring.

Illinois Utilities Building New Transmission Lines.—The Public Service Company of Northern Illinois, which affords continuous service to an area of 5,800 square miles, is beginning construction on three new transmission lines. A 33,000-volt line will start at Wilmington, where it will be connected to the transmission line from the Joliet station and then extended to Kankakee. Another line is to extend from Blue Island to Chicago Heights, making the fourth to be placed in service between these two points. The third line will be built between Evanston and Lake Bluff on the right-of-way of the Chicago & Northwestern Railroad. All of these lines will, it is expected, be completed before the annual peak-load period.

Sweden's Water Powers.—A European correspondent of the *Electrical World* writes concerning the gigantic project formed in Sweden under governmental auspices to provide electric power for that country and Denmark: "The construction of the power stations, canals and bridges is well under way. In addition to the waterfalls a great number of large rapids are being diverted into the canals, where an immense amount of power will be stored. The hydro-electric stations now under construction will largely exceed in generating capacity the three that the Swedish government now controls, viz., the Trollhättanworks in the south, the Aelvkarle works and the Porjus works in the far north, the combined output of these three stations being about 300,000 hp. A notable piece of engineering is the construction of the regulating dam in Lapland, about 10 miles north of Porjus, which has for its purpose to increase the pressure of the St. Lule-Aely at deep-water level from 30 cu.in. to 160 cu.in. a second. This means an increase of power of no less than 700,000 hp. An immense source of power, about 425,000 hp., is situated in the Götaälv, whence the current will be conducted by way of the Skagarrak to Cape Skagen and from there to Jutland and the island of Zeeland. It has not yet been decided how the current is to be conducted across the sea, but it is likely that this will be done by means of sea cables."

Lightning Fails to Put High-Tension Line Out of Commission.—The accompanying photograph comes from Windsor, Col., where it was taken on Aug. 17 last during an intensely vivid thunderstorm. Lightning struck within quarter of a mile of the 44,000-volt transmission line of the Western Light & Power Company, shown in the picture, but there was no interruption of service.

Interstate Line Nearly Finished.—Work on the new 110-mile, 60,000-volt transmission line from the Prospect plant of the California-Oregon Power Company to Springfield, Ore., is fast nearing completion, and after Nov. 1 it will be possible to transmit energy from the California plants of the company, several hundred miles away, to the Mountain States Power Company. When the increase in business justifies it the company plans to increase the line voltage to 110,000.

New Company to Take Over Chinese Radio Contract.—A new company is about to be formed under the name of the Federal Telegraph Company of Delaware to take over the thirteen-million-dollar contract with the Chinese government recently secured by the Federal Telegraph Company of California. Owen Young, president of the General Electric Company, will be chairman of the board of the new company, and R. P. Schwerin, president of the Federal Telegraph Company of California, will be its president. The company will be capitalized for $9,500,000, divided into $3,500,000 preferred stock and $6,000,000 common stock. The Radio Corporation of America will buy all of the new preferred stock, and of the common stock the Federal Telegraph Company of California will own 40 per cent and the Radio Corporation of America 60 per cent. The contract calls for the construction of four wireless stations in China, the one in Shanghai to be of great size. The completion of this station will bring direct communication between the United States and China.

Associations and Societies

New York Electrical Credit Association.—A "get-together" meeting of this association will be held at the Hotel Pennsylvania, New York, on Tuesday, Oct. 24, at noon. Carl Schneider of the Federal Reserve Bank of New York will speak on the financial situation and business future.

Commercial National Section, N. E. L. A.—Group meetings of this section will be held next month as follows at the Hotel Somerset, Boston: Nov. 15, 10 a.m., Lighting Sales Bureau, Power Sales Bureau; 2 p.m., committee on electrically equipped furniture, committee on "Electrical Salesman's Handbook." Nov. 16, 10 a.m., Electrical Vehicle Bureau, Merchandise Sales Bureau; 2 p.m., committee on education, committee on commercial service and relations with customers. On Nov. 17 the executive committee of the section will meet at 10 a.m. at the same place. Technical National Section committee meetings will be held in Kansas City, Mo., on Nov. 20-23.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Electric Power Club—Asheville, N. C., Oct. 30-Nov. 2. S. N. Clarkson, Kirby Bldg., Cleveland, Ohio.

Arkansas Utilities Association—Hot Springs, Ark., Nov. 7-9. R. P. Brown, Little Rock Ry. & Electric Co., Little Rock.

Electrical Credit Association (interstate convention)—Philadelphia, Nov. 10. J. W. Crum, 1328 Land Title Bldg., Philadelphia.

Ontario Association of Electrical Contractors and Dealers—Toronto, Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.

National Association of Railway and Utilities Commissioners—Detroit, Nov. 14-17. J. B. Walker, New York Transit Commission, New York.

Electrical Manufacturers' Club—Hot Springs, Va., Nov. 15-19.

Electrical Credit Association, Central Division—St. Louis, Nov. 16-17. F. P. Vose, 1347 Marquette Bldg., Chicago.

Electrical Supply Jobbers' Association—Cleveland, Nov. 20-24. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Society of Mechanical Engineers—New York, Dec. 4-8.

Commission Rulings

Principles Followed in Appraisal.—In its recent evaluation of the property of the Colorado Power Company, the Colorado Public Utilities Commission based its findings on the normal cost of reproduction now, with consideration as to the periods of construction and reflecting average costs over these periods, so that the cost used was neither the highest nor the lowest, but included these in the average whenever available, so-called war prices receiving consideration only as they entered into averages or influenced the general trend of labor and material cost.

"Firm" Power and "Dump" Power.—Averring that it has jurisdiction over a rate contract for power supplied to a company distributing power in a "home rule" city when the energy is received in a substation outside of the city, the Colorado Public Utilities Commission permanently suspended rate schedules proposed by the Colorado Power Company embodying both new standard schedules for Denver and other cities and special power agreements with the Carbondale Light & Power Company and twelve other public utility, mining and industrial concerns. The effect of the new rates was an increase of aproximately 40 per cent in the regular schedules and of 20 per cent in the special power agreements, and the cancellation of these agreements, putting those benefiting from them under the regular schedules, means increases for some of the customers ranging from 17.5 per cent to 79.6 per cent over the rates heretofore enjoyed, based on 1919 consumption. These cases were before the commission nearly two years, pending the completion of valuation proceedings. One question involved was whether particular customers were being served with surplus "firm" power at discriminatory prices or with so-called "dump" power. The question of surplus or overbuilt plant was also concerned. The commission found that power furnished continuously to large consumers and causing the principal system peaks, which were simultaneous with other peaks, and causing also a wider variation of load than is caused by any other consumers, is "firm" power, although sold at "dump" power rates because of inability to dispose of the entire product of an overbuilt system at regular rates. The property of the company should, therefore, the commission held, be apportioned between the users of "firm" power and the users of "dump" power for the purpose of fixing "firm" power rates in cases where the company is unable to dispose of the surplus energy at the regular rate. A transmission line used jointly by the two classes of consumers was allocated on the basis of the relative traffic over the line, and a percentage ratio as between the use of "firm" power and the total use of the line was thereby determined. The company was instructed to make an effort to dispose of its surplus "firm" power at the highest obtainable price while awaiting the time when it can obtain customers at regular rates. The commission found insufficient evidence to enable it to pass upon a charge that the rates charged "firm" power customers were discriminatory as between these companies themselves.

Recent Court Decisions

Power to Render Conclusive Decision on Conflicting Evidence Not Power to Act Arbitrarily.—"The mere fact that an administrative body, like the commission, has to decide some contested question of fact upon evidence presented, which decision is conclusive, does not," the Supreme Court of Errors of Connecticut declared in State vs. Darazzo, a case affecting the commission's power to license jitney operators, "make its action a matter of discretion and arbitrary, unless we use these words in a sense that would class the decision of a court upon a contested question of fact as a matter of discretion and arbitrary." (118 At. 81.)[*]

Owner of Water Lot Entitled to Proportionate Share of Water Despite Inability of Less Well-Situated Owners to Obtain Theirs.—In Henry Cheney Hammer Company vs. Collins and the Utica Gas & Electric Company an effort was made to restrict the company named in the use it had been making of water impounded for power and manufacturing purposes by what is known as the middle dam at Little Falls. The Supreme Court of New York, equity division, vacated an injunction obtained against the company, asking: "The Utica Gas & Electric Company being entitled to five-seventeenths of one-half of the whole flow, subject to the preferred rights aforesaid, and it being in a position by which it can utilize its just proportionate share of the water which flows to and properly pertains to the north shore of the river, is it to be deprived of the right to use its said share of water because certain other owners are unable to obtain their shares?" The company, the court held, was entitled to its proportionate share of flood water as against the contention of owners of other lots that such water is not waste water. Declaring that the full enjoyment of common water privileges can only be obtained through keeping the water at the level of the crest of the dam, the court found a proposed development of the defendant company entirely reasonable and held that neither the plaintiff nor any other user could be in any manner damaged by the drawing by the defendant of its just proportion of water, rather than allowing it to flow over the dam. (196 N. Y. S. 25.)

City Cannot Be Held Responsible for Delay of State Commission Which Hinders Execution of Contract.—The Supreme Court of New York, Appellate Division, has held, in Degnon Contracting Company vs. City of New York, that contractors with the Public Service Commission for the construction of a subway cannot hold the city liable for negligence of the commission's engineer in delaying to furnish plans.

Commission May Compel Utilities to Cease Operations.—The power of the California Railroad Commission to compel utilities to cease operations held by the commission to be illegal has been sustained by a unanimous decision of the California Supreme Court. The decision was rendered in dismissing a writ of review sought by the Motor Transit Company against an order of the commission relating to a local stage service, but the court's interpretation of the powers of the commission is held to apply in the case of all utilities. The motor company had contended that the commission did not have power to order it to discontinue a local operation because it possessed no jurisdiction to grant "injunctive relief." The court held that the commission has power to make whatever order may be necessary in the exercise of its jurisdiction. As to the enforcement of such an order, the court referred to a former decision upholding the commission's right to punish for contempt and pointed out that the commission has in addition the right to apply to the court for permission to exercise injunctive powers.

Insufficient Insulation of 2,300-Volt Wires Constitutes Negligence.—Weaver vs. Bristol Telephone Company and Bristol Gas & Electric Company was a suit for damages because of the death of a telephone lineman who had hold of an insulator on a telephone pole around which the end of a dead wire connected with a house on the opposite side of the street was wrapped. The pole suddenly sagged under the lineman's weight, causing the dead wire to come in contact with a 2,300-volt line of the electric service company, also on the opposite side of the street and over which the dead telephone wire passed. The Supreme Court of Tennessee found that the defective insulation of the power wire had been established and constituted a ground for the damages awarded, the lineman having no duty of inspection; but inasmuch as violation of a city ordinance by the power company was charged and dwelt on in the trial court's instructions to the jury, while no evidence to show that the injury took place within the city's boundaries was introduced, the Supreme Court remanded the case for retrial. (243 S. W. 299.)

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[*] The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Ward Harrison Takes Office as President of I. E. S.

Ward Harrison, who was elected last spring to the presidency of the Illuminating Engineering Society and took office on the first of October, is the head of the illuminating engineering staff of the engineering department of the National Lamp Works. Mr. Harrison has been responsible for much pioneer illuminating engineering work and has taken a prominent part in the activities of the electrical industry. He was among the first to conceive the possibilities of high-power gas-filled incandescent lamps for street lighting, and very largely through his experimental demonstration work the city of Chicago was able to adopt the series incandescent lamps as the standard for street lighting a few months after the first gas-filled lamps had been produced in a laboratory.

WARD HARRISON

In addition to authorship of papers covering a wide variety of illuminating engineering subjects which have appeared in the technical press, Mr. Harrison is the author of a textbook entitled "Electric Lighting." For some years he has been a lecturer in the illuminating engineering course at the Case School of Applied Science. He has also been active in the work of the Lighting Sales Bureau of the National Electric Light Association. He became a member of the Illuminating Engineering Society in 1910 and was a vice-president of the society during 1913 and 1914, representing the Pittsburgh Section. Mr. Harrison was born in East Orange, N. J., and was graduated with honors from the Stevens Institute of Technology in 1909. He entered the engineering department of the National Lamp Works of the General Electric Company in the same year and was appointed illuminating engineer of that company in 1914.

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Lewis A. McArthur Vice-President of Pacific Power & Light

Lewis A. McArthur, general manager of the Pacific Power & Light Company, Portland, Ore., has just been made vice-president of the company. Mr. McArthur has been with the Pacific company since its organization in March, 1910, when he was made chief clerk to the president. Later he filled successively the positions of assistant to general manager and assistant general manager, and in 1917 he was made general manager. Mr. McArthur is a native Oregonian and a graduate of the University of California.

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Henry J. Pierce, president of the Washington Irrigation & Development Company, Seattle, Wash., has just returned from a trip to Europe. Mr. Pierce will remain in New York for about ten days before going West.

Edwin H. Armstrong, inventor of the regenerative and super-regenerative radio circuits, has sailed on the Mauretania for a sojourn of several months in England and France.

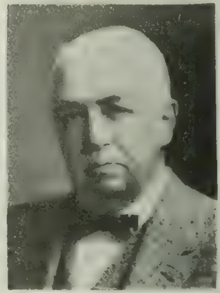
Raymond Bennett, formerly general manager of the Douglas (Wyo.) Light Company, and more recently connected with the Sheridan County (Wyo.) Electric Company, has been appointed power apparatus specialist of the Western Electric Company in the Rocky Mountain district. Mr. Bennett is now on a tour of the Eastern plants and branches of the company.

Dr. Charles Russ Richards, formerly dean of the College of Engineering, University of Illinois, was inaugurated president of Lehigh University on Saturday, Oct. 14, in the presence of many delegates from other educational institutions. In his inaugural address President Richards indicated that Lehigh would embark on the work of engineering research. Dr. Richards was born in Clarkshill, Ind., in 1871 and attended Purdue University. He received the degree of M. E. in 1891 and four years later the M. M. E. degree from Cornell University. In 1891 Dr. Richards joined the staff of the Colorado Agricultural College as instructor in mechanical engineering. It was in 1911 that he became associated with the University of Illinois as professor of mechanical engineering in charge of the department. From 1913 to 1915 he was acting dean of the college of engineering and acting director of the engineering experimental station. Later he became dean and director.

Empire State Association's New President

M. J. Brayton, the new president of the Empire State Gas and Electric Association, is one of the pioneers in the electrical industry in New York State and has been continuously associated with the Utica Gas & Electric Company and one of its predecessor companies since Jan. 1, 1889. Mr. Brayton was born in Poland, near Utica, N. Y., July 20, 1852, and was educated in the old Fairfield Military Academy and Whitestown Seminary, both of which institutions in the days of their existence enjoyed a high reputation.

Mr. Brayton became associated with the Utica Electric Light Company in 1889, soon after its organization, as director, secretary-treasurer and general manager. In 1899 the company was reorganized as the Utica Electric Light & Power Company, and it was merged into the Utica Gas & Electric Company in 1902. Mr. Brayton was largely responsible for the building of the company's station at Trenton Falls, which was among the earlier hydro-electric developments in the United States.



M. J. BRAYTON

On the organization of the Utica Gas & Electric Company in 1902 Mr. Brayton became a director and general manager of its electric department. He was elected secretary in 1904 and was made a vice-president in 1920.

Mr. Brayton was one of the organizers of the Empire State Gas and Electric Association, has served almost continuously on its executive committee since its organization, was president of the association in 1911 and has always been active in its counsels.

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Harry Sessions of the Southern California Edison Company is visiting various industrial centers in the East where important equipment is being manufactured for his company. He will spend several months gathering economic data on the installation and operation of power-plant equipment.

Thomas N. Wynne, superintendent of the Indianapolis Light & Heat Company, recently was elected president of the Indianapolis Optimists' Club.

Fred H. Fowler, district engineer for the United States Forest Service in California and Nevada, has resigned to open an office in San Francisco as a consulting engineer.

W. F. Raber, general manager of the Southern Colorado Power Company, has been appointed a member of the board of directors of the Pueblo flood conservancy district.

W. J. Delles was recently appointed executive engineer of the turbine engineering department of the General Electric Company at Schenectady and O. Junggren was appointed consulting engineer.

J. N. Shannahan, president of the Newport News & Hampton Railway, Gas & Electric Company, Hampton, Va., was elected second vice-president of the American Electric Railway Association at the convention in Chicago.

Lewis B. Newell, formerly general manager of the Automatic Illuminated Advertising Corporation, New York, has become associated with the sales department of Hoagland, Allum & Company, Inc., New York.

Victor J. Shear, who for the past eighteen years has had a large and varied experience in the electrical supply line, is now assistant to George A. Lichtenstein, head of the Garfield Electrical Supply Company, New York City.

P. Rabon, who has been with the Frank Adam Electric Company, St. Louis, for a number of years, has taken over the Chicago territory of that company and has also become associated with the Major Equipment Company, Chicago.

Harry D. Randall, Rocky Mountain manager for the General Electric Company, has been elected chairman of the committee to develop outside territory for the Denver Electrical Co-operative League, which is intended to include almost the entire State of Colorado.

G. E. P. Smith, irrigation engineer of the Arizona agricultural experiment station, Tucson, is co-operating with the United States Geological Survey in the preparation of a report on the water resources of San Pedro Valley, Arizona.

Joseph H. Stewart, formerly superintendent of the municipal water, light and heat plant at Goshen, Ind., has been engaged as manager of the Delphos (Ohio) plant owned by the Northwestern Ohio Electric Company. Mr. Stewart had been in Goshen about three years.

Paul H. Diver, associated with the Ohio Electric & Controller Company, Cleveland, as sales representative for four years, has been appointed manager of sales. C. J. Pagel, associated with the Robbins & Myers Company in the Cleveland district, has become sales representative of the Ohio Electric & Controller Company.

Saling H. Wolfe, formerly with the Western Radio Electric Company and radio instructor in the United States Navy for a year and a half, is now specialty salesman in charge of the radio department of the Pacific States Electric Company's Los Angeles office.

A. M. Bohnert, for the past three years high-tension sales engineer for the Ohio Brass Company in the East, has been appointed representative of that company in the Intermountain district, with headquarters in Salt Lake City. Before his connection with the Ohio Brass Company Mr. Bohnert was in the engineering department of the Pacific Gas & Electric Company.

A. J. Moan, Pacific Coast representative of the Johns-Pratt Company of Hartford, Conn., has opened offices at 530 Call Building, San Francisco. The Johns-Pratt Company has recently separated its activities from the H. W. Johns-Manville Company and in the future will operate as a separate unit in so far as distributing activities are concerned. Mr. Moan will have charge of the Pacific Coast territory.

G. P. Atkinson has recently been appointed representative at Atlanta of the Electric Power Equipment Corporation of Philadelphia. In addition to his association with the "Elpeco," Mr. Atkinson is handling the material of the Ward Leonard Electric Company and the Weston Electrical Instrument Company. Previous to going into business for himself he was connected for five years with the latter company at Newark, N. J.

Rufus G. Gentry, commercial manager of the Denver Gas & Electric Light Company, was re-elected treasurer of the Colorado Merchants and Manufacturers' Association at the annual convention of that organization recently held at Sterling, Colo. Mr. Gentry is one of the incorporators of the Colorado Industrial Exposition and Prosperity Carnival, which will be held in Denver next February.

Warren Stoutnor, a member of the Public Utilities Commission of Utah, has returned to Salt Lake City after attending the accounting conference held in Washington, D. C., between the executive secretary of the Federal Power Board, on the one hand, and state commissioners and public utility executives, on the other. Mr. Stoutner is chairman of the special committee representing the National Association of Railway and Utilities Commissioners in this matter.

Albert Lyle Chavannes has recently been appointed instructor in the department of electrical engineering of the University of Illinois. He was graduated in 1918 with the degree of B. S. in electrical engineering from the University of Tennessee, where he has been instructor in mathematics and mechanics since September, 1919. Mr. Chavannes was connected for a short time with the Westinghouse Electric & Manufacturing Company as production clerk at East Pittsburgh.

H. R. Eilertsen has resigned as electrical engineer of R. Hoe & Company, New York, and is now sales engineer with the Cutler-Hammer Manufacturing Company, printing equipment department, New York. Mr. Eilertsen will specialize in the electrical problems associated with the small accessory machinery used in the printing industry.

Robert E. S. Pope has been appointed engineer and superintendent of the Electric Motor Repair Company, Springfield, Mass. Mr. Pope was graduated from the Worcester (Mass.) Polytechnic Institute in 1910 and received the degree of electrical engineer from that institution in 1912. For the past ten years he has been associated with the Crocker-Wheeler Company, Ampere, N. J., as test foreman, erector, superintendent of erection, and more recently as a designing engineer.

F. M. Webber, who for the past three years has conducted an electrical appliance business in Philadelphia, has joined the Robbins & Myers Company as assistant sales manager in charge of motor sales, filling the place vacated by A. J. Reed, recently resigned. For sixteen years Mr. Webber was connected with the General Electric Company, entering the Fort Wayne works in 1903, and from 1913 to 1919 he was apparatus sales manager at St. Louis.

N. G. Hardy has been selected to succeed R. H. Forney as chief engineer of the Waco generating station of the Texas Power & Light Company. Mr. Hardy was graduated from Rensselaer Polytechnic Institute in 1910 and then spent eight years in power-plant work with copper companies in Mexico and Arizona. In 1918 he became associated with the Du Pont Engineering Company and later returned to the Arizona Copper Company at Clifton, Ariz., as chief engineer of construction and operation for the electrical power system. Mr. Forney resigned this post to become associated with the Dallas Power & Light Company.

Obituary

John Forrest Kelly, an electrical engineer and a pioneer in electrical research, died recently at his home in Pittsfield, Mass. In 1879, the year after his graduation from the Stevens Institute of Technology, Mr. Kelly was employed in Thomas A. Edison's laboratory, and after a number of years in the employ of the Westinghouse Electric Lighting Company, Newark, N. J., he went to Pittsfield as consulting engineer for the Stanley General Insulating Company, which later became the Pittsfield works of the General Electric Company. He received more than eighty patents on devices for generating, transmitting and distributing electricity and was a pioneer in high-tension transmission.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Swindlers Angling for American Motors

Large-Scale Operation Baited with Cash-in-Advance Letters of Credit on Fictitious Greek Bank a Menace to Manufacturers—Warning from Electric Power Club

INTERESTING evidence of the need for vigilance in trading with the distracted areas of eastern Europe at the present time has been submitted by the Century Electric Company of St. Louis for the information and guidance of other electrical manufacturers engaged in export business. About a month ago the export department of the Century company received a letter of credit from the "Credit Bank of Piræus, Greece." As the accompanying reproduction shows, it was impressive in appearance. It carried the number 141,578, bore numerous stamp imprints and signatures and counter-signatures in various styles of ink, with all the atmosphere of the foreign banker's traditional style. It read as follows:

> Century Electric Company,
> St. Louis, Mo.
>
> GENTLEMEN: We request you to please take note that we have at your disposition and from the Société de Constructions Industrielles et Représentations the sum of $20,000 (twenty thousand dollars) against presentation of the shipping documents as follows:
>
> - Complete set of bill of lading to order,
> - Invoice and certificate of origin,
> - Policy of insurance covering marine and war risks,
>
> for a shipment of engines (motors) for the above amount, to be shipped to Piræus with destination to Athens.
>
> This credit memorandum will be paid if the documents are sent to us direct from this date, August 16, 1922, to September 30, 1922.
>
> We request you to please send the documents as above stated and by registered mail and charging us the exact transportation charges to C.I.F. Piræus, mentioning in your letter the charge under the number of the present memo. The present credit is identical to the one which we cabled to you as per copy.
>
> P. S.—Kindly take note that the Ministry has authorized the transfer of the money abroad, but only after the goods have been landed and delivered in Greece.

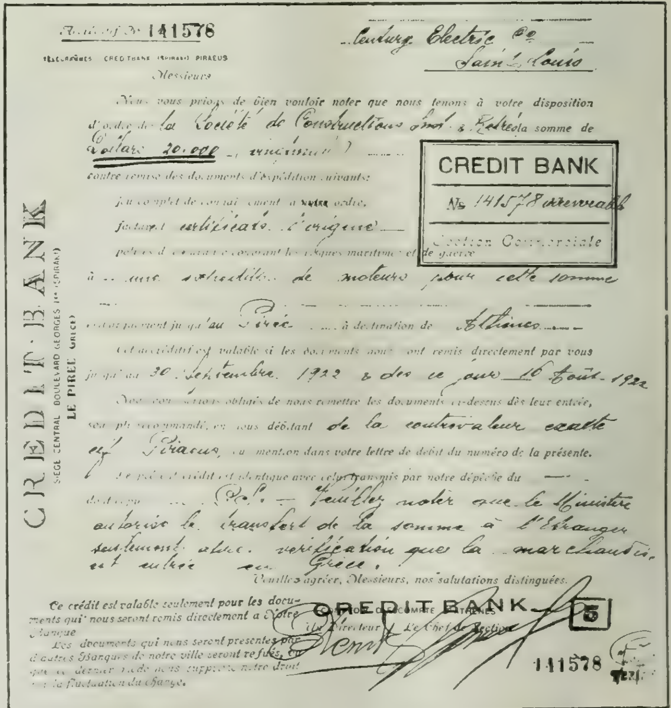
Stamped on the corner of the document was this further statement:

> This credit is valid only for documents which are to be sent to us direct through our bank.
>
> Documents which will be presented to us by other banks of this city will be refused, as such presentation is prejudicial to our rights in connection with exchange fluctuations.

The communication bore every appearance of a valid letter of credit, and a letter of credit offering cash in advance is a dainty morsel that appeals to the eye of any manufacturer who sees the prospect of business development in the export field and is on the watch for opportunities to establish new connections in fresh fields that he has not yet touched. But the translator had heard a rumor of the activities of the "Credit Bank" and added this note:

> I would suggest that you investigate this matter thoroughly because this Credit Bank has been sending numerous memorandums of credit to different American manufacturers, and besides I do not think that there are 20,000 gold dollars in Greece.

An investigation was made, and it turned up the interesting information that the "Credit Bank of Piræus" was non-existent and the mental creation of a set of swindlers, who had been discovered in a purely accidental way. A firm of exporters in New York that has been seeking a market for automobiles and automobile supplies in the Near East had



CREDIT · BANK
SIEGE CENTRAL BOULEVARD GEORGES 1er (SPIRAKI)
LE PIRÉE (GRÈCE)

Avis of № 141578
TÉLÉGRAMMES CREDTBANK (SPIRAKI) PIRAEUS

Century Electric Co
Saint Louis

Messieurs

Nous vous prions de bien vouloir noter que nous tenons à votre disposition d'ordre de la Société de Constructions Ind. & Repres. la somme de dollars 20.000 (vingt mille) contre remise des documents d'expédition suivants:

jeu complet de connaissement à votre ordre,
facture et certificats d'origine
polices d'assurance couvrant les risques maritimes et de guerre

à une [illegible] de moteurs pour cette somme expédiés jusqu'au Pirée à destination de Athènes

Cet accréditif est valable si les documents nous sont remis directement par vous jusqu'au 30 Septembre 1922 & dès ce jour 16 Août 1922

Nous vous serions obligés de nous remettre les documents ci-dessus dès leur entrée, sous pli recommandé, en nous débitant de la contrevaleur exacte CIF Piraeus, en mention dans votre lettre de débit du numéro de la présente.

Le présent crédit est identique avec celui transmis par notre dépêche du — dont copie. P.S. — Veuillez noter que le Ministère autorise le transfert de la somme à l'Etranger seulement après vérification que la marchandise est entrée en Grèce.

Veuillez agréer, Messieurs, nos salutations distinguées.

CREDIT BANK
№ 141578 irrevocable
Section Commerciale

CREDIT BANK
COMPTOIR D'ESCOMPTE ATHÈNES
Le Directeur / Le Chef de Section
5
141578

Ce crédit est valable seulement pour les documents qui nous seront remis directement à notre Banque.
Les documents qui nous seront présentés par d'autres Banques de notre ville seront refusés, ce dernier mode nous supprime notre droit sur la fluctuation du change.

A BOGUS LETTER OF CREDIT USED IN EFFORT TO BUY MOTORS been advertising in foreign journals. The swindler, noting the name, sent them a letter of credit for $8,000 identical with the one received by the Century company and an order for six motor cars to be shipped against this sum of money deposited in the "Credit Bank of Piræus." By the same mail came a letter from the "International Bank of Piræus, Greece," Foreign Trade Department, marked urgent and reading:

> GENTLEMEN: We beg to advise you that the letter of credit deposited with us to your order having expired (No. 21,618), we have transferred under the instructions of our customer the sum of $6,900 to your order, to the Banque de Credit (Credit Bank), Boulevard Georges I (Spiraki), Piræus, to which you are requested to send your instructions up to October 20, 1922, together with shipping documents, with copies by the next mail following to this bank, advising us at the same time.
>
> If in the meanwhile we should receive documents sent to us direct, we will return them to you in due course.

NAME UNKNOWN ABROAD

But the men behind the swindle also sent similar orders and credit letters to several other automobile manufacturers, and by chance one of these direct orders came to the desk of the manufacturer's export manager on the same day that he received a similar order and letter of credit through his New York export agent. This, of course, was too striking a coincidence to pass unnoticed, and a careful inquiry was made by cable to authorities abroad and brought this reply:

> Re International Bank Piræus, and Société de Constructions Industrielles et Représentations, Athens, Greece.
>
> The above-named firms do not exist in our city. This is a mere malevolent fiction on the part of a certain Ch. Theodoridis, who after having cheated banks and commercial houses, was pursued by justice and imprisonment.

So the automobiles were not shipped and neither were the motors, but in all probability goods have been delivered and lost under some of these credits. For the document looks authentic, the corroboration from another bank strengthens the impression, as does also the ingenious rubber stamp that instructs the shipper not to send documents through any other Piræus bank on account of the exchange situation. Every one knows that exchange is jumbled and it might well be to the benefit of the bank to receive the papers direct. But these are uncertain times and it pays to be careful. American electrical goods are needed abroad and there is opportunity for profitable foreign trade, but it is not safe to take any order, any letter of credit or any bank as security for goods unless the house is known. Therefore, basing its action on this case, the Electric Power Club has just sent out to all its members the following warning:

> Any member receiving orders and letters of credit from Greece should scrutinize them very carefully, as it has come to our notice that some letters of credit have been received in this country that have been issued by swindlers.

The Meaning of Simplification

The Relation of the Elimination of Excess Varieties to the Development of New Products—Primarily a Commercial Activity

THERE has been considerable discussion and uncertainty in various quarters in reference to just what "simplification" means as it applies to the program of the United States Department of Commerce and the activities which have been carried on under that name in many industries.

The feeling has been voiced by some manufacturers that to urge upon them the simplification of their lines by the elimination of excess varieties would be an unwarranted interference with their freedom of action in a competitive market and that any general application of the principle would act as an obstacle to the development of new varieties and the progress of manufacture.

As a result of several conferences between Secretary Hoover and W. A. Durgin of the Division of Simplified Practice and representatives of the electrical industry there has been evolved this statement, which is clearly the conception of the department on the subject:

"It would be difficult to give a clear definition of simplification, but the underlying principle of simplification is the elimination of excess varieties of manufactured products in regard to already existing varieties and in no way affects the development of new varieties."

Regarding this Mr. Durgin also writes:

"I believe it is quite safe to use that definition in addressing any electrical group, but I hesitate to make it a final definition. You will appreciate that with a somewhat hazy idea at the back of this movement it is hardly wise to limit possible developments by fixing a rigid definition at the start. That is my only fear in this connection. In so far as my own vision goes, I would say that simplified practice may well mean any activity suggested by the words which industry may care to undertake.

"I am just trying to recognize the very probable limitation of our present vision. At any rate, there is now no thought, nor can there ever be any thought, of simplified practice limiting, restricting or even directing development in any art. This is as far removed from the prevalent conception of standardization as is the viewpoint of the futurist painter."

As a result of this definition it seems entirely clear that "simplification" is primarily a commercial activity, although it possibly affects the manufacturers of various products to a greater extent than any other of the parties at interest. Therefore simplification has the practical purpose of eliminating excess varieties of manufactured products, through agreement between the parties at interest and the United States Department of Commerce to discontinue the manufacture and sale of such excess varieties after conferences between the manufacturers and other parties at interest with a view to determining just what excess varieties should be eliminated to conserve the best interests of the public as well as the manufacturers and those who distribute and sell them.

There has been some confusion as to the question of whether engineering standardization is to be a part of simplification. During these conferences it may be necessary for the manufacturers and others to discuss engineering standards, but the final agreement which brings about simplification is not an engineering matter, and such conferences, it is felt, should not change or set up new engineering standards.

It is generally recognized that engineering standards should be prepared either by an industrial organization or by a special committee of the American Engineering Standards Committee, after which the standard becomes a recognized American standard. Therefore, in so far as engineering standards are concerned, the American Engineering Standards Committee, probably should have representation in the various simplification conferences.

Simplification in itself presupposes the existence of certain commercial standards of sizes, styles, types and varieties or it indicates a lack of similar commercial standards in an industry.

Broadly the aim of simplification is to eliminate waste, and it has been a matter of keen interest since the survey of six typical industries by the Federated American Engineering Society developed the fact that at least 40 per cent of the effort, investment and energy expended by these industries was absolute waste, which meant that, with a liberal discount to make allowance for the zeal of the specialized investigator, fully 25 per cent of our industrial activity is being wasted and a considerable proportion of this waste is said to be attributable to lack of standardization. How this occurs was indicated significantly in a recent address by Mr. Durgin in these words:

"In all sorts of lines the plea is: 'We are making altogether too many sizes and styles. Our sales department is leading us by the nose! Instead of going down to Texas and selling the thing we make, they can only find the customer who thinks he wants something just a little bit different, and then they make life miserable until we produce that different thing.' As a result of this diversification each group in the industrial structure is suffering—not only the manufacturer, but the wholesaler and the retailer, and indeed when it comes to maintenance, replacement and repair, the ultimate user. The diseases that come from excess variety are evident enough. Stocks and investment are needlessly extended, turnover is decreased, and cost of production is run up in each of numberless varieties. Deliveries are delayed and time is lost in getting the item ordered. It is unsafe to accumulate stocks during slack periods, for no man can predict just what variety will be demanded when the boom appears. All the wastes attendant on indecision in production and use are prevalent. Selling expense is boosted to a maximum in covering these tremendously extended varieties. Misunderstandings and misrepresentations are unavoidable, and there is little fundamental investigation and development of basic lines as it is so much simpler to change trifling details and start a new variety, while foreign commerce goes to foreign producers of simplified merchandise."

All these diseases have been known, of course, for many years, but the stress of war was needed to focus the attention of industry and develop a true remedy. The opportunity to profit by simplification in some lines in the electrical industry is marked and it is most important that the purpose of the movement be understood and sympathetically furthered.

Survey of Business Conditions

Failures Show Small Increase

Despite the fact of a five-day business week in the United States owing to an observance of the holiday, failures reported to R. G. Dun & Co. show a small increase, being 390 for this week, as against 383 in the six-day business week preceding. The total for the corresponding week in 1921 was 375. Defaults with liabilities of more than $5,000 in each case number 208 this week, being one less than were reported last week. They are also a slightly smaller proportion of the total, amounting to 53.3 per cent this week, as against 54.5 per cent last week. A year ago similar insolvencies numbered 232, being 61.8 per cent of the total.

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Imports of Radio from Germany Totaled $23,202

An analysis of imports at New York by the Department of Commerce shows that the imports of electrical goods are steadily increasing. During September electrical goods valued at $103,283 were entered at New York. It is estimated that 90 per cent of the imports of electrical goods are made through that port. By countries the totals are as follows: Germany, $59,862; France, $21,687; England, $14,486; Czechoslovakia, $4,670; all other countries, $2,558. Wireless apparatus heads the list. During September Germany sent $23,202 worth of wireless apparatus to this country; England, $8,650, and France, $5,440. Carbons came next, Germany furnishing $10,823 and France $12,112. The detailed figures are given in the accompanying table.

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Expect Good Christmas-Tree Lighting Set Business

Business in Christmas-tree lighting sets during November and December promises to be the best in years, according to dealers and manufacturers in the Eastern territory. It is said that the situation is particularly satisfactory to the manufacturers because of the low stocks left over in the jobbers' and dealers' hands from last year. Dealers in the New York territory are expressing active interest, and business in this line is expected to open up fully around the first of December.

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American Interests Meeting Brisk Competition in China

American electrical interests are meeting with energetic competition from German companies in the China field. Several contracts on which Americans bid were awarded to either the Siemens China, Ltd., or the A. E. G. The fact that both of these German interests are in this field is disconcerting to American interests, because with the A. E. G. and Siemens bidding on the same job, prices are cut much more than would be the case if only one German firm were bidding against British and American interests.

PRELIMINARY FIGURES OF ELECTRICAL IMPORTS THROUGH NEW YORK, SEPT., 1922

	Germany	France	England	Czechoslovakia	All Other Countries
Carbons	$10,823	$12,112			
Lighting fixtures	5,466	3,160	$315	$3,803	
Wireless apparatus	23,202	5,440	8,650		$165
Arc lamps	59	....	350		
Electric irons	9,241				
Telephone parts	1,136				
Household appliances	418	....	4,850		
Batteries	58				
Electric hair driers	2,851				
Electric fans	11				
Water heaters	507				
Perfume burners	1,600				
Push-buttons and bells	55				35
Flashlights	895		21		
Table lamps	1,540	975		867	2,355
Miscellaneous	2,000		300		3
Total	$59,862	$21,687	$14,486	$4,670	$2,558
Total from all countries					$103,263

Improving Demand in Foreign Lands

Heavy Imports of Cables, Turbines, Lamps and Motors by Manchuria —Promising Market for Automatic Telephone Systems in Australia

THE demand for electrical products is increasing in Europe and Asia, according to reports received last week. Trade statistics of Manchuria show electrical imports for 1921 valued at 2,470,089 Haikwan taels, compared with 1,862,136 Haikwan taels in 1920. Expressed in dollars, the 1921 imports were as follows:

Cables, wire and cord	$404,633
Turbines, etc	338,010
Lamps and lampware	207,441
Motors and parts	180,323
Transformers	164,239
Batteries and dry cells	73,235
Switches	41,691
Insulators and porcelain cleats	31,030
Miscellaneous goods	436,665
Total	$1,877,267

The average value of the Haikwan tael in 1920 was $1.25; in 1921 it was $0.76. Most of the imports were through the port of Dairen and were largely for the South Manchuria Railway. America, Japan and England furnished each about a third of the imports.

INTEREST IN AUTOMATIC PHONES

An improvement in the automatic telephone market is seen in recent activities in Melbourne and the surrounding territory. Members of the Australian Federal Public Works Committee are expected to recommend to Parliament the installation of automatic telephone exchanges at Box Hill, Canterbury and South Melbourne, following an inquiry which considered the necessity for making such improvements in order to reduce operating costs and effect new installations for subscribers. The erection of these exchanges is part of a scheme to establish a system of automatic exchanges throughout the metropolitan area, several of the subdivisions of Melbourne already having automatic exchanges.

Late cable advices from Paris received by the Department of Commerce indicate that French electrical equipment factories are active and manufacturers are even preparing for more business in the future. A rapid development in the use of electricity is taking place in France, and extensive water-power projects now contemplated are expected to be soon under way.

By a royal decree dated July 16, 1922, published in the Rome *Gazzetta Ufficiale*, funds are appropriated for the purpose of fitting up a building in the central part of Rome as a new automatic telephone exchange, says Consul Russell in a report to the Department of Commerce.

Outdoor and indoor switchgear for the Khundallah substation of the Mangahao power scheme is being purchased by the Public Works Board of Wellington, N. Z. Tenders for this material, including supervision of the erection and testing, will be received by the Public Works Tender Board at Wellington on Nov. 28 next.

This substation will receive power from two overhead three-phase transmission lines at 110,000 volts, 50 cycles, delivered to two banks of single-phase transformers, each of 12,000 kva. capacity, the voltage being 11,000.

POSSIBILITIES IN ESTHONIA

Consul Albrecht, Reval, reports to the Department of Commerce that electrical machinery and other products obtained from Germany at present are reported as being very frequently of inferior quality. Furthermore, it is stated that no assurances can be obtained as to price or time of delivery with reference to such goods, which generally are received at a much later period and cost considerably more than anticipated, even when allowing for the falling rate of exchange. Under these circumstances Esthonian firms are said to be transferring their orders to Sweden and Great Britain, from which countries they can obtain articles of good quality at a previously fixed price with delivery at a definite time.

Indications are, the consul says, that American manufacturers might do business here with the local factories if the latter had fuller information as to their products, prices, terms of sale and delivery, and time required for the latter. No doubt, many manufacturers of machinery and products of this character have representatives in Europe from whom this information could be obtained without the delay attendant upon communication with the United States, but in general neither the local factories nor the consuls have been informed of their names and addresses.

Except for one woodworking factory which placed important orders for American machinery as a result of a business trip of its representative to the United States, it is believed that none of the larger factories here has ordered any machinery from the United States since the war, and they are in general out of touch with manufacturers there.

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Soft Coal Shipments Are Increasing

Although the aggregate shipments of soft coal have increased gradually during September, the shipments from individual producing districts have fluctuated irregularly. A government table showing by districts the average daily shipments for the last three weeks in September and the daily shipments for the first three working days of October indicates that in Pennsylvania there was a slight decrease each week since Sept. 9, and that the week of Oct. 5 was begun with shipments at a lower rate than the previous week. In Maryland and part of northern West Virginia there has been a steady increase, but in southern West Virginia there has been a steady decline. In Kentucky there was little or no change up to the present week, for which, however, a decline is indicated. In Alabama daily shipments have been falling off since the close of the first week of September. In Ohio, Indiana and Illinois there have been gradual gains up to this week, which now appear to be checked. West of the Mississippi shipments have in the main steadily increased.

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The Metal Market

Copper and Zinc More Quiet Than Usual—Importers Have Fairly Large Stocks

Copper and zinc have been more quiet than usual during the last week; lead has been in the normal good demand, and tin has been active at advancing prices. The market for the minor metals, minerals and ores cannot be said to be established as yet, because of the dislocation caused by the tariff. Many importers have fairly large stocks on hand that were brought into the country with the expectation of a tariff advance, and these are being released at prices which represent all the way from a fair profit on the purchase price to a figure which takes full advantage of the tariff advance. Fundamental business conditions in the country continue good, and the next few months should see an improvement in the fuel supply and transportation conditions, facts which should have a favorable effect on the metal markets. Many mining companies are seriously affected by a labor shortage which will tend to cut down production but at the same time, by restricting the supply, will increase the price of metals.

Copper is distinctly weaker. Sales have been very unsatisfactory during the last few days, though consumers of the metal are in general working to capacity, and it is felt that the present lull can therefore be no more than a temporary one. As most producers are well sold up, there has been no great pressure of metal on the market, but a slight tendency to a price recession can be observed. Most of the large producers, if not all, are holding at 14 cents, delivered, and in the last week have sold possibly 25 per cent of their normal business. They seem willing to book business somewhat further ahead than usual. There are persistent rumors to the effect that large consumers have had plenty of copper offered to them at 13⅞ cents, delivered, even to Connecticut Valley points, but it is difficult to find a producer who will acknowledge having shared in this business except to points near New York where the freight rate is around 15 cents per 100 lb. Several orders of this nature have been placed, however, which are reflected in quotations, this being the first quotational break in the 13.75 cent refinery figure since Sept. 1.

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

WARMER weather during the last few days has caused a slight falling off in the sales of heaters, and this let-up has allowed jobbers and dealers time to make replacements of the stocks disposed of so quickly during the past few weeks. Cleveland reports that conduit stocks are now around normal and that prices are again firm. The business of the central stations is far above that of a year ago. Fixtures are selling actively throughout the country owing to completion of much construction. Record buying of appliances during the holidays is expected by most of the jobbers. Collections generally are satisfactory.

Boston

Demand for Vehicle Batteries Taxing Deliveries—Wire Sales Excellent—Fixtures Meeting Requirements

Business conditions are better, with few exceptions, week by week. Textiles are resuming production, central-station expansion is continuous, jobbers are more active and retail electrical sales picking up. Prices are firm, with a decided stiffening tendency in sockets. Deliveries are uneven. Building operations are progressing rapidly, and electrical manufacturing in New England is far ahead of a year ago. Financial conditions are easier. Plans are being made for a record-breaking holiday trade.

Storage Batteries.—The demand for vehicle and truck batteries is taxing deliveries more than for a long time. Radio batteries are not as yet in heavy demand. Prices are firm.

Wire.—Sales are in excellent volume. Rubber-covered No. 14 wire is moving steadily at $6.25 per 1,000 ft. in 5,000-ft. lots. Outside construction is absorbing fair quantities of weatherproof and some bare copper is being sold for radio aërials.

Sockets.—A price advance of about 7½ per cent was expected early in the present week, putting "pulls" in case lots on a 33½-cent basis, net, "keys" at about 22 cents and keyless sockets at about 19½ cents. New schedules had not been made out Monday by local jobbers, but the advance was expected by Tuesday.

Lamps.—Sales are improving rapidly. Stocks are meeting current needs and are heavier. The recent reductions in higher-wattage lamps have led to increased interest in this trade. New England textile mills are ordering more freely as a result of resuming operations after protracted strikes.

Fixtures.—Stocks are easily meeting present requirements, notwithstanding talk to the contrary. Active sales are apparent, notably in portables. Residential and commercial installations are absorbing much more material than earlier in the year.

Rigid Conduit.—Much improvement in local stocks is reported. Incoming shipments and a slight falling off in the demand for larger sizes are responsible for this condition of affairs. Prices are firm.

Heaters.— Milder weather has given the trade a little chance to catch up in part on orders. The resumption of coal deliveries has carried the public past emergency heater buying for the time being. Substantial sales based on emphasizing the convenience and economy of short-time heater operation are still anticipated for the remainder of the fall.

New York

Greater Business in Appliances—Collections Easier—Warmer Weather Slows Heater Sales

Business continues to improve, greater activity is reported in appliance sales, and central-station outputs are much more than a year ago. The conduit market is steadied by better stocks, and prices generally are firm for the smaller sizes. Dealers' business is picking up and jobbers report greater activity all along the line. Collections are easier.

Heaters.—The warmer weather during the last week has done much to slow down the active demand reported for the week before. Greater activity is seen among the manufacturers and jobbers, and dealers are stocking up in fair amounts to be ready for the late fall and winter business, which is expected to be record-breaking. Prices generally are even.

Fixtures.—Present requirements are met easily with good stocks. Portable lamps are selling best, and the recently constructed houses are taking heavy amounts of all kinds.

Lamps.—Demand is better and stocks on hand are ample. Increased interest is evident after the recent price reductions in the higher wattages. Much replacement business is being done.

Motors.—Demand has switched to the smaller sizes. Stocks are reported fair and prices firm. Second-hand dealers are receiving a large amount of the orders.

Cleveland

Jobbers Confronted with Shortage of Heaters—Washers Have Favorable Week—Prices Firm

With relief of the conduit shortage in sight, jobbers are now confronted with a shortage of heaters. Dealers are able to supply the present demand from the stocks of those jobbers who made capital from the stock phrase of the conservative faction which met all speculative suggestions with, "It's going to be a long, cold winter."

Lamps.—Dealers and jobbers report a fair activity in the sale of ordinary sizes. Declining prices have had a tendency to retard orders slightly, but stocks are good. It is indicated that building will continue throughout the mild weather, and a prolonged lamp and fixture market is generally expected.

Heaters.—Small portable heaters of popular makes were the feature of this week. Dealers report heavy demand and greatly reduced stocks, although deliveries have been fair, and jobbers are continuing to accept orders for fall delivery. Prices have stiffened slightly.

Radio Equipment.—Much improvement in equipment sales is considered responsible for the general optimism among jobbers and dealers. It seems the consensus of opinion among the dealers that consumers have graduated beyond the experimental stage and are now demanding that better equipment be supplied.

Washers.—A favorable week is reported and receipts are far above expectations. Dealers will concentrate on moving out the present supply during the coming week.

Appliances. — Keen competition for the holiday trade is already noticeable. No estimate has been placed as yet upon the holiday sales other than that a record-breaking season is expected.

Motors.—Movement to the smaller type has been invigorated with better shipments during the week. Prices are firm.

Chicago

Lamp Sales Are Active—High-Tension Equipment Demand Is Brisk—Fall Radio Call Starting

Business in the electrical trade is moving steadily upward. Reports from jobbers indicate that the call for wiring materials is active and that shipments from manufacturers are varied because of the scarcity of freight cars. The conduit situation remains unchanged, with spotted supplies and a very active demand.

The sale of lamps for railroads and industrials is brisk. Prices on certain types were reduced about 20 per cent on Oct. 1. Movement of high-tension equipment is active, all companies reporting large sales. Interest in radio is better and dealers feel that fall business will be good.

Wire.—Call for rubber-covered wire is continuing at a steady rate. No. 14 is quoted at $6.25 to $6.30 per 1,000 ft. in lots of 5,000 ft. Stocks are fair. Bare and weatherproof wire is moving slowly at 16¾ cents per pound.

Conduit.—The ten-day freight embargo has not helped the conduit situation in Chicago since stocks are spotted and the demand very active. The ½-in. black pipe sells for $55 per 1,000 ft. in lots of 5,000 ft.

Flexible Armored Conductor. — Demand for armored conductor is steady. The No. 14 two-wire, single-strip conductor is available in 5,000-ft. lots for $48 per 1,000 ft. Stocks are normal.

High-Tension Equipment.—Orders for this equipment are steadily coming in. One manufacturer received orders for one 9,000-kva., 66,000-volt outdoor substation for the West and sixteen 44,000-volt substations with capacities ranging from 600 kva. to 3,000 kva. Other companies report that their standard equipment is moving well.

Lamps.—Fall buying of lamps by railroads and industrial plants has started and is progressing well. Price reductions Oct. 1 on railroad, round bulbs and miniature types range between 20 and 25 per cent. Larger sizes of the "Mazda C" were also affected by this reduction. Stocks are good.

Schedule Material.—The steady call for this material is due to the active building construction. Prices have remained stationary. Pull sockets sell for $33 per 100, key sockets for $18.15 and the keyless for $16.50 per 100 in standard packages.

Radio.—With the coming of cooler weather, radio has started to return to popularity. Dealers have good stocks on hand and expect good sales during the winter.

Atlanta

Heater Business Fair—Stocks of Outlet Boxes Good—Brisk Movement of Telephones

Practically all of the railroads have lifted embargoes on freight shipments and are accepting freight in the regular routine way, although there are still one or two roads accepting freight shipments, subject to delay. Electrical business as a whole reports very fair activities throughout the entire line, and it is predicted that a number of firms that have stocked heavily on radio equipment are going to find themselves with top-heavy inventories the first of the year.

Air Heaters.—Movement is fairly good with a tendency on the part of a number of firms to cut prices in order to clear out stocks and prevent carry-overs. Stocks are in good shape, shipments satisfactory and deliveries fair.

Meters.—A fairly good volume of sales is reported. The 5-amp. two-wire type constitutes 80 per cent of the volume with 10-amp. two-wire second. There is a tendency to use the 15-amp. size for range purposes as a substitute for the 25-amp. size. Good stocks are on hand and shipments are satisfactory.

Outlet Boxes.—Building construction continues to take this article in large volume. While stocks still are good and factory shipments satisfactory, freight deliveries are not all that might be desired. Prices are steady.

Telephone Equipment.—An unusually good movement of P. B. X. and interphone equipment is reported, with other lines of standard telephone equipment moving fairly well. Prices are steady, with stocks and shipments satisfactory.

Cross-Arms.—Very good sales are reported with the anticipation of fall extensions and winter replacements. Ample stocks are on hand. Prices steady.

Sewing Machines. — Disappointment in volume of sales continues, the fall season failing to revive this line. Jobbers have good to heavy stocks, but have not made any general price reductions.

Denver

Hollow-Ware Supplies Ample—Preference Given to Standard Heaters—Wiring Devices Active

Competition between electrical contractors is still severe, but improvement is noticed. Department stores and electric shops have an ample supply of hollow ware on hand. Medium-priced pot percolators lead in demand.

Radiant Heaters.—Frosty mornings and cool days have developed interest in all types of air heaters. Jobbers and dealers report increasing demand. Preference is being given to standard heaters.

Porcelain.—Three carloads ordered some weeks ago are expected daily. A shortage is found in most jobbers' stocks due to transportation delay. Knob and tube orders from outside territory are still holding up.

Conduit.—Smaller jobbers report considerable business with supply greatly improved. The ½-in. loricated is quoted by association jobbers at $56 per 1,000 ft. in lots of 2,500 ft. or over; $58.50 per 1,000 ft. in lots of 500 ft. to 2,500 ft., and $65 for less amounts.

Armored Cable. — Strong demand. Several big sales were reported last week at price of $55 in 1,000-ft. lots.

Wiring Devices.—Splendid business reported by jobbers.

St. Louis

Rubber-Covered Wire Prices Tending Lower—Fuse Business and Stocks Are Good

On the basis of building permits, construction activity is about the same. The value for September is $1,715,117. A year ago the value was $4,307,172, the high amount being due to two million-dollar structures on which the electrical work is now just becoming active. The amount of industrial construction is, however, increasing, being $42,500 in September, 1921, and $107,200 this September. Work is just starting on a tack factory, to cost $1,500,000, but several smaller factory jobs are being postponed until next spring.

Wire.—Prices on No. 14 rubber-covered are tending lower, one jobber quoting $6.20 per 1,000 ft. in 5,000-ft. lots. Other prices run to $6.50 per 1,000 ft. in 5,000-ft. lots. No. 12 is priced from $9.15 to $9.50 per 1,000 ft. and No. 10 from $12 to $12.50 per 1,000 ft., both in 5,000-ft. lots. Stocks are in good condition and demand is steady and active.

Conduit.—There is some improvement in receipts, but stocks continue extremely low. In 1,000-ft. lots ½-in. black is now quoted at $52.60 per 1,000 ft. and ½-in. galvanized is quoted at $60 per 1,000 ft.

Fuses.—Business and stocks are good. Cartridge fuses, 0-amp. to 30-amp., sell from $5.20 to $5.40 per 100 and 31-amp. to 60-amp. from $7.80 to $8.10 per 100, in standard packages.

Flexible Armored Conductor.—A good and active demand is reported, with stocks tending low. No. 14 two-wire, in coil lots of 250 ft., is priced at $4.80 per 100 ft.

Portland-Seattle

Jobbers Report Business Is Good—Unusual Demand Reported for Air Heaters

Business generally is reported in good shape. Lumber production for the week of Oct. 7 was 10 per cent above normal and was 33 per cent above new orders and shipments. Though a slump exists in the demand for lumber from Japan, this is offset by increasing orders from Australia. The grain movement continues steady and cargoes of apples and prunes are beginning to move out.

Electrical jobbers report business to be continuing in good shape. Stocks are ample in every line except conduit. The unusual demand for air heaters in this section has temporarily depleted some stocks. Lumber and pulp mills are active in electrifying at this time, which produces a very good demand for industrial material. An advance of approximately 10 per cent is reported in snap and push-button switches. The demand for farm-lighting outfits is improving, as is also the demand for lamps.

Some Christmas orders for future delivery are being received. Jobbers report collections improving and credits are easing up somewhat. The average period for outstanding accounts for September for the Northwest was forty-nine days. Contractor-dealers report business good, although much wiring work is still being taken on a very close margin. Fixtures are moving more actively than any other line at present. It is reported that new labor has come in to such an extent that apparently no shortage exists in the supply of electrical workers.

San Francisco

Fixture Firms Busy Because of High Tide in Construction— Ranges Active

September was an exceptionally good building month. There are signs that industrial building is increasing. Nonemployment is increasing slightly, especially in coast cities.

Fixtures.—All fixture firms are busy because of the high tide in dwelling construction. It has even been thought profitable to establish new firms, necessarily increasing price competition. Fixture designing is playing an important role in the public's mind.

Ranges.—Northern California companies are placing an average of about 150 ranges per month on their lines. This business is spread among a variety of manufacturers.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Robbins & Meyers Company Gross Sales $2,498,915

The consolidated income account of the Robbins & Myers Company for the six months ended June 30 last shows gross sales of $2,498,915; gross profit, $507,805; profit from operations, $130,446, and operating loss after interest charge, etc., $188,312.

The balance sheet as of June 30 last shows inventories totaling $4,010,404; cash on hand and in banks, $499,355; notes receivable, $61,874; customers' accounts receivable, $41,039,122; notes payable, $1,637,000; accounts payable, $48,706; earned surplus, $243,535, and total assets and liabilities of $13,131,473.

Foxboro Company Opens Boston Office

The Foxboro Company, Inc., Foxboro, Mass., manufacturer of indicating, controlling and recording instruments for temperature, time, flow and motion, has established a branch office at 49 Federal Street, Boston, under the direction of F. G. Hatch.

Rhode Island Electric Heating Organization Expands

C. I. Hayes, manufacturer of industrial electric heating apparatus, has opened a new office at 194 Friendship Street, Providence, R. I., and in addition to various types of electric furnaces, ovens and special industrial heating appliances of his own production has arranged to market the following equipment in southern New England: Berwick electric metal heater, manufactured by the American Car & Foundry Company, Berwick, Pa.; heavy-duty, high-temperature furnaces manufactured by the Hoskins Manufacturing Company, Detroit; electric ovens, Oven Equipment Company, New Haven; General Electric Company industrial heating apparatus, Leeds & Northrup pyrometer and other instrumental equipment. In recent years over 1,000 kw. in Hayes equipment has been added to the lines of the Narragansett Electric Lighting Company alone.

A representative of Mr. Hayes informed the *Electrical World* this week that business is gradually improving in the industrial heating field.

Multi Electrical Company Moves New York Sales Office

The Multi Electrical Manufacturing Company, 1848 West Fourteenth Street, Chicago, manufacturer of wire bushings, etc., announces that it has moved its New York office to 155 West Twenty-first Street, at which place it will carry a stock of "Powerlet" fittings, "Multi" porcelain bushings and fuse cut-outs and accessories. The New York office is in charge of A. C. Walton, who has been calling on the trade in the metropolitan district during the past year and a half. This firm reports improving business.

P. A. Geier Company to Give More than $5,000 in Prizes

What is said to be the greatest sales contest ever held in merchandising Royal electric cleaners, and, likewise, the greatest ever held by a manufacturer in the electrical appliance business, is to be started Oct. 23 by the P. A. Geier Company, Cleveland. More than $5,000 is to be distributed in thirty-three cash prizes to salesmen of the company.

Allis-Chalmers Reports Net Profits of $299,796

The Allis-Chalmers Manufacturing Company for the quarter ended June 30, 1922, reports net profits of $299,796 after federal taxes, equivalent after preferred dividends to 4 cents a share on its $25,770,750 common stock, contrasted with $278,733, or $1.69 a share, on the preferred stock in the preceding quarter and $635,880, or $1.34 a share, after preferred dividends in the corresponding quarter of 1921. Unfilled orders on hand of June 30, 1922, aggregated $9,110,514.22.

Armstrong Manufacturing Company to Double Size of Plant

Contract for the erection of a building to double the size of its present plant has been let by the Armstrong Manufacturing Company, Huntington, W. Va.

The capital stock of the company has been increased from $300,000 to $500,000 to take care of this expansion, it is announced. The company manufactures a complete line of hardware and electrical specialties.

New Series of Hoover Company Sales Schools Opens

Of importance among the activities of the Hoover Suction Sweeper Company, North Canton, Ohio, which have been set in motion following the big sales convention in August was the recent opening of a new series of sales schools at North Canton.

Under the direction of E. C. Marine, the Hoover sales school will during the coming months help the Hoover men become better salesmen. During the past several months Mr. Marine has been devoting his time and energy to Hoover field schools—condensed sessions of the Hoover sales school, as it were—and has covered a great portion of the United States and Canada.

J. F. Kinder Resigns from Sales Staff of "Tuec" Company

Announcement is made by the United Electric Company, Canton, Ohio, manufacturer of portable and stationary electric cleaners, that J. F. Kinder, who has acted as Western sales manager, has resigned. The company will in the future distribute its products, the "Ohio Tuec" electric cleaner, the "Tuec" stationary cleaner and the "Tuec" swimming pool cleaner through distributors.

Move Westinghouse Krantz Works to Mansfield, Ohio

Increased business, necessitating increased production and more adequate facilities, has resulted in the transfer of the Krantz works of the Westinghouse Electric & Manufacturing Company to Mansfield, Ohio.

The Krantz works have been situated for many years at Brooklyn, N. Y., but, with a gradual increase in business, indicating a return to normal, the Krantz officials decided that the Brooklyn works were not large enough to furnish adequate facilities to meet the impending demand for production.

The transfer of the Krantz works to Mansfield offers better facilities for increased production and gives the works a location in the central part of the country with easy access to a large number of railroads and to both the Middle West and Eastern offices of the Westinghouse compnay.

Westinghouse officials expect that the

transfer of the Krantz works to Mansfield will result in quicker and better service in meeting the requirements of the trade.

Marconi Wireless Company to Raise Additional Funds

Announcement has been made by the Marconi Wireless Company, London, England, that it proposes to raise additional funds by creating £3,000,000 short-term convertible debenture stock. Of this, £1,500,000 is to be issued forthwith and the remainder when required.

Proposals involve extension of borrowing powers and an increase of ordinary capital to provide for conversion rights. A special meeting has been called for Oct. 20 to pass resolutions, one of which provides for increasing capital to £4,000,000 by creating 1,000,000 ordinary shares at £1 each.

General Electric Company Receives Motor Order

Motors totaling several hundred horsepower for the new planing mill of the Clark-Wilson Lumber Company, Portland, Ore., have recently been ordered from the General Electric Company. This mill was electrified several years ago. The company operates its own generating plant, in which Curtis turbo-generators are installed.

China Electric Company Completes Telegraph Installation

The China Electric Company of Peking and Shanghai recently completed at Hankow the first American-type telegraph plant installation for China. Prior to this time telegraph equipment for China has come from European countries and from the shops of the Chinese Telegraph Administration at Shanghai. From an American point of view the equipment used throughout the government system, while of unusually high grade and durable, is nevertheless obsolete. The "open-circuit" plan of operation is used for the Morse circuits, and Wheatstones with undulators, worked at a very moderate speed, are in use on the long trunk lines, the source of emf. being primary batteries.

Hankow has the largest telegraph office in China, and for its proposed large new office the Ministry of Communications about two years ago directed the China Electric Company to make a study of the requirements such as might be considered in a similarly sized office in America.

This study was made by an American telegraph engineer, and in time the order was placed for a majority of the apparatus recommended. The present installation consists of distributing frame, pin-jack switchboard, fuse and resistance panel, powerboard with meters, switches and an equalizing switch for battery group control, eight groups of storage batteries, couple type, 40 volts per group, half positive and half negative groups; electric tape-drying oven, motor-generator, testing instruments, Lamson tube system, all-capital-lettered standard typewriters, etc. The cost of the new equipment was $20,000 gold.

Laundryette Company Appoints New Distributors

The Laundryette Manufacturing Company, Cleveland, announces that it has added several new distributors within the last few months. Among them are the William Hall Electric Company, Dayton, Ohio; the Hayes Electric Stores, Toledo, Ohio; the Robertson Supply Company, Orlando, Fla., and the Perry-Mann Electric Company, Charleston, S. C.

The company is now shipping orders to C. Possman of Stockholm, Sweden, who has taken over the Swedish distributorship of the "Laun-Dry-Ette" and has formed a special company to handle "Laun-Dry-Ette" sales there. Through his efforts the "Laun-Dry-Ette" has been installed in the Husmodern, maintained by the league of Swedish housewives in Stockholm. This home corresponds somewhat to our model electrical home and is visited throughout the year by members of the league of Swedish housewives.

National Conduit & Cable Proxies Obtained

Charles R. Meston, chairman of the stockholders' protective committee of the National Conduit & Cable Company, Inc., New York City, announced last week that more than 6,000 stockholders, representing more than 50,000 shares, had sent in their proxies in response to a previous call issued by the committee, which is working out a reorganization plan for the company. Mr. Meston said that his committee was working in conjunction with the bondholders' protective committee.

The Lapp Insulator Company, Inc., Le Roy, N. Y., manufacturer of high-voltage insulators, has appointed the O. H. Davidson Equipment Company, 1633 Tremont Street, Denver, Colo., its representative for Utah, Colorado, southern Wyoming and northern New Mexico.

The Electric Storage Battery Company, Nineteenth Street and Allegheny Avenue, Philadelphia, has plans in progress for erection of a branch plant on property recently acquired at Belmont Boulevard and Anderson Street, Kansas City, Mo., totaling about 2 acres of land. The initial unit will be one-story and basement, 160 ft. x 220 ft., and will include an electric substation with a 50-kw. motor-generator set for factory service. It will cost about $125,000, including equipment. Hans Von Unwerth, Finance Building, Kansas City, is engineer. Construction has also been commenced on a new assembling plant on Plymouth Street, Rochester, N. Y., to be one story, 134 ft. x 134 ft.

The Metropolitan Battery Service Company, 425 Eleventh Avenue, New York, has leased property at 321 West Fifty-fourth Street for a new plant.

The Argo-Lite Appliance Company, 649 Smithfield Street, Pittsburgh, manufacturer of electric lighting appliances, etc., has purchased property at Seventh and Smithfield Streets for $300,000, improved with three buildings, and will use one of the structures for immediate expansion.

The Apex Electric Company, Washington, D. C., has leased space in the building at 336 North Charles Street, Baltimore, Md., for local works.

The Pittsburgh Meter Company, East Pittsburgh, Pa., manufacturer of electric and other meters, has plans under consideration for the erection of an addition to its plant, on a site opposite the present works, recently acquired, estimated to cost close to $135,000, including equipment.

Landers, Frary & Clark, New Britain, Conn., manufacturers of electric heating and cooking appliances, etc., has filed plans for the erection of a six-story addition to its plant on Stanley Street, to cost about $70,000.

The Dubilier Condenser & Radio Corporation, 48 West Fourth Street, New York City, has made announcement of the approval by the Board of Underwriters of the "Ducon" device. This device, in the form of an attachment plug, is designed to be attached to an ordinary lighting socket for the utilization of the electric wiring system as an antenna.

The Tiffany Electric Company, 131 Howell Street, Jersey City, N. J., manufacturer of electrical equipment, has filed plans for the erection of one-story plant addition.

The General Electric Company has purchased a tract of 175 acres of farm and wood lands at Parsippany, N. J., for the establishment of a recreation center and summer camp for employees at its works at Newark, Harrison, Ampere, Belleville and Waverly. The recreation camp now owned and operated by the company at Lake George, N. Y., has been found too far distant from the New Jersey plants to bring about the desired advantages. Arrangements will be made on the Parsippany tract for outdoor sports of all kinds, summer and winter, and it is proposed to construct a log cabin in the near future to accommodate engineers of the company at technical conferences and to make available a suitable hall for lectures and addresses now being conducted at the Harrison works. A bungalow type of building will also be constructed for a general club house for employees.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., will commence the immediate erection of a new building at Lang Avenue and Susquehanna Street, to be used for a general warehouse and operating service, estimated to cost about $150,000.

Foreign Trade Notes

POWER STATION FOR PENANG, STRAITS SETTLEMENTS. — Negotiations are under way by the municipality of Penang, Straits Settlements, according to the *Electrical Review*, for the construction of a large electric plant on the Prai wharves, from which electricity will be supplied in Penang by the means of submarine cables. Plans for the proposed station provide for an ultimate capacity of 135,000 hp. It is planned to supply electricity in the whole of Penang, Wellesley Province and possibly parts of Kedah. The wharves will be equipped with electric cranes, etc., and the tramway system is being equipped for railless electric cars.

HIGH-POWER RADIO STATION PROPOSED FOR NEW ZEALAND.—The government of New Zealand, the *Electrician* states, is considering the erection of a high-power radio station. Whether New Zealand will have a system communicating directly with Great Britain or whether it will be a link in the Empire wireless chain has not yet been decided.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN ARGENTINA.—A scheme has been submitted to the Legislature of the Province of Mendcza, Argentina, by the Minister of Public Works, the *Electrical Review* states, providing for utilizing the water power of the Atual River for generating electricity and for the irrigation of 625,000 acres of land. It is proposed to erect a plant on the River Atual, near the town cf Nihuil, to develop from 40,000 hp. to 100,000 hp. The Legislature has been asked to pass a law authorizing the calling of tenders for a concession to be granted for the installation of a plant at Nihuil. Full details of the project can be obtained from the Minister of Public Works, Mendcza, Argentina.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Switzerland (No. 3,924) for 1,000,000 porcelain sockets for outdoor signboards of normal Edison type with as few metal parts as possible.

Purchase or an agency is desired in Spain (No. 3,935) for electrical supplies, etc.

Purchase is desired in Norway (No. 3,959) for electric pocket lamps.

An agency is desired in Norway (No. 3,961) for wireless telephones.

An agency is desired in India (No. 3985) for electrical goods, etc.

An agency is desired in Argentina (No. 3,986) for electrical equipment, with the exception of wireless and telegraphic apparatus.

PROPOSED HYDRO-ELECTRIC SCHEME IN PUNJAB.—Plans for utilizing the water power of the Sutlej Valley dam and other irrigation waters to develop electrical energy, according to *Commerce Reports*, are being considered by the Punjab Electricity Board. Application to the board from British and Canadian power interests for concessions to develop the hydro-electric power involved, with a lien on the water powers of the Ravi River, have been refused and a resolution has been published by the board declaring itself unanimously in favor of a government monopoly of water power for the Punjab. It is proposed to distribute the power to concessionnaire companies and by price regulation insure electrical energy at a low cost to consumers. In this manner the board hopes to promote industrial development and at the same time safeguard the public interest in the waters of the Punjab Rivers.

PROPOSED EXTENSIONS TO VIGO (SPAIN) TRAMWAY SYSTEM.—The Vigo Electric Tramway Company, according to the *Electrician*, contemplates extending its system to the towns of Redondela, Panjon, Ramallosa, Gondomar, Bayona and Canido, a distance of about 10 miles. The cost of the work is estimated at £280,000 and will include four substations, trolley wire, converters, transformers, rolling stock, etc.

ELECTRIC EQUIPMENT FOR MUNICIPAL PLANT AT MACKAY, AUSTRALIA. —Tenders will be received by the City Council of Mackay, Queensland, Australia, according to the *Electrician*, until Jan. 31, for boiler and generating plant, switchboard and transformers. Messrs. Frew & Bridger, Queen Street, Brisbane, Australia, are consulting engineers.

PROPOSED EXTENSION TO ELECTRIC LIGHTING SYSTEM IN MANLY, AUSTRALIA.—The City Council of Manly, Sydney, Australia, the *Electrical Review* states, has decided to appropriate £25,000 for extensions to the street-lighting system and mains.

EQUIPMENT FOR THE MONSWAI (NEW ZEALAND) HYDRO-ELECTRIC PROJECT.—Tenders will be received by the Southland Electric Power Board, Invercargill, New Zealand, until Dec. 15, according to the *Electrical Review*, for turbines, generators, exciters, battery equipment, switchboards, switch gear and cables, etc., for the Monswai hydro-electric project.

New Apparatus and Publications

STOKER.—The Under-Feed Stoker Company of America, Detroit, is distributing a leaflet describing and illustrating its "Lateral Retort" stoker.

PREVENTING CORROSION.—"Heating and Deaëration of Boiler-Feed Water" is the title of a leaflet distributed by the H. S. B. W. Cochrane Corporation, Philadelphia, describing its apparatus for preventing corrosion by dissolved oxygen.

SOCKET. — The Akron Specialty Company, 824 South High Street, Akron, Ohio, has recently brought out a new socket for use with the Westinghouse dry-battery tubes, "WD-11" detector and "WR-21A" amplifier. This socket is distributed exclusively by the Moock Electric Supply Company, Canton, Ohio.

PANELBOARDS AND CABINETS. — The Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York City, are distributing a leaflet covering the "Sprague" safety-type panelboards and cabinets.

SNAP SWITCH.—A new motor-operated snap switch that can be operated either on alternating or direct current and is applicable wherever the automatic operation of electrical devices is desired has recently been perfected by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

CHIMNEY CONSTRUCTION. — Ballard, Sprague & Company, Inc., 200 Fifth Avenue, New York City, engineers and contractors, have issued a small booklet in which they describe and illustrate various chimneys, boiler settings and other construction work done by the company.

SMALL MOTORS.—The Reynolds Electric Company, 2650 West Congress Street, Chicago, is distributing a leaflet calling attention to the "Reynolds" fractional-horsepower motors of the split-phase induction type. These motors are made at ratings from 1/20 hp. to ¼ hp., in six frame sizes and two diameters.

ORGAN BLOWER.—The Kinetic Engineering Company, Sixtieth Street and Baltimore Avenue, Philadelphia, is distributing a leaflet describing the "Kinetic" organ blower.

ELECTRIC PYROMETERS. — Catalog No. 1,401 issued by the Bristol Company, Waterbury, Conn., covers its various types of electric pyrometers and accessories. It also gives charts for several types of its recording pyrometers.

New Incorporations

THE SANDY RUN ELECTRIC COMPANY, Shelby, N. C., has been granted a charter with a capital stock of $25.000 to distribute electricity in the towns of Mooresboro, Lattimore, Boiling Springs and Ellenboro. The company is capitalized at $25,000.

THE BERGEN RURAL ELECTRIC COMPANY, Bergen, N. Y., has been incorporated with a capital stock of $7,200 by Clarence A. Rogers, James Stedman and others. The company will supply electricity in Bergen and vicinity.

THE FRANKLIN (MO.) ELECTRIC COMPANY has been incorporated with a capital stock of $20,000 to generate and distribute electricity. The incorporators are B. E. Perkinson, John Rogers, A. J. Alliott and others.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

STOCKHOLM, ME.—The Maine Utilities Commission has authorized the Stockholm Light & Power Company to issue $10,000 in capital stock, the proceeds to be used for the erection of transmission lines and to extend its service.

PORTSMOUTH, N. H.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 24 for four motors, controllers and spare parts for the local navy yard. (Schedule 216.)

BARRE, VT.—The City Council has decided to install a new lighting system on Blackwell and Washington Streets. The plans provide for the erection of 400-cp. lamps mounted on ornamental brackets. The Barre Light & Power Company furnishes the street-lighting service.

FALL RIVER, MASS.—The Richard Borden Manufacturing Company has awarded contract for the construction of a transformer and switch station, to cost between $6,000 and $7,000.

LOWELL, MASS.—The Boott Mills, Inc. has awarded the contract for the construction of a hydro-electric power plant at its local mills, to cost about $30,000.

SPRINGFIELD, MASS. — The United Electric Light Company will make extensions in its underground conduit system, to cost $50,000.

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Middle Atlantic States

AUBURN, N. Y. — The Empire Gas & Electric Company has issued $1,100,000 in bonds, part of the proceeds to be used for extensions and improvements.

BUFFALO, N. Y.—Plans are under way by Peter A. Porter, Jr., Marine Bank Building, in conjunction with the James S. Thompson estate, for the organization of a company to construct and operate hydro-electric plant at Niagara Falls. The cost of the initial installation is estimated at $4,000,000.

BUFFALO, N. Y.—Plans for the proposed flour mills to be erected on the water front in Buffalo by the Pillsbury Flour Mills Company, Minneapolis, include an electric substation. The cost of the plant with equipment is estimated at $2,500,000.

LITTLE FALLS, N. Y.—The installation of an ornamental lighting system, to cost about $15,000, is under consideration.

NEW YORK, N. Y.—The American Gas & Electric Company has issued bonds for $7,500,000, a portion of the proceeds to be used for extensions and improvements.

NEW YORK, N. Y.—The Department of Plant & Structures is preparing plans for a trackless trolley system on Staten Island, to cost about $4,235,000, of which $1,235,000 will be used for a power plant. Grover A. Whalen is commissioner.

OSWEGO, N. Y.—Plans are being prepared for the construction of a municipal hydro-electric plant, on the Oswego River, to cost about $750,000. John A. Bensel, 16 East Forty-first Street, New York, is engineer.

TUPPER LAKE, N. Y. — Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 15 for mechanical equipment for the power house at the proposed veterans' hospital at Tupper Lake. (Specifications 4719 and 4720.)

VISCHER FERRY, N. Y.—Bids will be received by Charles L. Cadle, superintendent of Public Works, Capitol, Albany, until Nov. 1 for the construction of power house and work incidental thereto, at the Vischer Ferry dam.

NEWARK, N. J.—The City Commission will install equipment at the power house and refrigerating plant at the new Center Market, now in course of construction, as follows: Generators, engines, etc., to cost $48,000; boilers, piping, etc., $40,000; elevator equipment, $40,000; refrigerating-plant machinery, $100,000; pumping equipment, $10,000; incinerators, $10,000; lighting fixtures, $10,000, and general market apparatus, $350,000.

TRENTON, N. J.—The Board of Education has completed plans for the erection of a power plant at Clinton Avenue and Perry Street. A refrigerating plant will also be installed.

ALTOONA, PA.—The Penn Central Light & Power Company has arranged for a bond issue of $80,000, the proceeds to be used for the construction of a power plant at Saxton.

ALTOONA, PA.—The Pennsylvania Railroad Company is considering plans for the electrification of its lines between Altoona and Johnstown, to cost approximately $15,000,000, including power houses, etc.

DILLSBURG, PA.—The Cumberland Valley Light & Power Company has arranged for a merger of twelve electric power companies operating in York and Adams Counties, as follows: Franklin Township, Washington Township, Reading Township, Hamilton Township, Latimore Township, Huntington Township, Menallen Township, Tyrone Township, York Springs Borough, East Berlin Borough, Bendersville Borough, Abbottstown Borough, and the Dillsburg Light & Power companies. Extensions and improvements will be made in the power plant at Dillsburg, with new transmission and distributing lines.

EASTON, PA.—The Pennsylvania Edison Company has issued $525,000 in capital stock, part of the proceeds to be used for extensions and improvements.

LANCASTER, PA.—Work will being within sixty days by the Edison Electric Company to place its overhead transmission lines in underground conduits in the business section of the city. The conduits for carrying the cables are already in place. The cost of the new system is estimated at about $160,000.

PITTSBURGH, PA.—Bids will be received by the Board of Education, until Nov. 2 for mechanical and electrical equipment for the South High School addition, including mechanical fans, motors, lighting fixtures, boilers and auxiliary equipment. George W. Gerwig, 725 Fulton Building, is secretary.

TRAINER, PA.—The Sinclair Consolidated Oil Corporation, 45 Nassau Street, New York City, has purchased a site at Trainer for a new oil refinery. Plans have been prepared for the initial plant, to cost about $2,000,000, which will include power station, machine shop and other buildings. Other units will be erected later, increasing the cost to $5,000,000.

WILKES-BARRE, PA.—The Candlemas Collieries Company, Exchange Building, is considering the installation of electric power equipment, hoisting apparatus and mining machinery.

WILLIAMSPORT, PA.—Plans are under consideration by the City Council for an issue of $1,000,000 in bonds for municipal improvements, to include extensions to the electric plant and system.

CUMBERLAND, MD.—The Cumberland Edison Power Company, recently organized, has acquired the holdings of the Cumberland Electric Railway Company and the Edison Electric Illuminating Company, and will consolidate the properties. Extensions and improvements to the systems will be made.

FAIRMONT, W. VA.—The Monongahela Power & Railway Company will make extensions in its power plants and system to cost about $1,000,000. Additional machinery will be installed in the generating plant at Rivesville and a new 66,000-volt transmission line erected from this plant to a point on the Pennsylvania state line.

WASHINGTON, D. C.—Bids will be received by the Board of Commissioners until Oct. 24, Oct. 30 and Nov. 13 for equipment for the Eastern High School, including motor-generator set, pressure and vacuum pump and auxiliary equipment for power service.

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North Central States

GREENVILLE, MICH.—Plans have been prepared by the Michigan Canned Food Company, Book Building, Detroit, for the erection of a factory and power house in Greenville, to cost about $150,000. The Industrial Construction Company, Eau Claire, Wis., is engineer.

LANSING, MICH.—The Lansing Pure Ice Company will install electrical equipment in connection with an addition to its ice-manufacturing plant, to cost about $100,000.

LORETTO, MICH.—Plans are being prepared by the Peninsular Power Company, Madison, Wis., for the construction of a hydro-electric plant, including a transmission line to cost about $225,000. Mead & Seastone, Journal Building, Madison, are engineers.

CLEVELAND, OHIO.—Bids will be received at the office of Commissioner of Purchases and Supplies, City Hall, Cleveland, until Oct. 27 for fiber conduit for the division of light and power.

CLEVELAND, OHIO.—The installation of a new ornamental lighting system on Clifton Boulevard, Detroit and Madison Avenues in the Lakewood section of the city is under consideration. The cost is estimated at $200,000. E. H. Fischer, City Hall, is engineer.

EAST LIVERPOOL, OHIO.—The Ohio & Pennsylvania Electric Company, recently organized, has acquired a site on the Ohio River, near Liverpool, for power plants to cost about $1,000,000. Blaine Graham, Steubenville, represents the new company.

LORAIN, OHIO.—The installation of a new ornamental lighting system on Broadway is under consideration.

MARION, OHIO.—The Columbus, Delaware & Marion Electric Company has issued $1,374,000 in bonds, part of the proceeds to be used for extensions and improvements.

NEWARK, OHIO.—The Ohio Power Company has issued $6,132,000 in bonds, part of the proceeds to be used for extensions and improvements.

TOLEDO, OHIO.—Work has started on the foundation of the power house at the Flower Hospital. The plans provide for the erection of seven new buildings, including power house, to cost about $1,000,000.

INDIANAPOLIS, IND.—Bids will be received by the Board of Sanitary Commissioners, City Hall, Indianapolis, until Oct. 31 for construction of section 3, division 3, and furnishing mechanical equipment for sewage-disposal plant, including coal-handling equipment, power-plant, piping, boiler-feed pumps, feed-boiler heaters, etc.

TERRE HAUTE, IND.—The Wabash Valley Electric Company contemplates the construction of a power plant on the Wabash River in Sugar Creek Township, to cost about $5,000,000. Application has been made to the County Commissioners for permission to erect extensions to its transmission system and distributing lines in Vigo County.

CASEY, ILL.—The contract for the construction of power station and installation of equipment, including generators, engines and boilers, for the municipal electric light plant has been awarded to the Power Supply Company, Terre Haute, Ind., to cost about $75,000.

EVANSTON, ILL.—A vocational department will be installed in the new high school for which bids will soon be asked. The cost, including equipment, is estimated at about $2,000,000.

BELOIT, WIS. Plans are being prepared by the Beloit Water, Gas & Electric Company for the erection of a new office building, to cost about $150,000. Hetherton & Krieg, Goodwin Block, are architects.

MANITOWOC, WIS.—The installation of an electric lighting system on the new Eighteenth Boulevard is under consideration by the City Council.

MERRILL, WIS.—The Wisconsin Valley Electric Company has submitted a proposal to the City Council offering to install a new street-lighting system.

MILWAUKEE, WIS.—The Milwaukee Electric Light & Railway Company has issued bonds for $12,500,000, a portion of the proceeds to be used for extensions and improvements.

PORTAGE, WIS.—The Ford Motor Company is reported to have secured a site on the Wisconsin River for the construction of a hydro-electric power plant to be used in connection with its proposed zinc-oxide plant in this section. The project will cost close to $500,000.

BEMIDJI, MINN.—The Minnesota Associated Lumber Company contemplates the construction of a new mill with power plant, machine shop and other mechanical departments, to cost, including machinery, about $500,000.

BRAINERD, MINN.—The Northern Pacific Railroad Company contemplates the construction of a large power plant in Brainerd to replace the present plant.

SIOUX CITY, IOWA.—The Hanford Produce Company will install electrical equipment in connection with its proposed ice-manufacturing plant, to cost about $100,000.

BRANSON, MO.—The Federal Power Commission has granted the Empire District Electric Company, Joplin, authority to construct a dam at Table Rock above Lake Taneycomo, [illegible] miles from Branson.

KANSAS CITY, MO.—Bids for the installation of a municipal underground fire-alarm system have been rejected, and new bids will be asked at an early date.

ST. LOUIS, MO.—The St. Louis Smelting & Refining Works, Inc. will install a 1,250-kw. turbo-generator set and other electrical equipment at its plant.

LINCOLN, NEB.—Extensions to the ornamental lighting system in the business district are under consideration.

YORK, NEB.—The Nebraska Gas & Electric Company will install additional equipment at its local power plant. A transmission line will be erected from Norfolk to Lindsay.

KANSAS CITY, KAN.—A new street-lighting system will be installed on the Quindaro Boulevard from Seventh to Twenty-second Street. Electric street lamps will also be erected in the Arackaree district.

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Southern States

KINSTON, N. C.—Plans are being prepared for an ornamental lighting system on North and Queen Streets, to cost about $25,000.

LINCOLNTON, N. C.—Extensions and improvements are contemplated to the municipal electric lighting waterworks and sewerage systems, for which $180,000 in bonds have been authorized.

SPARTANBURG, S. C.—The South Carolina Gas & Electric Company, recently organized, has taken over the plants and holdings of the South Carolina Light, Power & Railways Company. Improvements will be made to the property, to cost about $300,000, which will include enlarging the hydro-electric plant at Gaston Shoals, improvements to the steam and gas plants in Spartanburg, erection of transmission line from Spartanburg to Gaffney, etc.

FORT MEYERS, FLA.—Preliminary plans are being prepared for the installation of a municipal light and power plant.

BIRMINGHAM, ALA.—The Public Service Commission has granted the Alabama Power Company permission to build three dams across the Tallapoosa River, to develop about 120,000 hp.; also to erect a transmission line from Lock 12 to Opelika.

BIRMINGHAM, ALA.—The Crystal Ice & Storage Company will install electrical equipment at its proposed ice and refrigerating plant on Ninth Avenue, to cost about $90,000.

SCHLATER, MISS.—The Schlater Light & Ice Company plans to rebuild its local power house, recently damaged by fire, causing a loss of about $25,000.

LITTLE ROCK, ARK. Steps have been taken by the Seventh Street Business Men's League to install an ornamental lighting system on West Seventh Street from Main to Victoria Street.

THORTON, ARK.—Plans are being prepared by the Stout Lumber Company for rebuilding its planer and veneer mills and power house, recently destroyed by fire. The cost of the new plant is estimated at $200,000.

LAFAYETTE, LA.—The City Council is considering an issue of $144,000 in bonds for improvements and extensions to the municipal electric light plant and waterworks.

MANSFIELD, LA.—The capital stock of the Mansfield Light & Power Company has been increased by $50,000.

HEAVENER, OKLA.—The Oklahoma Gas & Electric Company, Oklahoma City, is reported to have acquired the municipal electric plant.

RED ROCK, OKLA.—Bonds to the amount of $25,000 have been approved for the installation of an electric light and power system.

DALLAS, TEX.—The Southwestern Dehydration Company, 409 Andrews Building, will construct a power house in connection with its proposed local plant, to cost about $75,000.

NEW BRAUNFELS TEX.—The Planters & Merchants' Mills, Inc., 604 Brady Building, San Antonio, plan the construction of a hydro-electric plant to cost about $85,000.

PILOT POINT, TEX.—The Civic Improvement League contemplates the installation of a street-lighting system in the residential districts.

RALLS, TEX.—The Texas Utilities Company, Lubbock, has been granted a franchise to install an electric system in Ralls.

TEMPLE, TEX.—The Texas Power &

Light Company is planning to place its wires underground, at a cost of about $40,000.

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Pacific and Mountain States

OLYMPIA, WASH. — Application has been made to the State Engineer for permission to utilize water from the Cowlitz River for a municipal hydro-electric power plant.

OLYMPIA, WASH. — The West Coast Pulp & Paper Company, Salem, Ore., will construct an electric substation in connection with its proposed paper mill here.

PORT TOWNSEND, WASH.—The Discovery Bay Logging Company plans to rebuild its mill and power plant, recently destroyed by fire, causing a loss of about $500,000, including equipment.

SEATTLE, WASH.—The installation of a lighting system on Olive and East Olive Streets has been approved by the Council.

TACOMA, WASH.—The installation of an ornamental street-lighting system on Broadway from South Seventh Street to North First Street has been approved by the Council.

BANNING, CAL. — Arrangements are being made by the City Trustees to take over the local electric plant, to be owned and operated by the Municipality, for which bonds have been issued.

BANNING, CAL.—Contracts have been awarded by the San Gorgonio Power Company, First National Bank Building, for the construction of two power house on the diverted Whitewater River, one to be located at Big Oaks and the other near Camp Comfort, to cost about $500,000. Later a third power house will be erected at a cost of about $400,000. The Southern Sierras Power Company, it is understood, is under contract to purchase all electrical energy developed.

GRASS VALLEY, CAL. — The Nevada Irrigation Company has applied to the State Water Commission for permission to construct two hydro-electric power plants on the Bear River, of 34,000-hp. and 28,000 hp. capacity, respectively.

HAYWOOD, CAL.—Plans are being prepared for the installation of an ornamental lighting system in the business district. J. B. Holly is engineer.

NEWPORT BEACH, CAL. — An ornamental lighting-system will be installed on the new municipal pier.

SAN BERNARDINO, CAL.—A co-operative plan is being arranged between this city and Colton for the installation of a joint lighting system on South Mount Vernon Avenue between the two municipalities.

SAN BUENAVENTURA, CAL. — Plans are in progress for the installation of an ornamental street-lighting system in district No. 4.

SAN FRANCISCO, CAL.—Roy H. Elliott, 1213 Hobart Building, and associates have plans in progress for hydro-electric power plants on Sardine and Salmon Creeks, to develop 113,000 hp., at a cost of about $1,000,000.

POLSON, MONT.—The Montana Power Company contemplates the construction of a new power plant in Polson.

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Canada

EDMONTON, ALTA. — The Municipal Electric Light and Power Department is planning to extend the lighting system to North Edmonton.

KERRISDALE, B. C.—The Council is considering a bylaw to appropriate $200,000 for the installation of a municipal street-lighting system.

BARTON, ONT.—The establishment of a hydro-electric plant and commission is under consideration by the Township Council.

LONDON, ONT. — The Public Utilities Commission is considering placing underground all electric wires in the business district.

NIAGARA FALLS, ONT.—A bylaw providing $100,000 for extensions and improvements to the electric lighting system has been approved by the City Council.

SHAWINIGAN FALLS, QUE. — The Shawinigan Water & Power Company is planning extensions to its system soon. In the spring construction work will be started on the proposed power development at Gres Falls, which will involve an expenditure of from $10,000,000 to $15,000,000.

STURGEON FALLS, ONT.—The Lower Sturgeon Power Company is planning to build a power plant, to cost about $1,250,000. Vielé, Blackwell & Buck, 49 Wall Street, New York City, are engineers.

Electrical Patents

Announced by U. S. Patent Office

(Issued Sept. 26, 1922)

1,430,388. Wire-Stretching Tool; J. W. Leslie, Evanston, Ill. App. filed Oct. 25, 1920. Used for reinforcing boxes, etc.

1,430,421. Sterilizer; A. J. Walter, Mansfield, Ohio. App. filed Sept. 15, 1920. Holder for razors and other edge tools.

1,430,438. Electric Forging and Heat-Treating Furnace; F. G. Dawson, Detroit, Mich. App. filed Jan. 11, 1922. Complicated automatic controllers eliminated.

(Issued Oct. 3, 1922)

1,430,528. Motor-Control System; B. O. Austin, Wilkinsburg, Pa. App. filed Nov. 12, 1920. Means for disconnecting impaired railway motor from control system.

1,430,534. System of Control; A. H. Candee, Forest Hills, Pa. App. filed Nov. 20, 1920. Interlocking the two controllers on railway car.

1,430,548. Humidifying Apparatus; O. D. Hogue, Brookline, Mass. App. filed Jan. 6, 1922. Complete humidifying unit with electric heating element.

1,430,549. System of Control; G. H. F. Holy, Pittsburgh, Pa. App. filed Dec. 2, 1920. Excess number of field-magnet turns to give greater speed range.

1,430,550. X-Ray Apparatus; G. Hotaling and W. D. Coolidge, Schenectady, N. Y. App. filed June 30, 1919. Protective device reduces danger of injury by electric shock to operators.

1,430,594. Trolley Clamp; W. Schaake, Pittsburgh, Pa. App. filed Sept. 8, 1919. Clamp for holding grooved wire.

1,430,603. Soldering Iron; W. A. Timm, Berwyn, Ill. App. filed Nov. 28, 1920. Lead-in wires kept away from handle on low-voltage high-current soldering iron.

1,430,607. Constant-Resistance Electron-Discharge Device; W. C. White, Schenectady, N. Y. App. filed Oct. 31, 1917. Electron tube arranged so that current varies directly as applied voltage.

1,430,619. Mechanical Rectifier; L. Bradley, East Orange, N. J. App. filed Feb. 14, 1919. Reduces destructive arcing.

1,430,674. Combined Lightning Arrester and Choke Coil; K. B. Narans and G. R. Gampher, Eldorado, Ill. App. filed Feb. 18, 1921. Combined unit with same line terminal but arrester terminal connected to ground and coil to transformers.

1,430,686. Trolley Pole; J. A. Sanner, Page, W. Va. App. filed July 15, 1922. Mine locomotive pole that can be varied in length.

1,430,703. Automatic Car, Train Pipe and Electric Coupling; W. V. Turner (deceased), Wilkinsburg, Pa. App. filed May 22, 1919. Coupler heads rigidly locked together with means for connecting the train pipe and electric wires.

1,430,706. Electric Radiator; J. G. Wallman, Oakland, Cal. App. filed Sept. 25, 1920. Governor switch cuts out one or more units as temperature rises above predetermined degree.

1,430,711. Braking System; C. C. Whittaker, Pittsburgh, Pa. App. filed Nov. 29, 1920. Electric braking for motor vehicles.

1,430,712. Dynamo-Electric Machine; H. M. Wood, Edgewood Park, Pa. App. filed Feb. 3, 1917. Generating unit at center of frame and motor armatures assembled around this in same frame and geared to generator armature.

1,430,724. Article of Fused Metallic Oxide and Process of Producing the Same; A. L. D. d'Adrian, Washington, Pa. App. filed Feb. 25, 1921. Has high refractory and chemical resisting qualities.

1,430,726. Manufacture of Dry Cells; H. de Olaneta, New Haven, Conn. App. filed Feb. 24, 1920. Depolarizer comprising purified manganate derivative.

1,430,727. Manufacture of Dry Cells; H. de Olaneta, New Haven, Conn. App. filed April 1, 1920. Method of assembling cells.

1,430,728. Machine for Assembling Dry Cells; H. de Olaneta, New Haven, Conn. App. filed May 19, 1920. Apparatus for squeezing paste around cartridge.

1,430,785. Method of Producing Chlorine Gas; G. N. Blanchard, San Francisco, Cal. App. filed July 21, 1920. Apparatus for uniformly producing chlorine gas in fixed ratio to water for water purification.

1,430,808. Two-Way Impedance Equalizer for Transformers; R. S. Hoyt, Brooklyn, N. Y. App. filed Nov. 29, 1918. Telephone network arrangement.

1,430,830. Electric Flatiron; W. A. Morgan, Los Angeles, Cal. App. filed Aug. 31, 1921. Protection afforded to prevent overheating.

1,430,844. Method of Cleansing Molds; A. R. Payne, Clarksburg, W. Va. App. filed Nov. 13, 1920. Electrochemical process for loosening scale on mold.

1,430,855. Apparatus for Automatically Electroplating Metallic Sheets by Means of a Revolving Cylinder; M. Schlotter, Berlin, Germany. App. filed Jan. 21, 1920.

1,430,858. Electrically Heated Furnace; C. W. Speirs, Battersea, London, England. App. filed Oct. 5, 1920. Plate supporting crucible carried on centering device.

1,430,860. Electric Lamp; R. Swimmer, New York, N. Y. App. filed Nov. 24, 1919. Eye shields detachably connected to shade.

1,430,861. Electric Furnace; B. Tang, Schenectady, N. Y. App. filed Dec. 11, 1920. Supporting structure for heaters of resistance furnaces.

1,430,862. Dynamo-Electric Machines; H. W. Taylor, Bilton, F. H. Clough, Hillmorton, and F. P. Whitaker, Rugby, England. App. filed June 10, 1919. Windings arranged to avoid local or unbalanced currents.

1,430,863. Dynamo-Electric Machine; H. W. Taylor, Bilton, England. App. filed Aug. 27, 1919. Windings so arranged that any voltage unbalance in them is prevented.

1,430,866. Commutator Construction; T. W. Varlye, New York, N. Y. App. filed March 5, 1920. Withstands high speed even though constructed of large size.

1,430,869. Semi-Automatic Coil-Winding Mechanism; C. A. Wickstrom, Chicago, Ill. App. filed Sept. 22, 1919. Machine for the winding of universal wound coils.

1,430,883. Signal Receiving System; B. Bradbury, Schenectady, N. Y. App. filed March 23, 1921. Two grid tubes employed.

1,430,907. Electric Arc Mechanism for Searchlights; L. C. Josephs, Jr., United States Army. App. filed June 9, 1919. Movement of the negative carbon so limited as to prevent abrupt changes in arc length.

1,430,926. Vaporizer for Internal-Combustion Engines; J. R. Schmidt, Marion, Kan. App. filed Feb. 28, 1921. Heating element stretched over manifold opening.

1,430,927. Electrically Heated Boiler; E. L. Smalley, South Orange, N. J. App. filed Aug. 2, 1921. Relates to boilers of fire-tube type provided with resistance condustors carried within the boiler tube.

1,430,939. Portable Electric Lamp; A. E. Case, Marion, Ind. App. filed April 30, 1920. Flashlight with case insulated from battery.

1,430,948. Electrical Furnace for Treating Ores; A. Counas, Paris, France. App. filed Aug. 21, 1920. Enables complete treatment of ores to be carried out in one furnace.

1,430,971. Method of and Means for Reducing Ores in Electric Blast Furnaces; E. Fornander, Sandviken, Sweden. App. filed April 14, 1922. Method of carrying out independent introductions of ore and reducing materials.

1,430,987. Electric Furnace; E. A. Hanff, Pittsburgh, Pa. App. filed March 27, 1920. Operator can control voltage and power factor.

1,431,014. Electrolytic Cell; E. A. Le Sueur, Ottawa, Ont., Can. App. filed Oct. 23, 1920. Current leading-in member of carbon surrounded by an open water bath.

1,431,022. Agitating Apparatus for Tanks; T. H. Mumford, Jr., Washington, D. C. App. filed March 2, 1921. Means for agitating liquids in electroplating tanks.

1,431,031. Blowtorch; R. E. Patchel, Philadelphia, Pa. App. filed March 31, 1921. Liquid fuel electrically heated and vaporized.

1,431,039. Electric Soldering Iron; F. F. Quednow and G. J. Vokel, Philadelphia, Pa. App. filed Oct. 27, 1921. Various degrees of heat may be applied.

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"When Public Service Isn't"

A LETTER from "an impatient sufferer" has just been published in *Collier's*. It is a frank, clever, sensible letter of protest telling in amusing good humor of an experience with a public service that doesn't seem eager to serve. It is a pathetic picture of the way it looks to the householder when the process of obtaining electricity is beset and bedeviled by the annoying inconvenience of slow official routine and an apparent total forgetfulness of the comfort and desire of the customer.

The fact that this article has been read by hundreds of thousands makes it a matter for consideration. For one cannot doubt that this picture is painted in true colors.

BRIEFLY—a household had waited long for service. Finally a line was built their way. They secured a contractor to wire the house, who borrowed tools and left litter all over the place. After a wait the power company's men dug a hole in the front yard and covered it with brush. After a wait they set the pole and left the brush. It was a joint pole, and after a wait the telephone people transferred their lines and left the old pole and dirt on the grass, abandoned. After a wait they were cut in, but found that the panelboard was wrong. The power company's man fixed this, but then the kitchen, dining room and barn were dark. They are now waiting for the contractor to come again and seek the cause. Meanwhile they find that they have bought lamps of the wrong size. The letter says:

> "Somewhat irritated—that's how we feel about it all. After forty years of electric light it ought to be possible for one company to plan, finish and test the work and clean up after itself. That would be a solider basis for public good will."

ONE company can't do it all. But one company can and should do what is necessary to insure good service to the householder in all his normal contact with the electrical industry, and to assure good will. And that one company is the central station.

The central station can not, should not do all the wiring—can not, should not sell all the appliances. But the central station can and should so operate its own departments and so guide, inspire and organize the local electrical family that the standards of service will be uniformly high. For the central station is the "daddy" of the local electrical family. They are its progeny. And the central station must hold itself actively responsible for the family's good name.

Whether the new customer gets service from the company promptly or not is merely a matter of organization and policy. Whether or not his house is wired quickly and well again depends on organization and ideals. Do the local contractors habitually do good work and make friends for electric service? The central station cannot rest until the standard reaches this height, for nothing counts unless the customer is thoroughly pleased with electricity and the service.

John Garrett Barry

A sales executive, now vice-president of one of the world's greatest industrial organizations, who has rendered valuable service in the promotion of research and development, especially in the street-railway field.

NO MAN can win a higher tribute from the world he works in than to have it said by all his fellows that he is one who "gets things done." For the foundation of industry is production and the life of industry is progress, and production and progress are achieved on the modern scale only through the work of massed men, inspired and led by executives with the vision to see what should be done and the power and courage to carry through large purposes to full accomplishment. Such a man is John Garrett Barry, in whose honor a distinguished company of men prominent in the electric railway field gathered at an elaborate banquet in New York on Thursday last to celebrate his appointment as a vice-president of the General Electric Company.

Thirty-two years ago, his school education over, Mr. Barry entered the employ of the Thomson-Houston Company as an apprentice in the shops at Lynn, Mass. His advancement from this point up to his present high position has been an even record of consistent service. After his apprenticeship he entered the construction department of the old company, first at Lynn and then at Boston. When the General Electric Company was formed he transferred to the railway department, then one of the two major divisions of the company. These were the pioneer days of the electric railway and there were many problems. Mr. Barry became intensely interested and set himself to help develop the great opportunities ahead for street railway transportation. His tremendous capacity for work, his broad vision, his soundness of judgment, and above all his deep human sympathy and understanding have enabled him to contribute greatly—a conspicuous figure in the evolution of this important branch of the electrical industry.

Mr. Barry was strongly attracted to the business field. His ability to sense the difficulties involved and work out their solution led to his promotion to assistant manager of the department in three years' time. In 1907 he became manager. In 1917 his signal success won him appointment to the position of general sales manager of the company while still retaining the direction of the railway department. And finally last June came the further distinction of his advancement to a vice-presidency. It has been called "the most popular appointment" of recent years.

Throughout this time Mr. Barry has been a mighty influence for the promotion of research and development work that has brought great benefit to the electrical industry. His rare faculty for inspiring men to loyalty, enthusiasm and effort has been a vital force in the upbuilding of his organization. He has rendered valuable aid to the American Electric Railway Association in years of service on the executive and finance committees. He has given generously to public work as a member of the Board of Education of Schenectady and as Fuel Administrator for the Schenectady district during the war.

Mr. Barry was born in Boston in 1868. He is a director of the Schenectady Savings Bank and the Schenectady Trust Company and a member of the Schenectady Board of Trade, the Mohawk Golf Club, the Mohawk Club, the American Institute of Electrical Engineers and the Engineers', Railroad, Bankers' and Lotos clubs of New York.

Editorial Comment

Electrical World, October 28, 1922
Volume 80 Number 18

Getting Joy in the Job

THE president of Columbia University, Dr. Nicholas Murray Butler, made some very interesting observations on thrift and thriftlessness before the American Bankers' Association two weeks ago. Always eloquent and instructive, Dr. Butler on that occasion let fall many pearls of wisdom which our industry especially can appreciate. "We must regard industry," he said, "as a co-operative undertaking between those who work with their heads, those who work with their hands and those who work with their savings, and the sooner we can by thrift make the man who works with his hands also a man who works with his savings the sooner we shall get back to joy in the job." To the truth of this observation our industry can testify. Ours has been the first to invite its workers and its patrons to become its partners on a large scale, and the effect on the individuals and on the community has been wonderful. Let those who still doubt or hesitate ask Britton or Insull or Miller or a number of others what transformation the sale of securities to employees has wrought in their organizations. "Joy in the job," yes! joy and zest and a pride which no mere salary could ever buy.

A Sensible Way to Co-ordinate Effort

CO-ORDINATION of the activities of the engineering committees of the several associations interested in power-plant construction and operation has been undertaken by a committee composed of the chairmen of a number of committees of the American Institute of Electrical Engineers, the National Electric Light Association, the American Electric Railway Association and the Association of Edison Electric Illuminating Companies. The definite movement, the desirability of which had been frequently voiced in the past, started at the instance of President McClellan of the American Institute early this year and represents what is probably the most practical form of co-ordination of effort.

Theoretically, perhaps, with the great specialization of today there ought to be one organization taking care of the problems of electrical equipment and another taking care of those involved in the use of mechanical equipment. Practically the use of the two classes of equipment has become so interwoven in industry that they cannot well be considered separately. Added to this is the growth of a group of problems involving finance, operation and management, either directly or indirectly, that cannot properly be considered except in connection with the technical problems. As a result, in each of the organizations concerned with these problems a body of men has been drawn together by interest in common problems in the form of committees whose activities duplicate to a greater or lesser extent the work done by the similar groups in the other associations. Regardless of the theoretical desirability of some other form of organization, the simple fact is that these organizations exist and have back of them a history of usefulness that prohibits wiping them out by the wave of a hand.

There are other fields in which a similar duplication of effort is taking place, and as time goes on others will develop from activities which now seem unrelated. The simplest way to work out the whole problem is along the lines followed in the case of the power-plant activities. Bring together the men who are interested in related activities so that they may be familiar with each other's work. If this can be done, the question of undesirable duplication of effort will solve itself as most of such duplication is due to ignorance of other activities in the same field.

Steinmetz and State Water-Power Development

BECAUSE a man is a great engineer or inventor it does not follow that he is a great statesman or artist. Rarely is it given a man to excel in more than one calling. Charles P. Steinmetz, for example, is a great engineer. The electrical industry respects and admires his engineering skill and proficiency; in fact, there are few that the electrical engineering fraternity holds so high in its esteem. But every informed engineer knows that Steinmetz is a socialist and that because of his socialistic utterances he was obliged to flee his native land and seek this haven of religious and political freedom. The world admires, even though it may not follow, a man of deep convictions, so long as he is sincere. Of Steinmetz's political sincerity there can be no doubt. The best and most convincing proof is the fact that he has clung to his political beliefs through bitter and relentless persecution. Of such stuff the martyrs and heroes of all ages have been made.

This year Steinmetz is a candidate for state engineer and surveyor on the ballot of the American Labor party, a composite of the Socialist and Farmer-Labor parties of New York. While he is eminently fitted for such a post, it is a foregone conclusion that he will run a bad third, so that his candidacy need not give the electrical industry any concern. What does cause the electric light and power industry grief, however, is to have a man of Steinmetz's standing and reputation publicly state that "as state engineer I shall be able to accomplish something in developing for all the people the abundant natural resources of our state, and more particularly the great water powers which now are running to waste, but which developed could operate all the industries and railroads and bring electric light and power to every home."

In the case of New York no state engineer, not even Steinmetz, could accomplish this without radical changes in the law. The electric light and power industry has not been remiss in its obligation to develop the water powers of the state whenever and wherever it was economically possible to do so. The stumbling block has been the law and not the industry, and any intimation, even by innuendo, that the industry has been slack does it a wrong. Steinmetz's utterances at this time, however, have a more far-reaching effect than this. At the present time state ownership of water powers is being combated in California, and one can readily imagine with what glee the proponents of state ownership will welcome such an utterance from a man of the high standing in the electrical industry attained by Steinmetz. The general public will not differentiate between Steinmetz the engineer and Steinmetz the politician, and hence unwittingly Steinmetz will bring hurt to his industry. We cannot believe that he knowingly or willingly intends any such thing. He himself has contributed so much toward its upbuilding that he would be one of the last to wish to help to tear it down, and we feel sure that had this phase of the situation entered his consciousness his public statement would have been greatly modified.

Reducing Transformer Core Loss Will Not Decrease Annual Over-All Expense

IT HAS sometimes been pointed out that one of the reasons for the relatively slow development of farm lines has been the expense involved in the all-day losses or core losses on the transformers. There is no question that these losses are a considerable item of expense, and that were it possible to reduce them without unduly increasing the copper loss at the time of full load, some material gain would be obtained. However, in this connection it must not be forgotten that cost of the lost energy per unit is considerably higher at peak-load time than it is during the rest of the day. It has been suggested that the transformer be so built that the core losses will be reduced considerably. It is unquestionably true that such a transformer can be designed. However, it means a larger transformer with larger copper losses, and every increase in size means an increase in first cost.

By studying this subject it will be seen that the core losses per year on our present distribution transformers, even assuming a high cost of energy, will only be from 25 to 50 per cent of the yearly fixed charges on the transformer considering the first cost of the machine, its installation and protection based on a life of from fifteen to twenty-five years. From this it is evident that the increase in first cost for the sake of cutting down the core-loss cost will result generally in an over-all increase in the annual charge on the installation. Our present-day transformer is a highly efficient piece of apparatus, and a further reduction in core loss would possibly result in an undue increase in first cost.

The problem which is before the manufacturer would seem therefore to be to produce a cheaper transformer not by materially changing its characteristics but by devising new means of quantity production which would cut down its first cost. Furthermore, operating companies would do well to study means by which they can lower their cost of handling and installing transformers. Progress along these two lines will tend to facilitate the building and operating of rural lines, which are now rightfully considered a necessity to the further development of our farms.

Further Suggestions on Utility Cost-Analysis Methods

ON ANOTHER page of this issue of the *Electrical World* an article appears which shows in detail the application of the theory of utility cost analysis that was described in its general features in an article in the Oct. 21 issue, page 878. The theory and method of the work the authors of the article outline has been developed as the result of the needs of an Iowa company and is the product of a thorough and exhaustive study that has taken nearly three years to complete. Undoubtedly the first response of many interested in such matters will be that the system is too complicated to become a practical method for any utility to use. Another "reaction" will be on the part of those who generally prefer not to know their costs of doing business, on the theory that detail cost figures will be used as a club to reduce rates. A careful examination of the method and its application does not indicate any more complication, or in fact as much, as that contained in the cost-analysis systems of many factories engaged in quantity production. It does not represent any more difficulties than are involved in the series of motion studies that have been so big a factor in the increase of efficiency in many industries, particularly the automobile industry, which has carried such studies to what a few are inclined to view as an extreme.

Industry has been driven to such methods because competition forbids waste and inefficiency. In the central-station rate situation some of the things that exist would be laughable if they did not contain elements of business tragedy. Public opinion has little tolerance for court and commission proceedings in which several experts can start with the same figures and end up with results that are as far apart as the poles. In central-station operations there are definite figures to start with. These begin with investments in physical property. The total cost of actual operation of the property is a definite figure. On top of this the average consumer of any class makes a demand on plant facilities that is measurable with a fair degree of accuracy. Eliminating, for the time being, all the intangible figures on which there may be logical reasons for wide disagreement, there is no reason why the definite figures cannot be analyzed to show the costs of maintaining the business in so far as these items are concerned. The method described by the authors of the article is a definite attempt to do this as a routine accounting matter. Quantities used are based on definite investment and operating figures obtained from the ordinary accounting figures found in any utility records. The load data on which distribution of costs is based are ascertainable if a serious effort is made to get them. In the method are a few items that are estimated. All of these things considered, it appears probable that the final figures are pretty nearly accurate. At least they are nearer accuracy than any spasmodic attempt at analysis.

Whether the method described will actually do all that its authors believe is a question that cannot be answered now, but the careful study and time put on the development of the scheme entitle it to a thorough study and a real attempt to learn all its merits or demerits. It is, at the very least, a step in the direction in which economic pressure is steadily forcing all business activities—that of a better and more complete knowledge of the cost of doing business.

Meter Maintenance on Power Systems

RADICALLY different in scope is the problem of meter maintenance on a large electric transmission system as compared with that of the ordinary localized central station. In both classes of utilities the work must be well organized and handled with technical precision, but the area of territory involved and the extensive wholesaling of energy characteristic of the transmission company broaden the problem as the engineer usually faces it. On another page H. M. Johnson describes the meter-testing practice of the New England Power Company, operating a great hydro-electric and interconnected steam-plant system at 66,000 volts and covering an area extending from tidewater to the Berkshire Hills. About 1,000 meters are involved, and considering their scattered location an annual maintenance cost of about $15 per meter looks like a remarkably good figure.

We have seen reading and maintenance costs ranging from $7.50 to $12 a meter from central-station companies using tens of thousands of instruments, and it is evidence of excellent planning to attain the New England Power Company's figure with the handicap of distance and relatively small number of units there imposed. Readers of this article will find a surprisingly small force required to perform the work, but with a divisional organization supplemented by a well-appointed centralized laboratory, complete schedules of routine inspection and thoroughly prepared forms and index records much can be done by a few persons. Labor and time-saving devices also play their part.

Significance of the Convention of the Great Lakes Division

SOME idea of the ultimate possibilities of the geographic division organization of the National Electric Light Association can be gained from the recent convention of the Great Lakes Division at French Lick Springs, Ind. While the division covers a territory in which central-station development is greater than in any other single division, and while it is perhaps the only division in which activities are great enough to parallel closely the national organization in all its work, the registration of nearly five hundred delegates was better than even the most hopeful could have expected. The program was excellent and the ideas brought out in the various papers and addresses were helpful, but the greatest benefit was in the personal contact among the delegates and the private discussion of problems that was stimulated by the convention sessions. It is impossible to bring together so large a body of men to listen to a well-rounded program and not send them home with an idea of how the day's work can be done better and more efficiently and a clearer recognition of the fact that the central-station business has passed definitely out of the period when each company can consider its problems as individual and solve them as if they concerned no one else.

More significant even than the large attendance was the fact that many of those there were men who do not expect to get to national conventions. In the sessions of the Great Lakes Division they were brought into contact with some of the most important questions in the field, discussed not only by their neighbors but by men who have taken part in the handling of the same problems in a national way. In short, men who have never attended and for some time to come cannot hope to attend national conventions had an opportunity to see problems from a national viewpoint and learn at first hand the national significance of events at home that have seemed to them to be of local concern only. This is an important function of the geographic division organization.

In spite of the points of criticism that can naturally be found in the development of any movement of this kind, the gathering at French Lick Springs indicated clearly the part the geographic division activities can and will play in bringing home to individuals the national aspect of their problems and the urgent need of meeting these as they arise with the best thought that the entire industry can bring to bear.

The Wise Choice of a Leader

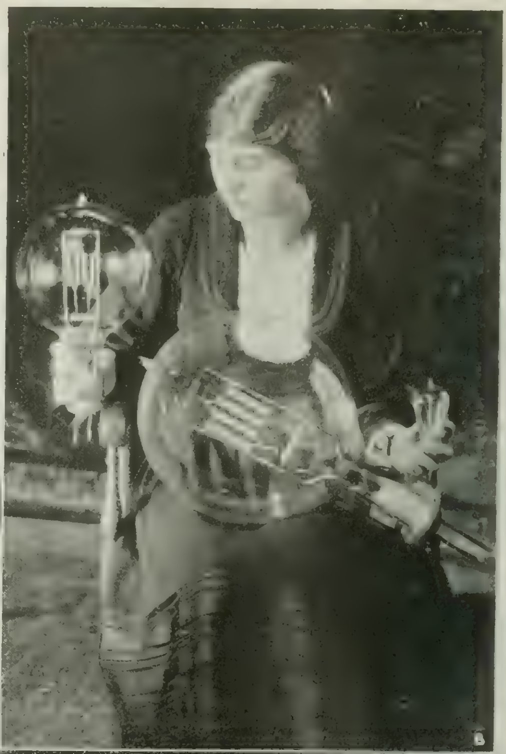
IN SECURING Dr. S. W. Stratton, long chief of the Bureau of Standards, for its president, the Massachusetts Institute of Technology has made a wise and fortunate choice. To head that great institution of learning efficiently requires a leader both of scholarly attainments and of great executive ability and tact. Dr. Stratton's ability as a teacher is remembered with pleasure by many who worked under him, and his successful and efficient administration of the National Bureau of Standards for more than a score of years shows plainly his qualifications for the very big task now looming ahead of him.

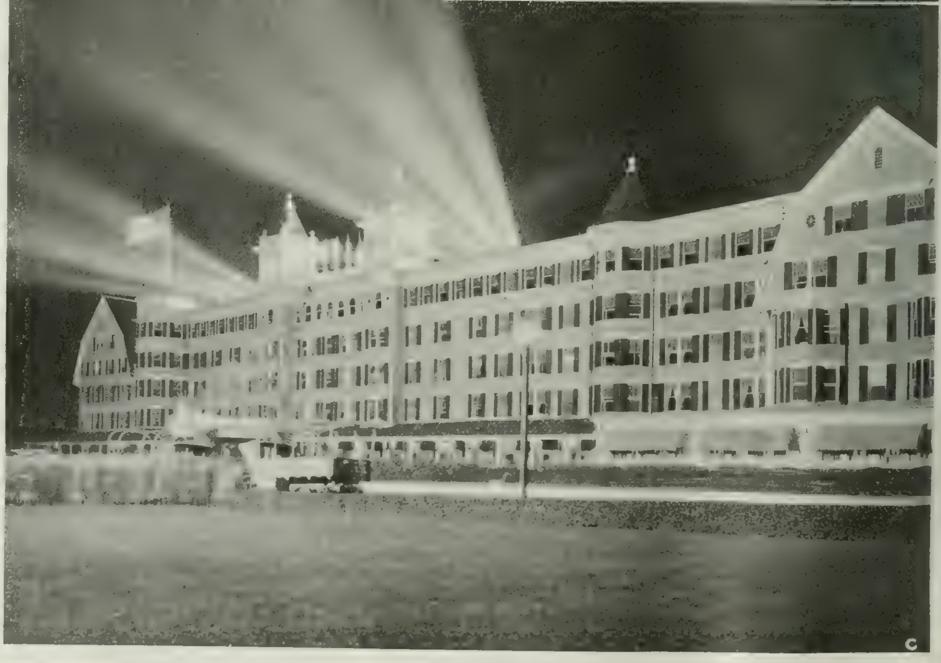
The Massachusetts Institute of Technology has possibilities not exceeded by any educational institution in the country, but it has been in various ways handicapped, at times by lack of funds and again by serious overcrowding. Beginning as it did in a small way numerically, governed by a great educational leader and its faculty sitting in committee of the whole, it has encountered more difficulties than usual in adjusting itself to great expansion and the effective co-ordination of widely expanded interests, but it has grown stronger with every year in spite of these casual difficulties. After the death of the lamented Dr. R. C. Maclaurin the institute was administered by a committee of the faculty until Dr. E. F. Nichols assumed the presidency, only to resign from ill health before actively taking office. Then it was fortunate in obtaining the guiding hand of Prof. Elihu Thomson to steady its course through another interim, until a new and fit man could be found to take the full responsibilities of the presidency.

We felicitate Dr. Stratton on his appointment and the institute on having made it. He has ample experience as an educator for the work of the modern college president and still more experience in the strenuous work of organization and administration which lies at his hand. Moreover, he has, in addition to his Western experience, sufficient familiarity with Eastern institutions to realize something of the forces that give them power and permanence; for the strength of the older foundations of the East lies not in their presidents, or trustees, or faculty, or students, but in the great and earnest body of alumni and their friends who jealously guard the interests of their Alma Mater. If we mistake not, the alumni of Technology will find Dr. Stratton ready for cordial co-operation and anxious to keep the institute on the firing line of progress.

Largest Incandescent Lamp in the World

A 30,000-WATT gas-filled incandescent lamp, developing about 60,000 candlepower—the largest lamp of its kind—was shown publicly for the first time at a recent convention of the Illuminating Engineering Society at Swampscott, Mass. This monster lamp was developed and constructed at the National Lamp Works of the General Electric Company, primarily for motion-picture studio use. The bulb is 12 in. in diameter and 18½ in. high. The filament, which is designed for 120 volts and 250 amp. (total current), is made of tungsten wire, $\frac{1}{15}$ in. in diameter and 93 in. long, constructed in four coils. The filament support and sealing of lead-in conductors constituted two of the major problems of construction. Some idea of the illumination it will produce is shown by the foreground of C, which was lighted by this lamp alone. Dr. Langmuir and Thomas A. Edison are pictured in A examining the lamp. A comparison of this 30,000-watt lamp with a 10,000-watt and a 25-watt lamp is afforded by B.





Meter Maintenance on Scattered System

Organization of Work in the Extensive Territory Served by the New England Power Company—Field and Laboratory Test Schedules—Labor-Saving Equipment Used

By H. M. JOHNSON
Chief Meter Inspector New England Power Company, Worcester, Mass.

THE extensive area covered by the New England Power Company system and the nature of its business present many problems in meter maintenance peculiar to a system of its type. The business of the system is exclusively wholesaling electrical energy, which means that while the number of customer installations is comparatively small, each meter installation is of the greatest importance and the maximum of meter accuracy is imperative. Metering throughout the system is largely at primary voltages ranging from 66,000 to 13,000. A considerable number of installations are metered at secondary voltages, however, which extends the metering voltage range down to 220. To a large extent self-contained outdoor metering outfits are used for primary metering.

To maintain meters, of which about 1,000 are in service, most efficiently the system has been split up into three divisions segregated with reference to the number of meters in each as well as the area covered. The territory of each division is shown in Fig. 1. Routine testing and inspection of the meters in all the divisions is handled by three metermen, one man being assigned to each division. A fourth meterman handles shop testing and assists, when necessary, in maintaining schedules in all divisions. Headquarters for the West Division are permanently at Shelburne Falls, while for the rest of the system headquarters are at Worcester in the general offices of the company.

ROUTINE TESTING SCHEDULES BEST

It has been found advisable to use intervals of one, three and six months for routine testing schedules of three classifications of meters. Meters registering over 100,000 kw.-hr. per month are tested on the monthly schedule; all other customer installations are tested at three-month intervals. Station and lighting service meters are tested once in six months. The routine tests, with the exception of those on the monthly schedule, consist of a running-load check followed by a phantom-load check at full and light loads. Adjustments are made during the phantom-load test, and when adjustment has been found necessary a second running load test is made. Accuracy at the lower power factor of the running load must agree very closely with the final phantom-load test, or the meter is scheduled for early replacement by a shop-tested and properly lagged meter. This rather elaborate test covers pretty thoroughly the condition of the meter and is particularly necessary when compensation for instrument transformer errors is being made.

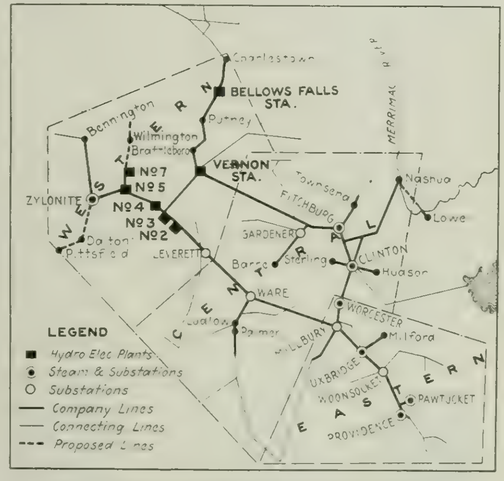


FIG. 1—METER MAINTENANCE IS SECTIONALIZED BY GEOGRAPHIC DIVISIONS

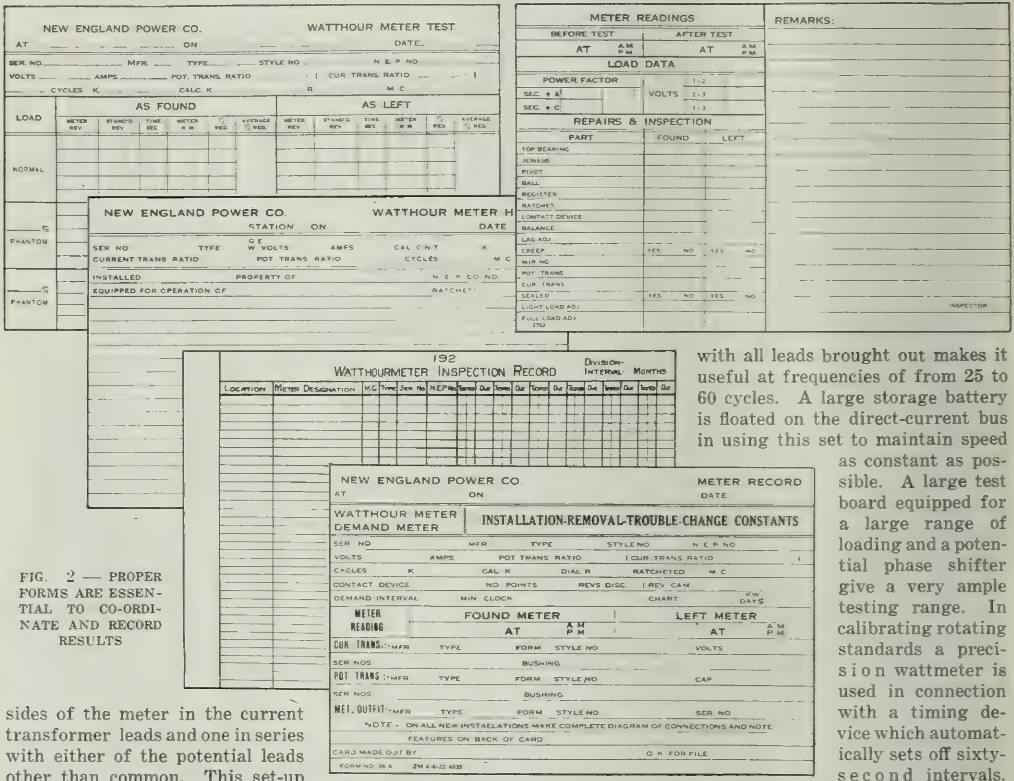
METER TEST SCHEDULES

R.L.=Test on normal running load plus inspection. P.L.=Test on phantom load at 10 per cent and 100 per cent of full load.

Meter Classification	Initial	Months Elapsed Since Previous Test 1	2	3	4	5	6
Customers using more than 100,000 kw.-hr. per month	R.L. +P.L.	R.L.	R.L.	R.L. +P.L.	R.L.	R.L.	R.L. +P.L.
Customers other than above	R.L. +P.L.	..	..	R.L. +P.L.		..	R.L. +P.L.
Lighting service and station	R.L. +P.L.	.				.	R.L. +P.L.
Station indicating and graphic	P.L. Calibration						P.L. Calibration

In the case of meters on the one-month schedule, this complete test is gone through only at three-month intervals, the intervening tests consisting only of running load checks plus general inspection. The meter test schedule chart shown in the table gives the general set-up for this work. Meter test results are recorded on cards of the form shown in Fig. 2. Records of tests are entered, as received, on charts laid out as shown in figure, each separate schedule list for each of the three divisions being typed on a separate chart. Each month a list of meters due for test during that month in each of the divisions is drawn off from these charts. These lists are then passed on to the metermen in the form of mimeographed complete divisional lists of meters, with the meters due for test checkmarked. At each test load power factor is determined by comparing separate element registrations and is recorded on the test card. Further, voltage readings between each pair of phases are required. These voltage readings have on several occasions served to discover incorrect potential transformer ratios due to the breakdown of one or more sections of primary windings which would not have otherwise been evident. Meter readers are provided with test lamps and are required to check all potentials each monthly reading date.

Polyphase rotating standards are used in all test work. For phantom-load work these are used with elements in series-parallel. All service meters are rated at 110 volts, 5 amp., and are used in connection with instrument transformers. To facilitate the cutting in of the standard for tests, test blocks of the types illustrated in Fig. 3 A_1 and A_2 are used in all installations. The standard meter connection places a test block on both sides of the meter in the current transformer leads and one in series with either of the potential leads other than common. This set-up permits the cutting in of the standard for running load tests or cutting the meter clear of the instrument transformers, except for the one potential used in phantom-load tests, without disturbing wiring. The test block shown at A_1 in Fig. 3 is the older type of block, of which a great many are in use in connection with both meters and relays. The newer type shown at A_2 was developed to economize space required for mounting. The brass bar across the top is connected at one terminal to the transformer lead. In a slot at right angles to the top bar is a second bar which has a terminal brought through the fiber base at either end, one of the end terminals being connected to the meter. This leaves one terminal on each bar free for connection of test meters. The large brass screw at the center of the block serves as the connecting link between the two bars and is removed after the test meters have been connected.



NEW ENGLAND POWER CO. WATTHOUR METER TEST
AT ON DATE
SER. NO. MFR. TYPE STYLE NO N. E. P. NO
VOLTS AMPS. POT. TRANS. RATIO : 1 CUR. TRANS. RATIO : 1
CYCLES K CALC. K R M C

LOAD	AS FOUND						AS LEFT					
	METER REV	STAND'D REV	TIME SEC	METER K W	% REG	AVERAGE % REG	METER REV	STAND'D REV	TIME SEC	METER K W	% REG	AVERAGE % REG
NORMAL												
% PHANTOM												
% PHANTOM												

METER READINGS

BEFORE TEST	AFTER TEST
AT A M P M	AT A M P M

LOAD DATA

POWER FACTOR		VOLTS	
SEC. + A			1-2
			2-3
SEC. + C			1-3

REPAIRS & INSPECTION

PART	FOUND	LEFT
TOP BEARING		
JEWELS		
PIVOT		
BALL		
REGISTER		
RATCHET		
CONTACT DEVICE		
BALANCE		
LAG ADJ		
CREEP	YES NO	YES NO
WIRING		
POT TRANS		
CUR TRANS		
SEALED	YES NO	YES NO
LIGHT LOAD ADJ		
FULL LOAD ADJ		

3763

REMARKS:

INSPECTOR

NEW ENGLAND POWER CO. WATTHOUR METER H
STATION ON DATE
SER NO TYPE G E W VOLTS AMPS CAL C N T K
CURRENT TRANS RATIO POT TRANS RATIO CYCLES M C
INSTALLED PROPERTY OF N E P CO NO
EQUIPPED FOR OPERATION OF RATCHET

192
WATTHOURMETER INSPECTION RECORD DIVISION- INTERVAL- MONTHS

LOCATION	METER DESIGNATION	M.C.	TYPE	SER. NO.	N.E.P. NO.	TESTED	DUE	TESTED	DUE	TESTED	DUE	TESTED	DUE	TESTED	DUE	TESTED	DUE

NEW ENGLAND POWER CO. METER RECORD
AT ON DATE
WATTHOUR METER
DEMAND METER
INSTALLATION-REMOVAL-TROUBLE-CHANGE CONSTANTS
SER NO MFR TYPE STYLE NO N E P NO
VOLTS AMPS POT TRANS RATIO 1 CUR TRANS RATIO 1
CYCLES K CAL K DIAL R RATCHETED M C
CONTACT DEVICE NO POINTS REVS DISC 1 REV CAM
DEMAND INTERVAL MIN CLOCK CHART KW DAYS

METER READING	FOUND METER	LEFT METER
	AT A M P M	AT A M P M

CUR TRANS.:-MFR TYPE FORM STYLE NO VOLTS
SER NOS BUSHING
POT TRANS :-MFR TYPE FORM STYLE NO CAP
SER NOS BUSHING
MET. OUTFIT:-MFR TYPE FORM STYLE NO SER NO
NOTE - ON ALL NEW INSTALLATIONS MAKE COMPLETE DIAGRAM OF CONNECTIONS AND NOTE FEATURES ON BACK OF CARD
CARD MADE OUT BY O K FOR FILE
FORM NO 06 A 2M 4-6-22 4035

FIG. 2 — PROPER FORMS ARE ESSENTIAL TO CO-ORDINATE AND RECORD RESULTS

Centralized Laboratory Service Used

The meter laboratory for the system is at Worcester (Fig. 4). This laboratory is equipped for general calibration of service meters and rotating and indicating standards. Energy for testing is supplied at single-phase from the local distribution system. When a polyphase source is required, a single-phase alternating-current to direct-current motor-generator set is used to supply a variable speed direct-current motor direct, connected to a 3-kw., three-phase, 110-220-volt alternator. Subdivision of the armature winding of this machine with all leads brought out makes it useful at frequencies of from 25 to 60 cycles. A large storage battery is floated on the direct-current bus in using this set to maintain speed as constant as possible. A large test board equipped for a large range of loading and a potential phase shifter give a very ample testing range. In calibrating rotating standards a precision wattmeter is used in connection with a timing device which automatically sets off sixty-second intervals. The device is quite simple and is shown in Fig. 3C and D. The time element is derived from a weight-driven, eighty-beat Seth Thomas clock equipped with a one-point cam on its escapement-wheel shaft, the cam serving to close a pair of light brushes once for each revolution of the escapement shaft, or once a minute. These brushes control a telegraph-relay circuit, which in turn controls the actuating magnet of the timing device. This magnet, through the lever and ratchet mechanism of an old graphic type demand meter, revolves in steps the old-type printometer commutator. The fixed brush is alternately in contact with a conducting and insulating segment of this commutator as impulses are given to it by the clock. The rotating standard potential circuit is completed and broken through the brushes and the meter commutator. This device has served its purpose very well, and much more accurate results are possible by its use than were possible with the stopwatch. Rotating standards are normally checked for calibration once a month unless in a shorter period reason is given to suspect inaccuracy. Since standards must be transported over considerable distances each day, both in automobiles and trains, considerable care has to be exercised in handling them that accuracy may not be lost. In connection with automobile transportation a special box with padded sides and spring-mounted false bottom has been found of considerable value. A small meter shop is maintained at Shelburne Falls for general repairs and shop testing of service meters.

In all routine testing 100 per cent accuracy is the objective of meter inspectors and is to be maintained within the closest possible limits. In shop testing of both service and standard meters separate elements and elements in series-parallel are calibrated within the closest possible limits over a range of power factor from 25 to 100 per cent and from 5 to 100 per cent load.

New installations are carefully checked for all data in connection with instrument transformers and meter constants previous to being put into actual service. All connections are at the same time rung out lead by lead, the diagram being drawn on the reverse side of the meter record card and checked for correctness. The internal connection of double-ratio current transformers is particularly noted. As soon as possible after the meter has gone into service an initial test is made. At this time kilowatt load registered by the meter is checked against connected load, and power factor, as indicated by separate meter element registration, is checked against the probable load power factor. When practicable, the connection check described by Kouwenhoven, interchanging one and three primary potential leads, is used as an additional check.

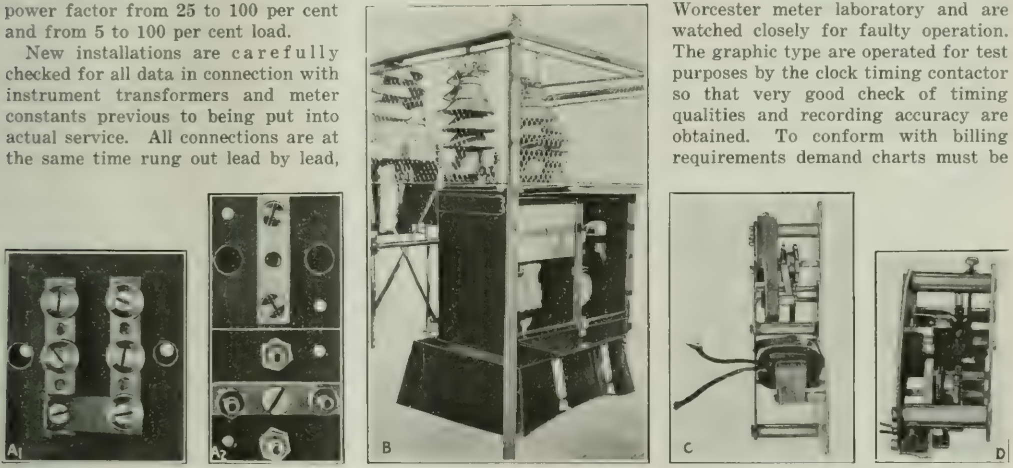


FIG. 3—A_1 AND A_2, TEST BLOCKS. B, OUTDOOR METERING IS DONE IN A WEATHERPROOF SHED. C AND D, TIMING DEVICE FOR METER TESTS

Testing Demand Meters

A very large percentage of customers' installations include demand meters, all of the recording type. Several forms of these meters are in use on the system, the graphic type being predominant, with a number of the printometer type and some graphic wattmeters. In a few installations where power factor as well as demand records are required continuously two element meters of the Ingalls type are used in connection with reactive kilovolt-ampere-hour and kilowatt-hour meters. Installations on which power-factor records are required only at intervals are taken care of by two graphic power-factor meters of portable type. These are moved about from one installation to another at frequent intervals. It has been found advisable on the largest installations to use a separate watt-hour meter to operate demand meters of the types requiring contact devices in order to maintain the best accuracy at light loads in the energy-measuring watt-hour meter. Heating elements for all clock elements exposed to low temperatures have been found essential to satisfactory operation. All clock-driven devices are set up on an annual schedule for cleaning and oiling by an experienced clock repair man. It has been found that by placing all this clock work with one clock repair man who has familiarized himself with meter operation very satisfactory results are to be obtained.

Several spare meters of each of the various types used are kept in operation at the Worcester meter laboratory and are watched closely for faulty operation. The graphic type are operated for test purposes by the clock timing contactor so that very good check of timing qualities and recording accuracy are obtained. To conform with billing requirements demand charts must be taken from meters at weekly intervals. Owing to the widely scattered meter locations, it is impossible to have a meterman handle this work in such a short period, so that in many cases it has been necessary to train customers' electrical maintenance men to remove charts and keep clocks wound. This method undoubtedly presents many difficulties in obtaining the most efficient results from these meters. Ordinarily the men so trained take considerable interest in the proper operation of the meters, and, although the method is admittedly unusual, it works out quite satisfactorily and results in a great saving of money. The method, moreover, affords the customer an opportunity of using the charts to check his plant operation.

Equipment for the precise measurement of ratio and phase angles of instrument transformers has been lately added to the meter laboratory equipment. The apparatus has a range of 1,000 amp. and 22,000 volts. In the use of this apparatus stock transformers are tested at the laboratory and are used to replace transformers in service. All new installations are furnished with tested transformers. The process of checking all old installa-

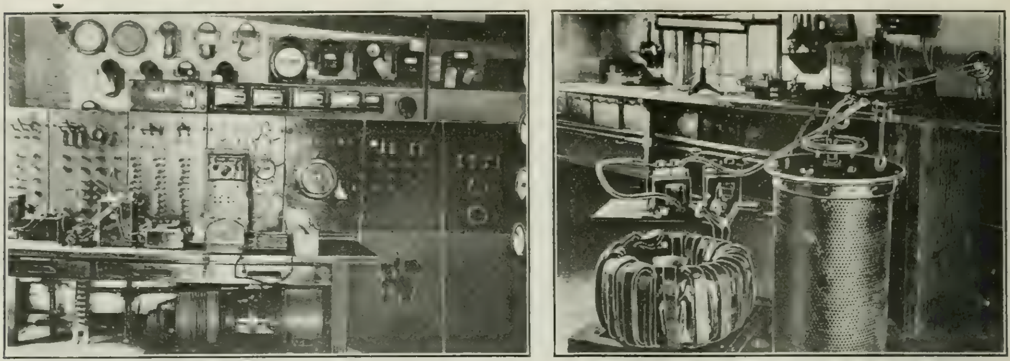


FIG. 4—THE GENERAL LABORATORY IS EQUIPPED FOR TESTING ALL THE METERS ON THE SYSTEM

tions is necessarily a gradual one and will require considerable time. For each calibrated installation curves of corrected meter registrations at various loads, at 50 and 100 per cent power factor and for the normal load power factor, are worked up for use of the metermen.

Station-indicating instruments are tested on an annual schedule by a meterman who has been sent to the manufacturer's factories for training. A stock of instrument transformers and high-voltage bushings, necessarily covering a very considerable range of voltages and currents, is kept at Worcester with a small branch stock at Shelburne Falls to cover emergencies.

The approximate annual cost of meter maintenance on the system is $15 per meter.

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Impregnation of Enameled Wire Coils

Suggested Methods Based on the Fact that Certain Impregnating Compounds Contain Solvents Injurious to the Enamel

By W. D. A. Peaslee
Chief Engineer Belden Manufacturing Company, Chicago

THE impregnation of coils after winding is for the purpose of filling the air spaces in the coil, binding the coil into a more compact mass, excluding moisture and improving the heat-dissipating qualities. When a varnish is used for this purpose on coils wound with enameled wire certain precautions must be observed that are not necessary in a similar treatment of coils wound with textile-covered wires. This is due to certain characteristics of the enamel used to cover the wire.

Wire enamel is in general a varnish consisting of a base and a solvent. One type consists of a base and volatile solvent. The base consists of a high percentage of a drying oil and a small quantity of a hard resin. The base is reduced in consistency by a suitable volatile solvent so that the enamel will flow smoothly on the wire. This type of enamel when applied to the wires dries first by the evaporation of the solvent and then by the oxidation of the drying oil. This results in a drying from outside inward, with the formation of a skin of hard enamel on the surface at the start of the process. The oil is changed chemically by this drying, forming a new substance which is practically infusible and also practically insoluble in ordinary solvents. The resin of the film is the only portion seriously affected by heat or solvents, and it is protected by its intimate mixing with the oxidized oil.

This enamel is applied in from three to six coats, each coat being baked before the application of the next coat. The baking is done at rather high temperatures, and the ability of the enameled wire to withstand temperatures that will ruin ordinary textile coverings is a strong point in its favor.

In another type of enamel compounds and oils are used such that after the solvent has evaporated the remaining oils and bases solidify because of an action called polymerization, an action of instant molecular readjustment throughout the mass of the enamel. This method is quite distinct from the use of the oxidizing varnishes previously discussed and has certain technical features in its favor, producing a coating that is in general superior to that produced by the oxidizing varnishes. This varnish is also applied in several coats, each coat being baked before the application of the next coat.

It is obvious that in impregnating coils wound with enameled wires compounds must be selected and methods adopted that will not injure the enamel coating of the wire.

It has been found that petroleum naphtha is least active as a solvent of wire enamel, and therefore the varnishes used should contain nothing as a solvent but petroleum, benzine or naphtha. The practice of certain varnish manufacturers of using coal-tar products as solvents and of certain users in using alcohol as a thinner is probably responsible for more than half the difficulties encountered in impregnating coils wound with enameled wires.

In all cases avoid phenol products, coal-tar derivatives and alcohol in impregnating varnishes for enameled wires.

Process with Varnishes

Some varnishes are available having a polymerizing oil in the base, and these have been very successfully used as impregnating varnishes for enameled wire. In case of doubt as to the suitability of a varnish for such work it is well to consult the engineering department of the manufacturer of the wire used in the coil.

It is extremely difficult to dry the varnish on the interior of a deep coil. If baking is begun at a high temperature, the progressive oxidation forms a hard skin of varnish on the outside, preventing the escape of solvent from the inner layers of the winding. This solvent remaining in the coil may attack the enamel of the wire and short-circuit the coil. Instances are known where after several months the inside coils were soft and sticky, and in these cases considerable trouble had developed from short-circuited turns.

The following instructions outline a process that has, with the necessary adjustment in time of drying, etc., to suit different coil designs, proved quite successful in impregnating coils wound with enameled wire.

METHOD OF IMPREGNATING ENAMEL WIRE COILS

1. Thin the varnish with petroleum naphtha (benzine) to the heaviest consistency that will give the required penetration. This can be determined only by trial. This specific gravity should be carefully recorded and should be maintained for all future work on this coil.
2. Dry the coils thoroughly. Heating at 105 deg. C. to 110 deg. C. in a well-ventilated oven is a very satisfactory method, the time of heating depending on the coil.
3. Cool coils to 80 deg. C. (approximately) and dip. In general it is not necessary to dip more than ten minutes at the most.
4. Drain until dripping stops. Upper portion during draining should be lower portion during baking.
5. Place the coils in a well-ventilated oven at 85 deg. C. (approximately) and raise the temperature slowly until the baking temperature is reached, after which the baking is finished at this temperature. The final temperature is usually between 100 deg. C. and 110 deg. C., but the instructions of the varnish manufacturer should be carefully followed in each case. The time required to raise the temperature from 85 deg. C. to the final temperature depends on the size of the coil and must be determined by experiment in each case. In ordinary work it may run from one to four hours. A second treatment is only necessary to produce a higher finish, and if adopted, the coils are simply dipped again after the first baking, removed at once and baked at finishing temperature to dry the thin enamel coating so obtained.

If this process with carefully worked-out adjustments as to time and temperature for the work in consideration is followed, no difficulty should be encountered in the impregnation of coils made of enameled wires.

The use of air-drying varnishes is in general limited to repair work and coil work in which the varnish is applied for a finish and to protect the coil from moisture, oil, etc. In this process the coil is simply dried and dipped in the varnish, removed immediately and dried in the air. The drying period for a coat applied in this manner is from fifteen minutes to three hours, depending on the varnish used. In no case should the coils be soaked in the varnish as it is practically impossible to dry the coil on the inside if the varnish is allowed to penetrate deeply into the winding. This process is suitable only for applying a surface coat and is not an impregnation. For a superior finish two or more successive dippings and dryings are often used. In any case the varnish must be thoroughly dried throughout.

PROCESS WITH SOLID COMPOUNDS

Impregnating varnishes contain about 50 per cent of solids, the remainder being a volatile vehicle. One can therefore never completely fill the air spaces in a coil with varnish, as part of the varnish runs out when the coil is drained and about half of the remainder evaporates. As stated before, impregnation is employed to fill these spaces and so secure water exclusion, rigidity, and improved heat radiation. The last feature greatly influences aging of the coils by reducing the temperature in operation and effects economies in design, permitting the use of higher current densities for the same hot-spot temperature. Solid insulating compounds applied by the vacuum process or vacuum-pressure process effect a more complete filling of these air spaces.

However, more expensive equipment is necessary for this treatment, and the compound cannot be used well in rotating coils, as it is sure to be thrown out as the coils warm up. Indeed, on stationary coils there is a distressing tendency of the compound to flow under temperatures met with in ordinary overload conditions.

In using such compounds for enameled wires care must be taken that they do not contain materials that have a solvent action on the enamel or a material that combines with the enamel at impregnation temperatures. In general it is wise to consult the manufacturer of the enameled wire used as to the suitability of a particular compound.

If the coils have absorbent material between layers, they may be successfully impregnated with solid compounds by the vacuum-pressure process, as follows:*

1. Determine proper consistency to obtain desired penetration by trial. Do not use a temperature of more than 150 deg. C. (300 deg. F.) on coils made of enameled wire. The compound should be used at the consistency determined above for all future use on the same coils. Be sure the compound is heated throughout before turning it onto the coils.
2. Heat the coil in a well-ventilated oven at 110 deg. C. for one to four hours according to the coil.
3. Transfer at once to the impregnating tank and mount the coils so they will drain easily. Apply a vacuum for two to three hours according to the coil.
4. Close vacuum-pump valve to flood coils with the compound. A thermocouple should be placed in the part of the tank nearest the source of heat so that temperatures greater than 150 deg. C. (300 deg. F.) will be avoided. Raise the pressure in the tank to about 80 lb. per square inch and hold two to three hours according to the coil.
5. Drain compound out of tank and drain the coils for a time, dependent on the coil, but usually not over one-half hour.
6. Remove the coils from the tank, scrape off excess compound and bake in an oven at 110 deg. C. to 120 deg. C. for six hours to set the compound, if it is of such a type.

If the above procedure is followed with the necessary modifications as to time to suit the particular coil treated, the impregnation of enameled wires will be entirely satisfactory.

It has been the author's experience that, regardless of the quality of enameled wire used, more coils have been ruined in impregnating than in any other way. Manufacturers are continually confronted with the statement that this lot of wire would make first-class coils while the last lot would not. In the majority of such cases where it has been possible to trace the trouble to its source it has been found that the variation was not in the quality of the wire but in the way that it was impregnated.

It cannot be too strongly recommended that accurate and complete records be kept of the treatment of each particular type and kind of coil. These records should show clearly the specific gravity of the impregnating varnish or compound, the number of minutes necessary to dry the coil, the number of minutes necessary to submerge the coil to insure satisfactory penetration, the time required to drain the coil, the temperature of the oven when coil is placed in it and the temperature cycle until the treatment is completed. Moreover, instruments must be provided that will enable the operators to follow the directions given.

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*Coils having non-absorbent paper or other material between layers are rarely impregnated.

Allocation of Electric Service Costs

Method of Cost Analysis Devised by an Iowa Company Applied to the Allocation of Service Costs to Various Classes of Consumers—Some Advantages of Accurate Cost Knowledge

By W. J. GREENE, C. F. SCHOONMAKER and C. B. GORTON

THE essential features of a method for obtaining unit costs of electric service, developed for the use of the Iowa Railway & Light Company, were outlined in a previous article. In this article it is proposed to take up briefly an example of the application of the method used in obtaining the unit costs of service of a utility operating its own generating plant in a small city which is assumed to have 800 residence consumers, seventy commercial-lighting "connected-load" consumers and thirty commercial power "connected-load" consumers. Four systems of service are assumed—general light and power, municipal lighting, special power, and rural. The monthly power-plant expenses are assumed to be: Energy, $1,752; capacity, $750, and indeterminate, $250. The distribution, commercial office, franchise and consumer elements of general expenses are assumed as given in Table I, column 18, of the example. The values used in the example are not taken from the records of any utility but are representative values.

Method of Allocating Costs

In this article no attempt will be made to show the method of allocating power-plant, transmission and distribution substation expenses to transmission and distribution centers.

Table I shows the complete tabulation used in arriving at the final results. Columns 1 to 11 cover the load data and the ratios for allocating the costs to the four systems. Column 1 shows the kilowatt-hours to each system as determined by meters at the distribution center of the power plant. Column 2 gives the demand in kilovolt-amperes on the distribution center of each system at the time the combined load of all the systems is the maximum for the period. This demand is termed the peak responsibility. Average hourly loads are given in column 3, and the difference between the peak responsibility and the average hourly load of each system is given in column 4. That the sum of these differences equals the sum of the average hourly loads is only a coincidence. The chances are that this would happen rarely. The difference between the total amount of the second column, or the capacity measured in kilovolt-amperes, and the total amount of the third column, or capacity measured in kilowatts, is the kilovolt-ampere unused capacity that must be allocated to the various systems. This allocation is made by the unused-capacity ratios shown in column 5. By reference to column 4 it will be noted that the special power system has no unused capacity. Any 100 per cent load-factor system, off-peak system or partially off-peak system would have no unused capacity. A partially off-peak system has 100 per cent load factor referred to its peak responsibility for that part of its average hourly load that is equal to its peak responsibility and is off-peak by an amount equal to the difference between its average hourly load and its peak responsibility. The unused capacity of 70 kva. is allocated by the ratios in column 5 to the three systems whose demands during the peak period, or peak responsibilities, are greater than their respective average hourly loads, and the results of the allocation are shown in column 6. These results are added to the average hourly loads to obtain the period capacities shown in column 7, from which the period capacity ratios in column 8 are determined. The energy ratios in column 9 are derived from column 1. The indeterminate ratios in column 10 are the average of the period capacity, and the energy ratios and are used to allocate the indeterminate expense item. Ineffective-energy ratios are given in column 11. Ineffective energy is the remainder found by subtracting a system's average hourly load from its average daily peak responsibility. The ineffective fuel is the fuel required for banking boilers and bringing banked boilers to working conditions. The fuel ratios are given in column 12.

The power-plant expenses, column 13, are allocated to the systems by the ratios in columns 8 to 12 inclusive, and the results are shown in columns 14 to 17 inclusive. Further consideration of the municipal street lighting, special power and rural systems is omitted in this article.

The expenses of the general light and power system shown in column 14 and all other items entering into the general light and power system's expenses, except expense portion of the general expenses, are shown in column 18. Column 19 gives the total expenses with the expense portion of general expenses distributed. One hundred and five per cent is assumed as the expense element ratio. The next step is to divide the costs into consumer, capacity and energy groups. This is accomplished by the application of the factors given in Table II. The results are given in columns 20, 21 and 22. The number of consumers and consumer ratios are shown in columns 23 and 24. The consumer ratios are used to allocate to the classes the consumer expenses in items 5 to 14, column 20, and the results are shown in column 34. Columns 25 to 31 inclusive give the data on which the peak responsibility and maximum demand ratios are determined. Although the connected load is expressed in kilowatts, the fact that a motor horsepower is given the equivalent rating of 1 kw. places the connected load practically on the same basis as though measured in kilovolt-amperes, because, with the exception of motor load, most other loads included in a connected-load class are practically 100 per cent power factor. Columns 28 and 31 give these ratios. The peak responsibility ratios, column 28, are used to allocate to the classes items 1, 3 and 4, column 21, and the results are shown in column 35. The maximum-demand ratios, column 31, are used to allocate to the classes the remainder of the items in column 21. The results are shown in column 36. The monthly kilowatt-hours used by consumers and the energy ratios are given in columns 32 and 33. The energy expenses, items 2 and 3, column 22, are allocated to the classes by the energy ratios, column 33, and the results are shown in column 38. The consumer expense of each class is divided by the number of consumers in each class and the energy expense by the number of kilowatt-hours sold to each class. The sum of the peak responsibility and maximum-demand expenses of each class, column 33, is divided by the sum of the demands of the consumers in each respective class, and the results are the base-unit demand costs. Column 39 shows the total costs of each class. The unit costs are shown in columns 40 to 42. A tabulation of results is given in Table III.

The average cost per kilowatt-hour for all classes is 10.5 cents. Using this value, the average consumer in each class would have had a monthly cost of: Residence, $1.37; commercial light, $8.72, and commercial power, $56.60; whereas the actual costs are: Residence, $2.57; commercial light, $6.19, and commercial power, $29.45.

The $960 loss on the 800 residence consumers is made up by a gain of $177.10 on the seventy commercial-lighting consumers and $814.50 on the thirty commercial-power consumers. This illustrates very clearly how a flat rate per kilowatt-hour causes discrimination.

TABLE I OPERATING DATA AND RATIOS BY WHICH SERVICE COSTS ARE ALLOCATED

This table also shows the process involved in using the cost analysis method of the Iowa Railway & Light Company and the final results expressed in costs to various classes of consumers

Systems	1 Kilowatt-hours at Power Plant	2 Peak Responsibilities Kva.	3 Average Hourly Loads, Kw.	4 (2) − (3)	5 Unused Capacity Ratios (Col 4), Per Cent	6 70 × Col. 5	7 Period Capacities (3) + (6), Kva
General light and power	38,690	120	53	67	84	58.8	111.8
Municipal	2,920	12	4	8	10	7.0	11.0
Special power	14,600	10	20		0	0.0	20.0
Rural	2,190	8	3	5	5	4.2	7.2
Total	58,400	150	80	80	100	70.0	150.0

Systems	8 Period Capacity Ratios, Per Cent	9 Energy Ratios, Per Cent	10 Indeterminate Ratios Per Cent	11 Ineffective Energy Ratios, Per Cent	12 Fuel Ratios, Per Cent
General light and power	74.5	66.4	70.4	82	Ineffective fuel 10
Municipal	7.4	5.0	6.2	13	Effective fuel .90
Special power	13.3	25.0	19.2	0	
Rural	4.8	3.6	4.2	5	

ALLOCATION OF THE POWER PLANT EXPENSES

Power Plant Expense Items	13 Total	14 General Light and Power	15 Municipal Street Lighting	16 Special Power	17 Rural Lines
Ineffective energy	$175.20	$143.66	$22.78	....	$8.76
Effective energy	1,576.80	1,047.00	78.84	$394.20	56.76
Indeterminate	250.00	176.00	15.50	48.00	10.50
Capacity...	750.00	588.75	55.50	99.75	36.00
Total..	2,752.00	1,925.41	172.62	541.95	112.02

GENERAL LIGHT AND POWER SYSTEM'S EXPENSES

	18 Total Before General Expenses	19 Total After General Expenses	20 Consumer Expenses	21 Capacity Expenses	22 Energy Expenses
Power plant expense items:					
1. Ineffective energy	$143.66	$150.84		$150.84	....
2. Effective energy	1,047.00	1,099.35		.....	$1,099.35
3. Indeterminate	176.00	184.80		92.40	92.40
4. Capacity ..	558.75	586.69		586.69	....
Sub-total ..	1,925.41	2,021.68		829.93	1,191.75
Distribution expense items					
5. Poles and fixtures	$350.00	$367.50	$183.75	$183.75	....
6. Overhead conductor	200.00	210.00	105.00	105.00	....
7. Transformer	60.00	63.00	6.30	56.70	....
8. Transformer core loss	45.00	47.25	4.72	42.53	....
9. Services	84.00	88.20	79.38	8.82	....
10. Meter	125.00	131.25	105.00	26.25	....
11. Meter shunt loss	35.00	36.75	36.75		.
12. Commercial office	240.00	252.00	252.00		.
13. Franchise	5.00	5.25	5.25	.	....
14. Consumer element	150.00	150.00	150.00	.	....
Sub-total	$1,294.00	$1,351.20	$928.15	$423.05	....
Grand total	3,219.41	3,372.88	928.15	1,252.98	$1,191.75

GENERAL LIGHT AND POWER SYSTEM'S CONSUMER DATA

Classes of Consumers	23 Number of Consumers	24 Consumer Ratios, Per Cent	25 Sum of Consumer Demands, Kw.	26 Peak Responsibility Factors	27 Equivalent Peak Responsibilities (25) ÷ (26)	28 Equivalent Peak Responsibility Ratios, Per Cent
Residences	800	88.9	850	12.14	70	62
Commercial light...	70	7.8	100	6.67	15	13
Commercial power	30	3.3	120	4.29	28	25
Total	900	100.0	1,070		113	100

Classes of Consumers	29 Maximum Demand Factors	30 Equivalent Maximum Demands (25) ÷ (29)	31 Equivalent Maximum Demand Ratios, Per Cent	32 Monthly Kilowatt-hours	33 Energy Ratios, Per Cent
Residences..............	8.85	96	80	10,200	31.8
Commercial light	9.01	11	9	5,780	17.9
Commercial power ...	9.23	13	11	16,170	50.3
	....	120	100	32,150	100.0

CONSUMER DEMAND AND ENERGY EXPENSES OF GENERAL LIGHT AND POWER SYSTEM

Classes of Consumers	34 Consumer Expense (20) × (24)	35 Peak Responsibility (21) × (28)	36 Maximum Demand (21) × (31)	37 Total Demand (35) + (36)	38 Energy Expenses (22) × (33)	39 Total Expenses (34) + (37) + (38)
Residences	$825.12	$514.56	$338.44	$853.00	$378.98	$2,057.18
Commercial light..	72.40	107.89	38.07	145.96	213.32	431.60
Commercial power	30.63	207.48	46.54	254.02	599.45	884.10
Total..........	$928.15	$829.93	$423.05	$1,252.98	$1,191.75	$3,372.88

UNIT COSTS OF ELECTRIC SERVICE

Classes of Consumers	40 Consumer (34) ÷ (23)	41 Demand (37) ÷ (25)	42 Energy (38) ÷ (32) Cents
Residences	$1.03	$1.00	3.7
Commercial light.....	1.03	1.46	3.7
Commercial power	1.03	2.12	3.7

In the problem the average energy expense of the residence consumer is 18.42 per cent, that of the commercial-light consumer is 49.41 per cent, of the commercial-power consumer 67.89 per cent, and of the general light and power consumer 35.33 per cent of each consumer's respective total average costs. This shows that costs cannot be allocated equitably on a kilowatt-hour basis, since a watt-hour meter measures only the energy element of the total costs. It should be remembered that the values used in the example are not taken from the records of any utility, but are representative.

Some may criticise the assumption that the energy costs are the same for all consumers. The attention of such critics is directed to the fact that no expense items are included in energy costs except those that vary directly with the kilowatt-hours used by a consumer. Changes in energy costs due to any cause should be shared by all consumers in proportion to the kilowatt-hours used. Prevailing rates tend to give consumers the erroneous impression that unit energy costs should decrease with increase in kilowatt-hour consumption. This is the result of attempting to combine and collect a portion of all of the consumer and demand expenses with the energy expense on a kilowatt-hour basis.

ADVANTAGE OF COST KNOWLEDGE

A *Guide for the Determination of Rates.*—When a utility serves a number of communities from a common transmission system the costs chargeable to each community and to each consumer in the community must be known if it is desired to give equitable and non-discriminating rates. The information is not essential where political rates are made, although if the actual costs are known, efforts can be made to provide political rates that approach a cost basis. A knowledge of the costs does not prevent a utility from making any kind of a rate that will be acceptable and will bring in the total revenue required; but with the cost facts known the utility can make such provision as will protect it in case the business that is taken on at less than cost increases more rapidly than the profitable business. The utility will in such cases know how to make a proper readjustment of rates.

TABLE II—RATIOS ON WHICH EXPENSE ITEMS ARE ALLOCATED TO CONSUMER, CAPACITY AND ENERGY EXPENSE

Expense Items	Consumer, Per Cent	Capacity, Per Cent	Energy, Per Cent
1. Ineffective energy	...	100	
2. Effective energy..			100
3. Indeterminate...		50	50
4. Capacity		100	...
5. Poles and fixtures	50	50	
6. Overhead conductors..	50	50	
7. Transformer	10	90	
8. Transformer core loss.	10	90	
9. Services..........	90	10	...
10. Meter ..	80	20	...
11. Meter shunt loss	100		
12. Commercial office.....	100		
13. Franchise . .	100		
14. Consumer element....	100		

A Basis for Cost-Plus Sale of Service to Large Consumers.—The sale of energy to large power consumers on a cost-plus basis offers some advantages to the utility. The revenue thus obtained follows the cost of production much closer than it would with any form of rate schedule.

A Logical Method for Presenting Costs in Rate Controversies.—The knowledge of the costs of service for each class of consumers will become of greater and greater importance in rate controversies.

A Method for Determining Costs of Service in Each Town or City on a Common Transmission System.—Without an accurate, logical and equitable method for allocating the costs incurred by a utility operating a large system it would be very difficult to determine the true costs of service in each town or city served by the utility.

A Measure for Taking on New Business.—Unit costs provide an accurate measure for determining the value of any new business to the utility, especially such business as the utility is not required to take by its franchise.

A Measure for the Extension of Transmission or Distribution Lines.—The method may be used to determine how far lines can be profitably extended for new business under the existing rates. The utility therefore has a means of knowing whether each prospective customer will pay his portion of the costs of service.

A Method of Determining the "Rate of Return" from a Class of Consumers or a City.—The usual method of determining the revenue that would be considered equitable is to allow, in addition to the costs, a fair rate of return on the fair value of the property used and useful for the town or city. The method provides an accurate means for determining the rate of return on the property chargeable to any town or city. In using the method for this purpose interest on the money is omitted from the investment expenses. The property values are allocated by the same rules as the capacity expenses. The costs, allocated to the town or city, are deducted from the revenue, and the difference divided by the value of the property used and useful will give the rate of return realized on the property.

A Statistical Knowledge of the Business.—The benefits to be gained from a knowledge of unit costs depend to a large extent on the margin between cost and selling price. If an industrial company is selling its product for three times its total cost, knowledge of the exact costs in detail would not be very important. However, when an enterprise is compelled to operate on such a small margin as is a utility accurate unit costs of classes are of great importance. The utility must know in which class of consumers the losses are sustained before it can adjust rates.

A Method of Determining the Efficiency of Plant Operation.—The data necessary to determine unit costs will also permit of a daily check on the efficiency of plant operation. Few utility companies have installed the proper meters in the proper places to determine operating efficiencies of the various plant units. To realize the greatest advantage the proper data must be in such form that any decrease in efficiency can be detected immediately.

The results obtained in determining unit costs depend to some extent on the proper division of certain costs into their elements as given in Table II. For example, the steam plant's indeterminate expenses are allocated to capacity and output on a fifty-fifty basis because the exact relation has not been determined. Additional experience may show that a different division would give more accurate results. The other percentages for the separation of a system's expenses into consumer, demand and energy elements were selected after a careful analysis of each item. There can be no question that the effective energy expense is 100 per cent energy and the power plant capacity expense is 100 per cent capacity. These two items of expense constitute over 56 per cent of the total cost. The division of some of the other items is a matter of judgment, and a consensus of opinion is probably the only way of establishing results that can be accepted generally. The additional knowledge gained by other utilities applying the method may lead to a more exact determination of some of the values.

TABLE III—THE BILLS OF THE AVERAGE CONSUMER OF THE SEVERAL CLASSES UNDER THE ALLOCATION OF COSTS BY METHOD USED BY IOWA RAILWAY & LIGHT COMPANY

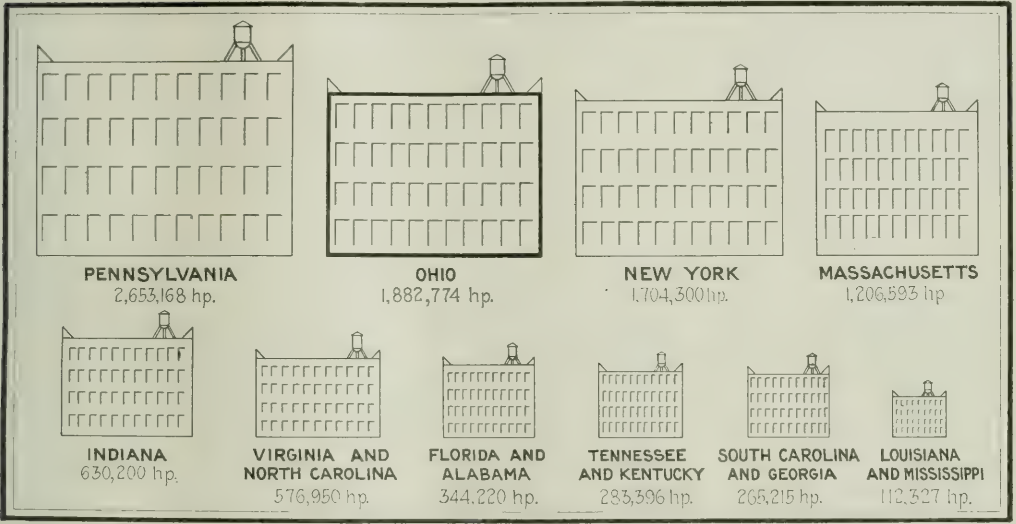
	Residence	Commercial Lighting, Connected Load	Commercial Power, Connected Load
Average, demand in kw................	1.06	1.43	4
Kilowatt-hours......	13	83	539
Monthly consumer cost ...	$1.03	$1.03	$1.03
Monthly demand cost per consumer.....	1.06	2.09	8.48
Monthly energy cost per consumer...	48	3.07	19.94
Total monthly cost..................	$2.57	$6.19	$29.45
Cost per kw.-hr (cents)................	19.8	7.5	5.5
Load factor (per cent)..	2.74	8.0	18.5

The Iowa Railway & Light Company believes that an accurate knowledge of costs is essential to its further economic development and has arrived at the conclusion that, in addition to the generally recognized basic fundamental principles, there are other elements that have not been generally recognized in utility cost accounting, and believes that these elements must be recognized as characteristics of public utility costs and must be used in connection with the others as the foundation for the determination of unit costs.

Industrial Energy Consumption in Ohio

More than Half of the 2,820,452,000 Kw.-Hr. Consumed by Ohio's Industrial Plants and Mines in 1920 Was Used by the Iron and Steel Industry —Of the 130,437 Installed Motors, About 40 per Cent Are Under 5 Hp.

By ROBERT M. DAVIS
Statistical Editor Electrical World



HOW OHIO COMPARES IN ELECTRICAL POWER WITH OTHER STATES COVERED TO DATE BY "ELECTRICAL WORLD" SURVEY

On account of the nature of its primary industries, Ohio was one of the chief sufferers during the industrial depression from which the nation is just emerging. The extent to which the machinery in the factories, mills and mines of the state was non-productive is clearly indicated from a survey just completed by the *Electrical World*, covering the years 1920 and 1921. In 1920 the total electrical energy consumed by industrial plants, mines and quarries of Ohio is estimated at 2,820,452,000 kw.-hr., while the energy consumed by the same plants and mines in 1921 is estimated at 1,936,540,000 kw.-hr., a decrease of 31.4 per cent. The iron and steel industry, the most important primary industry in Ohio,

TABLE I—SEGREGATION OF THE INDUSTRIAL LOAD IN THE STATE OF OHIO

These data are compiled from an industrial survey being conducted by the McGraw-Hill Company, Inc., under the supervision of the editorial departments of the *Electrical World* and *Power*, and cover plants in all industries employing more than fifty operatives

Industry	Companies Reporting		Electric Generators — Direct Current		Electric Generators — Alternating Current		Electrical Energy Consumed During 1920		Motors Installed			Distribution of Drives		
	Total Number	No. Using Electrical Energy	Number	Total Rating, Kw.	Number	Total Rating, Kw.	Privately Generated, Kw.-hr.	Purchased, Kw.-hr.	Number	Total Rating, Hp.	Number Under 5 Hp.	Belt	Chain	Direct or Geared
Chemicals	41	21	10	818	5	1,275	8,029,250	7,888,685	1,503	16,173	508	1,250	92	161
Electrical equipment and machinery	37	26	9	2,270	[illegible]	500	9,087,659	17,975,185	2,518	20,249	1,337	1,665	74	779
Food and kindred products	71	52	22	2,626	7	1,026	4,874,950	25,952,752	1,418	16,640	593	1,183	332	1,003
Iron and steel and their products	380	312	192	41,192	73	61,288	236,015,047	690,985,693	26,959	503,149	4,535	10,891	682	15,386
Leather and its products	27	20	12	1,890	2	307	306,615	7,208,921	1,481	8,313	278	1,290	115	76
Lumber and its products	57	37	8	426	6	956	1,301,290	2,389,255	887	11,705	365	738	4	145
Metals and metal products other than iron or steel	41	21	4	95	15	423	264,000	11,399,938	1,290	8,781	734	944	47	299
Paper and printing	40	32	24	7,492	6	3,665	42,168,335	17,469,926	1,624	29,429	888	1,313	34	277
Railroad repair shops	16	12	7	647	5	1,500	5,808,000	4,246,816	724	11,416	133	310	37	377
Rubber	30	25	18	3,683	18	16,730	71,470,900	52,903,396	3,229	73,654	2,341	1,290	148	1,792
Stone, clay and glass	103	67	54	15,154	3	375	35,810,343	16,559,645	1,527	31,563	572	835	106	586
Textiles	73	41	15	579	5	1,175	1,015,900	2,776,094	1,380	4,343	1,078	429	145	806
Vehicles for land transportation	26	17	8	961	2	270	2,882,660	6,973,258	1,592	17,904	664	1,236	30	326
Miscellaneous	40	38	29	5,573	[illegible]	1,170	6,176,000	22,074,012	2,111	29,039	1,357	1,143	110	858
Bituminous coal mining	112	50	48	6,066	2	225	5,610,944	7,028,295	850	22,286	104	282	38	530
Tobacco	23	14	0	0	[illegible]	0	0	100,541	44	149	35	44	0	0
Totals for all industries of Ohio	1,117	785	460	89,472	159	90,885	430,821,893	893,932,412	49,137	804,793	16,522	24,843	1,994	23,401

TABLE II—"ELECTRICAL WORLD" ESTIMATE OF THE USE OF ELECTRICAL ENERGY IN OHIO IN 1920 AND 1921

Industry	Electric Generators: Direct Current		Electric Generators: Alternating Current		Electrical Energy Consumed			
	No.	Total Rating, Kw.	No.	Total Rating, Kw.	Generated in Private Plants, Kw.-hr. (1920)	Purchased from Public Utilities, Kw-hr (1920)	Total Energy Consumed in 1920	Total Energy Consumed in 1921
Bituminous coal mining	60	7,590	16	1,310	21,650,000	29,200,000	50,850,000	46,400,000
Chemicals	26	2,120	8	2,040	18,700,000	26,070,000	44,770,000	30,600,000
Electrical equipment and machinery	26	6,550	8	2,000	18,900,000	48,250,000	67,150,000	46,100,000
Food and kindred products	68	8,120	22	3,220	49,150,000	108,200,000	157,350,000	107,900,000
Iron and steel and their products	622	133,200	236	198,800	765,000,000	678,500,000	1,443,500,000	945,000,000
Leather and its products	15	2,360	3	406	3,848,000	6,385,000	10,233,000	6,990,000
Lumber and its products	10	533	7	1,120	2,540,000	8,370,000	10,910,000	7,450,000
Metals and metal products other than iron or steel	69	12,400	22	7,560	50,400,000	123,000,000	173,400,000	143,400,000
Paper and printing	37	11,400	9	5,560	64,100,000	64,900,000	129,000,000	88,100,000
Railroad repair shops	28	2,580	9	2,700	20,040,000	27,720,000	47,760,000	40,450,000
Rubber	49	10,000	49	45,500	194,000,000	99,000,000	293,000,000	200,000,000
Stone, clay and glass	101	28,300	6	700	67,000,000	92,300,000	159,300,000	118,900,000
Textiles	20	4,000	8	1,880	5,960,000	7,220,000	13,180,000	12,000,000
Tobacco	0	0	0	0	0	443,000	443,000	400,000
Vehicles for land transportation	9	1,130	2	270	3,392,000	40,600,000	43,992,000	29,400,000
Miscellaneous	91	17,500	29	4,250	66,000,000	72,200,000	138,200,000	94,200,000
Shipbuilding	5	1,000	2	2,660	3,720,000	7,023,000	10,743,000	1,000,000
Petroleum and natural gas (not refining)	1	82	0	0	36,000	135,000	171,000	200,000
Quarries	6	1,683	2	234	4,150,000	22,350,000	26,500,000	18,050,00
Totals for all industries of Ohio	1,243	250,548	438	280,210	1,358,586,000	1,461,866,000	2,820,452,000	1,936,540,000

TABLE III—"ELECTRICAL WORLD" ESTIMATE OF NUMBER AND RATING OF MOTORS INSTALLED IN INDUSTRIAL PLANTS OF OHIO

Industry	Motors Run by Purchased Energy		Motors Run by Energy Generated in Private Plants		Total Motors in All Plants			Distribution of Drives		
	Number	Total Rating, Hp.	Number	Total Rating, Hp.	Number	Total Rating, Hp.	Motors under 5 Hp.	Belt	Chain	Directly Connected
Bituminous coal mining	1,647	51,447	1,498	38,145	3,145	89,592	385	1,025	142	1,978
Chemicals	3,290	26,436	2,360	18,960	5,650	45,396	1,910	3,734	166	1,750
Electrical equipment and machinery	4,480	36,144	1,760	14,150	6,240	50,294	3,315	4,123	184	1,933
Food and kindred products	4,970	58,372	2,260	26,561	7,230	84,933	3,025	3,401	953	2,876
Iron and steel and their products	19,720	368,541	22,300	416,508	42,020	785,049	7,080	17,003	1,063	23,954
Leather and its products	1,260	7,060	760	4,260	2,020	11,320	379	1,758	157	105
Lumber and its products	2,010	26,589	610	8,056	2,620	34,645	1,078	2,180	12	428
Metals and metal products other than iron or steel	13,600	92,584	5,580	37,934	19,180	130,518	10,900	14,020	700	4,460
Paper and printing	1,770	32,096	1,750	31,650	3,520	63,746	1,924	2,846	74	600
Railroad repair shops	2,000	31,654	1,450	22,926	3,450	54,580	634	1,480	176	1,794
Rubber	2,560	58,581	5,040	115,006	7,600	173,587	5,510	3,034	349	4,217
Stone, clay and glass	2,680	55,559	1,950	40,388	4,630	95,947	1,737	2,530	322	1,778
Textiles	2,620	8,261	2,170	6,820	4,790	15,081	3,740	1,490	502	2,798
Tobacco	195	659	0	0	195	659	155	195	0	0
Vehicles for land transportation	6,550	73,608	386	4,333	6,936	77,941	2,890	5,385	131	1,420
Miscellaneous	5,390	74,116	4,930	67,747	10,320	141,863	6,640	5,586	538	4,196
Shipbuilding	294	7,495	156	3,983	450	11,478	197	66	8	376
Petroleum and natural gas (not refining)	11	137	2	37	13	174	4	13	0	0
Quarries	308	13,466	120	2,505	428	15,971	161	234	30	164
Totals for all industries of Ohio	75,355	1,022,805	55,082	859,969	130,437	1,882,774	51,664	70,103	5,507	54,827

TABLE IV—ALTERNATING-CURRENT MOTOR-OPERATING VOLTAGES OF INDUSTRIAL PLANTS IN OHIO

Industry	Number of Companies Reporting Various Motor-Operating Voltages																					
	90	110	120	125	160	210	220	225	230	235	240	250	410	440	450	460	480	500	550	2,200	2,300	3,800
Bituminous coal mining							6							2						1	1	
Chemicals		1					9							3								
Electrical equipment and machinery		3					12							5						1		
Food and kindred products		4					22							5						2	1	
Iron and steel and their products		6		1		1	117		9	1		3		45				2		10	5	
Leather and its products		4					9							2								
Lumber and its products		3					10	1						3								
Metals and metal products other than iron or steel		1					9					1		4						1	1	
Paper and printing		2					8						1	7					1			
Railroad repair shops							2				1		1	3			1					
Rubber	1			2	1		3		1			6		13	1				1	2	1	1
Stone, clay and glass		2				1	20					1		6		1				2		
Textiles		2	1				14				1			2								
Tobacco		4					2															
Vehicles for land transportation							8		2			1		4								
Miscellaneous			1				11		1					7								
Totals for all industries of Ohio	1	32	2	3	1	2	262	1	13	1	2	12	2	111	1	1	1	2	2	19	9	1

TABLE V—TYPES OF FUSES USED IN INDUSTRIAL PLANTS IN OHIO

Industry	Total Number of Companies Reporting on Fuses	Standard Fuses			Refillable and Renewable Fuses			*Electrical World* Estimate of Fuses Used per Month by All Industrial Plants of Ohio	
		Number of Companies Using This Type	Fuses Used per Month: Number	Fuses Used per Month: Number per Motor	Number of Companies Using This Type	Fuses Used per Month: Number	Fuses Used per Month: Number per Motor	Standard	Renewable and Refillable
Bituminous coal mining	5	11	38	1.726	12	266	0.785	330	2,320
Chemicals	9	5	143	1 000	5	452	0.553	840	2,660
Electrical equipment and machinery	17	4	28	0.528	16	948	0.559	100	3,380
Food and kindred products	22	7	146	0.930	16	663	0 803	1,074	4,880
Iron and steel and their products	148	41	1,473	0.558	130	7,467	0 791	5,142	26,000
Leather and its products	9	3	22	0.440	9	318	0.535	69	996
Lumber and its products	7	5	61	0.455	4	45	0.500	715	525
Metals and metal products other than iron and steel	3	9	175	0.356	10	247	0.450	3,230	4,520
Paper and printing	15	6	109	0.392	13	395	0.681	443	1,630
Railroad repair shops	9	2	100	1.610	9	236	0.647	805	1,907
Rubber	13	4	297	0.883	10	287	0 837	3,320	3,210
Stone, clay and glass	31	12	332	0.898	25	467	0.758	1,563	2,190
Textiles	21	5	44	1.100	18	287	0.275	645	1,154
Tobacco	3	1	5	1.670	2	8	0 500	62	79
Vehicles for land transportation	11	0	0	0.000	11	684	1.540	1,195	8,750
Miscellaneous	12	4	142	0.648	12	721	0 766	1,262	10,560
Totals for all industries of Ohio	335	119	3,115	13.194	302	13,491	10 980	20.795	74,761

TABLE VI—DIRECT-CURRENT MOTOR-OPERATING VOLTAGES OF INDUSTRIAL PLANTS IN OHIO

	Number of Companies Reporting Various Motor-Operating Voltages													
Industry	110	115	120	125	210	220	225	230	240	250	440	500	530	550
Bituminous coal mining		.	..	..	1	7	.	2		21				2
Chemicals	3	..	..	..	..	3	..	1			1			..
Electrical equipment and machinery	4	..	..	1	..	5	..	2			1	..	.	..
Food and kindred products	5	..			.	4	..	2	.		.		..	..
Iron and steel and their products	11	2	.	.	1	56	1	19	3	14	1	1	2	..
Leather and its products	..	..	..	..	..	4					1			..
Lumber and its products	2		1	1	.	6	.	.						..
Metals and metal products other than iron or steel	2	.	.	..		3		1						..
Paper and printing	7	1	.	..	..	5	..	1	1		2		..	..
Railroad repair shops	1	..	..	..	.	1	.	1	..	1	..	.	..	
Rubber	4	..	1	1	.	4	..	4	1	3	3			..
Stone, clay and glass	4	3	.	1	.	7	..	5	1	4	2	1	..	
Textiles	4	1	.	..	.	9	.	.	.			.	.	.
Tobacco		..	.	.	.	1	.		..			.	.	.
Vehicles for land transportation	3	.	.	.	..	2	..	..	..	1	1	.		
Miscellaneous	3	.		..	..	8	.	1	..	1			.	5
Totals for all industries of Ohio	53	7	2	4	2	125	1	39	6	45	12	2	2	7

reported the greatest decreased consumption from 1920 with 34.5 per cent.

During the past three years the *Electrical World* has conducted a country-wide survey to ascertain the extent to which electrical energy is being used by the various industries. The survey has been undertaken by states, and Ohio is the sixteenth state in the series. A detailed analysis of the industrial load of California appeared in the *Electrical World* for Aug. 28, 1920. A similar analysis of the industrial load for the Southern States appeared in the issue of June 25, 1921, and the industries of New York, Pennsylvania, Indiana and Massachusetts were covered in the issues of July 30, 1921; Dec. 31, 1921; Feb. 18, 1922, and June 24, 1922, respectively. Returns are now being received from Illinois, Michigan, New Jersey and Wisconsin, and the analyses of these states will appear in early issues of the *Electrical World*.

The returns received from the survey have been grouped under nineteen general industries as indicated in the accompanying tables. Complete returns were received from 1,117 mines and factories, scattered throughout the state, employing fifty or more operatives each. Of these plants, 785 reported the use of electrical energy as the main source of power. The data in the tables are for the year 1920, but an estimate of electrical energy consumption is also made for 1921, based upon the information furnished by the companies reporting. Reports from only a part of the industrial plants of the state, such as were received by the *Electrical World*, are useless, however, for practical purposes except as they are used as a basis for an estimate of the use of electrical energy by all industrial plants and mines of Ohio. The *Electrical World* has accordingly made such an estimate for the various items covered in the survey, based upon the information given in the reports received and supplemented by federal census data. These estimates are presented in the accompanying tables.

TABLE VII—TYPES OF MOTOR CONTROL USED IN INDUSTRIAL PLANTS OF OHIO

	Number of Companies Reporting Various Types of Motor Control						
Industry	No. of Companies Reporting on Motor Control	Snap Switches	Knife or Safety Switches	Auto-Starters	Magnetic-Switches	Remote Control	Circuit Breakers
Bituminous coal mining	23	2	15	9	9	3	15
Chemicals	14	2	10	6	5	4	3
Electrical equipment and machinery	21	13	21	14	7	6	4
Food and kindred products	39	10	32	18	5	4	18
Iron and steel and their products	263	66	208	168	71	80	114
Leather and its products	16	3	16	11	6	2	4
Lumber and its products	18	3	17	7	1	2	6
Metals and metal products other than iron or steel	19	2	13	11	2	5	7
Paper and printing	21	9	19	11	4	6	8
Railroad repair shops	8	3	8	6	1	4	4
Rubber	21	10	19	16	11	11	15
Stone, clay and glass	42	10	31	18	10	5	13
Textiles	31	10	28	5	4	4	8
Tobacco	4	2	4	1	0	0	0
Vehicles for land transportation	13	7	10	10	6	6	2
Miscellaneous	25	7	23	10	4	4	5
Totals for all industries of Ohio	578	159	474	321	146	146	226

The total consumption of electrical energy by the mills, factories and mines of Ohio during 1920 is estimated at 2,820,452,000 kw.-hr., of which 1,358,586,000 kw.-hr., or 48.3 per cent, was generated in private stations of the plants and mines. There are estimated to be 1,681 generators installed in the private generating plants, with a total rating of 530,758 kw., of which

TABLE VIII—SIZE OF LARGEST AND SMALLEST MOTORS INSTALLED IN INDUSTRIAL PLANTS OF OHIO

	Largest Motor Installed (Number of Plants Reporting								Smallest Motor Installed (Number of Plants Reporting)							
Industry	Under 10 Hp.	From 11 to 25 Hp.	From 26 to 50 Hp.	From 51 to 100 Hp.	From 101 to 300 Hp.	From 301 to 1,000 Hp.	From 1,001 to 5,000 Hp.	Over 5,000 Hp.	Under ¼ Hp.	From ¼ to ½ Hp	From ½ to ¾ Hp	From ¾ to 1 Hp.	From 1 to 2 Hp	From 2 to 3 Hp.	From 3 to 5 Hp.	Over 5 Hp.
Bituminous coal mining	1	8	15	6	7	1	0	0	0	2	0	3	6	10	11	0
Chemicals	2	3	6	4	4	0	0	0	1	8	1	1	1	2	4	2
Electrical equipment and machinery	2	7	8	1	6	1	0	0	3	14	5	3	0	0	0	4
Food and kindred products	6	14	6	5	11	2	0	0	2	12	8	9	4	5	0	1
Iron and steel and their products	8	40	113	60	37	6	13	1	11	66	29	60	34	39	25	15
Leather and its products	2	15	6	0	0	0	0	0	0	1	1	5	1	2	0	1
Lumber and its products	3	7	13	4	0	0	0	0	0	8	4	5	1	2	5	1
Metals and metal products other than iron and steel	0	7	4	3	2	1	1	0	1	8	3	4	1	1	1	0
Paper and printing	4	7	6	0	9	1	0	0	3	10	3	4	2	2	2	1
Railroad repair shops	0	2	2	1	2	3	0	0	0	4	1	0	1	1	1	2
Rubber	0	0	0	3	14	6	2	0	3	8	0	8	0	2	1	0
Stone, clay and glass	4	15	14	9	8	3	0	0	3	9	1	10	7	7	10	4
Textiles	17	15	1	3	0	0	0	0	0	10	5	8	5	2	3	1
Tobacco	6	3	1	0	0	0	0	0	0	3	1	2	2	0	1	0
Vehicles for land transportation	1	5	6	3	3	0	0	0	2	5	4	0	2	2	2	0
Miscellaneous	5	13	8	2	6	2	0	0	5	11	5	3	5	3	2	1
Totals for all industries of Ohio	61	170	203	104	109	26	16	1	34	179	71	125	72	80	68	33

machines rated at 250,548 kw. are direct-current generators. By far the largest user of electrical energy in Ohio is the iron and steel industry, which in 1920 consumed 1,443,500,000 kw.-hr., or 51.2 per cent of the total electrical energy consumed for power purposes by the plants and mines of that state. The rubber industry, an industry peculiar to Ohio, is second, with a total consumption of 293,000,000 kw.-hr. in 1920. The extent to which operations in these two industries were curtailed during the late industrial depression is indicated by the large decrease in the amount of electrical energy consumed in 1921 as compared with 1920 and shown in Table II.

It is estimated that there are 130,437 electric motors installed in the factories and mines of Ohio, with a total rating of 1,882,774 hp. Of these motors 51,664, or 39.6 per cent, are under 5 hp. About 53.7 per cent of the machines are belt-driven, 42.1 per cent are directly connected, and only 4.2 per cent are chain-driven.

The returns indicate that fourteen voltages are in use in Ohio by mines and factories for the operation of direct-current motors and that twenty-two voltages are used in the operation of alternating-current motors. It appears that about 41 per cent of the direct-current motors are operated at 220 volts, but a large percentage are also operated at 110, 230 and 250 volts. Iron and steel mills particularly reported a high percentage of direct-current motors operated at other than 220 volts. More than one-half of the alternating-current motors are operated at 220 volts and about one-quarter are operated at 440 volts. It is apparent from these figures that there is much remaining to be done toward the standardization of voltages in Ohio. The survey indicates, however, that voltage standardization in Ohio is on a par with that attained in the neighboring industrial state of Pennsylvania, where seventeen voltages are used for the operation of direct-current motors and twenty-one voltages are in use for the operation of alternating-current motors. On the other hand, reports from the intensely industrial state of Massachusetts indicate that voltage standardization has played a very large part in the electrical generating industry there. The details of motor-operating voltages in Ohio will be found in Tables IV and VI.

More than 85 per cent of the companies reporting on types of motor control used knife or safety switches exclusively or in conjunction with other types of motor control. About 58 per cent of the companies reported the installation of automatic starters, and only 41 per cent reported circuit breakers in plants or mines.

TABLE IX — FREQUENCIES USED IN INDUSTRIAL PLANTS OF OHIO

Industry	Total Number of Companies Reporting on Frequency	Number of Companies Reporting Various Frequencies Used (The first figure gives number of phases, the second figure the number of cycles.) 1–25	2–25	3–25	3–40	1–60	2–60	3–60
Bituminous coal mining	14						2	12
Chemicals	14					1		13
Electrical equipment and machinery	23		1				1	21
Food and kindred products	31			3		1	1	26
Iron and steel and their products	250			29		6	9	206
Leather and its products	11						1	10
Lumber and its products	16						1	15
Metals and metal products other than iron or steel	17	1		1			1	14
Paper and printing	14			3				11
Railroad repair shops	9			1			1	7
Rubber	22		1	1			1	19
Stone, clay and glass	37				1		5	31
Textiles	21			1			3	17
Tobacco	5					2	2	1
Vehicles for land transportation	13						3	10
Miscellaneous	23					2	1	20
Totals for all industries of Ohio	520	1	2	39	1	12	32	433

One of the iron and steel plants reported an installation of an 8,000-hp. motor, but only seventeen companies in the state reported motors of more than 1,000 hp. More than 33 per cent of the companies reported the largest motor as under 25 hp. Slightly more than one-quarter of the companies reported that the smallest motor installed ranged between ⅛ hp. and ½ hp.

Over 83 per cent of the plants and mines use three-phase, 60-cycle service, in the operation of their motors, and 7.5 per cent reported the use of two-phase, 25-cycle service. Of the other odd frequencies used, two-phase, 60-cycle service was used by thirty-two companies. The use of odd frequencies to such a large extent is probably due to the continuous operation of private electric generating plants which were installed several years ago. Table IX shows the use of the various frequencies by the industrial plants and mines of the State of Ohio.

The use of refillable or renewable fuses was reported by 302 out of 335 companies, as against 119 companies using standard fuses. A large number of companies reported the use of both types. The figures are quite different from those reported by the industrial plants of Massachusetts, where 173 out of 269 companies reporting used standard fuses as against 158 companies using refillable and renewable fuses. It is estimated that 95,556 fuses of all types are used per month by all the plants and mines in the aggregate.

TABLE X—"ELECTRICAL WORLD" ESTIMATE OF TOTAL PRIME MOVER EQUIPMENT IN INDUSTRIAL PLANTS OF OHIO

Industry	Total Hp. Prime Movers in Industrial Plants	Steam Engines No.	Hp.	Steam Turbines No.	Hp.	Internal Combustion Engines No.	Hp.	Waterwheels No.	Hp.	Boilers No.	Hp.
Bituminous coal mining	84,578	650	79,949	4	3,275	120	1,354	0	0	318	76,000
Chemicals	54,184	121	33,890	11	18,002	18	1,884	4	408	199	47,400
Electrical equipment and machinery	7,271	22	4,533	1	670	10	2,068	0	0	44	10,600
Food and kindred products	157,514	754	121,881	100	11,371	128	18,024	68	6,238	509	121,600
Iron and steel and their products	1,104,334	2,600	810,541	98	218,656	477	74,437	5	700	2,860	682,500
Leather and its products	8,245	28	6,818	1	822	4	550	1	55	29	6,970
Lumber and its products	55,621	264	48,300	2	657	53	6,544	1	120	272	65,200
Metals and metal products other than iron or steel	55,351	148	35,816	2	3,799	125	15,426	3	310	151	36,200
Paper and printing	71,849	206	55,069	18	11,627	66	3,024	36	2,129	292	69,900
Petroleum and natural gas (not refining	153,083	1,172	24,274	0	0	6,134	128,809	0	0	117	28,000
Quarries	35,151	419	34,162	0	0	56	961	1	28	163	39,000
Rubber	111,821	62	32,043	29	77,657	15	1,792	3	329	401	96,300
Stone, clay and glass	146,433	928	122,843	4	10,720	173	12,720	1	150	492	117,600
Shipbuilding	6,724	27	6,617	1	10	1	97	0	0	31	7,500
Textiles	7,938	25	6,124	4	1,120	5	644	1	50	30	7,260
Tobacco	87	1	50	0	0	1	37	0	0	1	52
Vehicles for land transportation	15,739	54	12,967	1	440	19	2,332	0	0	51	12,220
Miscellaneous	106,736	255	83,483	15	17,631	45	5,501	1	121	435	104,000
Railroad repair shops	34,226	111	26,977	3	5,187	17	2,062	0	0	123	29,300
Totals for all industries of Ohio	2,216,891	7,847	1,546,337	294	381,644	7,467	278,266	125	10,638	6,518	1,557,602

Testing Transformers for Characteristics

Compact and Convenient Compilation of Methods, Instruments Required and Sequence of Tests for the Engineer Who Is Occasionally but Not Regularly Engaged in Such Work

By R. F. GOODING
Superintendent of Construction, Tucker & Laxton, Charlotte, N. C.

MANY small companies buy their power on a peak basis, and if they are using transformers with a high iron loss, they are paying for more energy than would be necessary if more care had been exercised in selecting the units. One company in Buffalo changed from one make of transformer to another largely for this one reason. Under these conditions it would be money well invested for such a concern to buy several units of different makes and run a competitive test in its own shop to determine the one most suitable for its particular use. Such tests would also be of great value in determining future purchases. By making these tests the company would furthermore be giving valuable experience to its men and would develop a force competent and anxious to look after its transformers properly. Transformers should be inspected occasionally at least, but the ordinary distributing transformer hardly ever has its top taken off except in case of trouble. Then it's too late! Some units should be tested when purchased and again after a year or eighteen months to see whether the iron has "aged." If the proper silicon steel is used, there will be no appreciable aging, but this can be determined only by such tests.

SHOULD PURCHASE ON GUARANTEE

In buying transformers the purchaser should obtain the manufacturer's guarantees as to iron loss, exciting current, efficiencies, reactance, impedance and regulation at 100 per cent and 80 per cent power factor. If the order is a large one, he may ask for a certified test sheet from the maker, this test to be on one unit only of each different size. If willing to pay the extra charge made by some manufacturers for witness tests, he may go to the factory and see them tested himself. Or he may decide to verify some of the guarantees by testing some of the units in his own shop. In either of the last two cases the procedure will be somewhat similar to that outlined below.

Resistance.—The unit to be tested should remain in the building for several hours (eight or ten) so that the temperature of its windings will be the same as that of the surrounding air. In making this test a direct-current voltmeter, direct-current ammeter, variable resistance and some source of direct-current power are necessary. Connect instruments as shown in Fig. 1A, then close switch and take a preliminary reading. The direct current used in this test should usually be about 25 per cent of the normal full-load current, and this value should not be exceeded very much for fear of overheating the windings and obtaining incorrect results. After taking preliminary reading adjust rheostat to give approximately the current desired. Close switch and take simultaneous readings of voltmeter and ammeter. Take three or four such readings, changing rheostat each time in order to arrive at a good average value. Applying Ohm's law ($I = E/R$) gives the resistance in each case, and the average value of all results obtained is the one to use. Resistances of both high-tension and low-tension windings should, of course, be taken.

Care should be exercised to see that the current reaches maximum steady value before readings are taken, otherwise the induced electromotive force produced by changing flux may introduce a considerable error. It may often take several minutes for the current to reach a steady value, and this makes it doubly important to use a relatively small current in order to prevent overheating of the windings. When testing high-potential units the direct current should be built up and reduced very gradually, as a rapid change in current with its attendant change in flux may produce excessive voltage, tending to injure, or even puncture, the insulation.

Before commencing this test an approximate estimate of the resistance and the necessary meter scales can be made as follows:

Assume a 25-kva., 2,300/230-115-volt transformer with a full-load efficiency of 97 per cent. Then the losses are 3 per cent and the copper loss probably twice the iron loss, or 2 per cent and 1 per cent respectively. With the total copper loss of 2 per cent, it is safe to assume that it is equally divided between the high-tension and the low-tension coils, or 250 watts each. Then 25,000/2,300 = 10.9 amp., say 10 amp. primary current. Secondary current would then be approximately 100 amp. Then for the primary with a copper loss of 250 watts, $I^2R = 100$, $R = 2.50$, so the resistance of the primary would be 2.5 ohms. Secondary resistance would then be 0.025 ohms. Such values are sometimes of use as a check on the readings obtained.

VOLTMETER MAY INTRODUCE ERROR

When the resistance of the low-tension coil is too low to give a good reading on the scale of the direc-current ammeter, a milli-voltmeter should be used. If especially accurate results are desired, correction must be made for the current taken by the voltmeter coil. With an ammeter reading of 2 amp. and a voltmeter reading of 5 volts, showing a resistance of 2 ohms and a voltmeter resistance of 150 ohms, the voltmeter current $I = 5/150 = 0.03$ amp. Then the actual current through the high-tension winding is $2 - 0.03 = 1.97$ amp., and the true resistance $= 5/1.97 = 2.54$ ohms. This shows with the voltmeter in circuit an error of only 0.16 per cent, which for all practical purposes may be neglected.

When the temperature is different from 25 deg. C all readings should be corrected to this temperature. This is done by the following formula: Resistance at

25 deg. C=*measured resistance*÷(1 + 0.0038T) where T is the number of degrees above or below 25 deg. C., at which measurement was made. When measurement is made at a temperature above 25 deg. T is positive in value; for measurements below 25 deg. it is negative. For good average results it is customary to use 0.004 instead of 0.0038, thus making it slightly easier to calculate the resistance.

SHORT-CIRCUIT SWITCHES ARE DESIRABLE TO PROTECT METERS

The sketches show short-circuiting switches for the alternating-current ammeters and indicating wattmeters. Although these switches are highly desirable, they are not absolutely necessary. However, with them it is possible in case of excessive currents to short-circuit the instrument immediately and prevent serious damage to the coils. The normal position of these switches is closed, and when taking a preliminary reading the switch should barely be opened so that if the current is excessive the switch can be immediately reclosed, thus getting the instrument out of circuit. When it is desirable to disconnect the voltmeter from the circuit before reading other instruments, this can be done in the case of most portable voltmeters by merely releasing the push-button which disconnects the voltmeter from the circuit.

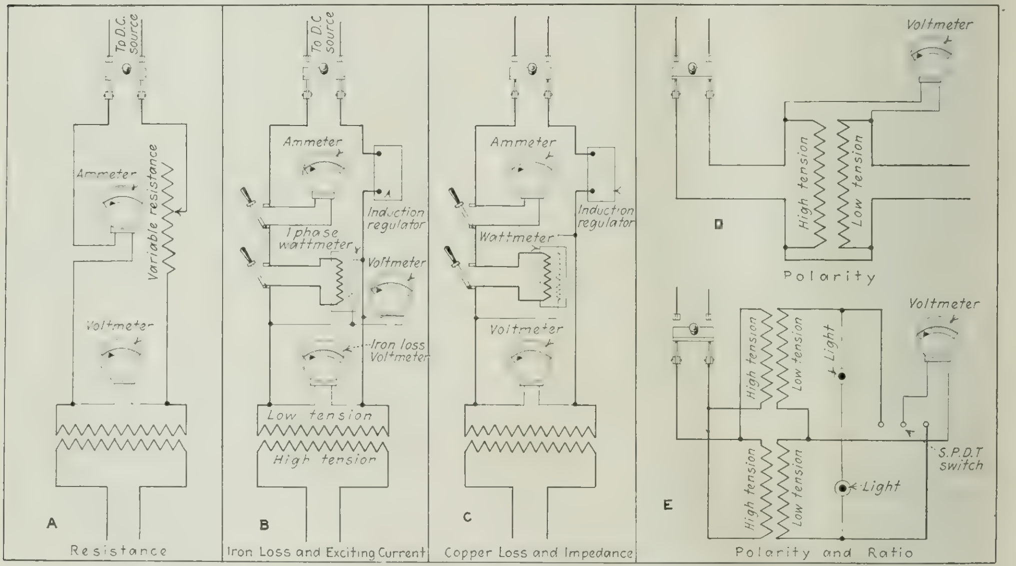


FIG. 1—GREAT PRECISION SHOULD BE REQUIRED WHEN TESTING TRANSFORMERS AND A CONVENIENT ARRANGEMENT OF SWITCHES FACILITATES THE WORK

Iron Loss and Exciting Current.—Iron loss is made up of two parts—(1) hysteresis loss and (2) eddy-current loss. The hysteresis loss depends upon the quality of iron used in the laminations and varies directly as the 1.6 power of the magnetic density. But the density varies directly as the voltage and inversely as the frequency, therefore iron loss increases with an increased voltage but decreases with the higher frequency. If the voltage is increased 10 per cent, this will increase the iron loss about 60 per cent and the magnetizing current approximately 100 per cent. An increase in voltage of more than 10 per cent will raise the magnetizing current sufficiently to cause excessive heating and will materially reduce the power factor of the system.

Iron loss is dependent also on the wave form, a peaked wave giving a lower loss (sometimes 5 to 10 per cent lower) than the sine wave. Guarantees are based on normal voltage of sine-wave shape and normal frequency. It is comparatively easy to obtain normal voltage and frequency, but not always such a simple matter to have a sine-wave current for testing purposes. It is customary, therefore, in this test to use an iron-loss voltmeter, an instrument which at some particular voltage indicates the same iron loss as would be produced by a sine wave of rated voltage and frequency. When the actual root-mean-square voltage impressed on the transformer is such as to produce the same iron loss as would be caused by the sine wave of normal frequency and voltage, this instrument indicates normal voltage on one of its scales; the other scale is calibrated in watts and indicates watts loss in the instrument itself.

It is customary in transformer specifications to give the iron loss in watts. This figure is considerably different from the apparent loss in watts found by multiplying the exciting current by the voltage at which current is measured. For 25-cycle transformers the apparent watts will be approximately six times the true watts, and for 60-cycle units about twice the true watts.

EXCITING CURRENT CAN BE SEPARATED INTO COMPONENTS

As its name implies, exciting current is that current necessary on one winding at normal voltage to produce normal voltage on the other winding when open-circuited. This exciting current is composed of two parts—(1) magnetizing current and (2) the iron-loss component; then $Ie^2 = Im^2 + Iil^2$. The iron-loss component is obtained by dividing the watts iron loss by the rated voltage. Magnetizing current then can be obtained from the formula just given. For making the iron-loss and exciting-current test the instruments necessary are an alternating-current ammeter, an alternating-current voltmeter, an iron-loss voltmeter and a single-phase indicating wattmeter. Connections are indicated in Fig. 1B. With connections as outlined, adjust voltage until the iron-loss voltmeter indicates normal voltage, reading standard voltmeter at the same time. Then disconnect iron-loss voltmeter and adjust voltage until the root-mean-square voltmeter indicates the same voltage as when the iron-loss voltmeter was in circuit. Read ammeter and wattmeter simultaneously. If the results are to be very accurate and the voltage is steady, the voltmeter should be disconnected before reading the ammeter and wattmeter. However, leaving it in circuit will cause no great variation, as its losses are very small. The wattmeter may then be corrected by subtracting the watts loss in its shunt coil from the instrument reading. This is a refinement which will hardly be necessary in ordinary commercial testing.

The iron-loss test is usually made on the low-tension side of the transformer, since this requires the handling of lower-voltage apparatus and on the ordinary distributing transformers obviates the necessity of current and potential transformers.

Copper Loss and Impedance.—The copper loss is the watts necessary to circulate full-load current through the two windings. Knowing the resistance of high-tension and low-tension windings, it can easily be calculated from the formula $I^2R_{total} = I^2_{ht} \times R_{ht} + I_{lt}^2 \times R_{lt}$. The calculated value is usually lower than the measured value on account of the eddy currents due to unequal distribution of currents in the conductors and a small core loss caused by the amount of flux necessary to circulate full-load current in the short-circuited winding. This calculated value will usually be about 20 per cent lower than wattmeter reading, and for transformers designed for rotary converter service the calculated loss will be 40 to 50 per cent lower than the wattmeter reading.

VALUE OF COPPER LOSS OBTAINED BY SHORT-CIRCUIT TEST

In order to obtain the copper loss, short-circuit one winding—usually the low-tension—and impress on the high-tension enough voltage to cause full-load current in it. This voltage will usually be between 6 and 10 per cent of the rated voltage. A wattmeter inserted in the high-tension circuit will then give this total loss.

The impedance drop is that percentage of normal full-load voltage necessary on one winding to circulate full-load current in the other winding when short-circuited.

The copper-loss and impedance volts can be measured at one time with connections as indicated in Fig. 1C. A very low voltage should first be applied to avoid excessive current. Voltage should be varied by means of an induction regulator or a transformer with variable taps in preference to using a series resistance which may introduce a serious error. Having made a preliminary test, bring up voltage until full-load current is obtained in the short-circuited winding. Read impedance volts, taking care that the reading is directly across the transformer terminal board and that the voltmeter leads are fairly short. Read ammeter and wattmeter simultaneously. Leaving the voltmeter in circuit while reading the other two instruments introduces a small error which can be corrected by subtracting its I^2R loss from the wattmeter reading. If voltage is steady, disconnect voltmeter before reading ammeter and wattmeter. The temperature of the coils, etc., should be carefully noted as copper-loss guarantees are now made on the wattmeter basis at 75 deg. C. These readings should be made quickly in order to avoid undue heating of the coils.

VALUE OF IMPEDANCE IS DESIRED FOR PARALLEL OPERATION

It is often very desirable to know the exact impedance of a transformer in order to determine whether or not it will parallel with other units of known impedance. As a general proposition, like transformers of the same make parallel satisfactorily, but if one be a new type and the other several years old there may be considerable doubt as to their satisfactory operation. If there is a slight difference in the impedance values derived, fairly good operation can be obtained despite small circulating currents. However, if these values differ widely, it is a warning that the three units will not operate satisfactorily in parallel. Even in this case, if two of the units have the same impedances, they may be connected in open delta and give enough power to tide over until a third unit can be obtained or one with a different value of impedance.

Reactance.—For ordinary distribution transformers it is not necessary to know the reactance if the impedance be known. However, in the case of power transformers on large systems or long lines, the reactance is generally the value used in the calculation of system short-circuit possibilities (see articles by the writer, ELECTRICAL WORLD, Oct. 18, 1919; Nov. 15 and 22, 1919; April 3, 1920; April 24, 1920). The reactance can always be obtained from the manufacturer when asking for bids, or, if not given on the nameplate of old transformers, by sending complete nameplate information to the manufacturer. It can also be calculated, when necessary, as follows (N. E. L. A. "Handbook"):

Let

Z = total impedance of transformer windings referred to primary (high-tension) in ohms.

r_t = total resistance of transformer windings referred to primary, in ohms.

X = total reactance of transformer windings referred to primary, in ohms.

r_p = resistance of primary in ohms.

r_s = resistance of secondary in ohms.

N = ratio of transformation.

Then from copper-loss test:

$$Z = \frac{E}{I}\left(\frac{\text{impedance volts}}{\text{full-load current}}\right),$$

$$r_t = r_p + N^2 r_s, \text{ and}$$

$$X = \sqrt{\frac{E^2 - r^2_t l^2}{l}} = \sqrt{Z^2 - r^2}$$

Having got the reactance in ohms in terms of high tension as per above equations, multiply this by the full-load current (high-tension) and divide by high-tension voltage to obtain reactance drop in per cent. Similarly the impedance drop in per cent will be obtained by multiplying the impedance in ohms by the high-tension full-load current and dividing by high-tension voltage. Knowing the reactance and impedance drops in per cent, the resistance drop is obtained from the formula:

$$\text{Resistance drop} = \sqrt{(\text{impedance drop})^2 - (\text{reactance drop})^2}$$

The values of reactance and resistance drops in per cent will be found very useful when determining regulation.

REGULATION GREATLY AFFECTED BY REACTANCE

As a general proposition it is found that transformers with high reactance are cheaper to build than low-reactance units, but, of course, they give poorer regulation. Transformers designed for use with rotary converters usually have a reactance of 12 to 15 per cent because this tends to increase the direct-current voltage with increase of load. In favor of high-reactance transformers it must be remembered that they reduce the short-circuit values on large systems and thus permit the use of much cheaper oil circuit breakers, structures, etc. These advantages must be weighed against the disadvantage of poorer regulation, and transformers must be selected which while limiting the short-circuit possibilities will also allow fairly good voltage regulation. This question becomes important only on large systems.

Polarity.—It is not often necessary to test the polarity, but this can easily be done when desired. It is understood that if the high-tension and low-tension leads on one side are connected together, and voltage applied to one winding, the voltage across the two free terminals (the ones not connected together) will be (1) the difference of the high-tension and low-tension voltage for negative or subtractive polarity and (2) the sum of the high-tension and low-tension voltages for positive or additive polarity.

POWER CLUB RECOMMENDATIONS ARE FOR SUBTRACTIVE POLARITY

The Electric Power Club recommends for power transformers that all units over 200 kva. shall have subtractive polarity, regardless of voltage rating. On distribution transformers of voltage rating above 7,500 and in sizes up to 200 kva. subtractive polarity is standard; but on sizes 200 kva. and smaller with voltage rating of 7,500 and below the club recommends that the manufacturers adhere to their own standards, which are almost all for additive or positive polarity on the transformers.

To determine the polarity of a 2,300/230-115-volt transformer, connect apparatus as shown in Fig. 1E and apply, say, 230 volts to the primary or high-tension side. This would give 23 volts on low-tension side. Then for subtractive or negative polarity the volmeter reading will be $230 - 23 = 207$ volts, and for additive or positive polarity $230 + 23 = 243$ volts.

But what a customer wants to know is not whether a transformer has positive or negative polarity, but whether it has the same polarity as the ones it is to work with. To determine this point then, connect the unknown transformer with the one of known characteristics as shown in Fig. 1E, having the primaries (high-tension) in parallel and secondaries in series. If the lamps light up, the polarities are the same, and, moreover, if the voltages as indicated on the voltmeter are identical, the two units also have the same polarity.

The second part of this article will be published in the next issue of the *Electrical World* and will discuss temperature, regulation, efficiency and voltage tests.

"Selling" the Sales Department to the Organization

Central-Station Executives and Employees Must Be Made to Realize the Possibilities of Business Development Through the Activities of the Sales Department

BY CYRUS BARNES
General Sales Manager Charles H. Tenney & Company, Boston

CENTRAL-STATION men willing to look facts in the face realize that throughout the industry as a whole the opportunities before our sales departments are far from fully appreciated today either by executives or by employees. There are many notable exceptions, of course; but it is undeniable that a great number of companies have never recovered in their commercial branches from the curtailment enforced upon them by the war. It is also unfortunately true that many other central-station companies have never been really "sold" upon the question of sales development. I believe that the time has come for a new start to be made, because the opportunities for the sale of electrical appliances and the supply of energy to them by central stations are nothing short of amazing. The central station is the electrical sponsor of its community and will continue to be so. If it falls short of its mission in the exploitation and merchandising of appliances to the public, it fails to measure up to modern requirements of service.

Unless a doctor has enough confidence in his own medicine to use it in his own family, his progress is bound to be unsatisfactory, and the same thing may be said of electrical men who fail to use appliances in their own homes. Right here is the point of departure from old ways. More than one electrical census has shown that executives and employees are neither testing nor owning many of the latest household appliances. In fact, a surprising amount of ignorance exists in our own industry as to the appliances available and their service capabilities. Many executives who travel extensively in their home states and vicinity have never visited any of the leading appliance factories in their own neighborhoods, and many others have failed to make use of opportunities to experiment with electrical conveniences in their homes as these devices have been developed. We have all been busy as the industry has hit its stride toward larger service, and so there has been a natural tendency to pass by opportunities which we can no longer afford to neglect.

In some companies, I venture to say, even the president's house is unwired for electric service. I heard of one case only a few days ago where the president's house, within a mile of the main generating station and less than half a mile from the main business street of a city of well over 100,000 people, used gas from the competing company for domestic illumination. In some of our own companies we have found that our employees and our executives, too, have been paying more money every month for gas service from the competing utility in the home town than for electricity supplied by their own plants—and the explanation is not that their own companies gave them either free or discounted service!

"Sell yourself continuously" should be the motto of every electrical man in regard to the use of appliances. Nothing is more important in the prosperous development of our sales departments than that our friends and neighbors shall see us using in our own homes the conveniences which we know are worth while and which we are trying to sell to the community at large. I have found cases where the terms on which employees could buy appliances were actually less favorable than those given to customers outside the company. The most liberal terms are justified in order to place appliances in the homes of employees. Credit should naturally be arranged according to circumstances, but even if it takes two years for the employee working on small wages to pay for an appliance, let us see that he gets the required time; for every appliance installed in an employee's home is more than a direct revenue earner.

A census of appliances used by all customers should be taken by every electric utility organization not possessing recent information upon this subject. Costs will vary in this work, but a pretty thorough census can be taken at a cost of say 5 to 10 cents per call made by the canvasser, including office records. This cost will soon be saved in future advertising by enabling the company to circularize its territory in a discriminating way. A lot of good material is at present wasted by sending it out hit-or-miss fashion. A man who already has a modern electrically driven refrigerating plant which renders first-class service is not a natural "prospect" to circularize with refrigerator advertising, but such things often happen in an indiscriminate direct-by-mail campaign.

GIVE CREDIT TO EMPLOYEES

Credit for house wiring should be extended to employees on the most liberal terms where they are without electric service. There is little use trying to cultivate the enthusiasm of employees or customers as a class in localities where the cost of wiring is burdensome. It is not necessary to dwell upon the reward central-station companies reap from liberal policies in financing house wiring, except to point out that, apart from the effect on the public, such policies have a prominent part in solidifying the good opinion of employees concerning our service.

In the Tenney companies the interest of executives and employees has been greatly stimulated in appliance sales by the establishment of a "merchandise sales cup race" in 1920. The company which wins this cup two years in succession will receive it as a permanent trophy. The Fitchburg (Mass.) Gas & Electric Light Company won this cup in 1921, and this year interest in the contest is literally at fever heat. Along with the award of the cup goes a cash bonus, divided among sales department employees in the winning company for the year, and it is surprising how much enthusiasm for appliance sales has come out of this contest. Employees working in power plants, on pole lines, in meter departments and other branches of local company organizations are enthusiastic "boosters" for the sales record of their home utilities.

Interest in the sales cup race is maintained in the *Tenney Service Magazine* from month to month. The interest of executives is heightened by their being requested to serve on the board of judges and awards. This results in a closer contact with our sales forces and incidentally in a better understanding of the problems of sales departments and a wider familiarity with the accomplishments and possibilities of appliance service. In this connection the boards of directors of many central stations should be considered from the "prospect" angle by progressive sales departments. Even though these men are often occupied actively in many other fields than the electrical industry, they are usually proud to be associated with electric utility development and hence should logically be users of the good things which it has brought forth for the comfort and convenience of the world. In some companies it is probable that a larger percentage of outside customers than of employees are appliance users.

IMPORTANCE OF AN ATTRACTIVE STORE

A pleasant, attractive store is an essential to "selling the sales department" to our own organization in the central-station industry. Cold, unattractive offices with repellant furnishings and a hodgepodge of appliances thrown about with little regard for taste and appearance tend to neutralize the efforts of our sales forces among our own people. The central station should maintain *the* appliance store of the town. If a new office building is planned, let us tell the local public that we are going to put up a new *store* and put the soft pedal upon the office end of the transaction. The office is of little interest to the public; but if we put up a real "honest-to-goodness" store, run on pure merchandising principles, we shall find in talking and advertising that it draws a good many more people than do references to the "electric light office." Our own executives will respond to the suggestiveness of a high-grade electrical store, to say nothing of persons outside our ranks. Here we can show prospective customers the latest wrinkles in electric service, and even in small and remote towns people like to be "posted up" on the latest developments of the appliance manufacturer. We don't have to wait until a new toaster has had a year's run on Broadway before it is safe to try its appeal to the citizens of small but progressive towns in the interior of the country which are blessed with ample hydro-electric development and whose inhabitants worry less about keeping warm in the winter than some of their metropolitan brethren.

STIMULATES SALES ACTIVITIES

With our survey of the market for our service, our up-to-date electric store, our employees started on the path of using appliances in a really liberal way, intercompany competition where centralized management prevails, and, finally, with actual figures showing the increased monthly loads and revenues resulting from energetic sales policies, we can look forward to more executive support and to broader recognition of our sales organization's usefulness and opportunities among our associates.

With at least a semi-annual call by salesmen upon customers in their territories, the good fruits of the survey can be ripened into greater profits. Certainly, among such Tenney companies as those at Montpelier, Malden, Fitchburg and Exeter greatly increased activity and interest in sales work has followed the adoption of commercial policies along the lines outlined above, and others of our companies are fast falling into line in their endeavors to cultivate more intensively the fields of service open to progressive electrical merchandisers. The electrical industry has been developed for so many years upon the basis of engineering progress and interests that it is small wonder that only within recent years its leaders have begun to see the opportunities before commercial men in this remarkable branch of public service.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Laminated-Frame Arc-Welding Generators

To the Editors of the Electrical World:

In the Oct. 7 issue of your publication a letter signed Pliny P. Pipes attempts to answer the question with reference to the benefits derived from laminating the frames of arc-welding generators which was raised by the writer in the issue of the *Electrical World* for Sept. 9 last.

In the manufacturers' publications referred to in the writer's original letter the reason given for laminating the frame is that it makes the generator more responsive to external changes, thereby assisting in stabilizing the arc and making the machine easier to operate. It is very interesting to note that your recent contributor not only abandons this theory completely, but goes even further and implies that from the standpoint of stabilizing the arc the damping effect of eddy currents in a cast yoke is beneficial, although not sufficiently so to get the desired results, and the reactor must therefore be employed in the arc circuit.

While the writer does not wholly share this opinion, we obviously agree that the theory of materially stabilizing the arc, and thus making the machine easier to operate by laminating the yoke, is untenable. In view of this the statement that lamination of the frame makes it possible for the arc current to adjust itself almost instantly to any demand is meaningless. Giving due regard to the relative meaning of terms, it will be readily conceded that in a circuit containing a large amount of inductance a direct current cannot change instantly or almost instantly from one value to another, and the greater the inductance the longer will be the time required for readjustment.

We are now informed that the main advantage of a laminated frame is a reduction in the hysteresis loss and that another big advantage is a somewhat smaller reduction in the eddy-current losses. Upon closer examination there appears to be as little foundation for this assertion as there is for the theory that was originally advanced.

Your correspondent gives 0.12 as the hysteretic coefficient of cast steel, or thirty times that of sheet iron. In his "Alternating-Current Phenomena" (third edition, page 116) Steinmetz states that he has found the hysteretic coefficient of cast steel to vary from 0.0032 to 0.028, according to the chemical or physical constitution, and even in hardened steel (tungsten and manganese) he gives as the upper limit 0.08. However, whether the hysteretic coefficient of cast steel lies in a range from slightly less than to seven times that of sheet iron, as claimed by Steinmetz, or is thirty times that of sheet iron, as claimed by your correspondent, is immaterial, because in any case the loss under discussion is negligible compared with the usual unavoidable losses in the motor and generator.

The hysteresis formula given in the letter is expressed in c.g.s. units or ergs per cycle. To transform it into practical units, and expressing it in watts, we multiply by 10^{-7} and the cycles per second. The formula then becomes $W_p = \eta V B^{1.6} f \times 10^{-7}$. During the welding operation the maximum flux pulsation in the frame unquestionably takes place when the molten metal drops off, forming a momentary complete short circuit. Data taken from oscillograms and calculations show that under these conditions a pulsation of flux density in the frame of a thousand lines per square centimeter is a high estimate and takes place at not more than 15 cycles per second. The volume of the frame of the machine in question was 3,850 cu.cm., and using the improbably high hysteretic coefficient, and the hysteresis loss is

$$W_p = 0.12 \times 3{,}850 \times 1{,}000^{1.6} \times 15 \times 10^{-7} = 44 \text{ watts.}$$

The insignificance of reducing this loss to one-thirtieth or one-seventh or any other fraction is at once apparent when it is considered that the losses in the motor-generator set, when operating at 175 amp., 22 volts, probably lie in the range from 1,500 watts to 2,000 watts. An examination of the eddy-current loss shows similar results, and incidentally it may be remarked that an important factor was omitted from the formula, namely, the conductivity of the material, which is probably higher in sheet iron than is the case in cast steel.

As contrasted with this small loss, the writer has observed machines in operation in which the I^2R loss in the reactor was more than half a kilowatt when operating at 150 amp. Great as this loss is in comparison with the insignificant losses in the yoke, it is not the greatest drawback to a reactor, which is added cost. It therefore appears to the writer that the next step in the development of arc-welding generators should be so to utilize the material in the machine itself as to eliminate the reactor, thereby increasing the efficiency and reducing the cost. For designers to concentrate their immediate efforts on the solution of this problem would seem to be the logical method to pursue.

K. L. Hansen,
Electrical Engineer.
Milwaukee, Wis.

Electric Ranges

To the Editors of the Electrical World:

In the Sept. 30 issue of the *Electrical World* "A Manufacturer" wonders why a "true electric range" is not produced instead of an electrified stove. There would seem to be no good reason why such a range could not be built.

If a new design is brought out, why stick to 110-volt heating units? Some manufacturers already provide 220-volt units if requested, and probably others would do so if the demand were sufficient.

The 220-volt range can be connected to the two outside wires of a three-wire system and a considerable saving in copper effected in the inside wiring as well as in the distribution system. A perfect balance on the three-wire system is obtained, and if the service is alternating, it is usually possible to use a smaller transformer, especially where several ranges are connected to the same secondary. The unbalance on a three-wire secondary caused by three-wire ranges is sometimes so great that a three-wire system becomes of doubtful value.

Ranges having types of units which cannot be successfully produced for 220-volt service can be balanced by the use of auto-transformer, as was described by W. C. Heston in the *Electrical World*, issue of March 11, 1922.

George M. Hardy,
General Superintendent.
Worcester Electric Light Company,
Worcester, Mass.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Radio Development Will Aid Central Stations

THAT central stations will in the comparatively near future benefit materially from developments now under way in radio apparatus for signaling by telephonic or carrier-current means was indicated in an address at the recent New London convention of the New England Division, N. E. L. A., by T. Johnson, Jr., of the General Electric Company, Schenectady, N. Y. Mr. Johnson pointed out that the use of separate antennas gives better results in radio telephony than the employment of utility distribution circuits for reception of waves by owners of modern sets for use with broadcasting station service. Broadcasting over central-station mains is as yet comparatively undeveloped. Recent carrier-current experiments have used frequencies up to 20,000 cycles, but if these are employed on circuits having gaps, secrecy is lost at the gaps.

Four carrier-current sets of the 50-watt size will soon be installed for central-station service in New England, the speaker said. Carrier-current equipment is now available for use on lines as long as 85 miles with no intervening tie-ins. Each tie-in reduces the range of transmission by about 10 miles because of reflection. Apparatus is being developed for 260-mile transmission, using a 250-watt transmitter. The same reduction in range applies to this larger work. Another forthcoming development is a concentrated condenser for transferring energy to a line with minimum loss. This will be available in about a year, according to present indications. It will probably be from eighteen to twenty-four months before portable carrier-current equipment will be available.

For straight radio telephony in central-station service with a range of 50 miles upward the antenna should be from 175 ft. to 200 ft. high and about 200 ft. long. It should be remembered that reliable service when wire lines are not available demands a very high standard of construction in the radio field. About 200 watts are required for 100-mile radio telephony, and with this amount of energy radio telegraphy can be carried 400 to 500 miles. Great advances in broadcasting equipment are to be anticipated in the next two to five years. In general, the power requirements in radio increase as the square of the distance. Present prices for carrier-current equipments range from $2,000 each for the 50-watt, 75-85 mile apparatus to $4,000 each for the 250-watt, 250-mile installations. A 200-watt straight radio telephone set for 50-100 mile central station service costs about $5,500, excluding antenna, and a 1,000-watt set $7,400. Radio can be duplexed, but carrier-current service gives better results.

Street Light Circuits to Be Controlled by Radio

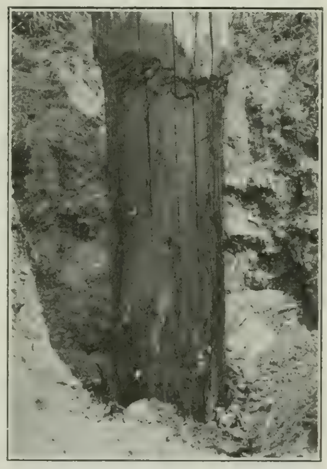
Within a year it is expected that a relay will be developed for turning on and off small-power lighting circuits in general practice. So far it appears impracticable to use carrier-current in underground cables having outside conducting sheaths. To do this on telephone lines would require loaded inductances every 1,000 ft.

Commenting upon data recently given out as to the small amount of energy required in radio broadcasting tests on the distribution circuits of central stations in Chicago and Cleveland, J. A. Vahey of the Edison Electric Illuminating Company, Boston, contended that 1 watt per square mile appears unreasonably low for such work. Recent tests at Boston between a fixed station and linemen in field service required 50 watts for broadcasting through the ether over an area with a radius of about 25 miles.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Increasing the Life of Poles in Service

TO INCREASE the life of transmission poles which have been in service for a number of years, the Portland (Ore.) Railway, Light & Power Company follows the practice of cutting away the rot at the base of the poles and applying wood preserver. This not only gives the pole line an estimated greater life of from five to eight years, but affords an opportunity to inspect each pole at the ground line and to replace or stub those that are badly decayed.



LIFE OF POLES TREATED IN SERVICE INCREASED FROM FIVE TO EIGHT YEARS

The method of carrying out the work is to excavate around the butt of the pole to a depth of approximately 2 ft., there being no reason to excavate any further than thoroughly to treat the portion of the pole subject to decay, which is normally 6 in. to 10 in. below the surface of the ground. An average of 1½ in. to 2½ in. of wood is cut away, or until sound wood is reached. Normally the shaving of the poles does not extend above the ground line more than 6 in. to 8 in., depending on how badly the sap wood is decayed. An attempt is made to taper the shaving at the ground line so that the pole presents a fairly neat appearance. This work is done during the summer months when the wood has a thorough chance to dry out before applying the preservative. A good carbolineum oil is applied cold by use of a brush. On one transmission line where 1,531 poles were treated 125 gal. of preservative was used. The unit cost per pole for material in this case was 6.93 cents, and that for labor and material was $1.31.

The increased life of the poles which will result from this treatment is, of course, problematical, but it is reasonable to expect five to eight years' longer life. After the sap wood has once decayed the heart wood takes the preservative much better than the sap wood does when treated before the pole is set. In the judgment of the engineers of this company, a mere brush treatment on new poles is of no practical value, but after the sap wood has decayed it does pay to apply a good preservative by the brush method. In all, more than 6,000 poles on the system of this company have received this treatment.

H. R. Wakeman,
Superintendent of Distribution.
Portland Railway, Light & Power Co.,
Portland, Ore.

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Making Electrolysis Tests on Cables

With a reversible voltmeter, portable load box and grounding staff, tests of the potential difference between lead-covered cable sheaths and adjacent tracks, hydrants and other grounded structures can be conveniently made. After making a series of these tests preventive measures to protect cables can be taken.

Electricity Saves Expense in Oil Fields

Operation and Maintenance Costs Materially Lower than Gas-Engine Drive—Load Constant Where a Number of Wells Are Operated—Curves from Actual Operation

Drilling is decidedly cheaper with electric drive than with gas or steam drive. In the opinion of men well versed in oil-field operation, the greatest benefit from the use of electric power is found during the flush period, when the small outage as the result of using electric power makes for greater production, and also in the low stages of production, when the low operating costs are a material influence in extending the life of the wells and therefore of the fields.

TABLE I—COMPARATIVE PUMPING EXPENSE ON 367 WELLS PUMPED WITH GAS-ENGINE-DRIVEN UNITS AND 241 WELLS WITH MOTOR-DRIVEN UNITS

	March	April	May	June	July	Total	Cost per Well per Month
	Gas-Engine Pumping						
Labor	$12,600 85	$12,431 59	$11,776 52	$10,969 85	$11,310 10	$59,088 91	$32 21
Gas	20,616 75	25,377 60	30,083 92	21,802 97	25,361 97	123,203 21	67.14
Supplies and expenses	3,151.84	2,049.66	1,821.35	2,709.65	3,104.76	12,837 26	7.00
Total lifting cost	$36,369.44	$39,818.85	$43,681.79	$35,482.47	$39,776.83	$195,129.38	$106.35
	Motor Pumping						
Labor	$5,434 57	$5,039 57	$5,201 74	$5,507 11	$4,612 84	$25,795 56	$21 41
Electricity	10,301 62	9,837 54	11,232,35	10,564 76	10,591 11	52,527 38	43 59
Supplies and expenses	408.72	290.31	474.76	550.22	680.40	2,404.41	1 99
Total lifting cost	$16,144.91	$15,167.15	$16,908.85	$15,622.09	$15,884.35	$80,727.35	66 99

Another advantage of electric motor drive lies in the use of electrical energy in the operations of cleaning out wells and abandoning them. The lower costs of cleaning out small producers and the cheapening of the operations involved in abandonment of wells are of great advantage in facilitating production. The figures and the other data following are taken from the experience of the Empire Gas & Fuel Company in the fields at Eldorado, Kan., where electrical energy has been utilized in the drilling and operation of wells for several years to a greater extent than in any other part of the mid-continental field.

Little can be added to information already available on the costs of drilling, but a few considerations from the standpoint of the practical driller can be added. In the maintenance of electrical equipment for drilling purposes the principal attention required in the field has been found to concern the contact fingers and segments on the main controllers. These become pitted by the arcing occasioned by reversals of the motor. This difficulty does not require constant attention from an electrical man but can be handled by a regular inspector who, perhaps, visits the installation once a day. The drillers and tool dressers can, if desired, be educated to take care of the equipment so that they will be virtually independent of the need of outside assistance in making repairs.

As noted in previous articles,* the cost of electrical power is less than that of steam or gas and the saving in water required is a large item. In the case of the electric motor it is not necessary to take precautions against fire or explosion if gas is encountered as the motors used are of the induction type, a special motor to meet the requirements of drilling and pumping being put out by several of the manufacturers of electrical equipment. The motor most used for either the deep wells or those of moderate depth is a two-speed motor with a rating of 15 hp. and 30 hp. In reality it is two motors mounted in one frame, the smaller designed for pumping duty with a high all-day efficiency and power factor and the other being a hoisting motor capable of developing about five times its rated torque from standstill. All of the work about a well can be handled with this rig except drilling, for which a special 75-hp. motor is used, though some engineers favor using two of the 15-30-hp. motors for drilling in order to avoid carrying repair parts for several sizes. Use is also made in

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*A general review of electrifying oil wells, with a table comparing pumping costs with motor and gas engine drive, was published in *Electrical World* for March 5, 1921, page 533. Power requirements for drilling wells appeared May 14, 1921, page 1111.

pumping work for some parts of the field of individual motor-driven jacks equipped with a constant-speed motor of from 3 hp. to 5 hp.

Viewed from the driller's angle, there seem to be a number of decided advantages in the use of electrical energy, despite the fact that steam has in the past been viewed by him as the last word in oil-well-drilling equipment, for as a rule the driller has been a very conservative individual. The following comments taken from the report of a practical driller are especially significant: In spudding with steam it is necessary to run up against the tools hard in order to compensate for the loss of power as the engine slows under the strain. With the electric motor the pull can be made an easy and steady one, which means a saving in equipment maintenance. In bailing electric power bails faster than steam and the trouble of falling steam pressure under heavy work is avoided. Steam will start tools more quickly in pulling, but the motor gets them out of the hole faster.

TABLE II—MAINTENANCE EXPENSE FOR MOTOR DRIVE IN ELDORADO OIL FIELD ABOUT ONE-SIXTH THAT OF GAS-ENGINE DRIVE

	March	April	May	June	July	Total	Average Cost per Well per Month
	Gas-Engine Pumping						
Labor	$1,947.07	$2,435.70	$2,393.12	$1,552.06	$1,446.83	$9,774.78	$5.33
Material	1,259.45	11,054.26	1,712.80	6,247.07	14,254.95	34,528.53	18.81
Total	$3,206.52	$13,489.96	$4,105.92	$7,799.13	$15,701.78	$44,303.31	24.14
	Motor Pumping						
Labor	$498.02	$561.28	$415.88	$305.10	$227.18	$2,007.46	1.66
Material	311.55	292.44	1,355.17	477.71	1,156.38	3,593.25	2.98
Total	$809.57	$853.72	$1,771.05	$782.81	$1,383.56	$5,600.71	4.64

The figures available for operating costs cover only gas-engine-operated and motor-operated wells. With gas available from the wells themselves such power has been considered the superior of steam in cost. For this reason the comparisons in Tables I and II are particularly significant. The study was made over a period of five months for 367 wells equipped with gas engines and 241 wells equipped with electric motors, all in the same general territory, with conditions the same. The total lifting expense for each month and the average cost per well per month is given in Table I, while the maintenance expense of both types of equipment on the same basis is shown in Table II. In the matter of lifting motor-operated wells show an expense that is roughly two-thirds of that of the gas-engine-equipped wells. The maintenance expense for electrical equipment is roughly about one-sixth that of the gas-engine wells. In addition to the saving in expense the item of the time for shut down to make repairs is decidedly in favor of electrical operation, and the total production is greater for that reason.

Motors for oil-field service are built for handling heavy overloads for short periods and under normal conditions run at less than their rating. As might be expected, the power factor of such a load is low, while the load curve, which might be expected to be very uneven, shows a remarkably straight line. In one instance, for a period of twenty-four hours, the load varied in one substation of the Empire Gas & Fuel Company, operating in the Eldorado field, from 1,250 kw. to 1,400 kw. with very small instantaneous fluctuations.

Current readings taken from the Barnhill substation, which supplies all of the operations of the company with energy in this field vary only from 220 amp. to 280 amp. over twenty-four hours. When it is realized that the number of units in use is large and the individual sizes comparatively small, the reason for the constancy of the total load is readily seen. At any one time relatively few of them are undergoing the pulling and cleaning operations that call for the full capacity of the motors. Even with a considerable number of them undergoing these operations the diversity factor is high.

The load factor of the Barnhill substation is an interesting study. Because of the pumping load this factor is very high, running in these particular cases around 80 per cent. In the particular case under observation the power supply is from the system of the Kansas Gas & Electric Company. Viewed as a central-station load proposition, there are several things to be considered. In a sparsely settled and arid territory where there is little chance of other developments the principal question at issue is the possible life of the oil field, since the failure of the field would mark the end of the business. In a territory situated in the midst of other possible developments and covered with settled communities the big question will be the fitting of the business into the development of the entire territory. In the mid-continental fields the development of service to the oil fields from the central-station lines has been slow, first, because of the difficulty encountered during the war in making any extensions, and, again, because of a doubt as to the life of the fields. Now, however, the transmission systems are being extended to cover the entire territory. The load in its general characteristics is attractive from a central-station viewpoint.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

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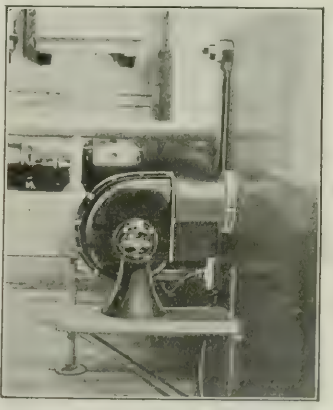
Ventilating Cells Housed in Instrument Room

IN A MASSACHUSETTS industrial plant an extensive storage battery installation occupies a portion of a room devoted to recording and indicating instruments, motor-generator sets and telephone equipment. To insure adequate removal of all gases from the cells the compact arrangement of exhaust blower and air dust shown herewith has been installed. The blower is mounted on a wooden platform supported with the aid of metal brace rods just above a stairway leading to the basement, the duct being carried between the battery boxes and the blower as shown. The equipment occupies no otherwise useful space, is accessible and insures excellent protection of sensitive relays, etc., from gases.



BATTERY VENTILATION PROTECTS SENSITIVE EQUIPMENT

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Underground Construction Above Ground

THE first step in connection with underground conduit construction is usually excavation. None the less, a short section of conduit line was recently constructed by the New York & Queens Electric Light & Power Company in Long Island City with almost no excavation, the reason being that the line of the subway extends across some low ground which is later to be filled to form a city street. The subway consists of twenty-one ducts of 4-in. fiber conduit arranged three wide by seven high with 1½-in. spacing between conduits and a 3-in. concrete envelope around the ducts.

The manholes employed at points where four conduits enter or in straightaway where only two conduits enter are built in the form of rectangles with the conduits entering at each corner. At dead-end streets or where only three duct lines enter the manholes they are constructed with one side cut off as shown in Fig. 2. These two shapes of manholes were adopted as standard for all subway construction by the company after a careful study of a large number of designs. With the minimum radius of 18 in. which has been adopted for cable bends in manholes, it was found that there was a large amount of waste in the corners of rectangular manholes and that the diamond shape with corners cut off is more economical in all cases where they can be used.

The method of construction employed in building this section of subway was to level the ground, pour the 3-in. foundation and lay the ducts one layer at a time, building up forms on the side. This is shown in Figs. 1A and 1C. The manholes were constructed by first pouring the floors and then erecting and bracing the forms above ground. A dead-end manhole is shown in Fig. 1B just before the conduit construction had been completed. The completed manhole is shown in Fig. 1D, with the exception of placing the manhole roof.

W. C. BLACKWOOD,
Electrical Engineer.
New York & Queens Electric Light & Power Co., New York, N. Y.

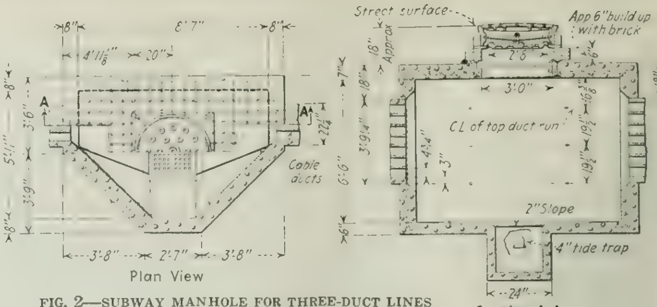


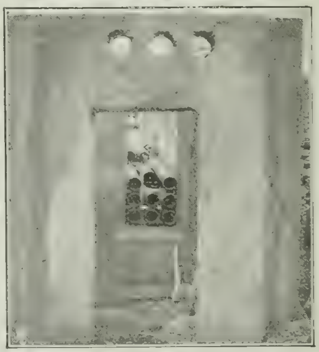
FIG. 2—SUBWAY MANHOLE FOR THREE-DUCT LINES THAT AVOIDS WASTE SPACE

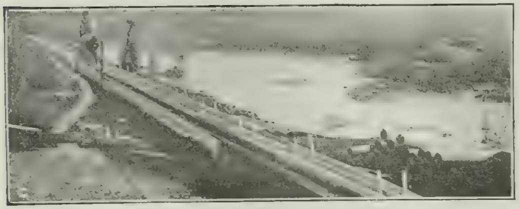
Testing and Setting Relays Periodically

METHOD and care in the testing and setting of relays are of paramount importance if proper operation is to be obtained. In all cases the proper functioning of relays depends upon periodic inspection and tests. All tests should be made under conditions as nearly equal to the operating conditions as possible, according to engineers of the General Electric Company.

The determination of relay settings must receive careful consideration. An analysis of all circuit conditions is necessary, and a calculation of the short-circuit currents which may be produced at different points on the system is desirable so that selective time-current characteristic curves can be made comparative for different points of the system. The determination of short-circuit currents is most easily accomplished by use of a "calculating table," consisting of a system of adjustable rheostats which represent the impedances of the different circuits to be investigated. Connections are made to represent any system network. The short-circuit current may be read by an ammeter at any point where a short is applied.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.





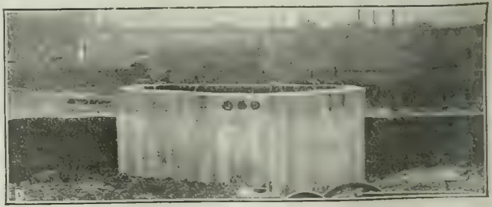


FIG. 1—SUBWAY CONSTRUCTION SIMPLIFIED WHERE LAND IS TO BE FILLED IN FOR FINAL STREET LEVEL

A—Ducts surrounded by 3 in. of concrete with 1½ in. between each conduit. B—Dead-end street manhole completed and ready for installing conduit. C—Conduits laid and ready for pouring concrete. D—Completed subway without manhole cover.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Banker's Appraisal of Utility Securities*

Effect of Customer Ownership in Marketing Senior Issues —Need of More Detailed Reports— Outlook for the Future

By John A. Prescott
Chairman of Committee of Public Service Securities,
Investment Bankers' Association of America

During the last two years there has been marked improvement in the demand for public utility securities, which, coupled with declining interest rates, has resulted in a broader market and higher prices. This has affected not only senior issues, like funded obligations, but also junior issues even to some of the more speculative classes. Mortgage bonds, and even preferred stocks, of the best-established companies can now be sold with comparative facility, although in case of preferred stocks still at relatively high cost. With very few exceptions, however, common stocks are difficult, if not impossible, to market. Thus the financial problem is still the overshadowing one.

Capital for Common Stock

As was indicated in a previous report, we believe a much larger proportion of capital than has been the practice in recent years should, to accord with sound principles, be hereafter supplied by junior financing. It is very generally understood that if mortgage bonds are to be readily sold, they must be protected not only by a sufficient equity or margin of security, but also by a satisfactory margin of divisible income. It is not so well understood, by the public at least, that if a preferred stock is to be readily sold, it also must have behind it a margin of security and of income adequate to give it a high degree of safety and reasonable assurance of continuity of dividends.

Capital for the final equity or common stock should be obtained primarily from the people of the community which is to enjoy the service, but if conditions should be such that it cannot be obtained from them, it must be sought in other money markets. Investors in such markets can receive no direct benefit from the development of the utility service itself and must, therefore, be attracted by safeguards to their investment and yields such as will seem attractive to their eyes, as compared with other similar investment opportunities.

Protection of the security and income of the capital invested in the final equities, or common stocks, of public utilities evidently must be, as it should be, the fundamental factor in the development of public utility service. Where such conditions have existed and companies have, therefore, been able to build up sound financial structures, investment bankers have felt safe in supplying common stock capital. As such protection and conditions become more widespread new sources of such capital will be found and drawn upon by investment bankers, and customer ownership will become increasingly common.

An increased confidence of investors in public utility securities will accrue from the dissemination of more complete and comprehensive information concerning the economies of the public utility business. A careful study of annual reports, circulars and statistical manuals disclosed a marked improvement in recent years in this direction. We believe that co-operative effort on the part of the industry, investment bankers and publishers of statistical and rating manuals will bring about still further improvement. Additional data are really available because many states require the filing of complete operating and statistical reports. These data require only to be made more accessible.

Perhaps the greatest need for more complete information is with regard to so-called holding companies. These are often very large and their relations with their operating companies are sometimes complex. Full information necessary to a complete disclosure of their financial condition often would be detailed and voluminous, but the fact that such information is furnished by some of them indicates, in the opinion of your committee, that there are no serious obstacles to its disclosure by all. We believe that any such company which seeks capital from the investing public should make available and readily accessible all information and data pertaining to both the holding company and subsidiaries necessary for a thorough study of earnings, expenses, maintenance expenditures or reserves, fixed charges, dividends, assets, capitalization and liabilities. Without these an appraisal of the real worth of its securities would not be possible.

Public Utility Bonds as Legal Investments

Public utility bonds are already legal investments for savings and trust funds in twelve states. For some time it has been felt generally that savings banks in other states should logically be extended the privilege of purchasing gilt-edged utility bonds, which are generally conceded to constitute one of the safest classes of investment securities and which yield on an average a somewhat higher rate of return than legal rails.

A joint committee of the National Conference of Mutual Savings Banks and the National Electric Light Association was appointed last December to consider this question. A member of our committee is serving on that joint committee and it is hoped that substantial progress will be made during the coming winter.

It would be strange indeed if the public utility industry, unlike all other forms of business enterprise, should have emerged from the upheavals of the great war with no changes in the conditions of its existence, no new problems to confront it. Like others, it was obliged to meet higher operating costs and heavier taxes with reduced income.

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*From a report relating to utility securities presented at the annual meeting of the Investment Bankers' Association of America, Del Monte, Cal., Oct. 10, 1922.

On the other hand, adverse and discouraging conditions are being overcome by favorable and encouraging ones. Costs have declined considerably, and gradually improving general business conditions are bringing some increases in earnings. The practical experiences and lessons of the war and its aftermath seem to have done much to clear the atmosphere and bring about a more widespread popular understanding of the economic and financial conditions under which efficient and satisfactory service, keeping pace with public demand, alone is possible.

The present practice of many utility managements of frankly discussing the problems of the industry with their patrons is stimulating public confidence and good will. There is a growing recognition of the real mutuality of interest between the companies and their patrons. To paraphrase a recent statement of the president of one of our most successful companies:

1. The customer's attitude toward a public utility can now be guided and made informed and friendly.
2. Satisfied customers now can be used to build up good will.
3. Pleased customers will voluntarily help a utility to get new business.

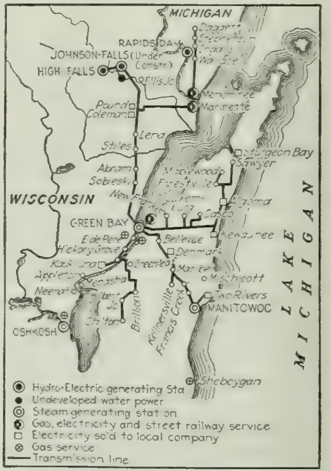
This better mutual understanding already has enabled the managements to eliminate much useless expense and many artificial obstructions to efficient operation and has also removed much of the uninformed popular objection to adequate rates. It certainly will bring many other practical and profitable results, including improved credit. Investment bankers will naturally give great weight to such favorable conditions in considering public utility financing.

Utility Business Fundamentally Sound

This committee has faith in the fundamental soundness of the public utility business, including gas and transportation as well as power and light. There is an insistent and, we believe, permanent demand for the services it renders. We expect that public utility credit will be soon established upon a basis of greater permanency and stability than ever before. As in other industries, there will be exceptional situations; and discrimination and sound judgment will be required. But the solution of the impending financial problems of the public utility companies will, in our opinion, afford investment bankers opportunities for both constructive public service and profit, and will demand the assumption of duties and responsibilties from which they should not shrink.

Benefits of Consolidation of Central Stations

A GOOD example of the economies to be effected through tying together a number of small and medium-size central stations is seen in the recent consolidation of several Wisconsin utilities and one Michigan utility into the Wisconsin Public Service Corporation. Although the plan has been under tentative consideration since 1912, because of unfavorable financial conditions it was not deemed advisable to consolidate the companies until the present time.



TERRITORY SERVED BY WISCONSIN PUBLIC SERVICE CORPORATION

The physical property of the company includes five electric generating plants with an aggregate installed normal capacity of 28,600 kw., of which 12,000 kw. is hydro-electric; twenty-three substations with a transformer capacity of over 52,890 kw.; 349 miles of three-phase, high-tension transmission lines, and adequate distribution lines.

The company's field of operation, as shown in the accompanying map, embraces eleven counties of northeastern Wisconsin and one county in Michigan. The territory includes the Fox River Valley, one of the most prosperous and populous farming and manufacturing districts of Wisconsin, as well as several important communities along the western shore of Lake Michigan.

Of the advantages realized by bringing these various companies under one operating and financial head, Clement C. Smith, president of the Wisconsin Public Service Corporation, says:

"We expect by this consolidation to give coherence and added strength to the company, to extend further its field of business, reduce expenses and make its securities stronger and more desirable to the public and investor. The company gains a great diversity of business, tying together three large water powers and two steam stations. We now have under construction a fourth hydro-electric plant and may follow this with another.

"The interconnection of the several water power and steam stations by transmission lines will result in a very considerable improvement of load factor and the distribution of power. It will also be possible to effect many distinct economies in the management and operation of the property."

Value of Purchase Organizations Emphasized

EARLY anxieties as to the results of forming an association of utility and other purchasing agents in New England have been dissipated by experience, according to a report made by H. L. Ogden before the New England Division of the N. E. L. A. at its recent New London convention. Public utilities now operate a Purchase Information Bureau at 77 Franklin Street, Boston, under the direction of Mr Ogden, and the first year's service of the bureau was recently completed. Thirty-five companies are members.

Weekly bulletins are issued giving information regarding prices and conditions of the coal and coke markets, copper market, fuel and gas oils, cement, iron and steel, cast-iron pipe and railroad conditions, supplemented from time to time by prices on pole-line hardware, automobile tires, etc. Quotations are also obtained on other materials or apparatus in which the members are interested. The conservatism of the purchasing agent as a class has rendered this development rather slow, but there is now a New England branch of the National Association of Purchasing Agents, with a regional membership of about 350. Contrary to early fears, the association has been welcomed by the manufacturers and is working in harmony with them on matters of importance to the business interests of the country.

During the first six months of the operation of the Purchase Information Bureau the members were saved between $5,000 and $6,000. This was ascertained in order to determine whether the bureau should be continued, and since that time no effort has been made to keep or obtain such records. Letters received by the bureau testify as to specific savings, through being put in touch with vendors quoting the right price, in checking prices, in stabilizing quotations from jobbers and in the use of bulletin data as permanent records for stock and rate hearings. The bulletin has also put buyers in contact with firms whose facilities were formerly unrealized and has guided purchasers in placing orders in advance of actual needs.

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Alabama Power Launches National Publicity

THE Alabama Power Company, which is this month celebrating its tenth anniversary, has started a campaign of national aspect to advertise the industrial advantages and development of the South. An interesting program of publicity has been announced by Thomas W. Martin, president of the company.

Moving pictures are being taken of Alabama industries which will be shown not only in the theaters and schools of that state but throughout the Union. Three films have already been completed and two more, devoted exclusively to the exposition of the industries served by the Alabama Power Company, are being made. There are fifteen classes and 160 major industries served by the company.

Full-page advertisements are being run in some of the leading popular publications of the country detailing the advantages which Alabama offers to manufacturers, in line with the statement of Roger Babson that "Alabama is destined to become a leading industrial state."

A promotion department is also maintained by the company which devotes its time to inducing new industries to locate in those sections of Alabama served by it. Recently representatives of the company went to New England, where they conferred with some of the largest textile interests, telling of Alabama's plentiful and cheap labor, climate as affecting living conditions, superior transportation facilities and abundant hydro-electric power.

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Making Every Employee a Personality to the Public

By Al C. Joy

San Joaquin Light & Power Corporation, Fresno, Cal.

TO DISPROVE the charge that the company has no personality, the San Joaquin Light & Power Corporation is following the practice of many hotels in placing the name of the clerk on duty where it may be seen by guests. On every desk in the company offices is placed the name of the man to whom it belongs, so that there will be no question in a customer's mind about the employee's name with whom business was transacted, and he thus becomes not merely a clerk or an official, but "Mr. Jones" or "Mr. Smith," to the customer. This idea is being carried to every department of the company. The accompanying cut shows how the names of the men on duty at the Kerckhoff power house are indicated at the entrance to the plant. At other stations and substations similar racks are used.

HOW NAMES OF MEN ON DUTY AT POWER PLANT ARE DISPLAYED

On auto trucks the names appear on a brass plate near the driver's seat. Elsewhere the names are printed on cardboard and slipped into a frame so that they may be interchanged when changes are made.

This practice has accomplished two definite things. It has created better relations with the public through giving a personal touch to contacts between employees and customers and it has accorded a greater dignity to the individual employee within the organization.

◆

What Other Companies Are Doing

Cleveland, Ohio.—This city's fifth electrical home, which has just been completed, was sold for $45,000 cash before it was thrown open to the public. The new owner will occupy the home upon the close of the display, Nov. 1. The salability of the electrical homes in Cleveland is an interesting indication of the public's appreciation of the value of the convenience afforded.

New Orleans, La.—Following the plan of familiarizing themselves with all branches of the electrical industry, the members of the Electric League of New Orleans, as guests of Barton T. Baird, district manager of the Cumberland Telephone & Telegraph Company, held their October meeting at the company's headquarters. A tour of inspection of the plant was made and a demonstration of the switchboard and main exchange was given. Dinner was served in the company's dining room, and following this the regular session, which was designated as "manufacturers' night," was given over to talks by several of the leading electrical manufacturers.

Chicago, Ill.—New power business contracted for by the Public Service Company of Northern Illinois between Jan. 1 and Sept. 9 this year totals 16,122 hp. This is 5,000 hp. in excess of the same period in 1921. Electric range sales during the first eight months of 1922 were greater in number than those made during each of the years 1920 and 1921. The total number of houses wired from Jan. 1 to Sept. 2 was 572. Independent contractors wired 1,340 houses during this period, making a total of 1,912, nearly four times as many as were wired during the same period in 1921 and exceeding the number wired in 1920.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Evaporators in the Stationary Power Plant.—After a short review of elementary principles, this article takes up the high-pressure and low-pressure systems of evaporators, describing the apparatus and showing how the lay-out is determined by the heat balance of the particular plant. Attention is called to the fact that both low-pressure and high-pressure evaporators when properly fitted into the station heat balance return to the feed water most of the heat in the steam supplied to them, so that the selection must be made largely on the basis of first cost, reliability and labor required, giving due weight to blow-down and radiation losses.—*Power*, Sept. 19, 1922.

Hydro-Electric Plant at Goesgen, Switzerland.—The erection of an adjustable dam 90 m. wide across the River Aar, a canal 4.8 km. wide above the power house and a tailrace 1.4 km. in extent provided an average head of 15 m. at a maximum of 350 cu.m. of water per second for this modern station. Six turbines of 10,000 hp. maximum output each are now installed, with room for a seventh unit. These wheels are vertical-shaft units of the Francis type, with a speed of 83 r.p.m. to 93 r.p.m. According to the existing load conditions the best efficiency of these turbines is at 6,500 hp., when it is 85 per cent. The three-phase alternators have a continuous rating of 7,050 kva. at 70 per cent power factor and are wound for 7,700 volts to 8,400 volts. Four of the machines are designed for 50 cycles (83.3 r.p.m. and seventy-two poles) and the other two for 40 cycles (75 r.p.m. and sixty-four poles). Provisions are made to operate any generator at either of these two frequencies. Their efficiencies at unity power factor are about 95 per cent for loads between 5,000 kva. and 9,000 kva. An oil-pressure-operated brake is provided to stop the units quickly after shutdown. A 145-kw., 250-volt exciter with ten main poles and ten commutating poles is connected to the shaft directly above the thrust bearing. An interesting detail of these large machines is the fact that they are mounted about 5 ft. above the main floor on a number of heavy pedestals. This gives excellent ventilation for the machines and makes the regulating apparatus easily accessible. Seven forced-oil-cooled three-phase, 7,050-kw. transformers are installed in the switching building. Four of these transformers step up to 50,000 volts and three of them to 77,370 volts. The latter transformers have taps to deliver 50,000 volts in case of emergency. A double set of buses is provided for both the low (8,000) and the high (50,000 and 77,370) voltages of the station. The transformers, the buses, the switches and the protective apparatus are all installed under the roof in a spacious switch house. The erection of this important Swiss generating station entailed a large amount of difficult but very efficiently handled hydraulic building work, which is described and illustrated to the smallest detail in this elaborate book of fifty-seven pages with 138 illustrations. — *"L'Usine Hydro-Electrique de Goesgen" (published by the Motor Société Anonyme pour les Application de l'Electricité, in Baden, Switzerland)*.

Generation, Control and Switching

Fuel Saving.—R. BOSSELMANN.—A statistical survey of a great number of German isolated steam-power plants disclosed the fact that the average station operates at only about 20 per cent of its capacity, a low load factor which is responsible for a very high coal consumption per generated kilowatt-hour. Of the 2,500 plants investigated the overwhelming majority are direct-current systems. The author suggests changing these highly wasteful stations into substations, connecting them to high-tension trunk lines, and installing automatically operating rotary converters which can feed the local networks in conjunction with a storage battery. A specially designed contact-making wattmeter will start and stop the units without manual help, according to the demand. It is claimed that this method will elevate the load factor to some 66 per cent to 75 per cent and will result in a great saving of fuel. A projected change of such an isolated plant is described with all details considered.—*Elektrische Kraftbetriebe und Bahnen*, Sept. 10, 1922.

Transmission, Substations and Distribution

Economy in Substation Construction.—W. J. HOWARD.—A number of substations of very simple construction have been built by the Sheffield Corporation, England. Each accommodates two 1,000-kva. transformers, 11,200/2,030 volts, together with two 200-kva. transformers, 2,000/205 volts. Protective arrangements, building construction, ventilation, etc., are considered.—*Electrician*, Sept. 15, 1922.

Transmission Line of 120,000 *Volts.*—E. DUVAL and S. BOUKSPOUN.—Running from the 28,000-kw. hydro-electric power station at Basse-Isère two double three-phase transmission lines have recently been finished, operating at 120,000 volts. One line to Saint-Etienne is 42 miles long, the second to Saint-Chamond is 50 miles long. The design of the lines is such as to permit later an increase of the voltage to 150,000. Steel-aluminum cables were made use of throughout, with diameters of 13 mm. and 16 mm. respectively for the two lines. The larger cable for the second line was chosen on account of more severe climatic conditions of that right-of-way. Chains of six to eight Hewlett disks support the conductors and are used as double chains at crossings of road or other lines. Square-base steel towers with a frame-like top of three different types have been employed along the lines. The three conductors of each of the two double lines are carried on separate towers, so that the two are fully independent of each other.—*Revue Générale de l'Electricité*, Sept. 16, 1922.

Units, Measurements and Instruments

Oil-Testing Methods.—H. STAGER.—The author reviews the general properties of oils and gives a detailed description of different oil-testing methods, with the shortcomings of each. A method is then described which, the author claims, imitates as closely as possible actual service conditions. Aside from the proper amount of oxidation of the oil, the influence of copper upon it and its discoloration, a new feature is introduced by testing the mechanical strength of a sample piece of cotton, such as is used to insulate the windings of a transformer, before and after the influence of the acids in the oil upon it. The very complex nature of oil makes it necessary to investigate its behavior under a great variety of conditions to obtain a valuable and not too single-sided result.—*Brown-Boveri Mitteilungen*, August, 1922.

Chrono-Photographic Method of Measuring the Speed of Water Flow on Dams.—P. MORIN.—An interesting and simple method is described to measure the speed and acceleration of the flow of water. The speed of the revolving shutter of a camera is adjusted so as to produce streaks from a floating glass ball. The lengths of these streaks, measured against a simultaneously photographed scale, give an exact measure of the speed of the waterflow at every point within the field of the lens.—*Revue Générale de l'Electricité*, Sept. 23, 1922.

Relation Between Magnetic Hysteresis Loss and Coercivity.—N. L. ANDERSON and T. M. C. LANCE.—The principle presented is that the specific hysteresis loss is a function of the product of the coercivity and the maximum induction density. The value of the function is determined for different magnetic materials, and a general law deduced.—*Engineering*, Sept. 22, 1922.

The Regular Icosahedron as a Substitute for the Ulbright Sphere.—K. S. WEAVER and B. E. SHACKELFORD.—Owing to the difficulty of constructing large true spheres and to the limited head room usually available, a regular icosahedron has been selected as being most suitable for photometer work. The value of this shape was determined by means of experiments on a 30-in. model. As a result a 10-ft. icosahedron has been constructed for testing the largest street-lighting fixtures.—*I. E. S. paper, Swampscott, Mass.*, Sept. 25-28, 1922.

Illumination

Restoration of Burned-Out Incandescent Lamps.—H. LUX.—The article gives a review of the many possible methods of renewing the broken or burned-out filaments of incandescent lamps. Four main methods for such renewals are known: (1) The glass bulb may be made with a joint in the first place; (2) the bulb may be opened at the exhaustion tip; (3) same as in (2), but additional openings are made near the base of the lamp; (4) the bulb is cut open along the base and afterward resealed. The fourth method is being used to some extent in England and Germany, where the present high cost of new lamps makes the renewing of old lamps a commercial success.—*Zeitschrift für Beleuchtungswesen*, Aug. 14 and 31, 1922.

Motors and Control

Electric Drive in a Beet-Sugar Factory.—A. J. FORBESS.—The advantages and disadvantages of electric drive as compared with steam-engine drive are discussed from the standpoint of the operator and manager. A beet-sugar factory operates but one-third of the year, and the operating power is in the nature of a by-product, so that the higher power efficiency claimed for electric drive is not a deciding factor. It is shown, however, that properly applied electric motors give greater continuity of service, lower cost of operation, etc., than the steam engine.—*General Electric Review*, August, 1922.

Electric Blooming-Mill Drive.—S. N. ROBERTS.—As the subject of electric blooming-mill drive is very wide, the author confines himself to a specific example in which he gives a description of a particular drive with its special features, mentioning such operations and advantages as might apply to any blooming mill.—*Electric Journal*, September, 1922.

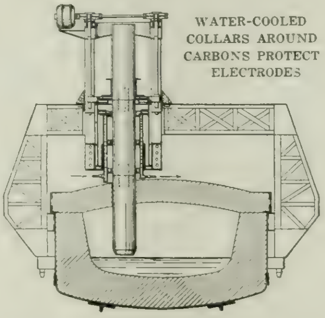
Electric Motors for Driving Pumps—R. A. JONES.—The author treats of the characteristics of reciprocating, rotary and centrifugal types of pumps, direct-current and alternating-current motors, speed control of motors and motor controllers.—*Power*, Sept. 5, 1922.

The Application of Electricity in the Manufacturing Industry.—In the manufacture of cement from its raw materials a variety of crushing and grinding operations are involved which readily lend themselves to the adoption of electric power. The severe conditions met with in crushing, grinding and calcining of the raw materials require that the electrical apparatus be of very rugged construction. The adoption of the synchronous motor and the magnetic clutch is described.—*Electrical News*, Sept. 1, 1922.

Troubles in Direct-Current Armatures.—MARIN PHILLIPS.—Much labor may be saved when winding armatures if coils are tested as they are placed in the slots. If trouble is found, it will be much easier to make repairs at this time than to make them after the job has been finished. The author points out the tests to make and gives some practical hints on correct methods of winding and connecting the coils so as to prevent trouble in the first place, with details of how to remedy defects which may develop.—*Industrial Engineer*, September, 1922.

Heat Applications and Material Handling

Electric Steel Furnace.—G. VITALI.—The Italian "Fiat" works have had such excellent results with their six 5-ton electric steel furnaces for the last few years that their new steel plant was equipped with four 20-ton and two 6-ton electric furnaces, to which eight more will soon be added. These latest three-phase steel furnaces have a number of unusual features, among which are a marked reduction of the electrode consumption, an easy and independent electrode removal and unusually low current requirement. Two concentric airtight and water-cooled collars around each of the three carbons prevent the flames from consuming the electrodes. Only the extreme end of each electrode is subjected to oxidation. As a rule, 8 kg. to 15 kg. of graphite electrodes were consumed in older types of furnaces, while the new model needs only 2.8 kg. per ton of melted steel. Each furnace is fed from a three-phase transformer, which delivers 130 volts and 2,000 kva. at the start, connected in Y, and 75 volts and 1,150 kva. during the refining period, when it is delta-connected. An average consumption of 0.7 kw.-hr. per ton has been established, after the production of about 1,250,000 kg. of steel. This figure comprises all transformer losses and also the heating of the furnaces during holidays. — *Electrotechnische Zeitschrift*, Sept. 21, 1922.



WATER-COOLED COLLARS AROUND CARBONS PROTECT ELECTRODES

Traction

Using Direct Suspension Trolley in High-Speed Train Service. — CLIFFORD HUTTLESTON.—A change from a rather infrequent service employing single 30-ton wooden cars operating at a schedule speed of 15 miles per hour to a frequent service using from one to six steel 50-ton cars per train operated at an average schedule speed of 47 miles per hour and a maximum of 70 miles per hour, without any material changes in the overhead construction, is what has actually taken place on the Chicago, North Shore & Milwaukee Railroad. The difficulties that were met and the manner in which they were worked out are related.—*Electric Railway Journal*, Sept. 23, 1922.

Steel-Mill Yard Electrification. — DAVID C. HERSHBERGER. — Electric power is already extensively employed for certain classes of transportation work in and about steel mills with marked success. The installation of electric locomotives to perform the yard transportation system service is an important step toward the perfection of the operation of the steel plant as a whole. The subjects covering electrification considered in this paper are: System of electrification to be used, connection to adjoining railroads, operating conditions, locomotive design and control equipment, and conducting systems most applicable.—*Electric Journal*, September, 1922.

Electrophysics, Electrochemistry and Batteries

Electrolytic Zinc Works in Tasmania.—A description of the largest zinc-producing plant in the world at Risdon, Tasmania. The plant is able to produce 30,000 lb. of zinc in twenty-four hours. The rotary-converter equipment for furnishing the low-voltage energy for the electrolytic process is described in detail.—*Engineer*, Sept. 22, 1922.

Preparation of Perchlorates by Heating Chlorates.—FRANK C. MATHERS and J. W. H. ALDRED. — Possible uses for perchloric acids for preparing electroplating baths, especially for lead, make a cheap source of perchloric acid desirable, and results of experiments seeking to increase the yield by heating chlorate under various conditions are given.—*American Electrochemical Society paper, Montreal*, Sept. 21, 1922.

Telegraphy, Telephony, Radio and Signals

Radio References and Classifications.—References to papers in current periodicals which are of interest to radio engineers and scientists for the month of August. The list includes practically all the literature on radio communication principles, measurements, standardization, apparatus, systems, applications, stations and radio manufacturing.—*Pamphlet of the Radio Laboratory of the Bureau of Standards.*

Printing-Telegraph Machine.—A description is given of a new machine telegraph that employs a five-letter alphabet, operates on the closed-circuit plan and is a seven-unit system. The printer is a combination of the Hughes and Baudot, and the transmitting speed obtainable is forty words a minute. Full details of the apparatus employed have been included in the description.—*Electrician*, Sept. 8, 1922.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

A. I. E. E. 1923 Meetings

New York, Swampscott, Pittsburgh and San Francisco Selected for National Gatherings

IN ACCORDANCE with its policy of holding four national meetings each year, the American Institute of Electrical Engineers has taken steps to arrange its program for the coming twelve months. The board of directors has approved the holding of two meetings, the midwinter convention in New York on Feb. 14 to 16 and the summer convention at Swampscott, Mass., on June 26 to 29. At a recent meeting of the meetings and papers committee it was recommended that one of the other conventions be held in Pittsburgh in April and the other one at San Francisco in the latter part of September or October. With four conventions distributed about the country, each member of the Institute, it is held, should be able to attend at least one national meeting.

Surplus Power from Paper Mills to Be Marketed

Organization is announced of a company to be known as the Power Corporation of New York with the object of developing water power for the use of paper mills, the surplus horsepower to be sold for general power purposes. The new company, which is backed by interests affiliated with the Northern New York Utilities, Inc., and the Northern New York Trust Company, has a capital of $1,000,000 preferred and 300,000 shares of no-par-value common stock and is authorized to issue $5,000,000 in bonds. It has acquired by purchase from the St. Regis Paper Company and the Hanna Paper Corporation the water powers at the six mills of these companies, developing some 38,000 hp. These power sites are at Deferiet, Herrings, Norwood, East Norfolk, Norfolk and Raymondville.

In addition, the Power Corporation of New York has acquired water powers on the Racquette River, near the power properties of the Aluminum Company of America, capable of developing an additional 60,000 hp. This is said to be the largest aggregate of hydraulic power in New York State and the East, with the exception of the Niagara Falls development.

The president of the new power corporation is John N. Carlisle, president of the Northern New York Utilities, Inc., and formerly State Highway Commissioner. Most of the directors are identified with the paper-mill industry in northern New York.

It is reported in this connection that the 25,000 hp. of electrical energy being generated by the Northern New York Utilities, Inc., at Brown's Falls, N. Y., is to be sold to the Utica Gas & Electric Company and will be transmitted over power lines now under construction from the power site in St. Lawrence County.

Important Patent Suits Come Before Supreme Court

The United States Supreme Court has granted a writ of certiorari in the case of the Webster Electric Company against the Splitdorf Electric Company and will hear argument in this case, which, it is said, will invalidate thousands of patents if the decision of the lower court stands. The case involves a charge of infringement of patent of the Kane oscillating magneto ignition equipment used on gasoline engines. The defense was that the device had been in use two years before application for a patent was made. The trial court held that there had been infringement, but the Circuit Court of Appeals reversed this decision.

Appeal by certiorari has been denied by the Supreme Court in the case of the Whiting Manufacturing Company against the Alvin Silver Company, another patent case. While the suit arose over a design for spoons, the principle declared by the trial court that the complete design must be registered was considered so important that a number of electrical equipment companies and other manufacturers intervened in asking review by the Supreme Court.

I. E. C. Will Meet in Geneva on Nov. 18

A meeting of the International Electrotechnical Commission will be held in Geneva, Switzerland, starting Nov. 18, to consider principally questions of rating, but also symbols, nomenclature, high-voltage standards and possibly the international situation on lamp sockets.

The United States will be represented by C. O. Mailloux, Clayton H. Sharp, H. M. Hobart, C. E. Skinner and two or three others. Messrs. Skinner and Sharp, accompanied by their wives, sail on Nov. 1 on the President Adams. Sailing dates of the others and the complete membership of the committee are not known as *Electrical World* goes to press.

Bars Power Line from Road

Nebraska Supreme Court Forbids a 13,200-Volt Circuit Because of Inductive Interference

A DECISION of the Nebraska Supreme Court handed down this month bars a 13,200-volt circuit from a portion of the Lincoln Highway on the ground that such a circuit will seriously interfere with the automatic signal system of the Union Pacific Railroad. The case arose originally through the activities of a firm of contractors which has been engaged in working up the construction of lines from neighboring transmission systems to small plants, largely municipal, thus bringing about the shutting down of these inefficient generating stations. In the case involved a line was to be constructed to serve the towns of Maxwell and Brady. The available route lay along the Lincoln Highway, for some distance adjoining the right-of-way of the Union Pacific Railroad. When the case came before the State Railway Commission of Nebraska evidence was submitted to show that such a parallel is dangerous to automatic block signals. So far as the record in the case indicates, no experienced witnesses appeared to give testimony counteracting that for the railroad, and on the showing of fact the commission refused permission to the contractors to build the line.

The case was taken to the Supreme Court on the plea that the commission, under the law, lacked authority to bar such lines from the highway and could only specify the construction and location to protect other utilities on or near the same highway. The Supreme Court dismissed the appeal without opinion, thus upholding the right of the commission to bar such lines from the highway if in its judgment they cannot be constructed and operated to avoid imperiling the service of other utilities.

Rehearing in Kahlotus Interference Case

The Supreme Court of the State of Washington has granted a rehearing on the petition of Receiver A. F. Phillipay of the Connell-Kahlotus Telephone Company. This is the case in which it was held that the Pacific Power & Light Company was not responsible for the cost of metallicizing telephone circuits and taking other measures to prevent troubles due to induction. It was shown that the power company had used every precaution in the construction of its own lines and that the telephone lines were not in good physical condition.

In the petition for rehearing the receiver claims that the decision sets up as law the assumption that an owner must preserve and guard his own premises from injuries caused by the wrongful acts of another. He contends that "allowing the power company to erect its power line and release its destructive influence within such close proximity to the plaintiff's established line is in violation of the constitution of the State of Washington," which declares that "no private property shall be taken or damaged for public or private use without just compensation having first been made." It is further claimed in the petition that there was no reason for the power company constructing its line in close proximity to the telephone line, and that the power company having elected to do so thereby became liable for the resulting damages. The case has been set for argument on Dec. 11 next.

International Power Plan

License Sought from Federal Board for Dam in Rio Grande to Serve Laredo, Mexico

THE first power project affecting the international boundary between the United States and Mexico which has come before the Federal Power Commission is that covered by an application of R. W. Morrison of St. Louis. It involves the erection of a power dam 30 ft. high in the Rio Grande 10 miles above Laredo, Tex. No public lands are involved, but Congress has declared on various occasions that the Rio Grande is to be regarded as navigable as far up as El Paso. The commission cannot, of course, authorize the construction of that part of the project located in Mexican territory but it is understood that the necessary permission already has been obtained from the Mexican government. It is the intention to install equipment capable of generating 5,000 hp. to supplement the 5,000-hp. steam plant which now is furnishing the electricity used in Laredo.

OTHER PROJECTS BEFORE BOARD

The Idaho Power Company has applied to the Federal Power Commission for a license covering a 44,000-volt transmission line from American Falls to Pocatello, Idaho. This line will connect the Idaho Power Company's system with that of the Utah Power & Light Company. The Idaho company has a large pumping load which during two months of the year reaches a high peak, and the interconnection will permit much more economical handling.

Anna P. Gray of Pueblo, Col., has applied to the commission for a preliminary permit covering three small projects at the headwaters of South Colony Creek in Custer County, Col. The primary power available is 1,080 hp. It is to be used for mining purposes.

The Home Power Company of Skagway, Alaska, has applied for a permit for a small project on Blank Creek just above the town of Skagway. The power is intended for public utility purposes.

Utility Control in Indiana

State-Wide Poll Shows Great Majority of Business Men in Favor of State Regulation

FIRST returns from a state-wide poll in Indiana on the subject of governmental regulation of public utilities show conclusively that the business interests of the state are overwhelmingly in favor of regulation of some sort. Those polled were the members of the Indiana State Chamber of Commerce, the Indiana Manufacturers' Association and the Indiana Bankers' Association. The returns show a vote of 614 to 48 in favor of regulation of public utilities. On the question whether the utilities should be regulated by the state the vote was 587 to 77.

Another question, "Should the state regulate even those utilities operating only in one city?" the vote was 589 to 88 in favor of regulation. The vote showed 604 to 52 in favor of keeping all regulation out of politics. When these returns were made public only about 30 per cent of those asked had yet voted, but the preponderance of sentiment was clear.

Just what attitude the cities now opposing state regulation will take in face of the poll is problematical, though city officials have organized an association whose main purpose is to introduce legislation inimical to the Public Service Commission at the coming session of the Legislature. The Mayor of Indianapolis has not been so active in opposition of late.

Miller Ranks Water Power Above Navigation

Governor Miller of New York continues to assail the St. Lawrence River development project as chimerical and has not hesitated to attack it even in the northern counties of the state, where it has the strongest support.

"The sooner our people get out of their heads this wild dream that it will be possible for ocean ships to ply back and forth between the Great Lakes and the Atlantic through a St. Lawrence Canal, the better," he is quoted as saying. "Of two related projects now under consideration — navigation and water power—the latter is far away and fundamentally the more important. The development of water power means that all of our people will be able to get the essential comforts and conveniences much cheaper than at present. It means that the cost of living will really come down. It means that before long we should have 1,000,000 hp. from the interior streams and 1,000,000 hp. from the St. Lawrence, or the equivalent of 20,000,000 tons of coal."

Importance of Publicity

West Virginia Utility Men, Meeting at Charleston, Plan to Promote It

AT THE annual convention of the Public Utilities Association of West Virginia, held at Charleston on Oct. 20 and 21, plans were made for a publicity campaign in the state to educate the public concerning the utilities. M. H. Aylesworth, executive manager of the National Electric Light Association, told of the advertising campaign launched by the body he represents.

Former Governor W. A. MacCorkle was toastmaster at a dinner given the delegates at the Kanawha Hotel, at which Mr. Aylesworth declared that within the next ten years public utilities will sell their securities over the counter in scrip form. He contrasted customer ownership of public utility stocks with political ownership and showed to what an enormous extent the people by direct ownership and through ownership by life insurance and other mutual companies were interested in the welfare of public utilities. Dozier A. Devane of Washington, D. C., a former member of the Florida Railroad Commission, supported Mr. Aylesworth's views and advocated that employees "sell" their companies to the users of public service. He pointed out that all public utilities had the common-law right to make rates themselves without any reference to public service commissions and that the commissions could not initiate rates. There was a line beneath which the commission could not go. It was the line of confiscation. But if the public utilities, in going above that line, charged more than a reasonable price for the service rendered, then the commission intervened.

OFFICIALS AGAINST PUBLIC OWNERSHIP

W. H. Hallanan, State Tax Commissioner, said that next to the banks the public utilities are taxed closer to the legal mark than any other taxpayers in the state. He depreciated the idea of municipal ownership, as it withdrew taxable assets from the tax lists.

Governor Morgan asserted that he knew of some public utilities that were taxed higher than their properties would sell for on the open market. Speaking from his four and one-half years' experience on the Public Service Commission, he urged that all public utilities continue to give improved service and when increases are needed ask for only as much as is their just due. He condemned municipal ownership and said paternalism and bolshevism, which he described as socialism in action, were the two arch enemies of government.

The association elected C. P. Billings of the Wheeling Traction Company president. Vice-presidents chosen were C. H. Brues of Wheeling, Mentor Hetzor of Moundsville and W. R. Power of Huntington. A. M. Hill of Charleston was re-elected treasurer and A. Bliss McCrum of Charleston was again chosen secretary.

Emergency Surplus Appeals to Bankers

At Del Monte Convention They Indorse the Principle of a Revolving Fund Under State Regulation as a Means of Protection to the Investor

AT THE convention of the Investment Bankers' Association of America held at Del Monte, Cal., two weeks ago the greater part of one day's session was devoted to a discussion of the public utility situation. The delegates had been informed by Paul Shoup that California had unlimited resources to offer for legitimate development and that certain of its public service and other quasi-public corporation issues were among the choicest investments now known.

In the course of the discussion relative to the junior financing of public utilities, H. R. Hayes of Stone & Webster, C. Peirce of San Francisco, L. Chamberlain of New York and Mr. Allen of Allen & Company, Chicago, took a prominent part. Mr. Hayes declared that the provision of a surplus to guard against lean years, approved by state regulation, would pave the way for a confidence in many junior securities that does not now exist. Mr. Peirce said that if such a reservoir were established, to be drawn upon for dividends and interest in lean years, it would do away with the argument that advocates of municipal ownership put forth of ability to borrow money at lower rates. The rate of money, he said, is obviously governed by the risk to the investor. Reducing this risk by the creation of an emergency surplus under state authorization and regulation, it was asserted, would mean the strengthening of this class of securities and lend greater protection to the investor.

W. Ross of Chicago related the experience of Cleveland, where a stabilizing fund of $400,000 is created to provide for "lean times" in the railway business. When this fund drops below a specified amount car fares are raised to replenish it, and when it increases above the limit fares are reduced. The arrangement is elastic, but the principle is sound, declared Mr. Ross.

Regulation Protects Investors

In his report on public service securities (published in part on page 945 of this issue) Chairman J. A. Prescott recommended that the convention indorse state regulation as a necessity in protecting the investors, saying:

"It therefore becomes obvious that if a corporation is prevented in times of peace from accumulating a cash reserve, it must be protected from the raids of uncontrolled competitors. The power to restrict vested in the hands of state authorities imposes upon such authorities the necessity and obligation to protect the corporation, and it is obvious that this protection is essential to the public interest.

"The protection, however, must not be carried to the point where the utility becomes indifferent to the public interest. It must be kept efficient through fear of competition in the event of failure to maintain its service. It has been determined that the best method of protecting the company from this destructive competition is for a state regulatory board to determine when and under what conditions utility service shall be extended into every given territory and to issue or decline to issue a 'certificate of public necessity or convenience,' which is a prerequisite to the construction of such extensions. In view of the large amounts of new capital required for additions and extension of facilities to provide for normal growth and the increased demands of various communities for new utility service, this committee feels that any effort which might result in reverting to discarded theories of competition in the public utility business would be destructive to the confidence that has been built up among investors in public utility securities and could not be other than harmful and expensive to both investors and the public served."

State Telephone Ownership Condemned in France

That the French Republic, where the government has a monopoly in the ownership and operation of the telephone system, has become weary of this arrangement is indicated in a report just submitted to the Chamber of Deputies by a commission appointed by the Chamber to make recommendations for the improvement of the French system, declared by hostile critics to be the worst in the world. This report, says a cable dispatch to the New York *Times*, recommends that the state turn the telephones over to a private company.

The report is based on investigations in the United States, Sweden and Norway. It says that in those countries the whole management of the telephone systems, from the chief director to the operators, is specialized, whereas in France one department runs the post offices and telegraph and telephone lines, and that in all services there is a lack of specialists and a superfluity of politicians. "In these countries," says the report, "the management is always trying to get new clients, whereas in France we just let clients come when we don't discourage or refuse them."

Deputy Jean Lambert, who heads the commission, declared that France must base her telephone system on the commercial spirit or it will never be good. He recommended a system like that of the United States, with telephones operated by private companies under government supervision. This recommendation is especially significant in view of the recent decision of the French government to go out of the railroad business and indicates the general trend away from state operation of utilities as inefficient and uneconomical. For the last two years the telephone administration has, it is said, been doing its best to discourage applications for telephones, the extra charge of 700 francs a year being frankly explained as for the purpose of preventing those who wish service from asking for them.

Oklahoma Men Meet

Tulsa Conference of Utilities Electric Division Considers Service and Public Relations

SERVICE and plant problems occupied a prominent part on the program of the Oklahoma Utilities Association's electric light and power division at the district meeting in Tulsa on Oct. 17. Fifty public utility men attended this one-day conference, and another meeting on Dec. 1 is contemplated. James H. Buell of the Oklahoma Power Company's Tulsa plant read a paper on plant construction and operation.

P. B. Stockwell, engineer of the Corporation Commission, told how public relations can be improved by giving customers the fullest information upon matters affecting service and rates. He cited instances where meager information given by employees to customers caused dissatisfaction and resulted in complaints to the commission. Some objectives the association was trying to accomplish by the speakers' bureau were outlined by Fred W. Insull, president of the association.

With the Oklahoma Public Utility Information Bureau sending letters each week to 255 newspapers in Oklahoma, O. D. Hall, acting secretary of the association, stated that the bureau had passed the experimental stage and was now operating successfully. He said that most editors of the state had gained confidence in the bureau and that they had come to rely on the news letter as a dependable source of utility information. He advised public utility operators not only to advertise more extensively but to keep their local newspapers fully informed relative to their improvements and their operating problems. Several manufacturers and jobbers were present, and they pointed out ways in which central-station operators could co-operate more fully in extending the sale of electrical energy.

An instructive address was given by C. L. Procter, general manager Empire District Electric Company, Joplin, Mo., on the subject of company organization and management. He said public utility managers should be pleasant, accommodating and progressive "boosters" for their own communities and should help to surround themselves with an organization that will give their patrons the most efficient and courteous treatment.

Salt Lake Has Fine Show

Rocky Mountain Electrical Exposition Scores Success and Wins Public Applause

LARGE attendance and a high degree of public interest marked the Rocky Mountain Electrical Exposition held under the auspices of the Rocky Mountain Electrical Co-operative League at Salt Lake City in the fortnight from Oct. 2 to Oct. 14. Both the exhibits and the electrical displays were on a scale never before attempted in the Utah city. The archway of jewels, illuminated each evening by a battery of twenty 18-in. searchlamps, proved a large factor in advertising the exposition, its brilliance drawing the admiration of the visiting throngs.

The Mayor of the city opened the exposition, which was held in the Bonneville Pavilion, and a set program was carried out every day, including radio concerts, demonstrations of high-frequency, high-tension current, educational talks on the use of electrical appliances in the home, demonstrations and experiments in the "Hall of Electrical Wonders," dancing and orchestral music. The demonstrations and experiments were made by P. P. Ashworth of the Utah Power & Light Company and H. T. Plumb of the Salt Lake City office of the General Electric Company. Mr. Plumb's "stunts" included the production of artificial thunder and lightning, the wireless transmission of light and demonstrations of corona. A spectacular electrical parade held on the evening of Oct. 5, a public wedding with electrical presents donated by dealers, prizes of electrical appliances for the winners of contests and the designation of certain days as "Old Folks' Day," "Students' Day" and so forth added to public interest.

The Rocky Mountain Electrical Co-operative League maintained an information bureau and rest room where its achievements and aims were presented to the public. The advertising and publicity program, launched about two weeks prior to the opening and continued throughout the period of the exposition, consisted principally of newspaper display advertisements and publicity stories, billboards, mailing "stuffers," street banners, window cards, automobile signs, street-car banners, motion pictures, radio announcements by Salt Lake City daily newspapers, circular letters and co-operative advertising by various business firms.

Among the exhibits that attracted most attention were those of the Utah Power & Light Company, the Union Pacific Railroad Company, the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Mountain States Telephone & Telegraph Company, the Edison Lamp Works, the Utah Copper Company, the Western Union Telegraph Company, the Intermountain Electric Company, the Capital Electric Company, the Western Electric Company and the Mine & Smelter Supply Company. The total list of exhibitors embraced fifty-five companies and firms, representing not only the Intermountain States but both coasts and the Middle West as well. A. M. Jackson was manager of the executive committee, P. L. Goddard secretary and R. C. Nash treasurer. The chairmen of other committees were: Exposition, P. M. Parry; finance, W. S. Hodgson; exhibits, H. M. Ferguson; electrical features, P. P. Ashworth; advertising, M. L. Cummings, Jr.; music, E. L. Dee; Commercial Club, J. L. Bracken; arch and searchlight, C. R. Higson; co-operation with engineering organizations, H. T. Plumb.

Supreme Court Sets a Date to Hear Water-Power Motion

The United States Supreme Court, before entering on a three weeks' recess last Monday, set Jan. 2, 1923, as the date to hear the motion of the federal government to dismiss the case brought by the State of New York challenging the constitutionality of the federal water-power act of 1920. The government bases its motion on the ground that the state has not brought the suit against the proper federal officials or presented a concrete controversy over which the court has jurisdiction.

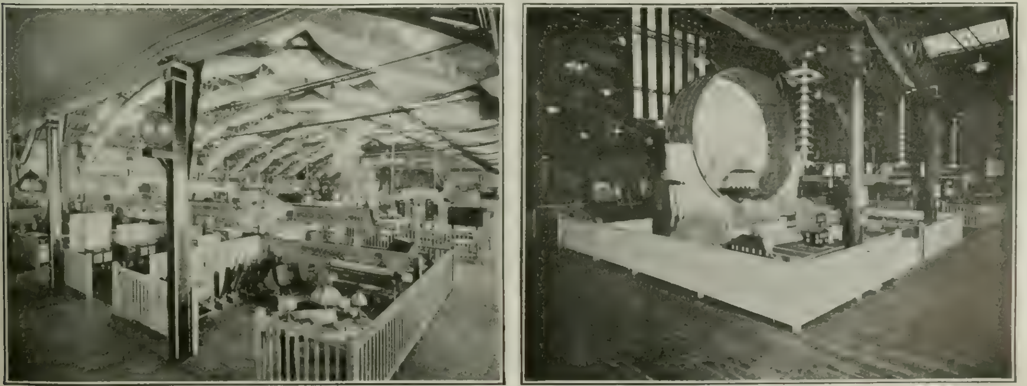
Technical Telephone Journal Appears

Vol. 1, No. 1, of the *Bell System Technical Journal* has been published. It is devoted to the presentation of technical and scientific articles in the field of communication engineering. It outlines its policy to collect, reprint and print articles of this character wherever obtainable in order to make them more available for communication engineers. The magazine is to be issued quarterly and has Dr. R. W. King as its editor with a consulting editorial board consisting of J. J. Carty, Bancroft Gherardi, E. B. Craft, F. B. Jewett, L. F. Morehouse, O. B. Blackwell, H. P. Charlesworth and E. H. Colpitts of the Associated Companies of the Bell System.

Public Utility Industry Is the Most Stable, Webster Says

"Any reasonable financing requirements of public utilities can now be met," said Edwin S. Webster, president Stone & Webster, Inc., to managers of railway, electric and gas properties under the organization's administration at the annual convention of executives held recently at Boston. Contrasting financial conditions of today with those prevailing at last year's meeting, Mr. Webster pointed out that during the twelve months the industry has had a very satisfactory and improving market, with declining interest rates for public utility securities. There should therefore be no present difficulty in financing any reasonable extension at a rate of interest from 2 to 4 per cent under what would have been needed a year ago.

"Since the beginning of the European war," the speaker said, "conditions have required the putting off of extensions as far as possible. In financial centers today, however, there is a better understanding of the whole public utility problem and a greater confidence in the business, which has proved, under the trying period which has been passed, to be the most stable of all industries."



GENERAL VIEW OF EXHIBITS, AND BOOTH OF THE UTAH LIGHT & POWER COMPANY

Industrial Engineers Discuss Economics

Elimination of Waste, Fundamentals of Maximum Production, the Engineer in Business and Welfare of Workers Are Among Topics at New York Convention

THE economics of industry was the main subject of discussion at the ninth annual convention of the Society of Industrial Engineers, which met in New York City on Oct. 18, 19 and 20, and an effort was made to determine the fundamentals necessary to maintain maximum production with minimum effort, waste and cost. The report of the American Engineering Council's committee on elimination of waste in industry shaped to a considerable extent the proceedings of the convention, at which the viewpoints of both worker and managing executive were presented.

President Joseph W. Roe, who is a member of the executive board of the American Engineering Council and head of the department of industrial engineering at New York University, in his opening address, said that the "hard-boiled" factory manager has been forced to accept the pure scientist from the laboratory and that the engineer, the chemist, the metallurgist, as the case may be, is now as accepted and necessary a part of large-scale industry as is the accountant.

"We are at another joining of the ways," added Professor Roe. "Fifty years ago it became apparent that industrial waste and mechanical inefficiency were no longer negligible. Today, with the increasing scale of production, it is becoming evident that social wastes are no longer tolerable."

A major cause of overproduction, according to Professor Roe, is the ignoring of the law of diminishing returns by industrial leaders.

ENGINEERS IN BUSINESS

J. H. Pardee, president of the J. G. White Management Corporation, New York, discussing "The Part of Economics in the Formation of a Policy of Business Administration," said that the engineer has presented the broadest and most comprehensive points of view of business practices.

Ernest Du Brul, general manager of the National Machine Tool Builders' Association, Cincinnati, speaking on "The Economic Aspect of Production," said that the idea that mere fabrication creates value is a common error of industry, continuing:

"The biggest and the most failures have been among the manufacturers of various kinds, fabricators of goods. Do these failures not indicate that something is very wrong with the economics these men applied in management? Business gets into such a state because business managers start out on false premises due to incomplete knowledge of economic theory."

Frank B. Gilbreth and L. M. Gilbreth of Montclair, N. J., presented a paper on "The Relation of Fatigue Elimination to Other Activities," which urged that the fatigue committee of the society work along two lines: First, increasing co-operation with others engaged in other types of work; second, development of units, methods and devices that will be useful in the elimination of unnecessary fatigue.

A feature of the convention was a discussion by William Geiger of Newark, representing the workers, and John A. Faust of New York, representing the executives.

Robert B. Wolf of New York, vice-president of the American Society of Mechanical Engineers and a member of the Hoover committee on waste in industry, in an address on "The Importance of the Elimination of Waste to the Economic Structure," said that in order to reduce industrial waste to a minimum industries must be so organized as to stimulate the workers' process of thinking.

Other prominent speakers at the convention covered a wide range of activities. Professor Roe was re-elected president of the society, F. C. Schwedtman of New York treasurer and George C. Dent of Chicago secretary and business manager.

Engineering Men Observe "Management Week"

"Management Week" meetings, bringing forcibly to public attention the increasing importance of the engineer in industry, were held in thirty cities in the week of Oct. 16-21, under the auspices of the American Society of Mechanical Engineers, the Society of Industrial Engineers and the Taylor Society. With these societies other engineering organizations and civic and economic bodies co-operated. Especially noteworthy were the meetings held in New York, Chicago, Indianapolis and Cambridge, Mass.

Messages presenting the American, the English and the German points of view were read at meetings throughout the country. Dexter S. Kimball, president of the A. S. M. E., speaking for the American engineer on the question of management, expressed the following views:

"The engineer has been drawn into the field of management partly because of his proximity to the problems of industry, partly because of the exigencies caused by the rapid growth of scientific methods, but more particularly because of his scientific method of attacking problems of all kinds. It has been found that his methods of attacking the problems of design and construction are powerful tools in handling the problems of administration. There can be little doubt that the engineering executive is to remain a dominant figure in industrial management. I do not contend that he alone can solve these human problems, but I do believe that if he will give his best effort to this work he can make a contribution that will go a long way toward the attainment of industrial peace."

James F. Whiteford, discussing the "Development of Management in the United Kingdom," said: "In general, it may be stated that management practices in the United Kingdom are following very closely the same sequence of developments as have been instituted in American industries. The application over here is a few years late, but the best portion of the practices in American industries are being fairly generally accepted over here."

G. Schlesinger of Charlottenburg, Germany, told of "The Development of Scientific Industrial Organization in Germany," saying: "It gives me pleasure to be able to place before the American industrial world some proofs of successful results in scientific and practical industrial organization in Germany. I am convinced that after a long period of 'lagging behind' we have at last caught up with the Americans in scientific management; but the deeper foundation that we possess and the greater economy in the manipulation of our system (we can carry out the work of accounting in factories according to our method with half the personnel that is required with the usual American system) will perhaps prompt American industry to take note of our organization, science and practice, as the German industry once gladly and gratefully accepted advice and information from American sources."

Oregon Commission's Rules for Rural Service

After many preliminary trials and hearings, the Public Service Commission of Oregon has promulgated a new set of rules for rural service which became effective on Oct. 15.

By the new rules the utility is required to finance and construct a rural extension on its own right-of-way where the cost does not exceed four dollars for each dollar of minimum annual revenue to be obtained from the extension. Should the cost exceed the above sum, the utility may require an advance deposit from consumers covering the excess cost estimated on a pro rata basis.

If the extension is on the consumer's right-of-way, the consumer is required to finance the entire extension and the construction work must be done by the utility at the expense of the consumer. The ownership of a completed rural district system is vested in the utility, and it is responsible for operation, maintenance and replacements. Rules are made covering refunds, rates and accounting methods, and the way is paved for arbitration by the commission in disputed cases.

Headwater Regulation Next

Rules Affecting Improvement Will Be Based by Power Commission on Broad Principles

With the depreciation and accounting regulations on the road to solution, the staff of the Federal Power Commission now is turning its attention to the headwater improvement regulation. Every effort will be made to obtain the best thought in the industry in the formulation of this very important regulation. Fully as much gray matter must go into the drafting of it as has been required in the formulation of the two other regulations mentioned.

The commission's staff is engaging in this work with the idea of setting up certain broad principles. Conditions vary so widely on different streams that it is recognized that any effort to apply detailed rules would result in an unnecessary burden on water development.

Under existing conditions the one who creates a headwater benefit gets nothing from it unless he can arrange a working agreement with the project further down the stream. The ideal condition, it is pointed out by the Federal Power Commission men, would be to have each river developed by a single concern. Since this is manifestly impossible, a plan must be worked out whereby reservoirs can be operated to the maximum advantage of several projects.

The importance of this regulation will be better understood when it is considered that it will apply to a very large number of streams, among which are the San Joaquin, Mississippi, White, Ouachita, Grand, Green, Columbia, Clamath, Deschutes, Feather, Yuba, Stanislaus, Merced, Kings and Kern.

There is acute need at this time on the San Joaquin River for the determination of the commission's headwater policy. The headwaters of that system have been improved by the Southern California Edison Company. Below this large reservoir system, now partly constructed, the San Joaquin Power & Light Company has an important plant. The operation of that plant could be materially affected by the handling of the reservoir system.

There will be need on the Mississippi in the near future for the determination of questions arising as to the handling of reservoirs. The War Department stores water on the headwaters of the Mississippi for navigation purposes. Other reservoirs will be constructed in the near future in that region. There already is a demand to know just how that storage will be handled.

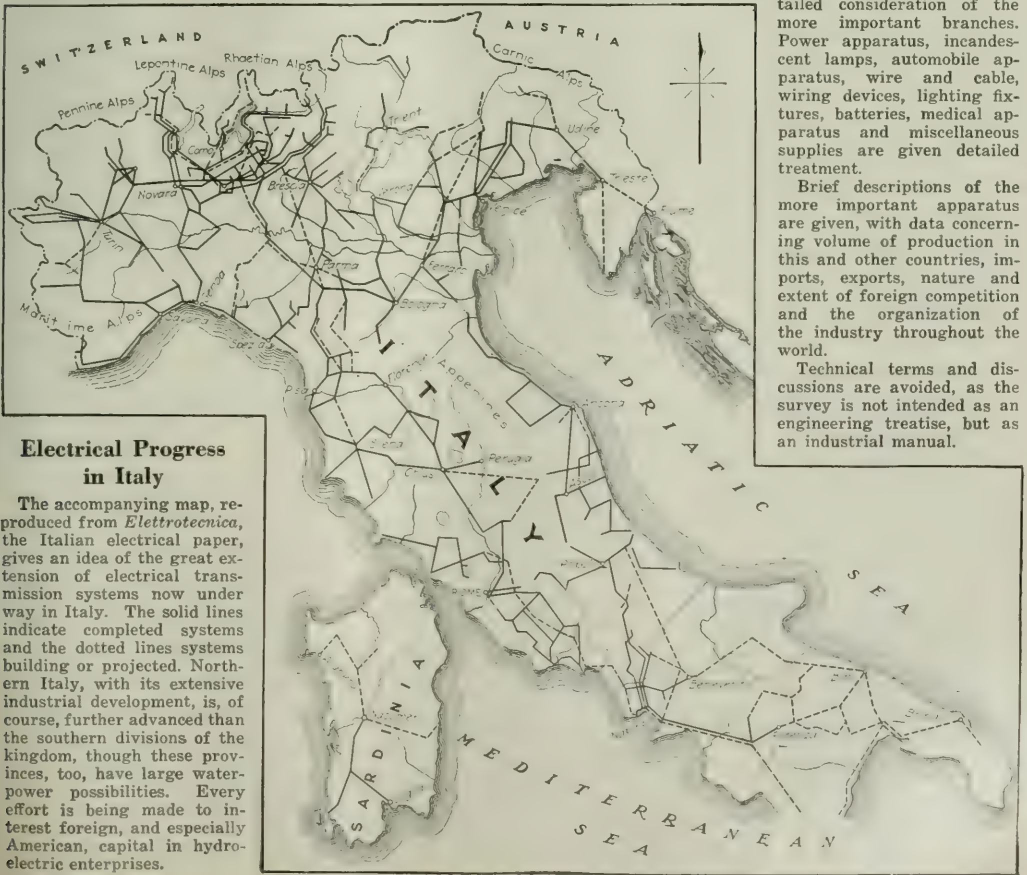
The Chippewa is an example of a river which is controlled under a state law. The Flambeau reservoirs are operated under a charter from the State of Wisconsin under which a charge may be collected from each of the plants benefited.

Electrical Industry Survey Issued by Tariff Board

The Tariff Commission has just issued a tariff information survey on the electrical industry. Intended as an aid to scientific tariff legislation, it presents briefly the pertinent facts as to the competitive situation of the industry in the United States and abroad. A brief survey of the whole industry is followed by a separate and more detailed consideration of the more important branches. Power apparatus, incandescent lamps, automobile apparatus, wire and cable, wiring devices, lighting fixtures, batteries, medical apparatus and miscellaneous supplies are given detailed treatment.

Brief descriptions of the more important apparatus are given, with data concerning volume of production in this and other countries, imports, exports, nature and extent of foreign competition and the organization of the industry throughout the world.

Technical terms and discussions are avoided, as the survey is not intended as an engineering treatise, but as an industrial manual.



Electrical Progress in Italy

The accompanying map, reproduced from *Elettrotecnica*, the Italian electrical paper, gives an idea of the great extension of electrical transmission systems now under way in Italy. The solid lines indicate completed systems and the dotted lines systems building or projected. Northern Italy, with its extensive industrial development, is, of course, further advanced than the southern divisions of the kingdom, though these provinces, too, have large water-power possibilities. Every effort is being made to interest foreign, and especially American, capital in hydroelectric enterprises.

Condemns Burning Raw Coal for Power Generation

Advocating the establishment of a permanent bureau of coal economics to furnish the country with the truth concerning wages, prices and other details of the coal situation, Floyd W. Parsons, editorial director of the *Gas Age-Record*, told the Western Society of Engineers at Chicago on Oct. 9 that this is one of four steps that should be taken toward the solution of the problem. The other three were to set up a legal definition of what constitutes a fuel emergency, including a minimum below which the total coal supply of the country must not pass; the institution of compulsory arbitration, and provision enabling the government at some stage of any controversy to step in and take over the industry and operate it till a settlement shall have been reached. Mr. Parsons said that the cost of the last coal strike was $1,200,000,000 and that even if the cost of intervention on the part of the government had been $500,000,000 there would still have been a material saving. He asserted that the mining of coal is not seasonal to the extent generally believed, the production of bituminous during the six warm months averaging about 43,000,000 tons per month and in the other six months about 57,000,000 tons.

Mr. Parsons held that much can be done by storage and proper distribution of buying to enable the mines to operate more efficiently and to relieve the railroads of heavy haulage during the cold months. Reduction of the number of miners and consolidation of many of the smaller mines were advocated. He also took a stand against burning coal in its raw state, saying that the various by-products should be extracted and used, the gas being employed for power generation.

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Movement to Co-ordinate Engineering Activities

At the call of the president of the American Institute of Electrical Engineers, the chairmen of several committees of the Institute, of the National Electric Light Association, of the American Electric Railway Association and of the Association of Edison Illuminating Companies, all dealing with power-station problems, met in New York last January to arrange some plan for co-ordinating the work of the committees to prevent undesirable duplication and so as to allocate subjects to the proper bodies. During the recent meeting of the Technical Section of the National Electric Light Association at Milwaukee another gathering of these men, together with their successors in the committee chairmanships, was held, and it was decided that the committee on co-ordination should hereafter consist of those who are serving as chairmen of the several committees concerned, in place of those originally participating.

These committees are the electric machinery and power-station committees of the American Institute of Electrical Engineers, the prime-mover and electrical apparatus committees of the National Electric Light Association, the committee on power generation of the American Electric Railway Association and the steam-turbine and generator committee of the Association of Edison Illuminating Companies. It is understood that representation was desired from the American Society of Mechanical Engineers, but the organization and work of that association is arranged in such a way that there are no committees whose work corresponds in scope with that of the committees represented.

At the Milwaukee meeting it was decided also that the chairman of the power-station committee of the American Institute should act as chairman of the co-ordinating committee. One means, and an effective one, of bringing about the desired co-ordination is by an interlocking committee membership, and several appointments to committees have been made with that in view. This enables all committees to be familiar with the work of the others. While the American Institute deals more particularly with the technical and scientific side of the power-plant problem, the other committees are interested in new developments, operating problems and application of equipment. Working alone, the various organizations to a greater or less extent duplicate each other's work. Set up as the co-ordinating committee is, the duplication of effort can be eliminated and the greatest good obtained with the least effort.

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Arkansas Utilities Association Formulates Program

The keynote of the convention of the Arkansas Utilities Association, which meets at Hot Springs Nov. 7, 8 and 9, will be the promotion of good public relations, with the object of more and better business and the resultant upbuilding of the state. Among the speakers expected are E. W. Lloyd of the Commonwealth Edison Company of Chicago, past-president of the National Electric Light Association; W. F. Wickshire, secretary of the Ohio Brass Company, Mansfield, Ohio; Earle Hodges, director of the Arkansas Public Service Information Bureau; Judge E. B. Downie and C. Hamilton Moses, all of Little Rock.

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Colorado River Commission to Meet on Nov. 9

The much-postponed meeting of the Colorado River Commission is now announced to begin on Nov. 9 at Santa Fé, N. M. Secretary Hoover of the Department of Commerce has made arrangements to attend. According to Washington advices, enough is known as to the sentiment within the seven states concerned immediately with the use of the waters of the Colorado to indicate that a final settlement will probably be reached at the coming hearings.

Brief News Notes

Hydro-Electricity in Jugoslavia.—According to government figures just published, Jugoslavia possesses about 3,500,000 hp. of available water power, of which only 160,000 hp. is utilized. Efforts are being made by the Belgrade government to interest foreign capital in the electrification of the country.

Sioux City Companies to Merge.—A merger of the Sioux City Gas & Electric Company and the Sioux City Service Company is under way, having been approved by the City Council as well as by a popular vote. A twenty-five-year franchise will be granted to the new company. The details will probably be completed next month.

Code Revision Committee to Meet.—The committee having charge of the revision of Part 2 of the Electrical Safety Code will meet in Washington early in November to draw up standard specifications for wire crossings and other matters pertaining to overhead lines. Any one having suggestions to make is asked to acquaint members of the committee or the Bureau of Standards at Washington.

Uniform Rates Established at Chicopee.—The Chicopee (Mass.) municipal electric light department has reduced its sliding scale of charges, establishing a maximum of 6 cents per kilowatt-hour and abolishing the difference in rates for energy used for power and lights. A flat charge of 35 cents a month for each consumer has been imposed as a service charge. The new rates will be effective Dec. 1.

Watonga Accepts Central-Station Service.—On Oct. 4 the city of Watonga, Okla., cut in on the Oklahoma Gas & Electric Company's transmission line and abandoned the local municipal electric plant. Watonga will be operated under the Enid division and will purchase wholesale energy. The municipal plant was abandoned because of the inefficient high cost of operation, limited capacity and the fact that it supplied only eighteen-hour service. Geary, 15 miles south of Watonga, will also have central-station service as soon as the transmission line is completed.

Automatic Telephone Service Between Subscribers Inaugurated in New York City.—Telephone subscribers connected with the Pennsylvania exchange in New York City began calling their own "parties" last week and got along as well as formerly, when the telephone girls did the work, according to the report of the New York Telephone Company. Seventeen hundred trunk lines and a total of 9,000 telephones were changed over from the old-style of operation to the new method by which the subscriber manipulates a dial on his own telephone and is connected mechanically with the number which he is seeking. Instructors had been working for many weeks. There are approximately 1,050,000 telephones in New York City, as well as tens of thousands of unfilled applications for instruments, and it will be more than ten years before the machine-switching telephone will have completely supplanted the present type.

Transmission Line Built in Record Time.—Building a transmission line 19 miles long in thirty-three actual working hours is a record established by the construction crew of the Mountain States Power Company at Myrtle Point, Ore. This three phase, 20,000-volt line connects Myrtle Point with Powers, Ore. A logging railroad paralleled the right-of-way, and by means of a locomotive crane the 334 poles were set in twenty-two and one-half hours. The No. 4 hard-drawn bare copper wire was strung by the aid of this crane in ten and one-half hours.

Japanese Railroad Electrification.—According to the *Japan Advertiser*, another big electrification project has been adopted by the Japanese Department of Railways, involving the electrification of the Tokyo-Odawara and the Tokyo-Yokosuka lines. The new project insures the electrification of the whole trunk line from Tokyo to Kobe. The work is to be started with the laying of overhead cables over the present tracks from both terminals. Most of the power is to be obtained from private power companies along the line, about twenty-five transformer stations being required between Tokyo and Kobe. The entire expenditure is estimated at 67,000,000 yen (about $33,500,000).

Washington Water Power Company to Take Over Okanogan Plants.—Through a stock merger the Washington Water Power Company will on Jan. 1 next take over the Okanogan Valley Power Company, operating two hydro-electric plants with 100 miles of transmission lines that supply light and power to towns and farming districts of the Okanogan Valley. The Washington Water Power Company will extend its lines into the new field to connect with the south end of the Okanogan territory at Pateros on the Columbia River. It is estimated that the connection will require from 55 miles to 70 miles of 60,000-volt transmission lines.

Hydro-Electrical Growth in Maine.—In order to keep ahead of demands the Central Maine Power Company has embarked on plans which call for the development of 6,800 additional horsepower. About 1,000 hp. will result from the redevelopment of the Union Gas & Electric Company plant on the Messalonskee stream in Waterville and 4,300 hp. from placing a new generating unit in the Skowhegan plant. About 1,500 additional horsepower will be provided by placing another unit in the Deer Rips station in Lewiston. In August, normally a dull month for power, there were days when the demand for service from the Skowhegan plant was so great that electricity had to be generated by steam in the Farmingdale station.

New Hydro-Electric Plant Begun at Wendell, N. H.—The Lake Sunapee Power Company, recently incorporated under the laws of New Hampshire with a capital of $300,000, has begun the construction of a 1,000-hp. hydro-electric generating plant at Wendell, N. H., on the Sugar River. The work includes a new dam and steel penstock, with generating machinery. A ten-year contract has been entered into between the Lake Sunapee company and the central-station companies supplying energy to Newport and Sunapee, N. H., and the lighting companies have an option to purchase the Lake Sunapee company's development at an appraised value, fixed in such case by the Public Service Commission.

Potomac Company Expanding.—In order to take care of expanding business, particularly in the domestic lighting field, the Potomac Electric Power Company of Washington, D. C., has appropriated $1,500,000 for plant improvement and extension in 1923, or $500,000 more than its recent annual expenditure for this purpose. The generating plant is being changed over for direct 60-cycle generation. One 12,500-kw. generator is being installed to replace a 9,000-kw. vertical unit. The new generator will be in operation in November, and another of the same type has been ordered for delivery Jan. 1 to replace a 5,000-kw. vertical unit. An additional high-tension 13,000-volt line from the Bennings power house to the substation is planned.

Village Plant Gives Up After Nine Years.—The taxpayers of the village of Lone Rock, Wis., have voted, 120 to 2, to abandon their municipally owned electric plant. Testifying before the Wisconsin Railroad Commission, the president of the village said that the power plant was broken down and entirely out of commission, although $1,000 had been spent for repairs in seven months. "We have been charging 18 cents per kilowatt-hour and that sum has not been sufficient to meet our cost of operation; I think the cost of operation is nearer 25 cents per kilowatt-hour," said the president. "It is for the best interests of the village to sell its plant and distribution system and contract for power and light from the privately operated company, which will supply us with electricity at 12½ cents, net, a kilowatt-hour."

Leipzig's Electrical Exhibition.—From Leipzig, Germany, comes an account of the annual autumn fair held there, which this year lasted from Aug. 27 to Sept. 2 with a record number of exhibitors and visitors, the latter being put at about 155,000, of whom 26,500 were foreigners, and the former reaching 13,019. It is claimed that this is the largest commercial fair in the world. The technical part of the exhibition is held in fifteen large halls, and electrotechnics holds the leading place. A splendid new building, to be called the "Haus der Elektrotechnik," is in course of erection for this display, which embraces practical devices of all kinds required in electrical installations, switches, insulating material, heating and cooking apparatus, lamps and lighting apparatus, meters, household appliances, electrotherapeutic devices, as well as heavy machinery for generating plants and, in short, electric manufactures of every description.

Associations and Societies

Wisconsin Utilities Association.—The 1923 convention of this association has been fixed for March 22 and 23 at the Hotel Pfister, Milwaukee.

Toronto Section, A. I. E. E.—The October meeting of this section had a record attendance of 170. Frank Ewart, a vice-president of the Institute, described its aims, and an attractive program of papers by prominent engineers was outlined for the coming season.

Cleveland Section, A. I. and S. E. E.—At the November meeting of the Cleveland District Section of the Association of Iron and Steel Electrical Engineers, J. S. Rowan, president Rowan Controller Company, Baltimore, will present a paper on "Installation and Care of Automatic Controllers in Steel Mills." The paper for the December meeting will be by Charles W. Burrows, New York, on the "Commercial Application of the Magnetic Analysis in the Iron and Steel Industry."

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Electric Power Club—Asheville, N. C., Oct. 30-Nov. 2. S. N. Clarkson, Kirby Bldg., Cleveland, Ohio.

Arkansas Utilities Association—Hot Springs, Ark., Nov. 7-9. R. P. Brown, Little Rock Ry. & Electric Co., Little Rock.

Electrical Credit Association (interstate convention)—Philadelphia, Nov. 10. J. W. Crum, 1328 Land Title Bldg., Philadelphia.

Ontario Association of Electrical Contractors and Dealers—Toronto, Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.

National Association of Railway and Utilities Commissioners—Detroit, Nov. 14-17. J. B. Walker, New York Transit Commission, New York.

Electrical Manufacturers' Club—Hot Springs, Va., Nov. 15-19.

Electrical Credit Association, Central Division—St. Louis, Nov. 16-17. F. P. Vose, 1347 Marquette Bldg., Chicago.

Electrical Supply Jobbers' Association—Cleveland, Nov. 20-24. Franklin Overbagh, 411 S. Clinton St., Chicago

American Society of Mechanical Engineers—New York, Dec. 4-8.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

National Electric Light Association—New York, June 4-8.

Commission Rulings

Competing Company Allowed to Enter Occupied Territory When Inadequate Service Is Proved.—A second electric utility may, according to a decision of the Indiana Public Service Commission in passing upon a petition from the municipal authorities of Parker City, be permitted to render service in a municipality where it is shown that the utility in possession is rendering inadequate, insufficient and unsatisfactory service, that there exists no reasonable prospect of improvement and that adequate and satisfactory service could be obtained from the utility desiring to enter the field.

Proper Charge for "Contact" Service.—The Wisconsin Railroad Commission has permitted the Oconto Service Company to increase its rate to the Oconto Electric Company for "contact" rental. The commission found that the relation which the total expense of operating and maintaining the poles, wire supports and wires of an electric utility bears to the investment in distribution system, excluding meters and transformers, may fairly represent a proper relation between these items, excluding wires, in a proceeding to determine a proper charge for contact service supplied to another utility. A return of 8 per cent on the investment in poles, cross-arms and insulators was allowed.

Inadequate Past Earnings and Past Deficits in Relation to Rates and Going Value.—The New York Public Service Commission, in arriving at a rate schedule for the Western New York Utilities Company, held that accrued depreciation should be deducted even though evidence was presented to show that the company had not had an adequate return and that therefore its reserve for depreciation as set up on its books had not been earned. The commission further declared that deficits over a period of more than twenty years do not constitute going value, since the public does not insure a utility against loss and said that if poor judgment has been exercised in the management of the company the present and future ratepayers should not suffer thereby.

Rates for Peak and Off-Peak Service.—In establishing rates for the Midwest Power Company the North Dakota Board of Railroad Commissioners made several observations respecting peak and off-peak service. The rates for commercial power service, it said, should be on a basis considerably lower than that fixed for commercial lighting since power service is largely an off-peak load and there is less expense in reading meters, accounting and collecting. Street lighting, which is metered with one instrument and is largely a peak-load service, compares very favorably with general lighting, and a rate for such service may be determined by establishing a rate equivalent to a further step in the commercial lighting scale. A low rate, the commission held, should be established for cooking by electricity, since this service is almost entirely an off-peak load and comes into close competition with fuel, making a low rate advisable from the standpoint of development.

California Commission Orders Coast Valleys Company to Extend Service.—The California Railroad Commission in two related decisions denied on rehearing the Del Monte Light & Power Company's request to serve East Monterey and Seaside and ordered the Coast Valleys Gas & Electric Company to serve this district. The two companies are closely related, the Del Monte company buying its electrical energy from the Coast Valleys. The commission held that the latter company was better able to serve the district in question and that it was its duty to extend its lines when applications were made for service. The Coast Valleys company objected to extending its lines on the ground of cost, but the extension was ordered made without expense to consumers and completed by Dec. 1.

Overhead Construction Rules Will Be Strictly Enforced in California.—Charged with the enforcement of the state law in reference to overhead electric line construction, the Railroad Commission of California has issued an order directing the Pacific Gas & Electric Company to eliminate by Aug. 1 of next year specified infractions of the law in its San José division and by Dec. 31 of next year to bring its entire system within the provisions of the law and the regulations of the commission. This order follows an inspection in the San José division made by engineers of the commission and representatives of the utility. According to the report 13,972 infractions of the law and other hazardous conditions were found. The original act, adopted in 1911, required all overhead electric line construction to conform to specified standards and gave the utilities five years to bring their old construction up to the new standards. In 1915 the law was amended to give the commission discretion in granting extensions of time and also to place the duty of enforcing the act upon the commission. Owing to the scarcity of labor and the high cost of material during the war period extensions of time were granted to all the utilities affected. Under the law as amended the commission has power to make additions or changes necessary for the safety of employees and the general public, and the commission now announces that it will require hazardous conditions to be remedied even when they are not in violation of the letter of the specified provisions of the state law. In the case of minor infractions existing prior to 1911 the commission said that extensions will be granted so that these conditions will be corrected in the ordinary course of maintenance or reconstruction work. When work is required to be done on any pole the entire structure must be brought into full compliance with the law. A like order was issued applying to the Coast Valleys Gas & Electric Company, on whose system 4,178 infractions and certain other hazardous conditions were found. This company has until July 1, 1923, to complete compliance with the commission's order.

Recent Court Decisions

Powers of Public Service Commission Not to Be Extended by Implication.—The New York Supreme Court, Appellate Division, has found, in City of New York vs. Public Service Commission, that the statute creating the commission did not repeal by implication former statutes creating a board of commissioners of electrical subways for the city of New York and requiring corporations using electrical wires to run them through the subways, transferring the power of the Board of Electrical Control to the city of New York, and apportioning such powers among city authorities, and that the commission cannot exercise jurisdiction over the charges for the use of such conduits. Powers given to the Public Service Commission, the court holds, should not be extended by implication beyond what may be necessary for their just and reasonable execution. (195 N. Y. S. 815.)*

Combinations to Increase Price of Electrical Installations Not Exempt Under Labor Clause.—J. W. E. Johnson, a dealer in electrical apparatus, was indicted and convicted in Colorado of two offenses—setting up a combination to increase the price of electrical apparatus and endeavoring to increase the price of electrical installations. His defense was that labor was excepted from the statute by a special clause and that therefore any combination as to installation was lawful. The Supreme Court of Colorado has ruled as follows: "Since electrical apparatus is usually sold with installation, to control the price of installation would be practically to control the price of the apparatus and to defeat the law. It follows that the control of the price of installation in such a way as to control the price of the goods is unlawful unless the statute somewhere permits it. . . . While labor is not a commodity under this act, yet electrical apparatus is. The control of the commodity price is forbidden and any sort of combination to control or establish its price is unlawful. It is unlawful then to control the price of electrical apparatus by means of the control of the price of labor, and so holding we do not treat labor as a commodity. It cannot be said, therefore, that the control of the price of installation is permissible under the statute."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Guthrie to Serve on Communications Board

Chairman Lasker of the Shipping Board recently designated F. P. Guthrie, head of the radio division operating department of the board, as the representative of the Shipping Board and Emergency Fleet Corporation to serve as a member of the interdepartmental committee appointed to study the problems to be considered at the forthcoming international conference on electrical communications.

◆

A. Jydstrup is now treasurer of the municipal electric light plant, Summit, S. D., replacing L. N. Thompson.

Gus Hadwiger is now vice-president of the Southwestern Utilities Company, Alva, Okla., replacing C. B. Zeigler.

W. E. Phelps is now president of the municipal electric light and water plant at Carmen, Okla., replacing E. A. Young.

Charles O. Wood is now secretary of the Southwestern Utilities Company, Alva, Okla., replacing W. W. Heironimus.

William C. Elder is now secretary and treasurer of the Belle Center (Ohio) Light & Power Company, replacing R. F. Harrod.

Boyd Simpson is now director of public service of the municipal electric light plant at Bellefontaine, Ohio, replacing R. P. Hoover.

R. L. Hearn, formerly with the Hydro-Electric Commission of Ontario, is hydraulic engineer for the Washington Water Power Company, Spokane.

Herman Russell was recently appointed to the board of directors of the Rochester Gas & Electric Corporation in recognition of his services as vice-president and general manager.

Frank B. Faris, until recently chief examiner for the Public Service Commission of Indiana, has become associated with Haynes & Mote, attorneys at law and public utility counselors in Indianapolis.

J. W. Perry is retiring from his office as treasurer of the Associated Manufacturers of Electrical Supplies and also from his membership on the board of governors of that organization. Mr. Perry was the guest of honor at a dinner given on Friday evening, Oct. 20, at the Yale Club, New York City, by the present board of governors.

J. E. Brickenden has joined the staff of the Canadian General Electric Company, Winnipeg, Manitoba. Mr. Brickenden until recently was Western representative of the Canadian Edison Appliance Company, which has been absorbed by the Canadian General Electric. He will continue to look after the Hotpoint lines in Manitoba, Saskatchewan and Alberta and will handle the jobbing end as in the past, including the Canadian General Electric branches.

◆

A. D. Flinn Heads Engineers

Alfred D. Flinn, who has been elected director of the Engineering Foundation, is the first incumbent of the new post created by the foundation's governing board—which is composed of the four founder societies of civil, mining, mechanical and electrical engineers—to meet expanding activities of the body.

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A. D. FLINN

From 1893-1902 he was identified with municipal engineering enterprises in Boston as a member of the engineering staff of the Metropolitan Water Works, and during his latter years with this organization he lectured in the Lawrence Scientific School of Harvard University. During 1905-1918 he was division engineer, department engineer and deputy engineer of the Board of Water Supply of the City of New York in the construction of the Catskill aqueduct and reservoirs. He has been associated with technical journalism as an editor and is the author of numerous books and articles on engineering.

◆

G. B. McNair has been appointed district lighting specialist for the Westinghouse Electric & Manufacturing Company, with headquarters at Denver, Col. Mr. McNair will cover both the Denver and Salt Lake territories and will specialize on street lighting. Mr. McNair is a Purdue graduate and has until recently been a member of the organization of the Western Electric Company at Denver.

South Norwalk Shows Its Appreciation of A. E. Winchester

Albert E. Winchester, who has been general superintendent of the South Norwalk (Conn.) municipal plant for thirty years, was recently the recipient of a purse of a thousand dollars from his fellow-citizens in token of their appreciation of his work in the community. Mr. Winchester is widely known in New England and has a host of friends. As an engineer and an active member of the A. I. E. E., he has a reputation for ability and enthusiasm, and his good citizenship has given him as well an enviable standing among his fellow-townsmen generally.

◆

Eugene E. Harrington has been appointed superintendent of the Lake Sunapee Power Company, Sunapee, N. H., in charge of the power plant which this recently organized company has under construction.

A. J. Reed, until recently general sales manager for the Robbins & Myers Company, Springfield, Ohio, has joined the Ohio Electric & Controller Company in the capacity of district sales representative of the motor department. His headquarters are in Philadelphia.

Obituary

John S. Lucock, for sixteen years superintendent of the Detroit Insulated Wire Company, Detroit, died Oct. 10. Mr. Lucock was born in England in 1865 and came to America at the age of eighteen. For many years he was connected with the Western Union Telegraph Company and in 1903 became superintendent of the National Cable & Wire Company in Pittsburgh. In 1906 he moved to Detroit and joined the Detroit Insulated Wire Company, remaining there until his death.

James M. Petrie, chief engineer and general superintendent of the Virginian Power Company, died suddenly at his home at Charleston, W. Va., on Oct. 9. Mr. Petrie's early work was confined to marine engineering, but later he became engaged in steam and electrical construction work in Mexico, in inspection work for the Maryland Casualty Company and as chief engineer for plant and distribution work for Kops Brothers, New York. After spending two years in the city of Panama as chief engineer for the Panama-American Corporation, Mr. Petrie became chief engineer for the Virginian Power Company and subsequently was appointed its general superintendent in charge of all engineering and construction work. He was also vice-president of the Engineering Service Corporation of Charleston and president of the Nitro Power Company of Nitro, W. Va. Mr. Petrie was born in Jersey City and was thirty-nine years of age.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic
Problems of the Producer and Distributor, with Market Reports, Trade
Activities, Foreign and Construction News

Distribution Trouble Not All for the Young

A Plea for More General Recognition of the Fact that the Old Manufacturer and the Old Jobber Have Problems Too and Have Had Them Since Their Youth

By L. L. Brastow

Sales Manager Trumbull Electric Manufacturing Company, Plainville, Conn.

L. L. BRASTOW

A GOOD DEAL has been published of late concerning the troubles of the small manufacturer in distributing his goods. It is comparatively easy to point out the problems facing jobber and manufacturer, both large and small. But the solution is a different thing.

The smaller and less known manufacturer, not being able to tie up with the larger jobber who has already made his arrangements, naturally ties up with the smaller and less experienced jobber. This is not surprising and should have been foreseen—in fact, is foreseen and thoroughly understood by the new manufacturer, who before he starts to produce has not counted on much assistance from the old-line jobbers who have been tied up with satisfactory connections for some time.

Newcomers Must Always Fight

It is not so much a question of "kept" jobbers who will not sell the small manufacturer's competing line. They represent only a small percentage of the fully recognized jobbers of the country. It is a question of establishment and prior connections which are not easily broken. It would be a most unfortunate affair if long-established relations between manufacturer and jobber were broken off first here and then there whenever a new source of supply came into being.

With every new manufacturer can be found several new jobbers. They may not function as do the older jobbers. Neither do the new manufacturers function as do the older manufacturers. Experience and maturity surely count for something. Neither manufacturer nor distributor can "arrive" all at once.

The experience of every new manufacturer and new jobber of today merely duplicates that of older manufacturers and jobbers when they, too, were new. It is an uphill fight to get recognition on the part of both. No institution is going to change relations sight unseen or overnight.

The new manufacturer of necessity must break into the middle of the line of distribution for his outlet. It has always been so. It is not a new thing, and the fact that a portion of the larger jobbers are owned by or tied up with the two large manufacturing companies has only a partial bearing on the subject. The control by contract or by financial backing of a jobber by a manufacturer very often does not tie up such a jobber as tightly as theory would indicate. They often break over in favor of a smaller manufacturer for this or that reason —mostly price—and thereon hangs another tale.

I cannot see that the present has any new problems in kind which the past has not held for the new manufacturer as well as new jobber. The problems, however, are more intense because of an excess in the number of both manufacturers and jobbers that is more than keeping pace with business expansion; and in trying to take business away from the older companies rather than in developing their own distribution systems they run into trouble.

Our own company in other days met the same situation. We were told even more plainly than is told today by the then established jobbers to "go create a demand and then come around." So we did that very thing and established our connections in the middle of the distribution line. We made jobbers of dealers just as is happening today. And many of these new jobbers of those days are large jobbers today.

We surely had a very strenuous uphill fight and could have written columns on our problems in dealing with the aristocrats of distribution. We went ahead as did the other youngsters and did the hardest work of all our existence and at last received recognition through the demand created by our energy and by the merit of our goods rather than by the price put upon them. Our young jobber connections also did some hustling and many of them have risen to prominence. Others passed out on the route upward.

Too many of the newer manufacturers and jobbers also are attempting to build their establishments on price and price alone—with service to needs and quality to high standards taking only secondary place. The future is not particularly bright for such. For those who have inventive brains and produce something new rather than copy what is now in abundance to be had—for such, if they will work and conserve, there is a future just as there has been in the past. You cannot keep a good man down—problems or no problems—"kept" jobbers or no "kept" jobbers.

Old Companies Have Trouble Too

But do not for a moment think that it is the new folks who have all the problems. The old ones blame the newcomers for as many troubles as do the newcomers blame the older companies. It is fifty-fifty for each.

There is constant danger that by buying from the "newly-comes" old jobbers will force the older manufacturers to widen their distribution and "open up." It is no less a fear than the anxiety that because they are not getting easy "big jobber" distribution the "newly-comes" will disorganize the trade by price cutting and the lowering of electrical standards, and compel temporary recognition by the very pressure of suicidal prices with accompanying poor quality. Note the word "temporary," because there is a limit to all things, even price cutters and poor goods. Such methods rarely solve the problem of distribution. They may help temporarily if not carried too far, but they make everybody lose money and give the ultimate consumer only a slight advantage in price and a big disadvantage in quality.

The solution of the problem is to be found in closer tie-ups between given manufacturers and those who constitute their given jobbers. Perhaps it may line up in a general way that the older classes will play together—"kept" and "unkept" alike—and the newer folks will tie up together and fight their battles through or go out.

SURVIVAL OF THE FITTEST

The live young jobbers and manufacturers will win recognition, as they always have. The older manufacturers and old jobbers who go to sleep will lose to the livelier "newly-comes," as they always have. As the new folk must fight hard to get recognition, so the older folk must fight hard to keep what they have. And so it goes and always will go—the slothful die, the "go-getters" live. And no jobber, be he "kept" or not "kept," has any right to expect the faithful support of his source of supply unless he too does the distributing, and not the manufacturer, who will do all he can to create demand and make distribution easy, but who in the last analysis is not a selling agency.

There are plenty of live young distributors who will work. Moreover, no manufacturer who fails to sense his competition and does not by improved methods and progressive development make his lines easy for his jobber to sell can last forever, because there are plenty of live young manufacturers coming along. It is the survival of the fittest, with life for the active and resourceful.

Stimulating Research by Organization

Importance of Thorough Co-operation—Staff Should Be Active in Scientific Associations and Conversant with Current Technical Literature

BY T. S. TAYLOR

Research Laboratory, Westinghouse Electric & Manufacturing Company

THAT research work, and hence the research man, is a very necessary part of any progressive manufacturing concern is no longer questioned. Probably the most important reason why any firm has established a research institution has been the fact that the usual methods of guess and try, as applied in many instances, were found to be entirely inadequate to meet the complex demands being continually made upon manufacturers. The engineer, being very busy trying to meet these demands, found he needed expert scientists well trained in technique and the fundamentals of their subjects to help him solve his problems. In fulfilling his obligations to his company the research worker may have to busy himself with problems arising from attempts to improve methods and apparatus, find substitutes and new applications, or he may have some problem of a purely scientific nature with apparently no immediate commercial application. The inherent nature of these latter problems naturally makes them the more attractive. The element of uncertainty and the possibility of finding something new give them an enticing aspect.

IMPORTANCE OF RESEARCH CHIEF

The most important personage in any well-organized research laboratory is the director. He should not only be a scholar well versed in the fundamental principles of laboratory technique and methods, but he should be a good organizer, manager and judge of men, both personally and intellectually. He must of necessity constitute the intermediary between the research staff and the commercial organization. It should be his first duty to try to be an inspiration to each man working in his department, always ready and available to discuss freely each man's special troubles and successes.

There are few persons who will not greatly appreciate helpful suggestions on the part of the director, and all will be encouraged if the director will only manifest a zealous interest in their work. A director full of enthusiasm and possessing an abundant supply of suggestions can work wonders in inspiring the men of his department to greater achievement. In fact, the director is the mainspring of the entire research laboratory, and the achievements of his men depend largely upon his leadership. By spending a few minutes each day or so with each investigator talking over problems and plans he can do much toward insuring a wide-awake department.

In order to carry on his investigations effectively, the man in charge must have enough assistants to do all his routine work, so that he can devote most of his time to planning the work, unraveling difficulties and considering the results obtained. Much very valuable time is lost by investigators in doing routine work which could be done just as well by younger, less experienced and less expensive men.

TECHNICAL LITERATURE INVALUABLE

It is quite important for the research man to have ready access to a good reference library in order that he may keep himself well informed upon matters pertaining to immediate and allied problems. This part of his work cannot receive too careful consideration. There are entirely too many instances where investigations are unnecessarily repeated because little attention was given to keeping well informed on the literature of the subject. It is little trouble for any research laboratory to have an excellent library of current scientific literature and standard reference books, but to supply technical literature issued long previous to its establishment is much more difficult and in many cases almost impossible.

Besides keeping himself well versed in the current literature of his subject, the research man must keep up his personal fellowship with as many men as possible who are working in his immediate field or in fields allied with it. He should attend the meetings of the scientific societies where topics of interest to him are presented and take part in their discussions. By so doing he will broaden himself wonderfully and obtain numerous ideas which will prove of unlimited value to him in conducting his own work. No one can well avoid absorbing some of the enthusiasm manifested at such gatherings. One will at the same time gain useful information by getting the viewpoints of others.

Influence of Compensation

The question of compensation for research work is of no little importance. Some establishments adopt the policy of giving a monetary reward in the form of a bonus for achieving certain results such as patents and commercial applications. Others seem to act on the plan of paying only such salaries as are absolutely necessary to keep their men at work. Neither of these plans is the best one. The former, which depends upon results, will tend toward secrecy and destroy the very best element in research work. It hampers the influence of free and open discussion, which is by far the best means of promoting science, each person being able to profit by ideas gained from others. The second method leads to discontent on the part of the research man and in some cases causes him to take steps toward trying his fortunes elsewhere.

Financial recompense, however, is by no means the only reward sought by a research man. The honor obtained from having accomplished definite results for his company is much desired and should receive proper mention by those in authority. It is considerable satisfaction to the research man to realize that certain definite perplexing problems have been cleared up by his efforts and that he has added some specific results to scientific knowledge. Whenever a research man has done a piece of work that is of general scientific interest he should publish an account of it in the proper journal in order that the scientific world may give him the credit which he has earned.

Survey of Business Conditions

Radio Men in Conference Look for January Boom

Revival of public interest in radio and a consequent boom in the industry were predicted by radio broadcasters from various parts of the country who met at the Hotel Sherman, Chicago, on Oct. 16, to organize a National Broadcasters' Bureau for the protection of their interests. The gathering was somewhat startled by the straight-from-the-shoulder announcement that was made by George S. Walker, president of the Western Radio Corporation of Denver, that five thousand radio dealers are on the verge of bankruptcy and that something must be done to readjust conditions in the industry to save this small army of business men from the loss of their investment. This statement aroused the conferees to a realization of the situation in the industry and brought out an expression of belief that the first of the year would see a renewed interest in radio by the public and therefore the movement of radio supplies from the dealers' shelves.

Mr. Walker made it clear that he did not wish to be mistaken for a pessimist. He is convinced that the radio industry is destined to become one of the greatest commercial enterprises in the world, but he insisted that the proper type of men should steer the radio ship and that the industry as a whole and not selfish interests should be foremost in their minds.

It was decided to hold the second national radio show, which will be in the First Regiment Armory, Chicago, on Jan. 13 to 20, 1923.

Platinum Imports Increase

Total imports of platinum into the United States in July amounted to 11,421 ounces, exceeding February, the best previous month of the current year, by 397 ounces and comparing with an average for the preceding half-year of 6,797 ounces. Imports from Colombia in July were 3,442 ounces against 4,719 ounces in February, the best previous month in the current year, and compared with an average of 2,650 in the first six months. July imports from Esthonia, France, Sweden and England, that is, evidently of Russian origin, totaled 7,935 ounces more than in any other month this year, comparing with an average of 4,105 ounces in the previous six months. Other imports were from Spain and Cuba, 44 ounces.

Price remained at $90 until July 27, rising to $98 on Aug. 17 and to $108 on Aug. 28. Increased production in Colombia always follows a rise in prices. August, September and October may therefore be expected to have shown an increased supply. In the middle of October $112 was touched. The current price is around $102.

Argentina Developing Radio

Broadcasting of lectures, concerts and other matters of an educational and recreational nature in Argentina is covered by a concession granted to an Argentine engineer by the municipal government of Buenos Aires for the installation of wireless-telephone transmitting stations.

Portable Lamp and Fixture Business Improving

Business in portable lamps and fixtures in Boston is remarkably good, and one large house reports that almost its entire stock is now of very recent design owing to demands upon accumulated material. Residence lighting absorbs the principal sales. On some orders deliveries require four weeks to complete service. Prices are firm and less field soliciting is needed. Portable lamps are moving better than for many months, and stocks are being prepared for late holiday trade.

Sweden's Apparatus Market Suffering Depression

Conditions in the electrical apparatus and equipment industries are far from promising in Sweden at the present time, according to late reports from that country. The world-wide depression in connection with the loss of the Russian market and extremely severe German competition are primarily responsible for the prevailing depressed condition in the electrical and other industries of Sweden.

October Market for Poles Shows Little Change

The October market for poles in most parts of the country has changed but slightly from that existing in September. The freight-car shortage is still seriously affecting deliveries. Most of the present activity is to finish work on utility lines for the winter. Prices are firm and no changes have been placed on types of poles.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0 0295	$0 0285	$0.0279
Cold finished shafting, per lb.	0.0378	0.0373	0.0379
Brass rods, per lb.	0 171	0.1700	0.148
Solder (half and half), per lb.	0.23	0.228	0.20
Cotton waste, per lb.	0.115	0.11	0.113
Washers, cast iron (½-in.), per 100 lb.	4.33	4.33	5.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.11	3.11	......
Machine oil, per gal.	0.36	0 36	....
Belting, leather, medium, off list	40-5@ 50%	40-5@ 50%	....
Machine bolts, up to 1-in. x 30-in., off list	55@60%	50@65-10%	50@60-10%

Americans Procuring Much Business in Ceylon

Imports of electrical goods into Ceylon show an upward tendency in volume. American manufacturers are procuring their share in the increase, as the following table shows:

Year	Imports from United States	Total Imports
1913	$8,405	$238,409
1919	27,612	183,543
1920	49,112	373,875
1921	35,001	345,003

The United Kingdom has ranked first as a source of supply in all four years. German goods ranked second in 1913, but have not been imported in any quantities since. Japanese goods were second in 1919, but Japan has dropped out as a source of supply during the past two years. American-made goods were third in value in 1913 and 1919, but rose to second place in both 1920 and 1921. Imports from British India have risen in importance, so that that country now occupies third place. Imports from Italy in 1921 were also fairly large.

◆

Electric Railroad Cars Built in 1921 Amounted to $14,856,068

During the year 1921 there were ten establishments in the United States engaged in the manufacture of electric railroad cars, and the total value of their products, according to government statistics just issued, was $14,856,068, as compared with seven establishments in 1919 with a total value of products of $18,441,976. This shows a decrease in the value of products of $3,585,908, or 19.4 per cent.

In 1921 there were 105 establishments engaged in the manufacture of steam railroad cars, and the total value of their products amounted to 314,394,867, as compared with ninety-nine establishments for 1919 with a total value of products of $538,222,831. The decrease in the total value of products was 223,827,964, or 41.6 per cent.

DETAILED STATISTICS OF ELECTRIC RAILROAD MANUFACTURING, 1921–1919

	1921	1919	Per Cent of Decrease
Number of establishments	10	7	
Persons engaged	3,356	3,286	*2.1
Proprietors and firm members	....	1	..
Salaried employees	444	365	*21.6
Wage earners (average number)	2,912	2,920	0.3
Salaries and wages	$4,334,934	$4,984,941	13.0
Salaries	1,135,789	852,851	*33.2
Wages	3,199,145	4,132,090	22.6
Cost of materials	7,880,405	12,058,942	34.7
Value of products	14,856,068	18,441,976	19.4
Value added by manufacture	6,975,663	6,383,034	*9.3

* Increase.

The number of cars manufactured during the year by both classes of establishments showed a decrease from 155,186 in 1919, valued at $387,447,866, to 51,894 in 1921, valued at $180,866,191. The decrease was chiefly in the manufacture of steam railroad cars. This class showed in 1919 153,288 cars made, valued at $373,945,213, as compared with 50,361 cars, valued at $170,325,626, for 1921. The decrease in the number and value of cars manufactured was 67.1 and 54.5 per cent, respectively.

These figures do not include the number and value of cars manufactured in repair shops of steam and electric railroad companies or as secondary products by establishments classified in other industries.

◆

Prevailing Conditions Affecting Cost and Volume

Demand for Freight Cars.—Demand for freight cars in excess of the current supply amounted to 141,252 cars on Oct. 8, according to reports just filed by the carriers with the car service division of the American Railway Association. This was an increase of 10,927 cars over the total on Sept. 30. Shortage of box cars amounted to 71,063, an increase in eight days of 4,534, while for coal cars it amounted to 40,499, an increase in the same period of 1,545.

Loading of Revenue Freight.—Loading of all classes of revenue freight totaled 968,169 cars during the week which ended on Oct. 7, according to reports just filed by the railroads with the American Railway Association. This was an increase of 68,488 cars over the corresponding week of 1921, but a decrease of 43,497 cars under the corresponding week in 1920

Failures.—Increases in all sections of the United States, but especially in the East, have raised the total for last week's failures to 442, as compared with the 390 defaults reported to R. G. Dun & Company for the five-day period last week. For the corresponding week in 1921 the total was 407.

Commodity Prices.—Although changes have been somewhat less numerous, the upward trend of wholesale commodity prices continues unabated, fifty-eight advances appearing in the 338 quotations received last week against twenty-eight recessions.

Bank Clearings.—Returns of bank clearings last week make a more favorable exhibit than has been noted for some time past, an aggregate of $8,515,400,000 at twenty cities in the United States, as reported to *Dun's Review*, representing an increase of 22.2 per cent over the total of a year ago and being 1.9 per cent in excess of the figures for this period of 1920.

Volume of Business.—Volume of business for the week ended Oct. 18 was $9,865,000,000, compared with $9,319,000,000 for the week before. This increase of 6 per cent is reported in spite of the fact that the week of Oct. 18 includes Columbus Day, which is observed as a holiday in most of the cities. Larger figures are shown for all the leading centers, except Pittsburgh and San Francisco.

The Metal Market

Some Larger Copper Producers Continue to Quote 14 Cents, Delivered —Others Meeting Competition

Some of the larger producers are continuing to quote 14 cents delivered, but little if any business has been done on this basis since last Saturday. Others are meeting the competition of those producers whose policy provides for marketing steadily their current output. In the last three or four days the price of 13⅞ cents delivered has been so common that it has been necessary to go even below this to attract purchasers, and several orders of fairly large size have been placed at 13.75 cents delivered. The amount of copper to be obtained at this price shows indications of being limited, however, and consumers generally are finding it a difficult matter to obtain copper for less than 13⅞ cents.

The decline in price is attributed entirely to the apathy of consumers. They are operating their plants to capacity, so some other reason must be assigned for the sudden lull in demand. Possibly the chief reason is the freight embargo. Whereas it ordinarily may take one week to ship from refinery to consumers' destination, it now takes three or four weeks, and the consumer is more interested in getting material in and out of his plant just now than in buying more raw materials. He has not forgotten the 1920 tie-up.

Export business continues quiet at prices which net producers figure not far from that realized on domestic business. Sales of lead have not been so large as last week, but producers have little to offer, and there has been no sign of a slump in price. Lead for prompt delivery is virtually unobtainable in the New York market except in small quantities from dealers who are asking up to 6.75 cents for it. With the St. Louis market firm at 6.30 cents, shipment from there could not be arranged under 6.65 cents, New York, so a slight premium on the smelting company's price is not unreasonable. There was some effort in St. Louis to obtain 6.35 cents for lead, but consumers were not particularly attracted by this price, and the basis of actual business has gradually returned to 6.30 cents. Embargoes are affecting the lead market, being troublesome alike to producers and consumers.

NEW YORK METAL MARKET PRICES

	Oct. 18, 1922 Cents per Pound	Oct. 25, 1922 Cents per Pound
Copper		
Prime Lake	14.00	14.00
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	5.75	5.75
Antimony	5.25	5.25
Nickel, ingot	36.00	36.00
Zinc, spot	6.50	6.50
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00–11.25	11.00–11.25
Brass, heavy	5.75– 6.25	5.75– 6.25
Brass, light	5.25– 5.50	5.25– 5.50
Lead, heavy	4.62½–4.75	4.62½–4.75
Zinc, old scrap	3.00– 3.37½	3.00– 3.37½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

STEADY demand continues in the electrical market, reports from all over the United States indicate. Central-station business is improving. Prices are firm, but some advances in the near future are expected. Heaters are selling satisfactorily, and the trade is optimistic about the future. Conduit is again becoming scarce in the Western States owing to the heavy amount of construction work. The radio trade is far from being satisfied with sales, but hangs on with optimism. Motors are slower than two weeks ago. Fixtures are in fair demand.

New York

Business Steady—Heaters Feature of Market—Socket Sales Improving—Radio Prices Lower

Electrical business during the last week was steady, jobbers and manufacturers reporting an even demand and little stiffening or lowering in prices. Heaters continue to be a feature of the market. Stocks of these are reported adequate to meet present requirements.

Motors.—Demand for motors is not so strong as during two weeks ago. Stocks are large and prices are firm. Second-hand dealers are receiving most of the business.

Sockets.—Sales are improving, and another increase in price in the near future is expected.

Storage Batteries.—Fair demand is reported, prices are firm and stocks are ample for present requirements.

Radio.—Dealers state that sales are improving each week but are not so strong as were expected. Prices generally are much lower than those of last year.

Chicago

Conduit Stocks Still Low—Pole Market Unchanged—Brisk Appliance Sales—Wire Improves

With a continuing unprecedented building construction in this territory requiring a good volume of wiring material, the largest snag in the path is the low stocks of conduit. Shipments from manufacturers come through fairly well, but a car shortage is seriously affecting the situation. The same cause is preventing utilities from finishing the rehabilitation of their pole lines before winter. The local demand for heating appliances, such as open air heaters, toasters and percolators, is active. The call for high-tension equipment remains steady.

Conduit.—Demand continues steadily, but most stocks are low. Prices on the ½-in. black pipe range between $55 and $57 per 1,000 ft. in 5,000-ft. lots.

Wire.—Prices are tending upward, since several dealers are quoting the No. 14 rubber-covered wire at $6.35 and $6.40 per 1,000 ft. in 5,000-ft. lots, according to conditions of sale. Stocks are fair but not excessive, since the call still remains active.

High-Tension Equipment.—Manufacturers continue to report a healthy volume of business. One firm this week filled orders for four 1,000-kva., 33,000-volt outdoor substations to be located in the Middle West and one 3,000-kva., 66,000-volt substation for a Southwestern utility.

Heating Appliances.—Fall trade is continuing quite briskly on standard lines such as open air heaters, toasters, tables stoves and percolators. Return of fall weather has started an active call for air heaters and dealers have ample stocks.

Boston

Conduit Stocks Are Uneven—Weatherproof Wire Quiet—Fair Demand for Cleaners Reported

The tide of business is rising in electrical lines from week to week. Jobbers' stocks are considerably depleted, with much unevenness in steel products. Electrical manufacturers are rapidly increasing their outputs, and general trade is improving. Contractor-dealer finances are causing some inconvenience, both in Massachusetts and Connecticut. Price-cutting is giving less trouble since the recent advance in sockets. Building contracts in New England sagged off a little last week. Central-station outputs and merchandise sales continue to show substantial gains over last year. Deliveries are hampered in some quarters by car shortages.

Rigid Conduit.—Stocks are very uneven, and shopping around among jobbers is frequent to fill out orders. Prices are firm, with upward tendencies.

Wire.—Weatherproof wire is quiet, but rubber-covered is moving well. Radio aërial demand is picking up a little on bare copper.

Flexible Armored Conductor.—Sales are active, No. 14 single-strip moving around $44.20 per 1,000 ft. in 5,000-ft. lots. Inside wiring improvement is reflected in local trade.

Radio Equipment.—The market improves from week to week, with spreading demand for low-cost and higher-priced sets. Deliveries are in fine shape. Improved equipment is going into the broadcasting installations, and this stimulates retail sales.

Appliances.—Vigorous sales efforts are yielding better results in the washing-machine field, and there is a fair demand for cleaners. Irons continue to sell steadily, and the current month has seen good business in hollow ware for wedding presents. Radiators are moving better and toasters are responding to well-directed advertising and personal sales efforts.

Motors.—Business is improving, and gains over earlier months this year are being well sustained. Deliveries are in excellent shape and prices are firm. Smaller units are in chief demand.

St. Louis

Socket Business Satisfactory—Safety Switches in Demand—Lamp Cord Inactive and Spotty

Agricultural conditions continue promising. Movement of cotton and amount in sight are slightly greater than last year and very much more than in 1919 and 1920. Carload shipments of fruits and vegetables to Oct. 1 were considerably above the amount of 1921. Recent rain has put the ground in good shape for winter wheat. Cattle prices are about average, but hogs and sheep are very low. Industrial plants are increasingly active, the general average of operations being apparently about 80 per cent of plant capacity on normal time basis.

Sockets.—Business in this line is very satisfactory, considering demand, stocks and prices. Representative quotations in standard package lots, f.o.b. St. Louis, are, per 100: Key, $18.15; keyless, $16.50; pull, $33; pendent porcelain key. $25.50; pendent porcelain keyless, $23; mica weatherproof, $9; composion weatherproof, $9.65; porcelain weatherproof, $9.90.

Safety Switches.—A very attractive demand exists, as virtually all local industrial switch installations are now of the safety type. One make of 250-volt bottom-fused switch is priced as follows: 30-amp., two-pole, $3.38 each; 30-amp., three-pole, $4.50 each; 60-amp., two-pole, $5.62 each; 60-amp., three-pole, $6.19 each; 100-amp., two-pole, $7.88 each; 100-amp., three-pole, $9.75 each. A 30-amp., 125-volt, two-wire entrance switch is quoted at $1.25 each, or $100 for 100.

Fuses.—The seasonal increase in demand for plug fuses is being felt and stocks are in healthy condition. Prices are firm on the following basis: Less than 100, $3.50 per 100; 100 to 499, $3 per 100; 500 or more, $2.75 per 100. Cartridge fuses, 0-amp. to 30-amp., are quoted at $5.20 per 100, and 31-amp. to 60-amp. at $7.80 per 100.

Lamp Cord.—In 1,000-ft. lots the following prices obtain per 1,000 ft: No. 18 twisted cotton, $11.50; No. 16 twisted cotton, $15.23; No. 14 twisted cotton, $23.02; No. 18 twisted silk, $24; No. 18 parallel silk, $26; No. 18 parallel cotton, $13.72. Demand is inactive on all lamp cord.

Atlanta

Lamp Cord Sales Are Good—Flatiron Price Reduced 10 per Cent —Washers Slow

Inclement weather for the past week has interfered with the picking of cotton and the harvesting of other agricultural products. It has also tended to slow up business generally. All of the larger rural county seats have held fairs during the past fortnight, and merchants are expecting this to stimulate the sale of farm implements, while money spent by visitors will serve to assist in the payment of debts by local merchants. Electrical business, as a whole, is reported very good with prospects for a brilliant finish for 1922.

Lamp Cord.—Sales are very good, stimulated somewhat by difficulty in obtaining fixtures on account of freight congestion. Local dealers' stocks are good with deliveries fair.

Flatirons.—Ten per cent reduction in price is to be noted, with sales better than for some time. Stocks are in good shape and shipments satisfactory.

Safety Switches.—Former activity in this line continues, showing healthy increases from month to month with the 30-amp. to 60-amp., 250-volt types in most demand.

Oil-Engine Generator Sets.—Renewed activity has manifested itself, and a number of very satisfactory sales have been recently reported. Stocks are low, with shipments listed at from four to six weeks.

Farm-Lighting Outfits.—Renewed interest is being displayed, with the largest jobbers anticipating a considerable improvement in volume of sales for this year over last.

Washing Machines.—Washing machines occupy a position similar to sewing machines, and efforts to revive interest seem of little avail. Prices are steady and stocks heavy.

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San Francisco

Insulating-Material Stocks Are High—Sewing-Machine Sales Show Spurt—Cleaners Active

Establishment of competing branches of several savings banks is evidence of the restoration of retail prosperity and retail activity in outlying city districts which will profoundly affect Christmas buying. Retail sales showed nearly 30 per cent increase for September over August.

Radio.—The industry expects the early establishment of excellent new broadcasting stations.

Insulating Material.—During spring certain insulating materials were quite depleted by the sudden radio boom, but heavy reorders were not quite matched by the decreasing demand, so that local stocks are high. These lines are now carried quite universally, and no longer may any particular jobber or dealer be considered as exclusive headquarters.

Household Appliances.—Exhibitors at fairs and industrial shows report great interest and long lists of prospects, yet the same territories have been considered pretty well saturated by selling crews. Washers and vacuum-cleaners sales have been very good. Sewing-machine sales are showing a spurt which is attributed to the regular fall demand. Buying has been late for Christmas. Table appliances are in demand.

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Denver

Demand for Conduit, Wiring Devices and Fixtures Holding Up Strong—Radio Improving

Building permits in Denver passed the million-dollar mark last week, establishing a record for the half month. Demand for wire, conduit, wiring devices and lighting fixtures is holding up strong. Transportation difficulties are retarding supply of many staple items. Jobbers report good business with holiday activity under way.

Radio.—Local jobbers have formed radio organization and all agree that radio business is improving, especially the sale of higher-priced sets. Slow movement in complete crystal sets, but demand for parts is increasing.

Motors.—Gradual improvement in inquiries and sales, with stocks being replenished by jobbers and agents.

Conduit.—Prices are firm, but increase is anticipated because of demand being greater than supply. All jobbers are anticipating requirements for next four months. Orders covering this period have already been placed. Prospects on deliveries are poor.

Wire.—Slight increase announced on several wire accounts with prospects of sharp raise shortly, according to several jobbers. Warehouse stocks still holding up.

Schedule Material.—Heavy demand with rising prices. Local stocks in good shape.

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Cleveland

Radio Sales Gaining—Dealers Stocking Shelves with Appliances—Small Motors in Demand

While no great activity has occurred in any line save the heaters, receipts have been wholly satisfactory. Other industries are settling down with the adjustment of labor and rail difficulties. All this has an invigorating effect on things electrical, and it is anticipated by manufacturers, jobbers and dealers that an active fall season will prevail. Building continues to indicate that the operations through the fall months will be of sufficient volume to insure employment for the various crafts engaged in construction, and electrical sales will necessarily be in proportion.

Radio Equipment.—Sales have gained steadily, and while the upward curve has not been especially pronounced this week a comparison with last month shows that the expected resumption of activity has started, and dealers assert that it will develop into an active season.

Appliances.—Dealers are continuing to stock their shelves to meet the anticipated holiday demand. Jobbers are not experiencing any difficulty in supplying them, however. Current sales are good.

Motors.—The season for motors is well under way, with each week bringing increased activity. Demand for the smaller absorbs the supply easily.

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Portland–Seattle

Business Conditions Good—Lively Demand for Pole-Line Material —Conduit Shortage Continues

Business conditions are reported good. Production of lumber continues to be above normal, but new business is falling off. Car shortage has seriously affected lumber shipments. It is reported that more than 50 per cent of the shingle mills of the Northwest have been compelled to close because of lack of shipping facilities. Forunately sufficient refrigerator cars have been diverted; to fruit shippers to save the apple crop.

Electrical jobbers report business very good. There is a lively demand for pole-line material. Many high-tension transmission lines are in course of construction throughout this section.

Farm-Lighting Plants.—These plants are becoming active as a result of demonstrations and exhibits at county fairs throughout the territory.

Conduit.—The shortage continues with little hope for material improvement, as back orders are accumulating to such an extent that they will absorb the greater part of the new shipments as they arrive. Prices generally are stiffening, although quotations on knobs, tubes and cleats remain unchanged.

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Salt Lake City

Electrical Contractors Busier than Ever Before—Wire Demand Is Good—Price Advances

Electrical contractors are busier than they have been for several years. There is an actual shortage of electricians at the present time. The demand is occasioned by a number of big construction jobs recently begun and by a persistent home-building campaign. Dealers are stocking much better than they did at this season a year ago.

Pole Line Hardware.—A dearth of line construction keeps the demand at low ebb. The trend is toward improvement.

Panelboards.—There is some activity, but it is spotty. One large factory reports good production, but the general condition is not promising.

Conduit.—A serious shortage is reported by jobbers. There has been a recent sharp upward turn in the price schedule.

Wire.—The demand is good. A price increase amounting to 5 per cent went into effect this week. Stocks are in fair condition.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Appoint Reorganization Body for Habirshaw Cable Companies

At a meeting of the committees representing the debenture holders, note holders and general creditors of the Habirshaw Electric Cable Companies Affiliated held Oct. 17, at which upward of 80 per cent of the respective interests were represented, reports of experts retained by the committee to advise on the business prospects of the companies upon reorganization and the amount of new capital required to effect a reorganization on a sound financial basis were carefully considered.

To facilitate an early reorganization of the properties the respective committees appointed a reorganization committee of five in which full power was vested to proceed with the least possible delay. This committee consists of E. A. Potter, Jr., vice-president of the Guaranty Trust Company; E. N. Potter, of Potter Brothers & Company; F. J. Leary, vice-president of the Central Union Trust Company; T. K. Stevenson of the Western Electric Company, and T. E. Quisenberry, of Howe, Quisenberry & Company, Chicago.

The committee on reorganization will devote its immediate attention to the final details of the plan of reorganization and the requisite financing.

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Electric & Radio Supply Company Formed Following Receivership

The Electric & Radio Supply Company, 165 North Wells Street, Chicago, has been formed by John F. Bowbin and F. J. Fencl following the receivership in July of the Columbia Light Company. This new company, which is a partnership, will continue to act as jobber and distributor of electrical supplies, including lighting fixtures and radio. About 5,000 sq. ft. of floor space is now in use. John F. Bowbin brings to this company thirty years of experience gained in the electrical supply business. He was formerly connected with the Electric Appliance Company for twelve years and with the Manhattan Electric Company eighteen years. His partner, Mr. Fencl, has spent twelve years in the industry.

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Syracuse Washing-Machine Firm Opens Connecticut Office

The Syracuse Washing Machine Company, manufacturer of the "Easy" washer, has established a sales office at 352 Asylum Street, Hartford, Conn., under the name of the Syracuse Washing Machine Sales Company, Inc.

H. W. Karstens, formerly of the H. W. Karstens Sales Company, Hartford, has been appointed manager. Two men have been placed upon the road to handle Connecticut wholesale business, and F. B. Moore, formerly with the Columbus (Ohio) office of the organization, has joined the Hartford staff. Both wholesale and retail distribution will henceforth be handled for Connecticut from this office.

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Electric Machine Corporation's Order to South Africa

The Electric Machine Corporation, Indianapolis, recently has shipped a large order of radio apparatus to South Africa. Its sales force has been enlarged to six men, who are traveling through the Middle Western territory. The company moved to its new building in May, where 12,000 sq.ft. of floor space is now in use.

◆

Societies Combine to Make Fixture Market a Success

Three electrical societies have combined forces in an effort to make the January convention of the fixture market a success. At a meeting of the executive boards of the Lighting Fixture Dealers' Society of America, the National Council of Lighting Fixture Manufacturers and the Illuminating Glassware Guild, held at Hotel Winton on Oct. 10 and 11, it was decided that henceforth there would exist closer co-ordination of the societies, which would work to the greater expansion of the fixture market.

It was also announced at this session that the convention would be held at the Hotel Winton at Cleveland the week of Jan. 15. The manufacturers' regular business sessions have been postponed to the midsummer meeting so as to leave the entire week of Jan. 15 to conduct the business sessions of the dealers. Inasmuch as the 1923 convention and market will not be open to the public, it was decided that exhibits in hotel rooms would be more satisfactory than the open booths in a public auditorium used at previous markets. It is the opinion of the executive boards also that the business atmosphere of a hotel is more conducive to a successful market than that of the auditorium.

A feature of the convention, which will include a display of glassware and lighting fixtures, will be practical demonstrations of the proper approach of dealer to retail customer and of salesman to dealer. Five hundred dealers and 2,500 salesmen are expected to attend. Officials will concentrate on a membership drive and manufacturers will have an opportunity to discuss the industry with the dealers.

Norma Firm Acquires American Patents of English Company

The Norma Company of America, Anable Avenue, Long Island City, N. Y., has acquired the American patents and business of the Hoffmann Manufacturing Company, Chelmsford, Essex, England, makers of "Hoffmann" roller, ball and thrust bearings. The line of "Norma" precision ball bearings will now be supplemented with "Hoffmann" precision roller bearings and other bearing products in the "Hoffmann" line.

During the past year the Norma company has thoroughly investigated the American market for roller bearings of this high quality and has found a distinct demand for high-grade units of roller type, interchangeable as to dimensions with standard ball bearings but having a much greater load capacity.

The Norma company will erect a new plant for the manufacture of "Hoffmann" products in America. Meantime, they are being imported and sold under the regular "Norma" engineering service.

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Westinghouse Opens Minneapolis Sales and Service Building

In order to serve adequately the territory known as the Twin City area, the Westinghouse Electric & Manufacturing Company has leased a six-story building in the Minneapolis industrial district which will serve as a combined sales, service and warehouse center. The structure, which was built especially for and is leased by the Westinghouse company for a period of twenty years, is one of a group of buildings included in the plan of the Northwestern Terminal Company of Minneapolis to provide an efficient and economical distributing service for the products of Eastern manufacturers.

The building, which houses the Westinghouse Electric & Manufacturing Company and the Westinghouse Lamp Company, is five stories above ground with one story underground. The top three floors are duplicate in arrangement and will be used for warehousing purposes. The material is carried to these floors by means of a 6,000-lb. elevator which can receive goods either from the loading platform, which is on the level of the first floor, or from the tunnel, which leads from the basement. The warehouse floors are 80 ft. by 100 ft. This gives a floor space of 8,000 sq.ft. each, or 24,000 sq.ft. for the three upper floors. The second floor contains the telephone switchboard and reception room and the offices for the Westinghouse Electric & Manufacturing Company and the Westinghouse Lamp Company.

A complete and entirely up-to-date service department for the repair of apparatus will be installed on the first floor. In this department all work previously jobbed through concerns in Minneapolis and that sent to the service station at Chicago will be cared for. The service department will be entirely modern, the machines being equipped with direct-connected motors. There will also be a shipping department on this floor, a band saw, a cut-off saw and a rip saw being available for shaping up the wood for shipping purposes.

Shipment from stock direct through the Northwest territory, which, of course, will be a great advantage for less than carload lots, will mean a considerable saving in time for the customer. For instance, a shipment from Chicago stock to Fargo, N. D., which would probably take from two to three weeks, will now be done in three days after receipt of the order in Minneapolis. With a stock ultimately amounting to a million dollars, all ordinary requirements will be taken care of for North Dakota, South Dakota, Minnesota and the northeastern section of Wisconsin. The Lamp company will maintain an emergency stock which can be replenished by Indianapolis or Milwaukee within two or three weeks, thus providing an improved service for the Northwestern district.

◆

McGregor Battery Engineering to Construct Plant Soon

The McGregor Battery Engineering Company, 681 Marshall Avenue, Memphis, Tenn., will soon break ground for the construction of a one-story plant, 30 ft. x 105 ft., at 678 Monroe Avenue for battery manufacture and repair.

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Stewart Electric Motor Company Plans to Rebuild Works

The S. J. Stewart Electric Motor Company, New Orleans, has tentative plans under consideration for rebuilding its works at 527-531 St. Joseph Street, partly destroyed by fire Oct. 14, with loss approximately $60,000, including equipment and building. The stock at the plant, valued at $125,000, sustained a heavy additional loss.

◆

Johns-Pratt Company Appoints G. W. Mapother Sales Manager

The Johns-Pratt Company, Hartford, Conn., manufacturer of fuses and protective devices, announces the appointment of George W. Mapother as the district sales manager for the electrical division in New York City. Mr. Mapother will make his headquarters at the New York office of the company, at 41 East Forty-second Street.

◆

The General Electric Company, Schenectady, N. Y., has awarded a contract to the Austin Company, Bulletin Building, Philadelphia, for the construction of a one-story building at its local works, 100 ft. x 340 ft., estimated to cost about $120,000. Contract has also been let to the Foundation Company, 120 Liberty Street, New York, for the construction of its proposed branch plant at Oakland, Cal., consisting of a main one-story building, 100 ft. x 300 ft., to cost approximately $110,000.

Formica Insulation Company Holds Annual Sales Meeting

Announcement was made at the annual sales meeting of the Formica Insulation Company at Cincinnati, Sept. 12 and 13, that the growing demand for "formica" for all sorts of electrical and mechanical uses had made it necessary to double the capacity of the plant during the past year. This increased capacity has put the company in a position where it can now deliver moderate quantities of formica in standard shapes and sizes the same day the order is received.

At the sales meeting the company's entire sales organization was present, the Atlantic and Pacific Coasts and all the territory in between being represented. Each representative reported on conditions in his territory, and all of them expressed confidence that the coming year would be the greatest in the history of the Formica company.

In addition to the general electrical manufacturing business, formica has a large business in the automotive field, both for insulating purposes and for non-metallic timing gears. It has a large gear business with the industrial gear cutters. Formica is also coming to be used extensively for pump valves in the oil industry, the packing industry and others where large numbers of pumps are employed.

One of the prime reasons for the sales meeting was the announcement and discussion of the advertising campaign planned for the company during the next twelve months. The sessions were held in "Advertisers' Hall" at the new building of the Procter & Collier Company, the Formica advertising agency.

The advertising campaign for the next year will be the greatest that has ever been undertaken for laminated phenolic insulation products. It will cover every field in which the material is sold and will combine strong publication advertising with intensive direct by mail work.

The meeting was under the direction of D. J. O'Conor, who directs the marketing, and an address was made by Mr. Faber, the financial officer and mechanical engineer of the company.

One of the speakers was Dr. L. V. Redman of the Redmanol Company of Chicago, which has supplied the phenolic resins from which formica is made. He explained the raw-material situation and discussed new raw materials and the possibilities of using them.

The speakers at the meeting included Allen Collier of the Procter & Collier Company; Mr. Ryerson, Formica representative of New York City; Mr. Morell, Cleveland; Mr. Montfort, specialist in automotive sales, Chicago; Mr. Steinberger, Chicago; Mr. Hill, Philadelphia; Mr. Bittner, Pittsburgh; Mr. Wolcott, Rochester; Mr. Hermans, San Francisco, and Messrs. Moll, Calhoun and Steiner of the Procter & Collier Company's service staff.

ANNUAL SALES MEETING OF FORMICA INSULATION COMPANY

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Says Appliances Need Suffer No Seasonal Slump in Summer

The P. A. Geier Company, Cleveland, Ohio. declares that the results of its recent midsummer sales contest prove that the retail electric appliance business need suffer no seasonal slump in the summer months. The usual slack period at that time has been due simply to a belief that such condition was inevitable, in the opinion of General Manager F. J. Gottron, who is now announcing a second campaign. In this new competition, timed for the best selling season of the year, thirty-three cash awards will be given, totaling $5,360, and in addition a "Royal" cleaner will be presented free to every man who sells twenty-five machines between Oct. 23 and Dec. 23.

Foreign Trade Notes

EXTENSIONS TO ELECTRIC SYSTEM AT DAIREN, MANCHURIA, CHINA.—The proposed extensions to the electric system in South Manchuria, China, according to *Commerce Reports*, include a transformer station at Shakako, additions to the power plant at Changchun, erection of service stations at Dairen, Mukden and Antung, and extensions to the street-railway system in Darien. Work will also be continued on the construction of power house No. 3 at Antung.

ELECTRIC TRAVELING CRANES FOR EGYPT.—Tenders will be received by the Administration of Ports and Lighthouses, Alexandria, Egypt, according to the *Electrical Times*, until Dec. 20 for eight traveling electric quay cranes, eight traveling cranes, eight electric lifts, rails, etc.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase and sole agency is desired in Norway (No. 4,009) from manufacturers for electrical supplies.

An exclusive agency is desired in Cuba (No. 4,021) for electric bulbs and other accessories for automobiles.

An agency is desired in Greece (No. 4,026) for electrical supplies, heating equipment, oil engine from 10 hp. to 150 hp., etc.

Purchase is desired by a firm in Canada (No. 4,038) for equipment for a 1,200-hp. hydro-electric plant.

An agency and purchase is desired in Australia (No. 4,045) for vacuum cleaners, etc.

An agency is desired in South Africa (No. 4,053) for electrical supplies, such as heater appliances, motor appliances, special instruments, pole-line material, lighting fixtures, glassware, bells, annunciators, fans and specialties.

Purchase is desired in Argentina (No. 4,057) for complete radio receiving and sending sets for installation on trains.

New Apparatus and Publications

PROTECTION FOR FEEDER SECTIONS.—A new automatic sectionalizing contactor for railway and mining use has recently been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

DIESEL ENGINES.—The Busch-Sulzer Brothers—Diesel Engine Company, St. Louis, is distributing a leaflet showing illustrations of various installations of the Busch-Sulzer Diesel engines.

NON-SCALING FLASH EVAPORATOR.—The Schutte & Koerting Company, Philadelphia, has recently developed a new non-scaling flash evaporator for the production of pure boiler-feed water.

AUTOMATIC SERIES CUTOUTS.—The States Company, 72 Francis Avenue, Hartford, Conn., has issued Catalog No. 3, Section 2, describing its automatic series cutout for series street-lighting circuits.

FLOOR COVERING.—"Carborundum Anti-Slip Tile" is the title of a booklet distributed by the American Abrasive Metals Company, 50 Church Street, New York City, sales representative of the Carborundum Company, Niagara Falls, N. Y., describing the "Carborundum Anti-Slip" tile for stair treads, elevator landings, factory and general floor surfaces.

CHAIN HOIST—An electrically driven chain hoist, known as "Motorbloc," has been placed on the market by the Motorbloc Corporation, Summerdale, Philadelphia.

MOTORS.—The Century Electric Company, St. Louis, is distributing bulletins Nos. 28, 30 and 31, describing its large and small polyphase and split-phase motors.

POWER-TRANSMISSION EQUIPMENT.—The Link-Belt Company, 910 South Michigan Avenue, Chicago, has issued a new general catalog No. 400. It contains 832 pages and covers the entire line of its products.

CIRCULAR SLIDE RULE.—The Pittsburgh Electric Furnace Company, Pittsburgh, has brought out a circular slide rule, known as the "'Lectromelt" calculator, for calculating the additions of various alloys and various metal mixtures to allow any given percentage of alloy. This device is intended for the aid of the furnace superintendent and melter in the foundry and the metallurgical industry generally.

STEEL CABINETS.—The Electric Motor & Engineering Company, Canton, Ohio, is distributing catalog No. 3, section 4, covering its new line of steel-guttered cabinets.

STOKER.—Bulletin CB1 issued by the Combustion Engineering Corporation, 43 Broad Street, New York City, describes the "Coxe" stoker and covers particularly the performance of this stoker on Western and Mid-Western bituminous coal. The company is also distributing a small booklet entitled "Service" which defines the meaning of this term from the standpoint of the stoker mnufacturer.

PANELS AND SUPPORTING FRAMEWORK.—"Switchboard Panels and Supporting Framework" is the title of bulletin No. 47,002, issued by the General Electric Company, Schenectady, N. Y., covering its vertical and bench types of switchboard panels.

TRUCKS.—The Barrett-Cravens Company, 169 North Ann Street, Chicago, is distributing a booklet describing the various types of the Barrett "lift-trucks" for use in industrial plants. The company is also distributing leaflets covering the Barrett "Never-Slip" cranes, "Steeleg" platform, barrel trucks, and the Barrett "lift-trucks" equipped as trailers.

RUSTLESS STEEL.—The Pyrene Manufacturing Company, 520 Belmont Avenue, New York City, is distributing bulletin No. 3, calling attention to "Parkerized" steel, the Parker process of making steel rustproof.

LIGHTING FIXTURES.—The Crescent Brass Products Company, 8410-12 Lake Avenue, Cleveland, is distributing catalog No. 6, covering its various types of lighting fixtures.

ELECTRIC FURNACE.—The Pittsburgh Electric Furnace Corporation, Pittsburgh, Pa., is distributing a leaflet describing the Moore rapid "'Lectromelt" furnace.

TEMPERATURE CONTROLLERS.—The Foxboro Company, Inc., Foxboro, Mass., has published bulletin No. 112-1, covering the "Foxboro" automatic temperature controllers. The company is also distributing a leaflet describing its automatic temperature or pressure recorder-controller with pneumatic switch.

CHART.—The Martindale Electric Company, Box 35, Station C, Cleveland, has issued a chart showing causes and effects of carbon brush and commutator troubles.

INDUSTRIAL TRACTORS.—"How to Calculate the Work That May Be Expected from an Industrial Tractor" is the title of the leading article in the September issue of the *Trackless Train*, issued by the Mercury Manufacturing Company, 4118 South Halsted Street, Chicago.

ENGINES.—Bulletin No. 1,001, issued by the Climax Engineering Company, Clinton, Iowa, gives illustrations of various installations of "Climax" engines in contractors' machinery.

ELECTRIC TRAMWAY FOR SAN JOSE, GUATEMALA, CENTRAL AMERICA.—A concession has been granted by the Ministry of Promotion to a foreign company, recently organized with a capital stock of $2,000,000, to operate an electric tramway of not less than 9 miles in length in the town of San José, Guatemala. The company is also given permission to extend the railway beyond the city limits to Chimaltenango and Sacatopéquez within two years. The concession stipulates that the overhead trolley system shall not be used.

New Incorporations

THE SANDY RUN ELECTRIC COMPANY, Mooresboro, N. C., has been incorporated with a capital stock of $50,000 to supply electricity in Ellenboro, Latimore, Mooresboro and Boiling Springs. The officers are C. F. Gold, Ellenboro, president, and L. Hmarick, Latimore, secretary and treasurer.

THE LACROSSE (VA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $5,000 to furnish electricity for lamps and motors in Brunswick and Mecklenburg Counties. The officers are O. F. Northington, president, and E. D. Nash, secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

HAMPDEN, ME.—The Public Utilities Commission has granted the Hampden & Newburg Light & Power Company permission to furnish electricity in certain portions of Hampden and in the towns of Newburg and Dixmont.

SUNAPEE, N. H.—Work has been started by the Lake Sunapee Power Company on the construction of a large hydro-electric power project at Sunapee Harbor. The plans call for a new dam and a steel penstock. The cost is estimated at about $300,000. I. M. Frost, Rutland, Vt., is president; C. C. Main, 201 Devonshire Street, Boston, is engineer.

VERGENNES, VT.—The Vergennes Electric Company contemplates extending its transmission line from Shelburne, 2½ miles, to furnish electricity to farmers in that district.

BOSTON, MASS.—The Edison Electric Illuminating Company has applied to the Public Service Commission for permission to issue $5,406,700 in capital stock, part of the proceeds to be used for a new power plant, extensions and improvements.

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Middle Atlantic States

HUNTINGTON, N. Y.—Electric power equipment will be installed in connection with the proposed two-story incinerating plant, 70 ft. x 100 ft., to be constructed by the Bureau of Public Works. Joseph P. Powers, Rockaway Beach, is architect.

JOHNSON CITY, N. Y.—The Binghamton Light, Heat & Power Company will build a two-story addition to its power house at Willow Point, cost about $75,000.

KINGSTON, N. Y.—Contract has been awarded by the Ulster & Delaware Railroad Company for the construction of an addition to the power house and boiler room adjoining the shops on the East Strand to the Michaud-Campbell Company, Inc., Kingston.

LITTLE FALLS, N. Y.—The Adirondack Power & Light Company, Amsterdam, has petitioned the Public Service Commission for permission to operate an electric transmission line in Little Falls and Schuyler.

SALISBURY, N. Y.—The Utica (N. Y.) Gas & Electric Company has applied to the Public Service Commission for permission to operate an electric transmission and distribution line in Salisbury.

SYRACUSE, N. Y.—The Chamber of Commerce has passed a resolution asking the City Council to adopt a uniform system of street lighting throughout the city.

PRINCETON, N. J.—The Public Service Electric Company will build a transmission line from Princeton to Hightstown, N. J.

CHESTER, PA.—The proposed plant to be erected in Chester by the Stauffer Chemical Company, 624 California Street, San Francisco, to cost about $500,000, will include a power plant.

CORAOPOLIS, PA.—The Vulcan Refining Company contemplates erecting a power house, one-story, 56 ft. x 60 ft. E. C. Dilworth, Walsh Building, is consulting engineer.

HARRISBURG, PA.—The Council has approved a resolution to replace the arc lamps now in use with 600-cp. incandescent lamps in the district from Locust to State Street and Court to Front Street. It is planned eventually to replace all the arc lamps in the city with incandescent lamps.

HAUTO, PA.—The Pennsylvania Power & Light Company will install a 20,000-kw. generating unit and auxiliary equipment in its local plant.

JUNIATA, PA.—Plans are being prepared by W. H. Cookman, architect, Broad Street Station, Philadelphia, for the erection of a local shop for the Pennsylvania Railroad Company, to cost about $300,000.

KINZUA, PA.—The Kinzua Light & Power Company is planning to build a new power plant in Kinzua.

PHILADELPHIA, PA.—F. W. Woodcock, F. B. Stem and associates have organized the following electric companies: The Dublin Township, Beale Township, Clay Township, Tuscarora Township, Cromwell Township, Tell Township, Tod Township, Granville Township, Springfield Township, Milford Township and Lack Township Power companies. Power plants and transmission line will be installed in the respective districts. Application for state charters will be made on Nov. 20. The companies are represented by James C. Jones, Bullitt Building.

PITTSBURGH, PA.—Plans for the proposed new baking plant of the Ward Baking Company, 3,100 Liberty Avenue, to cost about $1,500,000, will include a power house.

TREICHLER, PA. — The Pennsylvania Power & Light Company is planning to install a local distributing system.

ANNAPOLIS, MD.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 1 for deferrization plant and a high-power radio station.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company will build a substation on West Pratt Street, to cost $22,000.

WILLIAMSPORT, MD. — The Potomac Public Service Company is planning to double the capacity of its proposed local generating plant. The cost is estimated at about $5,000,000.

FAIRMONT, W. VA.—The Consolidated Coal Company is planning to build a power house at Coalwood, to cost about $90,000.

RIDGEWAY, W. VA.—The installation of a municipal electric system is under consideration.

GRAFTON, VA.—The Monongahela Power & Railway Company plans to erect a sectionalizing switching and substation in Grafton, to cost about $30,000. Feed lines will be erected from the power plant at Rivesville to Grafton in the near future.

LA CROSSE, VA.—The La Crosse Light & Power Company, recently organized, will operate a local power plant and construct a transmission line for service to a number of neighboring communities.

NORFOLK, VA.—The .United States Engineer Office will soon take bids for the construction of two power houses at Fort Storey, Va.

PORTSMOUTH, VA.—The Virginia Railway & Power Company has petitioned the City Council for permission to install an underground conduit from its substation on Middle Street to the navy yard gate to connect with the Richmond high-tension transmission line.

RICHMOND, VA. — Extensive improvements are being made by the Merchants' Cold Storage & Ice Manufacturing Company, to cost about $250,000. The work will include remodeling building, installing "Unaflow" engines and compressors, new boiler plant, 120-ton ice manufacturing plant, electric elevators, motors, etc. Ophuls & Hill, Inc., 112 West Forty-second Street, New York City, are engineers.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts until Oct. 31 for 15,000 weatherproof sockets for the Portsmouth Navy Yard. (Schedule 251.)

North Central States

CARO, MICH.—The property of the Caro Light & Power Company has been purchased by the Consumers' Power Company, Jackson, which will supply electricity in the city from its plant on the Ausable River. Transmission lines will be erected from Zilwaukee in the spring.

HOLLAND, MICH.—Plans for the proposed four-story hospital to be erected by the Holland Hospital Association, to cost about $275,000, will include a power house. Robinson & Campau, 715 Michigan Trust Building, Grand Rapids, are architects.

JACKSON, MICH. — The Consumers' Power Company has issued $14,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

JACKSON, MICH.—Work has started on the construction of the power plant at the Horton Street plant of the Hayes Wheel Company. The equipment will include two 750-kw. General Electric steam turbines and three boilers.

KALAMAZOO, MICH.—Work will begin at once by the Bryan Paper Company on the construction of a new central power plant, installation of a central machine shop and supply department, including a salvage plant for reclaiming and repairing supplies, to cost about $1,500,000.

NORTH MUSKEGON, MICH.—Bids have been rejected for the installation of an electrically operated pumping plant at the municipal waterworks, and new bids will be called at an early date. Hoad, Decker, Shoecroft & Drury, 303 South Street, Ann Arbor, are engineers.

ST. JOHNS, MICH. — Plans are under way for a power plant at the municipal waterworks, to cost about $150,000, including equipment.

CHILLICOTHE, OHIO.—Bids will be received by the Quartermaster General, 2,306 Munitions Building, Washington, D. C., until Nov. 14 for the installation of a lighting system in the proposed new hospital at Camp Sherman, Chillicothe, comprising twenty-two buildings.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Nov. 3 for paper-insulated lead-covered wire for the division of light and power.

CLEVELAND, OHIO.—The City Council is considering building a reservoir, administration building, power plant, chemical, gate and pressure houses at the Baldwin site, to cost about $4,500,000. A. V. Ruggles, City Hall, is engineer.

CLEVELAND, OHIO.—The installation of an ornamental lighting system on Superior, Rough, Wade Park, St. Clair and Euclid Avenue is under consideration by the City Council. The cost is estimated at $150,000.

WOODSFIELD, OHIO. — Contract has been awarded by the Council for a new power station for the municipal light plant.

HICKMANN, KY.—The Kentucky Light & Power Company will build a transmission line, about 20 miles long, with distributing lines at a number of towns along the route for light and power service.

JACKSON, KY.—The Kentucky Utilities Company is taking bids for a one-story and basement power plant, 40 ft. x 55 ft.

LOUISA, KY.—The installation of an electric lighting system is under consideration by the Council.

AUBURN, IND.—Bids will be received by G. Potter, city clerk, until Nov. 2 for furnishing and installing machinery and general equipment for the municipal electric light, power and water plant.

TERRE HAUTE, IND.—Plans are being prepared by the Vigo Mining Company, Rose Dispensary Building, for the erection of a power house, to cost about $75,000. The Shourds-Stoner Company, Tribune Building, is architect.

VINCENNES, IND.—The Blackford Window Glass Company contemplates the construction of a power plant in connection with its proposed glass works, to cost about $300,000.

MARSHALL, ILL.—Bids will be received by the Mayor and City Council until Nov. 9 for new power house, two alternating-current generators directly connected to "Unaflow" engines, switchboard, two boilers, piping, chimney, moving and resetting one fire-tube boiler, etc.; furnishing and installing ice-making machinery (15 tons daily capacity), distilled-water ice plant and erecting ice-plant building complete, etc. F. L. Wilcox, Chemical Building, St. Louis, is engineer.

CHILTON, WIS.—The Calumet Service Company is planning to extend its transmission lines to furnish electricity in Calumet Harbor, Charlesburg and Stockbridge. The cost is estimated at $25,000.

BAYARD, IOWA.—At an election held recently the proposal to sell the municipal electric light plant to the Iowa Railway & Light Company, Cedar Rapids, was carried. A franchise was also granted.

GILMORE, IOWA.—C. W. Lamphere will install electrical equipment at his proposed ice-manufacturing plants to be located at Eagle Grove and Clarion, to cost about $75,000.

KNOXVILLE, IOWA.—Bids will be received by the city of Knoxville until Nov. 10 for furnishing and installing complete an ornamental street-lighting system on certain streets of the city. Plans and specifications are on file in the office of the city clerk and in the office of Frank D. Paine, engineer, Station A, Ames, Iowa.

SPENCER, IOWA.—Plans are being prepared for an addition to the municipal electric plant, to cost about $30,000. W. C. Barton, 1221 Forty-third Street, Des Moines, is architect.

CARROLLTON, MO.—Improvements will be made to the local power plant of the Sinclair Oil Corporation, to include the installation of a new engine and auxiliary equipment.

MOBERLY, MO.—The Council is considering the installation of an ornamental lighting system, to cost about $7,000.

ST. LOUIS, MO.—Bids, it is understood, will soon be asked by the Department of Public Works for the construction of a power, ice and refrigerating plant at the training school at Scott Farm. W. E Bowen, City Hall, is engineer.

ST. LOUIS, MO.—Plans are being prepared by the Atlas Tack Company, Fairhaven, Mass., for the construction of branch factory at Union and Geraldine Avenues, to cost, including equipment, about $500,000. The Widmer Engineering Company, Laclede Gas Building, St. Louis, is engineer.

ST. LOUIS, MO.—The United Railways Company will build a power house at Eighth Street and Franklin Avenue. An electric substation will also be erected in this district.

ST. LOUIS, MO. — The Wood & Lane Company, 915 Olive Street, contemplates the purchase of an engine-generator set of not more than 500 kw. capacity and a 150-kw. motor-generator set.

SPRINGFIELD, MO. — The Mountain Grove Creamery, Ice & Electric Company plans to rebuild its power plant, recently destroyed by fire, causing a loss of about $100,000.

VANDALIA, MO.—The Missouri Utilities Company is planning to rebuild its local substation, recently destroyed by fire, causing a loss of about $7,000.

GRAND ISLAND, NEB. — The Central Power Company plans to build a 5,000-kw. steam-driven electric plant in Grand Island, to cost about $750,000. A transmission line will be built.

CENTERVILLE, KAN.—The Sinclair Oil & Gas Company, Tulsa, Okla., will build an addition to its local electrically operated pumping plant. Additions will also be made to the plants at Humboldt, Johnesburg and Sycamore, Kan.

EUREKA, KAN.—The Eastern Kansas Power Company has issued $150,000 in bonds, part of the proceeds to be used for extensions and improvements.

Southern States

GREENVILLE, S. C.—The addition to be erected at the textile plant of the Judson Mills, Inc., to cost about $500,000, will be equipped throughout with electrically-driven machinery.

MOORESBORO, N. C.—The Sandy Run Electric Company, recently incorporated, has been granted franchises to supply electricity in the towns of Mooresboro, Lattimore, Boiling Springs and Ellenboro. The company will purchase electricity from the Southern Power Company, which has agreed to erect a transmission line and a substation at Lattimore or Mooresboro. The company is capitalized at $25,000.

RIDGEWAY, S. C. — Plans have been authorized for a municipal electric light plant and waterworks. The Ryan Engineering Company, Columbia, is engineer.

MORRISTOWN, TENN. — The Taylor Manufacturing Company will install electrical equipment at its woodworking plant, including motors, controllers, etc.

BIRMINGHAM, ALA.—The Public Service Commission has granted the Alabama Power Company permission to erect a new transmission line from Leeds to Lewisburg. The company was also given authority to sell 10,000 shares of capital stock at not less than 95.

FOLEY, ALA.—The Foley Light & Power Company will install a local power plant for commercial service throughout this district.

MOSS POINT, MISS.—The Southern Paper Company contemplates building an addition to its power house in connection with general mill expansion.

UTICA, MISS.—Bids will be received by the Mayor and Board of Aldermen until Nov. 9 as follows: One oil engine directly connected to alternator, one belted alternator, switchboard, pumps, pole-line material, 12,000-gal. oil-storage tank, repairs to building, etc. Swanson-McGraw, Inc., United Fruit Building, New Orleans, are engineers.

PIGGOT, ARK.—The installation of a municipal electric light and power plant is under consideration.

NEW ORLEANS, LA.—The New Orleans Railway & Light Company is preparing plans for an addition to its generating plant. Two electric substations will also be built and extensions made in the transmission system. The cost is estimated at $150,000. Dwight P. Robinson & Company, 125 East Forty-sixth Street, New York, are engineers.

NEW ORLEANS, LA.—The Lukins Steel Company, Coatesville, Pa., will build a power house in connection with its proposed local plant, to cost about $300,000.

SHREVEPORT, LA.—The Southwestern Gas & Electric Company has isused $2,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

EMPIRE CITY, OKLA. — The Wichita Pipe Line Company, Walters, contemplates erecting a power plant in Empire City and an electrically operated pumping plant in the vicinity of Beaver Creek in connection with a new oil pipe line.

ENID, OKLA.—Contract has been let to R. G. Clark for the erection of a transmission line to Hillsdale, Kremlin, Goltry and Nashville, about 45 miles, at $24,000.

AMARILLO, TEX.—The installation of a municipal fire-alarm system, to cost about $30,000, is under consideration.

DALLAS, TEX.—The Dallas Power & Light Company has purchased a site on which it will erect the proposed extension to its present plant at a cost of about $2,180,000.

EL PASO, TEX.—The lighting committee contemplates the installation of a lighting system on a number of streets.

FARWELL, TEX.—A contract has been made for power service from the municipal plant at Clovis, N. M., for local distribution.

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Pacific and Mountain States

CHELAN, WASH.—The Great Northern Railway Company is planning to build an ice-manufacturing and cold-storage plant here, to cost, including machinery, about $450,000.

SEATTLE, WASH.—The Puget Sound Power & Light Company has issued $1,300,000 in capital stock, part of the proceeds to be used for extensions and improvements.

PORTLAND, ORE.—The Federal Power Commission has granted the Pacific Power & Light Company a permit to develop a power site on the Columbia River. The proposed plant will develop about 54,000 hp.

LOS ANGELES, CAL.—Prescott T. Stevens, 7353 Sunset Boulevard, and associates have petitioned the Water Supply Commission for permission to build a 450-hp. power plant on the White Water River, Riverside County, to cost about $75,000.

SAN DIEGO, CAL.—Edward Fletcher, 9 Twenty-eighth Street, and associates have received permission from the State Water Commission to construct a 3,000-hp. hydro-electric plant on Santa Ysabel and Black Canyon Creeks, to cost about $350,000.

SAN FRANCISCO, CAL.—J. W. Preston, Jr., 350 Post Street, and associates have applied to the Water Supply Commission for permission to construct hydro-electric power plants on the North Fork of the Makelumne River and Sutter Creek, to develop 35,000 hp. and 31,000 hp. respectively.

TURLOCK, CAL.—The Board of County Supervisors have granted the Turlock Irrigation District a franchise to erect transmission lines within the district.

WILMINGTON, CAL. — The Shell Oil Company of California, San Francisco, contemplates the construction of a power house in connection with its proposed oil refinery at Wilmington, to cost about $1,000,000.

BOISE, IDAHO.—Bids will be received by the United States Reclamation Service, Denver, Col., until Dec. 6 for two pumping units for the Black Canyon pumping plant, Boise, project.

BOISE, IDAHO.—The Idaho Power Company has petitioned the Federal Power Commission for a license to erect a 44,000-volt transmission line from American Falls to Pocatello. This line will connect the company's system with that of the Utah Power & Light Company.

PUEBLO, COL.—Application has been made to the Federal Power Commission by Anna P. Gray, Pueblo, for a preliminary permit covering three small power projects at the headwaters of South Colony Creek in Custer, which it is estimated will develop about 1,800 hp., to be used for mining purposes.

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Canada

YARMOUTH, N. S.—A proposed hydro-electric project on the east branch of Bear River, which would supply electricity on the north shore of Nova Scotia from Yarmouth to Middletown, was outlined in an address to the Town Council by K. H. Smith, chief engineer of the Nova Scotia Water Power Commission.

CAMPBELLFORD, ONT. — The Hydro-Electric Power Commission of Ontario contemplates building a new power house at Lock No. 8.

WESTON, ONT.—Imrovements are contemplated to the municipal electric light and power plant, to cost about $25,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 3, 1922)

1,131,047. Method of and Apparatus for Promoting Chemical Reactions Between Gases; S. Ruben, New York, N. Y. App. filed April 16, 1920. By passing high frequency current through liquid.

1,431,063. X-Ray Cathode; S. Tousey, New York, N. Y. App. filed Aug. 25, 1920. Cathode used of such form that relatively weak current may be employed.

1,431,091. Signaling System; W. H. Bendernagel, Brooklyn, N. Y. App. filed Oct. 23, 1918. Signaling means provided at intermediate station on a telephone line.

1,431,116. Semi-Automatic Telephone System; C. A. W. Hultman, Stockholm, Sweden. App. filed Dec. 28, 1918. Simplified switch operation in the group-switching stages.

1,431,135. Overload Apparatus for Alternating-Current Motors; H. F. Stratton, Cleveland, Ohio. App. filed May 19, 1919. Thermal overload relay.

(Issued Oct. 10, 1922)

15,466 (reissue). Method of Electric Welding; T. E. Murray, Jr., Brooklyn, N. Y. App. filed Jan. 16, 1922. Welding current from 50,000 amp. to 100,000 amp. per square inch.

1,431,158. Incandescent Electric Lamp; J. A. Heany, New Haven, Conn. App. filed Nov. 27, 1918. Means of joining lead-in wire and filament.

1,431,184. Electric Heating Device; J. R. Rose, Edgeworth, Pa. App. filed March 8, 1920. Reflector type.

1,431,195. Telephone Exchange System; J. F. Toomey, New York, N. Y. App. filed May 26, 1921. Arrangement for signaling called subscriber.

1,431,196. Thermo-Telephone Transmitter and Receiver; R. A. Baron Van Lynden, Utrecht, Netherlands. App. filed March 12, 1918. Provided with hot wire having insulating coating in contact with air.

1,431,202. Electric Arc Lamp; W. Wenderhold, New York, N. Y. App. filed Jan. 14, 1918. Carbon supports pivotally mounted for independent movement about common axis.

1,431,219. Electron Tube Repeater; G. Crisson, Hoboken, N. J. App. filed May 20, 1919. Apparatus and circuits for preventing cross-talk through filament circuits.

1,431,231. Resistance Unit; J. G. Homan, Steubenville, Ohio. App. filed Nov. 1, 1921. Composed of laminated structure formed of sheet metal having an oxide coating thereon.

1,431,245. Method of and Apparatus for Purifying Liquids; F. W. Mitchell and J. E. Pfeffer, Chicago, Ill. App. filed Aug. 2, 1918. Electric current used to kill bacteria in milk.

1,431,249. Motor Controller; F. H. Oberschmidt, Cleveland, Ohio. App. filed Nov. 6, 1920. Automatic regulation for acceleration and dynamic braking of rubber calenders.

1,431,254. Regulating System; F. L. Re Qua, Milwaukee, Wis. App. filed April 7, 1919. Apparatus for regulating generator voltage.

1,431,261. Electric Ignition Apparatus; L. W. Rosenthal, New York, N. Y., and G. J. Lang, Weehawken, N. J. App. filed Oct. 1, 1918. Simultaneously produces sparks at two or more spark plugs from two or more magnetos.

1,431,271. Radio-Sensitive Element; H. W. Van Allen, Springfield, Mass. App. filed April 12, 1921. Films of X-ray machine arranged to avoid any distortion of image.

1,431,295. Current Collector; G. B. Evans, St. Louis, Mo. App. filed June 4, 1921. Collector rings for machines of rolled brass.

1,431,301. Process of Extending the Catalytic Activity of Mercury Compounds; N. Grunstein, Frankfort-on-the-Main, and P. Berge, Griesheim-on-the-Main, Germany. App. filed May 21, 1919. Treating acid-reaction liquid containing mercury salts with electric current.

1,431,308. Circuit Controller; B. W. Jones, Schenectady, N. Y. App. filed Nov. 26, 1921. Electro-responsive line switches.

1,431,325. Electric Fixture; J. F. Pedersen, Racine, Wis. App. filed Aug. 23, 1920. Swiveled connection between the two parts of fixture prevents tangling of wire.

1,431,340. Trolley Wire Splice Runner; W. W. Terry, Portsmouth, Va. App. filed May 25, 1922. Protective runner clamps wires to be connected and extends beyond splice.

1,431,349. Adjustable Speed-Starting Device for Electric Motors and the Like; G. O. Wilms, Milwaukee, Wis. App. filed May 12, 1920. By compression of resistance medium.

1,431,393. High-Frequency Oscillator; A. L. Golden, Oakland, Cal. App. filed May 16, 1917. Employs electrodes which permit gases formed to discharge freely. Used with telephone or telegraph.

1,431,407. Electric Heating Unit; L. R. McClatchie, Penetanguishene, Ontario, Can. App. filed Aug. 1, 1921. Enlarged coils arranged at intervals support coils clear of grooved walls in grill plate.

1,431,418. Electric Heating Apparatus; E. Phillipson, New York, N. Y. App. filed May 31, 1921. Reflector type emits heat both horizontally and vertically.

1,431,424. Electric Furnace; I. Rennerfelt, Djursholm, Sweden. App. filed Aug. 10, 1921. Rotating hearth on which articles are placed surrounds heating element formed of electrodes.

1,431,468. Electrically Heated Device; J. F. Lamb, New Britain, Conn. App. filed Aug. 11, 1919. Plate type.

1,431,545. Magnetic Distortion Motor; M. A. Schwartz, Los Angeles, Cal. App. filed July 2, 1920. Temperature-varying magnetic elements, field magnets and heating jets placed around and below armature.

1,431,574. Electrolytic Apparatus; H. Y. Eagle, Brooklyn, N. Y. App. filed Nov. 12, 1920. Groups of electrodes, each group receiving current from a different conductor.

1,431,578. X-Ray System; H. D. Garretson, New York, N. Y. App. filed Feb. 5, 1921. No high-potential wires exposed.

1,431,580. Electric Water Heater; O. Graetzer, Zollikon and O. F. Bruman, Zurichenge, Switzerland. App. filed Aug. 31, 1921. Water-heating faucets in which liquid acts as resistance element.

1,431,597. Automatic Work-Recording Apparatus; W. Poppelreuter, Bonn, Germany. App. filed Nov. 20, 1919. Records work executed by men or man-operated machine.

1,431,602. Art of Electrolysis; C. G. Spencer, New York, N. Y. App. filed Jan. 15, 1921. Electrolytic generation of oxygen and hydrogen from water.

1,431,620. Electric Motor; E. C. Ballman St. Louis, Mo. App. filed Sept. 4, 1917. Stator end frames so constructed as to secure rigidity and uniform air gap.

1,431,622. Electrical Connector Device; R. B. Benjamin, Chicago, Ill. App. filed Dec. 12, 1919. Plug sockets for low-voltage lighting circuits.

1,431,627. Remote-Control System; W. H. Bristol, Waterbury, and M. J. Johnson, Naugatuck, Conn. App. filed March 18, 1919. Single-phase synchronized remote-control recorder.

1,431,638. Electrical Means for Detecting, Observing, Indicating, Measuring or Utilizing Minute Movements; J. J. Dowling, Rathgar, Ireland. App. filed May 17, 1921. Utilizes vacuum tube to discern very small differences in measurements.

1,431,666. Synchronized Apparatus; M. J. Johnson, Naugatuck, Conn. App. filed July 31, 1920. Provides for direct driving of phonograph or similar apparatus from corresponding rotor member of synchronized unit.

1,431,670. Parlor Floor Lamp; J. Klein, Cleveland, Ohio. App. filed Aug. 24, 1921. Pedestal lamp with floor lamp inclosed in base.

1,431,678. Circuit Breaker; B. M. Mooers, San Francisco, and L. E. Warner, Berkeley, Calif. App. filed Dec. 27, 1917. Disconnects apparatus when temperature becomes destructive and holds breaker opened until danger is passed.

1,431,686. Induction Furnace; W. Rohn, Hanau, Germany. App. filed Dec. 21, 1920. Annular melting channel surrounded on all sides by the primary coil and both channel and primary coil surrounded by iron.

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We Must Tell the World

WHEN Christopher Columbus discovered America in 1492 and returned with the great news to Spain, King Ferdinand in celebration caused a new coin to be struck off. It bore the Latin words "Nil ultra," meaning "Nothing beyond!" This strange land across the wide waters outspanned the imagination of the day. It reached the limit of human credulity.

To us, here and now, such ignorance, such smugness, such lack of mental elasticity, is incomprehensible — speaking geographically. But when it comes to the matter of a personal vision of the world we live in and a guiding picture of the future toward which our world is trending, how like King Ferdinand are the people of our day.

BEFORE the electrical industry today there are five great conceptions, five definite expectations, which in moments of enthusiasm we dream about:

1. We look forward to the eventual complete utilization of the water powers of the country.
2. We believe that some day great superpower systems will line the land, carrying energy from the falling waters and huge central-station plants to the stations that serve all cities.
3. We count on the complete motorization of all industries, so that wherever a wheel turns in a mill or on a railway its power will be electric.
4. We know that the universal electrification of the home is but a matter for natural development and that the use of electrical conveniences in the store and office will increase inevitably in full proportion.
5. We are confident that public utilities as a class will some day be owned by the people whom they serve, through the purchase of the securities of these companies by their customers, and that thereby the public service corporation will enjoy the public confidence fully, because with a share in ownership will come a better understanding and a broader sympathy.

These things we thoroughly believe. They are, in fact, the very fundamentals of our hope and planning. When men of the industry gather and discuss ideals and purposes, these are the things they talk about. And yet as individuals we give too little thought to actually harnessing these brilliant stars in our own towns as a very practical motive power for our wagons.

IT IS not enough that we electrical men think of these things. Each step in this evolution can only be achieved through the interest, enthusiasm and support of the public. It is all predicated on popularity, on a public eagerness for water development, superpower systems, more motors in the factories, more dependence upon electricity in daily living. For only from this source will come the millions and the billions which will make possible the realization of these great conceptions.

Unless this is a vision which we would exhibit only on fête days as a display of splendor, we must proceed to sell this picture to the public. We must convey to it this expectation and implant this hope.

No one man in his own town can bring these mighty things to pass. Until all men in every town believe in both their possibility and their desirability they never will be realized. And to sow the seeds of this desire every individual in the electrical industry has a part to play and must play it well. It is not enough for us to have this great conception in our hearts. We must tell the world. For the world is still prone to write "Nil ultra" on its coins.

William M. White

An engineer who has been intimately concerned with hydraulic turbine developments in America.

TO HAVE spent his active life in the development of the water powers of the United States through the design and construction of waterwheel equipment is the good fortune of William M. White. In this activity his services have been called into requisition by the largest installations in the country, and he has designed or superintended the design of a considerable portion of the total waterwheel capacity now in operation in central-station plants. Mr. White was graduated from Tulane University, in New Orleans, in 1899. He was assistant manager of the Drainage Commission of that city until August, 1901. He then entered the employ of the I. P. Morris Company of Philadelphia, which at that time was constructing the first vertical turbines for Niagara Falls under designs made by a foreign firm. In 1903, when a hydraulic department of the I. P. Morris Company was formed, he was placed at its head as hydraulic engineer. In 1911 he became the manager and chief engineer of the hydraulic department of the Allis-Chalmers Manufacturing Company of Milwaukee, and this post he still fills.

Early in his experience Mr. White was called on to rectify the difficulties experienced in an Eastern plant with what were then high-head turbines. By redesigning runners and making other alterations the guarantees of the foreign-built machines were finally met as a result of his work. As already intimated, he has been responsible for or intimately connected with the design of turbines for some of the largest hydraulic installations in the country. Among the first of these undertakings were the McCall's Ferry plant of the Pennsylvania Water & Power Company, station No. 3 of the Niagara Falls Power Company and the Caribou plant of the Great Western Power Company. Two 40,000-hp. turbines of his design for the Pit River plant of the Pacific Gas & Electric Company are now being erected, and the construction for the Niagara Falls Power Company of a vertical single-runner hydraulic turbine of 70,000 hp. for which also he is responsible has just been undertaken.

Mr. White has taken out about fifty United States and foreign patents for devices, among which may be mentioned the plate-steel spiral casing, the directly connected flyball and the hydraucone regainer. The last-named he considers his greatest contribution to the art. He is widely known, his work having taken him into every state in the Union.

Mr. White is a member of the Engineers' Club of New York City and of a number of Milwaukee social and athletic clubs. He finds his recreation on the golf links, whence come tales of his exceptional prowess at the game.

Editorial Comment

Electrical World, November 4, 1922
Volume 80 Number 19

Water Power as a Political Issue

THE approaching elections are not without interest to the electric light and power industry because much political capital is being made out of water-power development. In California the issue is very pronounced and clear-cut. There the voters will decide next Tuesday whether they will look to the state or to private enterprise hereafter for their supply of hydro-electric energy. On the Atlantic seaboard and in the interior no water-power measures will be voted on as such, but in New York all of the political parties make much of water power in their propaganda. Governor Miller in his speech last week came out flat-footed for private development with public regulation. To ex-Governor Smith the water-power trust is apparently more than a phantom, and the Labor party naturally stands for government ownership. Regardless of which party wins at the polls next Tuesday in the East and Middle West States, the water-power situation will be unchanged. It is only on the Pacific Coast that the issue is critical, and there too it is more than likely that the common sense of the voters will assert itself and threatened state ownership be defeated.

More Light on Losses in Central-Station Merchandising

THE detailed study of the costs of selling electrical appliances by nine central-station companies alluded to in his French Lick paper by John F. Gilchrist, vice-president of the Commonwealth Edison Company, Chicago, has been presented in the report of a committee of the Edison association of which Mr. Gilchrist was chairman, and is published in this issue. It lays before the industry the astounding fact that after an exhaustive investigation of the merchandise sales record of these nine large central-station companies, whose combined retail business totaled for the year 1921 more than $7,000,000, it was impossible to tell accurately how profitable or unprofitable it had been. No adequate separate cost figures had been kept, and therefore, to put it bluntly, the executives of these companies were in ignorance as to whether this considerable branch of their business had been well and profitably conducted or not. To provide a working basis of comparison, therefore, statistics were developed which would show what the cost of each of these nine merchandising activities would have been if they had been organized as separate business enterprises, carrying their natural overhead charges. The results showed a total combined loss of $650,000.

Laid down in black and white these figures are staggering. Here is household merchandise which the public wants to buy. Yet here we find a class of dealers, the most favored by position and opportunity, the most highly organized, the most adequately financed, failing utterly to pay expenses on a large volume of business. What shall be done? The committee clearly points the way.

The first need is for a knowledge of costs and an intelligent accounting system that will place this central-station department of merchandising squarely on its feet so that the men engaged in it—their executives and their stockholders—may know whether this retail business of theirs is a success or not. It must show exactly what it costs to carry on the merchandising business and what it costs to pioneer those other appliances that are not yet established in the market and must be supported by a substantial investment for educational publicity and the creation of a demand. For this pioneering will always be done at a loss. It is not merchandising at all.

All this will never be known unless the central station draws an honest balance sheet and measures itself against competitors. Moreover, until the light and power company's retail store does establish itself on this sound business basis it is neither playing fair with the other local electrical merchant who has no energy sales to carry overhead nor properly assuming its balance function in the broad distribution of electrical goods. Therefore the committee urges that in formulating such a cost-accounting system careful study be made of the experience of the contractors and jobbers.

But there is another thing that the central-station commercial man must learn. He must study deeper into the art and science of retail merchandising itself. Of course, with a knowledge of costs all that will come, for a true balance sheet is a great educator. It continuously and automatically weeds out wrong policies and educates executives to choose the right men.

Teaching Electrical Safety in Public Schools

THE introduction of studies in safety as a part of the routine work in public schools gives every evidence of becoming a widespread practice in the near future. Efforts toward drawing up outlines of study are being made and even the preparation of textbooks is being undertaken. One of the subjects that will receive attention is that of accidents due to electrical causes. To insure a proper and accurate treatment of this subject every central-station manager ought to take an active part in any movement in the schools of his community to provide instruction of this kind.

This is because too much unreasoning fear of the dangers of electrical circuits still prevails among uninformed persons. If truthful lessons concerning safety and hazards are to be taught the school children —and it is reasonable that this should be done—then the men whose life business it is to work with such circuits must help to build up a constructive program of education, and the way to do this is to take an active interest in the matter while it is in its development.

Keeping Up Morale in Station Operation

EXECUTIVES are prone to regard the running of modern steam plants as a purely routine job; but if they fail to recognize and emphasize the interesting viewpoints of this work and afford the men under them little or no opportunity for initiative, adverse results are bound to tell in time upon the log sheets. Morale can be kept up and heightened in more than one way, but perhaps nothing can take the place of providing both interesting and profitable work for the staff, assuming a competent and reasonable-minded chief. In a recent conversation with a central-station chief engineer the point was well made by the operating executive that putting responsibility for results upon the station staff, encouraging friendly rivalries between shifts as to economy of operation, paying liberal wages to capable men and keeping veterans in service as long as feasible, even if minor errors in judgment occasionally arise, pay large dividends in plant efficiency.

Equipment is constantly aging and depreciating, loads and fuel quality continue to vary, inspection and maintenance perpetually disclose new problems. Pride and contentment in plant operation arise from sustained and encouraged interest and adequate compensation for proved ability.

Short-sighted Scheming Against Progress

NOT long ago a contractor-dealer in a certain prominent city went to the manager of the local central-station company and asked if he might have a list of the company's residential customers—electric. It is a combination utility—gas and electric. But the manager said no. They did not want to have electric ranges, heaters and heating appliances sold, he said, because they wished to push the gas end of their business. There was more money in it, and they did not care to give out any list of customers to the local trade. They wanted houses to be piped rather than wired and to put the pressure on gas appliances, not electric. All of which was very stimulating to a man whose business was the sale of electric wiring and appliances.

Now the question is, Who is the owner of this public utility? The people of this city buy gas service and electric service, and they buy appliances for use with both. But the manager of the utility that furnishes both types of service decides that under his method of operation it is more profitable to his company to sell them gas. Therefore he adopts the policy of making it as easy as possible for the public to obtain and enjoy the use of gas and as hard as possible to obtain and enjoy the use of electricity. He arrogates to himself the right to decide which type of service the people of his city should buy and sets himself to interfere with the natural development of the electrical business in that town in the hope that the gas business will benefit thereby. And yet, as a matter of plain fact, by assuming the position of manager of that public utility this manager has accepted the responsibility of a servant of the public and an obligation to operate this utility in the public interest. To his stockholders he pays the fair return allowed on their investment, but other than that his duty is to the community he serves.

Some utility executives cannot see over the top of the power house or the gas holder. They forget that on beyond is a world far bigger than the properties intrusted to their care, and that the welfare of the public is a matter of more importance than the ends which are gained by such selfish scheming.

The Electron in Heavy Engineering

DR. LANGMUIR'S paper of a fortnight ago should make engineers who are still thinking in terms of stators and motors pause. Here we have electronic rectifiers, transformers and frequency changers rated in hundreds of amperes and tens of thousands of volts, able so far as mere output is concerned to stand side by side with the big generators and transformers of the beginning of the century. Moreover, while these are not in themselves of very high efficiency, they compare excellently well with the possibilities of the other apparatus when this is applied to the same extraordinary tasks. In a single decade the output of the fundamental three-electrode tube has been pushed up from a few tenths of a watt to a thousand kilowatts with no immediate limit in sight. Likewise the oldest practical form of electric valve—the mercury rectifier—has in its turn been pushed up at least to several hundred kilowatts output and is in use abroad in serious power work as it is here for arc-lamp operation.

Now, what does all this mean in the technical advance of engineering? It does not imply the decadence of the old so much as the full justification of the new. A careful perusal of Dr. Langmuir's paper shows very plainly that electric engineering has troubles of its own that must be gradually eliminated. In broad terms, its chief failing for immediate high usefulness is inherent in the fact that there is an electron stream as part of the working circuit, and it is hard to provide sufficient carrying power in this particular form and also hard to dispose of the waste heat in a structure requiring high vacua. Moreover, one has to deal very definitely with excitation losses, no more welcome as applied to the filament than they have been heretofore in the magnetic circuit. A very considerable use of static condensers in the new field is also indicated. They were tried in alternating-current practice about thirty years ago and now are just coming into use again in dynamic as well as electronic progress. So far as one can now look forward there are immediate practical uses for these giant power tubes in all classes of radio service, while in the wider field of power production and utilization there are possibilities that it would take a brave soothsayer to prophesy.

One thing is plain—that the whole scheme of operation lends itself peculiarly to very high voltages, whether direct or alternating, and if the latter, to frequencies easily outside those conveniently obtained from dynamos. The thing is quite in line with the drift of transmission practice, but as yet throws no light on improved methods of local utilization to match. The chief troubles from the apparatus standpoint bid fair to be smoothed out. The water-cooled anode was a step forward to larger things, and with the improvements now made in the working of high silica glass and even pure silica some of the difficulties of tube construction are going to be greatly lessened. The extremely refractory electrodes of the present tubes enable them to be worked at temperatures high enough to radiate well through ordinary glass, and the new glasses give even greater promise in the keeping down of troublesome temperatures. The production of seals reliable and permanent under high temperature conditions appears to be the outstanding problem in these new advances just as it was in the high power mercury rectifiers of a decade since.

Are Interconnection Log Sheets Desirable?

IN THIS era of multiplied records he is a brave man who will advocate increasing the clerical burdens of a central-station company unless the need is beyond question. Without categorically declaring that interconnection log sheets are indispensable where two or more utilities are tied together by appropriate trunk-line connections, we feel that the matter deserves consideration by operating men. Daily log sheets are of course expected to tell the story of intercompany doings by wire, but these are bulky to handle and often are incomplete. The amount of energy interchanged, the maximum and minimum blocks transmitted to and fro, the duration, cause and remedy of interruptions and the analyses of anticipated and actual load conditions that dictate changes in plant units put on the line, etc., are very suggestive.

As the money value of interconnected equipment rises it seems almost beyond doubt to be desirable to keep some sort of interconnection record, in loose-leaf pocket book if nothing more, constantly up to date and available for analysis. If this be done, the omissions in the log sheets which are conspicuous when the operating forces have been busy restoring normal service may be reinforced before it is too late, through special inquiry; the economics of interconnection can be more conveniently studied, and a valuable operating diary can be compiled. Such work is fast assuming so important a place in the industry that dependence upon haphazard or scattered records can in many installations hardly suffice much longer.

Small Automatic Hydro-Electric Plants Being Developed

OUT of the discussion of the utilization of the water-power resources of the country are growing some interesting automatic station developments in the Middle West. In that part of the country, except in a few localities, possible hydro-electric developments are not extensive because heads are low and stream flows are either very small or irregular, sudden floods coming at various times of the year as the result of heavy rains. The cost of measures to equalize the flow of streams is usually so great that the development of control is economically impossible. Many of the practicable sites have such a small amount of power that the expense of attendance is a serious item.

One of the situations typical of a large portion of the hydro-electric projects in the Middle West is described by Ralph B. Purinton elsewhere in this issue. It involved the substitution of a 300-kw. automatic generating station for an old cable-driven mill which furnished energy to the town of Fairbury, Neb. This development was made economically possible only by automatic plant control.

In another location in the Middle West a string of several plants on an old canal will soon be under construction. They will be automatically controlled from the water gates to the generator, even the overflow gates being controlled in this manner, so that only when the plant is operating at its full capacity will any water be allowed to go by any plant in the group. Other installations of this type and some similar to the Fairbury installation are under consideration, and some of them are expected to be under construction soon. None of these plants is spectacular, but with a properly functioning control system that is not excessive in first cost they mean that saving of fuel can be made a profitable proposition on many a Middle Western system.

The essentials in such plants are substantial construction at a cost that will not eat up the saving in fuel and an automatic control system that is practically foolproof. Designers have made great progress in automatic control in the past few years, and the possibilities in this direction afforded by the small water powers of the country should not be overlooked.

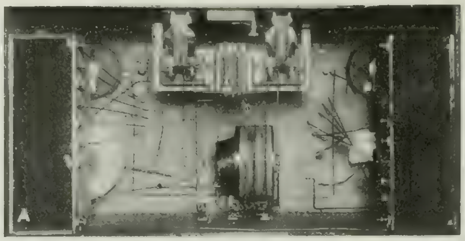
Simple Tests Will Suggest Best Operation of High-Tension Networks

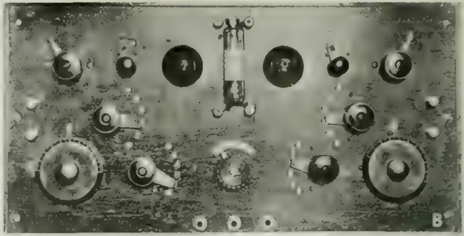
THE present practice in the operation of the principal transmission lines is to parallel them at every practicable point in order to get the benefit of better line regulation and distribution of the load upon the generating stations. This practice may require extensive changes, as is evident from the results of tests reported elsewhere in this issue by L. J. Corbett. These tests were conducted upon an ingeniously simple replica of the main transmission line of the Pacific Gas & Electric Company, and they indicate the large short-circuit current which will be encountered in the operation of large stations interconnected by 110,000-volt and 220,000-volt lines.

Although it is not impossible to build switches which will interrupt 4,500 amp. at 110,000 volts or 2,200 amp. at 220,000 volts, yet the economies of such construction and operation need the most careful scrutiny. In the West a plan has often been discussed of dividing the larger systems into two or more portions, each with its generating capacity proportional to its load, and operating these portions either entirely separately or else interconnected at only one point. If the latter practice is adopted, the number of switches of extremely large capacity required will be materially reduced as compared with the number required under present methods of operation. Such interconnection points will be designed to break the system into independent parts upon the occurrence of trouble and so prevent widespread interruption. The alternative practice of operating the system as several independent divisions has the advantage of definitely limiting the extent of disturbances but the disadvantage of a possible loss in operating economy. The first method appears the more desirable from an operating standpoint, but care must be taken that the switches installed are able to meet the duties imposed upon them.

Switch duty cannot be accurately determined for all cases, but one great advantage of the miniature system is that determinations of short-circuit currents may be made rapidly and the constants may be changed readily as the system grows. A disadvantage is the possibility of errors introduced by the difficulty of duplicating exact conditions in the system.

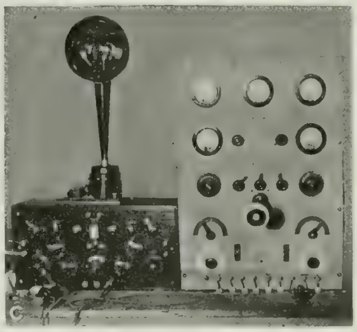
Radio Is Useful for Western Power Systems

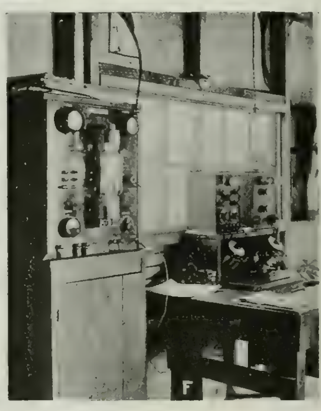




COMMUNICATION is the factor of chief importance in the successful operation of most any extensive power system. Most every system has its own private telephone lines and these are usually carried along beneath the transmission lines and on the same poles. Photographs E and G illustrate very well what may happen; in fact, what often happens to these pole lines, due to causes over which the operators have little or no control. It is in such instances that the radio telephone should prove its greatest value. Photographs A, B and C illustrate exeprimental radio-telephone apparatus being developed by one of the Western power companies for the purpose of emergency communication, C being the complete transmitting and receiving set built of standard parts, A and B "closeup" views of the receiving set, a detector-tuner unit and two stages of audio-frequency amplification incorporated in one cabinet. The set has a consistent range of 150 miles.

Another useful purpose of radio with the Western power companies is that of telegraphic communication with construction projects remote from headquarters, or even among the somewhat segregated camps of one large project. Photos D and F illustrate the use of the continuous or undamped radio telegraph.





Automatic Plant Replaces Cable Drive

Mill Station Feasible Owing to the Sale of Power to Nearby Village — Protection Against Overload, High Voltage and Overspeeding Obtained Through Standard Equipment

By **RALPH B. PURINTON**
Electrical Engineer General Electric Company, Chicago

AUTOMATIC GENERATING PLANT OF FAIRBURY MILL & ELEVATOR COMPANY, SITUATED ON LITTLE BLUE RIVER, NEB.

THE installation of an automatic hydro-electric generating plant at Fairbury, Neb., has several important features worthy of notice. In the first place, this plant has taken the place of an old water turbine which had driven the flour mill. Naturally the electric drive produced an increased over-all efficiency, flexibility and ease of control. Besides this factor, the new waterwheels, directly coupled to vertical generators, generated enough power to furnish energy to the city of Fairbury. This point, together with the low operating expense due to automatic control, served to convince the owners that the project was economically feasible.

The Fairbury Mill & Elevator Company owned on the Little Blue River a water-power development which consisted of a 12-ft. dam with a small power house at one end. This so-called power house was nothing more than a vertical turbine driving through a bevel gear a pulley on which ran a steel cable from the river to the mill, a thousand feet away. This cable drive was always a source of trouble. The cable was held off the ground by an idler pulley mounted on a tower, but in spite of this provision against excessive sagging, the cable would continue to stretch and thereby require frequent splicing to keep it fit. Another trouble experienced was that it was not always possible to shut the waterwheel gates tight enough to stop the pulleys. These were the operating difficulties.

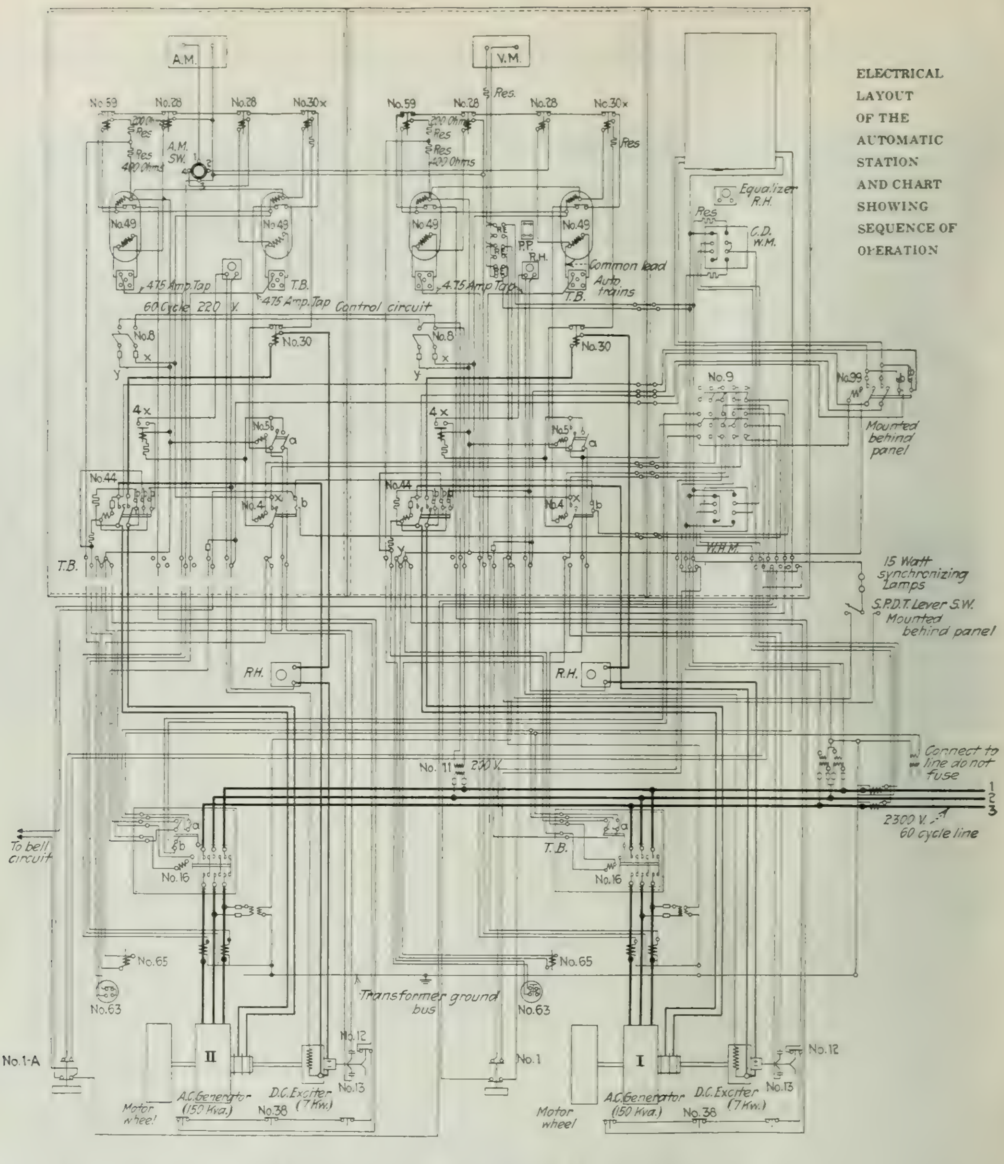
DECISIVE FACTOR LEADS TO CHANGE

From an economic standpoint it was not very desirable to continue with this inefficient drive and also lose the benefit of the river flow by being unable to utilize its latent power at times when the mill was not grinding. The decisive factor, however, which made possible and practicable the modernizing of this equipment by electrification was the fact that the city of Fairbury was willing to buy all electric power which could be generated by the mill power plant above the needs of the mill itself. The city electric light plant is entirely driven by steam. If it could have energy pumped into its lines at less than its own cost of generating the same amount, it was manifestly to its own interest to do so, and if the mill could sell all its excess power at a reasonable profit, this proposition would appeal to the mill owners.

Therefore, the old wheel was removed and a modern brick and concrete station built, housing two complete generating units of 150 kva. each. Direct connected exciters were mounted above and on the same shaft with the generators. These units were controlled by automatic oil-pressure governors and automatic switchboard equipment. The current from these machines, generated at 2,300 volts and 60 cycles, was transmitted at this voltage to the city power house over a line about 1,800 ft. long. Another line 700 ft. long was run from the mill to tap this transmission line. Then, with a 75-hp. motor installed to drive the mill machinery, the system was complete.

As it was very desirable to keep the operating expenses of this plant at a minimum and to assure complete protection of the generators, automatic control was installed. The control board was arranged so that the generators would start up and come on the line in response to the action of float switches operating on water level or of remote-control switches in the city plant. No attendant was required for starting or shutting down these generators. An occasional visit and a periodic inspection were all that was necessary to keep the plant in operation.

ELECTRICAL LAYOUT OF THE AUTOMATIC STATION AND CHART SHOWING SEQUENCE OF OPERATION



OPERATION	1	4	5	8	13	16	30	30x	44	11	1-A	4	5	8	13	16	30	30x	44	REMARKS
STARTING	MACHINE NO. I										MACHINE NO. II									
* Station ready to start	●			●			●	●		D	●			●			●	●		Transmission line deenergized
Demand for power	●			●			●	●		E	●			●			●	●		Remote oil circuit breaker closed
No 4 Closes	●	●		●			●	●		E	●	●		●			●	●		Governor solenoid energized and water wheel starts
No 13 Closes	●	●		●	●		●	●		E	●	●		●	●		●	●		Machine attains 95% speed
No. 5 Closes	●	●	●	●	●		●	T		E	●	●	●	●	●		●	T		Control apparatus energized
No. 16 Closes	●	●	●	●	●	●	●	T		E	●	●	●	●	●	●	●	T		Generator connected to line
No 44 Closes	●	●	●	●	●	●		●	●	E	●	●	●	●	●	●		●	●	Field established: Normal operation
Stopping No. II (Automatically)																				
No. 1-A Opens on low water	●	●	●	●	●	●		●	●	E				●			●	●		All devices assume off position (For Machine No II)
Stopping No I (Automatically)																				
No. 1 Opens on low water				●			●	●		E				●			●	●		All devices assume off position (Machines No I & II)
Stopping No. I & II (By hand)																				
No. 8 Switch opened by hand	●							●		E	●							●		Remote oil circuit breaker is open
Ready for restart	●			●			●	●		D	●			●			●	●		All devices assume off position

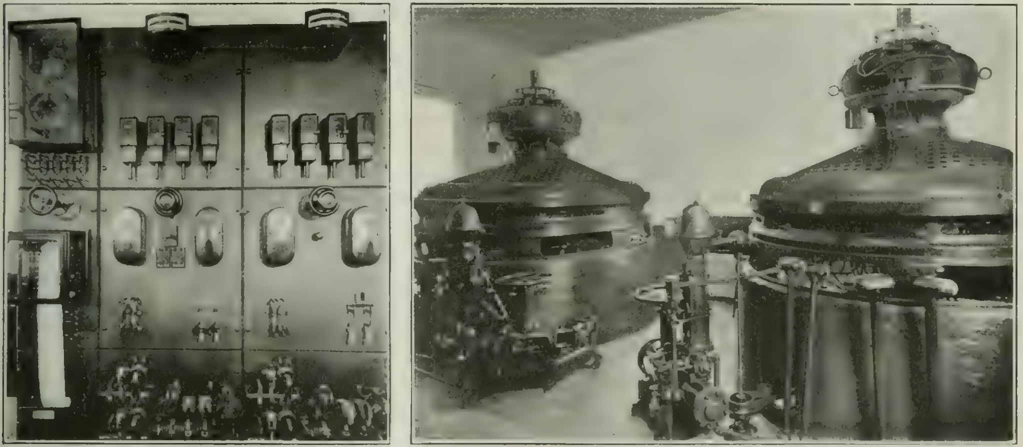
* Open No 63 Closed No 12 No. 28 No. 38 No. 49 & No. 59

Key—● = Contracts closed, **D** = Deenergized, **E** = Energized, **T** = Timing, Blank space = Contracts open

Float SW. No. 1-A opens its contracts before No. I on low water supply

The operation of the automatic control is as follows: The float switches No. 1 and No. 1-A are so adjusted that as the pond level falls switch No. 1-A will open its contacts ahead of switch No. 1; that is, switch No. 1 will always control the leading generator, or the one which stays on the line the greater part of the time, and switch No. 1-A will control the trailing generator, or the one which drops off the line first when the water level falls.

By means of a transfer switch, No. 9, either of the two generators can be controlled by either of the two float switches, thus increasing the flexibility of the station by allowing the desired machine to be operated as the leading generator. This transfer switch also throws the voltage regulator from one machine to the other, thus allowing it always to be on the leading generator. However, if either generator is tripped off the line through the operation of one of the protective devices described later, the regulator is automatically connected to the running generator by means of contactor No. 99, regardless of which way the transfer switch No. 9 is thrown.



AT LEFT—CONTROL PANEL, INCLUDING TEMPERATURE RELAYS, OVERLOAD TIME-DELAY RELAYS, GENERATOR-FIELD CONTACTORS, RECORDING WATTMETER AND VOLTAGE REGULATOR CONNECTIONS FOR AUTOMATIC CONTROL; AT RIGHT—THE 2,300-VOLT, 150-KVA. GENERATORS, SHOWING THE AUTOMATIC OIL-PRESSURE GOVERNORS

The protective devices operate to open the circuit when any of the following occurrences take place: Overload of generator as indicated by high temperature, overload of generator as indicated by high current, loss of generator-field excitation, high voltage on alternating-current line, loss of governor oil pressure, heating of generator thrust and guide bearings, and overspeed of generator.

Upon the opening of this circuit the generator is disconnected from the line and the governor closes the waterwheel gates.

SEQUENCE OF OPERATION

In starting up, if all of the protective devices are in their normal position, with the control switch No. 8 closed, and if voltage is on the control transformer No. 11 from the transmission line, the closing of the float switch will complete a circuit to pick up contactor No. 4. This energizes the governor solenoid No. 65, which allows the governor to open the waterwheel gates slowly. When nearly synchronous speed is reached a centrifugal switch on the generator completes a circuit to pick up contactor No. 5. This contactor closes the oil immersed contactor No. 16, which in turn closes field contactor No. 44. In the meantime the No. 4-X relay contacts have built up the voltage of the direct connected exciter so that when the field contactor closes the generator voltage is quickly built up and locks the generator into synchronism with the line. This method of putting a generator on the line is a very simple and practical way of operating. While not quite so smooth as perfect hand synchronizing, it is much better than poorly controlled hand synchronizing and permits operation without an attendant. The elapsed time between the impulse to start and the taking of load by an automatic generator is from fifteen to thirty seconds.

The results of this tying together of the mill power plant and the central-station plant and the electrification of the mill itself have been satisfactory. What might have been the prohibitive expense of erecting such a station, if the mill had obtained no outlet for its excess power, was changed to a very profitable investment. The sale of this power to the city was an ideal way of making this project pay its way as well as of bringing to the mill regularly a substantial income. On the part of the city this source of power meant that during the greater part of the year the steam station could be shut down for eight to twelve hours each night, and all day on Sundays and holidays.

From the experience of the Fairbury Mill & Elevator Company, as well as from the results obtained on several other recent installations of a similar type where a mill is tied into a transmission system able to absorb the mill power plant's excess energy, it can be seen that the development is advantageous to all the parties.

While the percentage return on the investment of this type of development is very satisfactory to the owner, there is another phase which the investing public should keep in mind—that is, that such an installation, tied to a transmission line, enhances the value of the securities of the transmission company by supplying it with reserve capacity at little additional cost.

Cash Value of Power-Factor Correction

Lower Power Factor Requires Use of Larger Line Conductors —Analysis of Some of the Costs at the Coal Pile—Possibility of Reducing Station Generating Capacity for a Given Load

By FRED C. DE WEESE

General Superintendent Eastern Minnesota Power Company

THIS article by F. C. De Weese, has been written in the hope that it will be of assistance to the smaller and medium-sized utilities. In most cases the larger companies maintain engineers who are perfectly capable of solving their power-factor problems and to whom the things here said may seem elementary. It is possible that many of the smaller companies whose operating costs are absorbing all their income could, under favorable power-factor conditions, change losses into profits. The story contained in Mr. De Weese's article points the way toward economies that will help in that direction.

THE subject of power-factor correction is receiving a great deal of attention at the present time, but not more than it should have, nor more than it will have as time goes on, for it is one of the foremost problems facing central-station managements today. Especially is this true of the power companies having an extensive system of power transmission lines.

It is not the plan of the author to dwell at length upon the subject, his desire being to bring more forcibly to the mind of the engineer and the manager certain points that seem to require special emphasis and which are along a line not being generally discussed, namely, that there is only one practical method of measuring power factor from the manager's point of view, and that is in dollars and cents. The sooner this is realized more fully, the sooner may we expect more satisfactory results. The all-important problems at the present time seem to be the establishing of a satisfactory rate for electric power based on the customer's power factor and the measurement of that power factor.

PRESENT METHOD UNSATISFACTORY

The method being used by some utilities of billing a customer, or, in other words, penalizing a customer, for a low average monthly power factor is very unsatisfactory, as a reasonably low average monthly power factor may not be a very serious matter to the central station, but a low peak-load power factor is. A customer should be penalized for low power factor during peak-load hours (daily peak). When some method is devised for measuring and recording the daily power factor, then will we be headed toward a satisfactory solution of this vexatious problem.

It is the general consensus of opinion among men engaged in the electrical industry that 80 per cent power factor is reasonably good, but when the fact that it requires 56 per cent more copper to transmit a given load at 80 per cent power factor than it does at 100 per cent is considered, the cost of low power factor may be easily estimated.

The accompanying table shows the percentage of increase in the weight of copper required to transmit a given load at any power factor from 100 per cent down to and including 50 per cent, being based on an equal amount of copper loss in each case. The minimum losses occur at 100 per cent power factor, and the weight of copper is assumed to be 100 per cent at 100 per cent power factor. A study of the table brings out very clearly the fact that in many instances a power company would be able to earn a higher return on money invested in power-factor corrective apparatus than for money invested in any other manner.

There are two general methods used for power-factor correction, the static condenser and the synchronous condenser. In comparing the two it must be said that each has its own field of service. In cases where the load is small, say 500 kw. and below, the static condenser answers the purpose satisfactorily, as, aside from improving the power factor, it will maintain a high voltage at full load. This is very advantageous from the standpoint of service, but, on the other hand, owing to the fact that a static condenser draws a leading current from the line and the power factor becomes leading at light loads, the voltage becomes higher at the receiving end of the line than at the generating station, which makes for bad regulation. A vector diagram showing the effect of a static condenser at the end of a line is reproduced in Fig. 1.

For the purpose of enabling the rapid solution of power-factor correction problems the accompanying chart (Fig. 2) has been constructed. This diagram may be used as a guide in the solution of problems when it is desired to determine which is the more suitable for any particular case, the static or the synchronous condenser.

THE SYNCHRONOUS CONDENSER

It seems to be the general belief that a synchronous motor will exert maximum power-factor correction when operated at zero leading power factor, but a study of this diagram reveals the fact that such is not the case. The explanation appearing under the diagram should be sufficient to enable any one at all familiar with vectors to solve almost any sort of a power-factor problem confronting him.

The table accompanying the diagram gives the motor kva. input, motor kw. output and the resulting kva. in per cent of the system kva. when the motor is operated so as to exert maximum power-factor correction, and also the resulting power factor for any initial power factor from 50 per cent to 80 per cent inclusive.

An important feature is that the lower the initial system power factor the higher the power factor of the synchronous condenser will be for maximum power-factor correction; that is, the more mechanical load will the motor handle in proportion to its size. The more nearly the power factor of the system approaches unity the more nearly will the power factor of the corrective

EFFECT OF POWER FACTOR ON COPPER REQUIRED

Power Factor, Per Cent	Copper Required, Per Cent	Power Factor Per Cent	Power Required, Per Cent
100	100	70	204
95	111	65	237
90	124	60	278
85	135	55	330
80	156	50	400
75	178		

apparatus approach zero leading, until the system power factor reaches unity, when any mechanical load on the motor will lower the power factor.

CONSIDERED FROM A STANDPOINT OF FUEL SAVING

It costs just as much to put on the switchboard a kilowatt-hour that is to be lost in transmission as it does to put one there that is delivered to the customer, but, of course, the only revenue derived from the sale of power is for that which is delivered. It is surprising to know the number of central-station engineers and managers that give this phase of the subject just a passing thought and the number that delude themselves into thinking they are making cheap power. Most of them will spend any amount of money to reduce their coal consumption per generated kilowatt-hour, which is well and good, but there is not enough thought given to subject of transmission losses due to low power factor.

As an example: Assume a load of 100 amp. over a line having 0.66 ohm resistance per wire at 100 per cent power factor, the coal consumption being 4 lb. per delivered kilowatt-hour. If the power factor drops to 80 per cent, the current will be 125 amp.

In the first case the power loss will be $(100)^2 \times 0.66 \times 3 = 19.8$ kw., and in the second case the power loss will be $(125)^2 \times 0.66 \times 3 = 30.9$ kw. The percentage increase equals $(30.9 - 19.8)/19.8 \times 100 = 56$ per cent. The amount of coal required to deliver a kilowatt-hour at the lower power factor is $4 \times 1.56 = 6\,24$ lb. If coal costs $5 per ton, the fuel cost per delivered kilowatt-hour at 100 per cent power factor will be 1 cent and at 80 per cent power factor will be 1.56 cents.

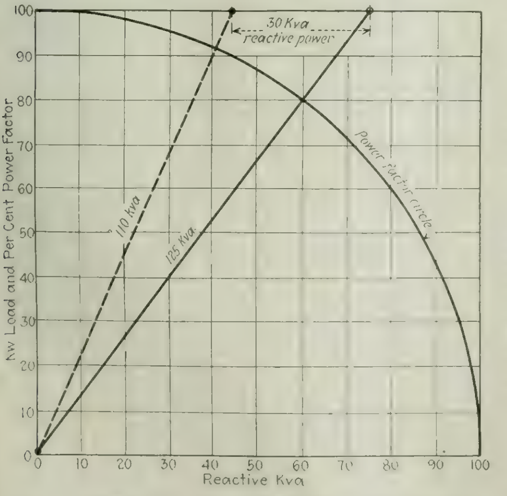
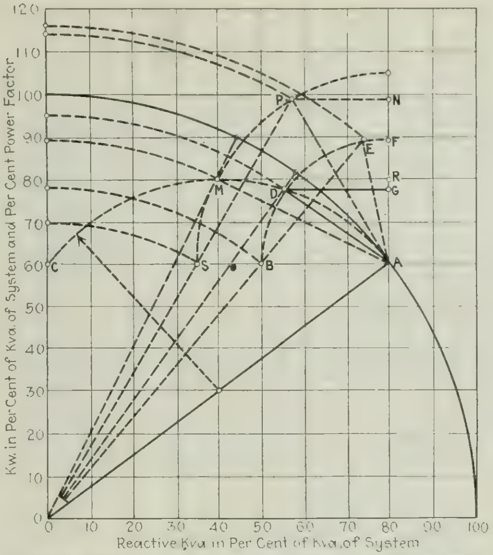


FIG. 1—EFFECT OF A STATIC CONDENSER AT END OF LINE ON POWER FACTOR

The condenser is rated at 30 kva. and is installed at the end of a 20-mile, 13,000-volt, three-phase, 60-cycle, No. 6 copper line serving a load of approximately 100 kw. This load consists of a mixed light and power load, the power being made up of both single-phase and three-phase motors. This load normally operates at about 80 per cent power factor without the condenser, and as will be noted from the diagram the power factor is about 92 per cent with the condenser on. This is just about the way it works out in practice. This type of condenser operates at approximately zero leading power factor, and for a 30-kva. condenser consumes slightly more than 200 watts.


P
N
E
F
R
G
M
D
S
B
C
A
Kw. in Per Cent of Kva. of System and Per Cent Power Factor
Reactive Kva in Per Cent of Kva. of System
0
10
20
30
40
50
60
70
80
90
100
110
120

MOTOR INPUT AND OUTPUT FOR MAXIMUM P. F. CORRECTION

P F of System	Motor		Resulting	
	Kva Input	Kw. Output	Kva.	P.F.
Per Cent	P2r Cent	Per Cent	Per Cent	Per Cent
50	50	25	86	86
60	45	20	89	89
70	38	15	91.5	91 5
80	31.5	10	94	94

FIG. 2—GUIDE TO DETERMINATION OF WHETHER STATIC CONDENSER OR SYNCHRONOUS CONDENSER IS MORE SUITABLE

Referring to the vector diagram, OA represents the kva. of the system at 60 per cent power factor, AD a condenser kva. vector equal to 30 per cent of the system kva. and operating at zero leading power factor, the system power factor being 77 per cent. With center at A and radius AD, strike an arc, this arc, being the motor kva. circle, will show the point of maximum power-factor correction, D being the point of tangency. AG represents the kilowatt load carried by the motor in per cent of the system kva. and is equal to 17.5 per cent. DG represents the reactive kva. in per cent of the system and is equal to 24.5, the motor power factor being 58 per cent leading. AF is the kilowatt load on the motor when operated to exert the same power factor correction as when operated at zero leading power factor and is 28.5 per cent of the system kva., the leading power factor of the motor now being 95 per cent and the resulting kva. 117 5 per cent of the system.

With any alternating-current system there is one condition of mechanical loading that a synchronous motor will maintain while exerting maximum power-factor correction. This condition of load exists when the vector becomes tangent to the motor kva. circle. For 60 per cent initial system power factor this is 45 per cent of the system kva., the reactive kva. is 40 per cent, the motor load is 20 per cent, and the resulting kva. is 89 per cent of the system kva. It is to be noted that the resulting power factor is at all times equal to the resulting kva.

If a motor of 45 per cent of the system capacity is operated so as to exert the same power-factor correction as when operating at zero leading power factor, the resulting kva. will be 113 per cent, the kilowatt load on the motor is 38 per cent and the motor power factor is 89 per cent of the system kva. It is to be particularly noted that if the power factor of the motor or the mechanical load on the motor is increased or decreased, the tangent point M will travel on a circle whose radius is equal to one-half OA.

No doubt the argument will be put forth that we do not base our coal consumption on coal per delivered kilowatt-hour, which is true, but if we reverse the reasoning and assume the transmission losses to be 10 per cent of the generated power, 19.8 is 10 per cent of 198 kw. and 30.9 is 10 per cent of 309 kw., so we have an additional generation of 309 — 198 = 111 kw.

Aside from the fact that it requires heavier coductors to transmit power at a low power factor, it also requires more generator capacity. To maintain a high power factor enables savings to be made in the first cost of equipment. It is usually the case when additional power capacity is needed that three methods are considered, namely, increased generator and plant capacity, increased size of line conductors and increased transmission voltage. It requires 25 per cent more generator capacity to generate the same amount of power at 80 per cent power factor than it does at 100 per cent, and as generator costs are about $20 per kva., this in itself is a considerable item. The first cost of line conductors is still more important. In good design these are facts that must be taken into consideration if the business is to be profitable. Before any of the methods for obtaining increased power capacity are considered the possibility of correcting the power factor should be gone into very thoroughly. In many cases it will be found that the increase can be obtained in this way at much less cost.

Of course, 100 per cent power factor is practically impossible of attainment, but when it is known that it requires 32 per cent more copper to transmit a given load at 80 per cent power factor than it does at 90 per cent, the advantage to be gained by a high power factor is certainly well worth striving for.

Testing Transformers for Characteristics

Compact and Convenient Compilation of Methods, Instruments Required and Sequence of Tests for the Engineer Who Is Occasionally but Not Regularly Engaged in Such Work

By R. F. GOODING
Superintendent of Construction, Tucker & Laxton, Charlotte, N. C.

PROBABLY no class of electrical apparatus has been more improved in the last ten or fifteen years than transformers. Where at one time they were about the weakest link on a transmission line or distribution system, they are now one of the most reliable. In fact, considering the relatively small amount of attention they usually get, it is doubtful if any piece of apparatus can claim greater reliability. Moreover, through co-operation between the different electrical societies and the manufacturers, they have become highly standardized—guarantees are made on the same basis, and the various voltages and voltage ratios are essentially the same.

This standardization and improvement in manufacturing methods has greatly lessened the number of tests made by customers, and the practice of transformer testing has become almost a "lost art" to the average operating man, who has turned his attention to other problems. If called upon to witness a test on some large units, or possibly to run a test himself, his first step is to look up his various text-books and hand-books for all available information, and even then he may be at a loss as to just what he wants to do, and *how* and *why* he wants to do it. For the convenience of the men with the smaller companies, who make these tests only occasionally, this article gives the various tests to be made, the instruments required, and the sequence in which these tests are usually run. The first portion of this article appeared in the issue of Nov. 28.

Temperature Run.—The usual way of running a heat test is by the loading-back method, using two similar transformers, as shown in Fig. 2. In this scheme the transformers are subjected to full load and voltage, but the only external power required is that to supply the losses of the two units. Circuit No. 1—Magnetizing supplies the combined iron losses, while circuit No. 2 supplies the copper losses. The voltage on circuit No. 1 is the normal rated voltage of the transformer, and for this reason it is usually best to connect the low-tension side of the transformer under test to this circuit. In this way, since the two high-tension sides of the transformers are short-circuited, all handling of high-tension circuits and instruments is eliminated. The voltage necessary on circuit No. 2 to circulate full-load current through the short-circuited windings is twice the impedance volts of one transformer. The voltage and frequency of circuit No. 1 should always be the exact rated values. This circuit supplies the iron and excitation losses, and as explained before, any variation in voltage or frequency has a great effect on these values. On circuit No. 2, which supplies the copper or I^2R losses, a variation in voltage or frequency would not cause so much error, as the I^2R loss varies very little (virtually not at all) with changes of frequency.

After connections are made, close switch in circuit No. 1 and adjust to give full-load current through ammeter with rated voltage across transformer terminals. Then close switch in circuit No. 2, adjust voltage to two times impedance volts of one unit, and read ammeter and voltmeter in circuit No. 1. If these readings are the same as before circuit No. 2 was closed no further adjustment is necessary. If not, adjust regulator in circuit No. 1 until the instruments show full-load current and rated voltage. As the transformers become hot the resistance will increase, cutting down the current, so frequent adjustments must be made to hold it and the voltage constant on the transformer under test. An induction regulator is used to secure adjustment.

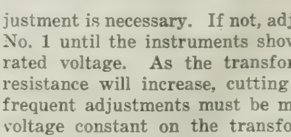


FIG. 1—CONNECT LOW VOLTAGE WINDING TO THE CORE TO FACILITATE TESTS

At least three thermometers should be placed in different parts of the coils so as to obtain a good average temperature. The run should be continued until the thermometer readings show no variation, indicating that the transformer has reached constant temperature. The highest thermometer reading is then taken and the temperature of surrounding air deducted from this reading. Transformers built today are guaranteed to run continuously at full load at a temperature rise not exceeding 55 deg. C. above the surrounding air. The use of the therometers gives a fairly good idea of the temperature rise, but this value should be checked by taking the "hot resistance" of both windings. This should be done immediately on completion of the heat run, without allowing any time for the windings to lose heat by radiation. This test is made exactly as described earlier in this article for cold resistance.

The temperature rise in degrees centigrade may then be determined as follows: Temperature rise = (increase in resistance ÷ initial resistance × (initial temperature + 238.1).

As all machine ratings now are made on the basis of an ambient temperature of 25 deg. correction must be made in above value to bring it to a 25 deg. basis. The A.I.E.E. standardization committee recommends a correction of one-half of 1 per cent for every degree difference from 25 deg. C., adding when room temperature is lower than 25 deg. and subtracting when temperature is above 25 deg. For instance, with a room temperature of 20 deg. C. the observed rise should be increased 2½ per cent, and for room temperature of 40 deg. C. the observed rise would be decreased 7½ per cent.

Another method of running a heat test is known as the motor-generator method as shown in Fig. 2. This scheme has the two secondaries in parallel and the primaries in series but connected so as to oppose each other. Although full voltage exists across the transformer terminals, the resultant voltage across circuit No. 2 is zero. Any voltage then impressed on circuit No. 2 will produce a current independent of the voltage across the transformer terminals. A voltage, then, of two times the impedance volts of one transformer will cause full-load current to circulate through the primaries and secondaries of both transformers. Circuit No. 1 will supply the iron and excitation losses with the I^2R or copper losses coming from circuit No. 2. The frequency and voltage of circuit No. 1 must be held constant at their normal rated value.

The procedure for this test is essentially the same as just described for the loading-back method and need not be repeated here.

Regulation.—The regulation of a transformer is the ratio of increase of secondary voltage from rated full load to no load (with constant impressed primary voltage) to the normal rated secondary voltage. It is always expressed in per cent. The regulation may be plotted when all characteristics are known, but it is usually calculated from the following formula:

Regulation at 100 per cent power factor and non-inductive load

Let IR = resistance drop in per cent

IX = reactance drop in per cent

Regulation per cent = per cent IR + (per cent $IX)^2$ ÷ 200.

For ordinary calculations this formula may be changed to read:

Regulation per cent = per cent copper loss + (per cent impedance)^2 ÷ 200.

Regulation at lagging power factor:

$$\text{Regulation} = IR \cos\theta + IX \sin\theta + \frac{(IX \cos - IR \sin\theta)^2}{200}$$

Where:

IR = resistance drop in per cent,

IX = reactance drop in per cent,

θ = angle of lag,

Cos θ = power factor in per cent.

For ordinary use the last term of this equation may be omitted, making:

$$\text{Regulation} = IR \cos\theta + IX \sin\theta .$$

For rough approximations on power transformers the term IR may be assumed as 1 per cent up to 1,000 kva., 0.75 per cent for units from 1,000 kva. to 2,000 kva., and 0.50 per cent for units of 3,000 kva. and above.

Often in applying transformers on a large system the question of regulation does not receive the consideration it deserves. In order to cut down short-circuit possibilities some engineers are rather prone to specify high-reactance units without checking to see what effect the resultant high regulation will have on the system voltage. The writer recently had to check up a line about 35 miles (56 km.) long which had very poor voltage regulation. He found at the power-station end a bank of transformers having a regulation of 9 per cent, while those at the end of the line had 4.5 per cent, making a total of 13.5 per cent for the two banks. Adding the line drop of 12.5 per cent made a total of 26 per cent to be taken care of. Even when running the generator at 10 per cent above voltage and using the 10 per cent taps on the substation transformers this left 6 per cent voltage drop which could not be eliminated. In this particular case the short-circuit question was not important, and it would have been just as easy to get units with a regulation of 4 or 5 per cent, exactly the same as at the substation. This would have helped out considerably on the voltage question without introducing any other difficulty.

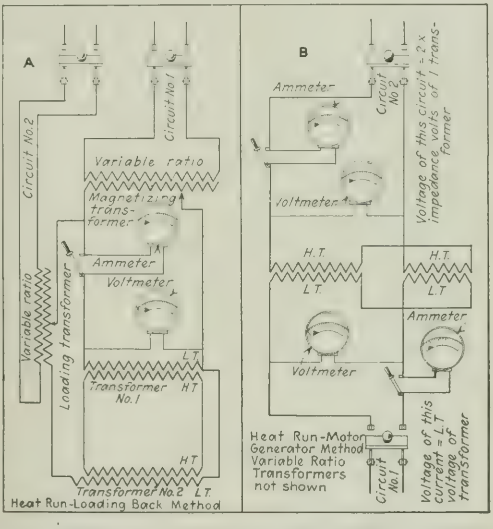


FIG. 2—CIRCUIT NO. 1 SUPPLIES THE IRON LOSSES AND CIRCUIT NO. 2 THE COPPER LOSSES DURING THE HEAT RUN

NOTE—For all sketches. Where voltage exceeds 750 oil circuit-breakers are necessary in place of knife switches. No instrument transformers are shown.

The guaranteed regulation at 100 per cent power factor is usually not of much use to the buyer, as he seldom has loads at unit power factor. The value at 80 per cent power factor is really the one that interests him most. If his power factor drops much below 80, it is time to take steps to bring it up at least to that figure or higher, if it can be done without spending too much money.

Efficiency.—Efficiencies are usually given for full load, three-quarters, half and quarter load. When transformers were sold on the 40 deg. temperature rise basis, a guaranteed efficiency for one and a quarter load was given, but with the 55 deg. rating overload guarantees are seldom made.

Maximum efficiency is obtained when the iron loss and the copper loss are the same. A transformer having a copper loss less than its iron loss will have its maximum efficiency at some point more than full load. Conversely, if the copper loss is greater than the iron loss, the point of maximum efficiency will be at some value less than full load.

Knowing the I^2R and iron losses, it is easy to calculate the efficiency from this formula:

Efficiency = output ÷ (output + losses), or

Efficiency = kva. output ÷ (kva. output + I^2R loss + iron loss).

The iron loss is constant at all loads, but the copper loss varies as the square of the current. Therefore for three-quarters load the I^2R loss will be nine-sixteenths of the full-load loss. It will be one-quarter full-load loss for half load and one-sixteenth for quarter load. With these figures in mind it is easy to calculate the efficiency at any given load.

On distribution transformers it used to be customary to figure the all-day efficiency based on no-load losses (iron loss) for twenty hours and full-load losses (copper and iron loss) for four hours. Then the all-day efficiency would be: output, full-load, for four hours ÷ (output for four hours + total loss, copper and iron, for four hours + iron loss for twenty hours).

The question of all-day efficiency is not discussed so much now, but is still rather important where transformers are used almost exclusively for lighting. In this case the iron losses may consume more energy than is paid for in lighting bills.

Voltage Tests.—The standard voltage tests recommended by the Electric Power Club are as follows:

HIGH-VOLTAGE WINDING TO LOW VOLTAGE WINDING AND CORE

Highest Operating Voltage	Test Voltage
Below 550 volts	4,000
550 volts to 4,500 volts, inclusive	10,000
Above 4,500 volts to 50,000 volts inclusive	Twice the highest operating voltage plus 1,000 volts

LOW-VOLTAGE WINDING TO CORE

Highest Operating Voltage	Test Voltage
1,500 volts and below	4,000
Above 1,500 volts to 4,500 volts, inclusive	10,000
Above 4,500 volts to 50,000 volts inclusive	Twice the highest operating voltage plus 1,000 volts

All tests for one minute

Transformers intended for Y connection should be tested according to the line and not the leg voltage. For instance, 6,600-volt transformers are often connected in Y for 11,000 volts service, and such units should receive the tests specified for the 12,000-volt class and not those for 6,600 volts.

Connections for voltage test are made as in Fig. 1. The testing transformer usually contains all the apparatus necessary—voltmeter, circuit breaker, method of varying voltage, etc. It is customary to connect the low-voltage winding to the core when making the test from high to low-voltage and core. This enables two tests to be made at once. One lead of the testing transformer would then be connected to the high-voltage winding, the other to the low-voltage winding.

The voltage on the testing transformer should be varied by an induction regulator (usually built in as part of it), rather than by step-by-step regulators. It is important in this test that the voltage be increased and decreased very gradually in order to prevent excessive inductive kicks. Moreover, all high-tension as well as all low-tension leads should be connected together while testing. This insures equal voltage strains on all parts of the windings, these strains being in direct proportion to the voltage applied.

It may sometimes occur that the required voltage cannot be built up, and in this event the fault is probably in the insulation. An ammeter placed in the circuit would then show a very heavy current. However, in some cases it may be that the testing transformer does not have sufficient capacity to furnish the charging current required at such a high voltage.

In addition to the tests just described, another one is usually specified—that there shall be developed twice full voltage in the windings at suitable frequency. In order to get this double potential it is often necessary to use a frequency of 133 cycles and even 500 cycles, and for this reason this test is not often made by the smaller companies.

One point should always be borne in mind when testing transformers, or, for that matter, any electrical apparatus, and that is that no manufacturer can guarantee exact figures for *all* losses. The iron loss may come slightly better than specified, and a natural result would be a copper loss somewhat higher than guaranteed. The average purchaser, however, is interested chiefly in knowing that his transformers have a well-balanced design, and, realizing that it must be a "give-and-take" proposition, he will not object seriously unless the variations are very marked.

Pioneer Edison Lighting Plants

Chronological List of Installations Made Soon After Invention of the Incandescent Lamp on Oct. 21, 1879.

The pioneer commercial application of Edison incandescent lighting appeared about May, 1880, on the S.S. Columbia, plying between San Francisco and Portland, Ore.

The first Edison isolated plant was installed on the premises of Hinds, Ketcham & Company, printers, New York City, in January, 1881. Other industrial and isolated plants were started the same year as follows: James Harrison Woolen Mill, Newburgh, N. Y., Sept. 15, and the Prospect Hotel, Blue Mountain Lake, in the Adirondacks, in October.

The first "jumbo" dynamo was sent abroad and started at the Paris International Electrical Exposition in October, 1881. The second "jumbo" was installed at the station of the Holborn Viaduct, London, England, on Jan. 12, 1882, and service from it was inaugurated on April 11, 1882.

The first commercial Edison central station was started on Pearl Street, New York City, on Sept. 4, 1882. It was steam-driven and had an extensive house-to-house system of underground two-wire distribution. The first hydro-electric Edison station was put into operation at Appleton, Wis., a short time later. In Roselle, N. J., was started in February, 1883, the first village plant. July 4, 1883, witnessed the first trial of an Edison three-wire station at Sunbury, Pa., and the first three-wire underground system was started in Brockton, Mass., Oct. 1, 1883.

Short-Circuit Current Calculating Table

Inexpensive Test Board for Determining Switch Duty—Duplicating System in Miniature Permits Studies that Assist in Selection of Equipment and Planning for Future Installations

By **L. J. CORBETT**
Assistant Engineer Hydro-Electric and Transmission Division, Pacific Gas & Electric Company

WHEN a transmission or distribution network grows in complexity it becomes extremely difficult to calculate mathematically the currents which must be broken in case of a short circuit. To obviate this difficulty test tables have been devised* which represent the circuits in miniature, and upon such a table it is possible to determine experimentally the approximate currents involved.

The usual form of table for this purpose has standard disk rheostats mounted symmetrically with one another and capable of being connected in any desired relation by means of cables and jacks. The rheostats are adjustable to represent different impedances of lines, loads and generating stations, and provision is made whereby an ammeter can be plugged in at any desired location and the current measured. Direct current at standard voltages is used, and the alternating currents to be expected are derived by applying the proper multiplier.

Upon such a table any system or network can be represented approximately by proper setting of the rheostats, and also any given condition of loading or of generator impedance. For a single company, however, with established lines and stations of fixed characteristics, such flexibility is not essential.

With this thought in mind the Pacific Gas & Electric Company has developed a comparatively inexpensive type of table applying to its system. Up to the time of writing about 952 miles of 110,000-volt circuit and 544 miles of 220,000-volt circuit are represented, anticipating construction of the next few years. The 60,000-volt circuits now total 2,084 miles, and it is probable that a number of these lines will be added. As in the tables heretofore developed, utilizing direct current, the effect of capacity of lines has been neglected as of minor importance for the purpose in view.

Considerations Involved

When a short circuit occurs near an alternating-current generator there is a severe momentary rush of current, but before the protecting oil switches can open this current falls in value along a curve which differs for different types and sizes of generators.† It will continue to fall, if the circuit does not open, until the armature reaction reaches a stable condition. This stage, where $Z = E/I$, is called the synchronous impedance. Usually, on a 60-cycle line 15 cycles to 20 cycles elapse after a short circuit before the switch opens, but the current has not yet reached its steady value. It is the condition at that moment which it is aimed to simulate on the calculating table by using resistance to represent generator impedance of the average short-circuit value.

The power factors of the impedance of generators and transformers are not very different from those of the impedance of lines, so within reasonable limits the use of resistance to represent impedance and direct current in place of alternating current enables a close enough approximation to be made of the occurrences upon the actual system. In fact, in many similar calculations the resistance only has been taken into account, the resistance being entirely neglected.

In stepping from one voltage to the other at a substation the current on the low-voltage side of the transformer is greater than that on the high-voltage side in the inverse ratio of the voltage. The impedance in circuit on one side referred to the other is the actual impedance multiplied by the ratio of the squares of the respective voltages. In the case of the Pacific Gas & Electric Company, changing from 220,000 volts to 110,000 volts involves an increase of the current upon the 110,000-volt side to twice that upon the 220,000-volt side, and the impedance of the 110,000-volt lines referred to the 220,000-volt side is four times what the same impedance would be on the 220,000-volt side.

CONSTANTS ASSUMED IN THE DESIGN OF THE TEST BOARD

Line Voltage	Impedance Percentage of Apparatus				
	Auto-Transformers	Trans-formers	Synchronous Condensers	Waterwheel Generators	Steam Turbo-Generators
110,000		4	33⅓	21	10-20
220,000	10	10	33⅓	23	

To represent this properly upon the table and to allow for drop in voltage due to the direct current used, it was necessary to make allowances in the resistances chosen to represent the circuits. Each ohm of impedance on the 110,000-volt system was represented by four times the resistance used to represent the same quantity on the 220,000-volt system, and the factor used to obtain the true alternating current from the direct current of the table on the 110,000-volt system was twice the factor used to obtain the current on the 220,000-volt system. The impedance of the connecting transformers reduces to the same value of resistance for the table when calculated from either direction.

Synchronous condensers are treated as generators, for because of their inertia they would actually pour considerable energy into a short circuit in their vicinity. In two stations condensers are fed through transformers which are connected to both the 220,000-volt and the 110,000-volt lines. In these cases the resistance representing the 220,000/110,000-volt transformers was tapped at the center and a resistance connected to this

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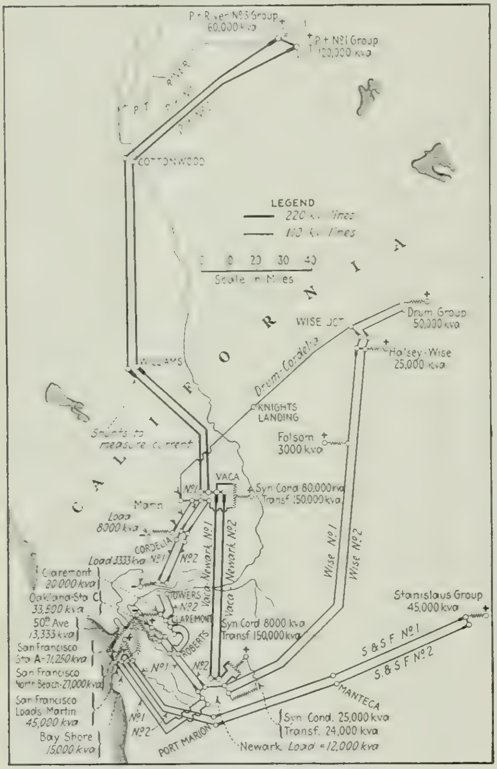
*"Calculation of Short Circuits in Alternating-Current Systems," Lewis, *General Electric Review*, February, 1919; "Calculating Short-Circuit Currents in Networks," Woodward, *Electric Journal*, August, 1919.

†"Alternator Short Circuits," Davis, *General Electric Review*, August, 1914; "Short Circuits," Diamant, *Proceedings A. I. E. E.*, September, 1915.

point such that the impedance to either line was properly represented by the resistance to that line on the board. As in the case of the transformers, the condenser impedance to either line is represented by the same resistance.

Construction of the Table

An outline map of the territory covered in central and northern California, on a scale of four miles to the inch, was mounted on a 4-ft. x 7-ft. drafting board. At the various locations of power houses and substations binding posts consisting of brass machine screws with both hexagon and knurled nuts were mounted, and between them resistance wire to represent the impedance from wire to neutral of the connecting line was stretched. No. 20 double-silk-covered "Advance" resistance wire was used, soldered to a brass washer at each line terminal. The wire was first wound on a thin rod and then pulled out to the necessary length to follow approximately the actual route on the map. The 110,000-volt lines were represented by two wires having a combined resistance equal to one-half of 1 per cent of the impedance of the corresponding line. On the 220,000-volt system six to eight wires having a combined resistance of one-eighth of 1 per cent of the impedance of the actual line were used, thus maintaining the ratio of four to one as to resistance. In each line a shunt with a resistance of 0.01 ohm was inserted, so that the current in each line could be read easily by taking the drop across the shunt on a millivoltmeter.



THE EXACT GEOGRAPHICAL RELATIONS OF LINES, GENERATING STATIONS AND SUBSTATIONS ARE MAINTAINED IN THIS SIMPLE SYSTEM TEST BOARD

A positive and a negative bus were mounted upon the back of the board. For the various power houses and synchronous condenser stations binding posts were connected by large leads to the positive bus. Resistances representing in the proper ratio the impedance of the generators and the transformers of the stations were inserted between these binding posts and the proper line terminals. Similarly loads simulated by resistances in the same ratio to represent impedances which would allow the designated load currents to flow through them at full-time voltage were inserted between the line terminals and binding posts connected to the negative bus. A large copper stud was brought through the table in a central location from the negative bus, and a large flexible lead from this stud was used to represent a short circuit.

Operation of the Table

Two cells of a storage battery in series with a carbon rheostat enabled a definite voltage to be maintained between the positive and the negative bus. The resistances being fixed in value, the voltage and current only could be changed. It was found convenient to maintain one hundred-thousandth of the star voltage on the 220,000-volt line, or 1.27 volts on the board.

Under these conditions the equations are:

$$\frac{E}{100{,}000} = \frac{I}{125} \times \frac{R}{800} = 1.27 \text{ volts for 220,000 lines, and}$$

$$\frac{E}{50{,}000} = \frac{I}{250} \times \frac{R}{200} = 1.27 \text{ volts for 110,000-volt lines.}$$

The short-circuiting lead was connected to different points on the system, and the currents in the various lines were read for direction and amount. The direct-current reading upon the miniature 220,000-volt lines was multiplied by 125 to obtain the alternating current on the actual line, and similarly the reading on the miniature 110,000-volt lines was multiplied by 250 to obtain the actual alternating current. The meters used in the tests were checked carefully with their leads, and corrections were made in the readings.

To determine the maximum duty of switches, a standard shunt of 0.001 ohm resistance was inserted in the short-circuiting lead. By opening certain lines following assumed operating conditions the duties of the successive switches could be determined by means of the ground shunt in combination with the line shunts.

Results Obtained

Two sets of duty tests were made, one with approximate 1922 conditions simulated and the other representing assumed conditions of later development, probably as late as 1928 or 1930. In the first case only 120,000 kva. is assumed on the Pit River development, and only those lines already in or projected are considered. In the latter case 280,000 kva. on the Pit River development is assumed, and extra lines probable with the growth of the company's business are taken into account. The complete development on Pit River will call for an additional pair of 220,000-volt circuits which have not yet been represented on the board.

Lessons have been learned which will modify the company's plans in some particulars. The danger of too much paralleling of high-powered circuits, was made manifest in these tests. As high as 4,550 amp. is indicated on the 110,000-volt lines at Newark substation as a possible switch duty if both the 220,000-volt lines and the 110,000-volt lines are paralleled at that important switching center. As high as 2,250 amp. is a possible duty on the 220,000-volt lines in case of a complete metallic short circuit. These figures mean a demand upon the connected synchronous apparatus for about 860,000 kva.

Some comparative tests were made on the 110,000-volt lines from Vaca substation to Claremont substation with and without paralleling connections. With trouble south of Vaca substation on one of the lines, if the Vaca switch is open the switch at Cordelia substation must break 1,450 amp. with the lines in parallel and 890 amp. if the lines are separated. With trouble north of Towers (a combination for convenience of North and South Tower substations), the switch at Towers being supposed open on reverse current, the switch at Cordelia substation must open 1,982 amp. with the lines in parallel and 1,358 amp. if the lines are separated. If the switch at Cordelia substation opens first, however, on overload, the switch at Towers must open 2,625 amp. with the lines in parallel and but 1,645 amp. with the lines separated. If the trouble is directly south of Cordelia, the switch at Cordelia being assumed to open first, the switch at Towers must break 1,793 amp. with lines in parallel and 1,252 amp. if the lines are separated. It is probable that some of the benefits of paralleling will have to be sacrificed in favor of safety for the connected apparatus, and the system separated into complete groups which will be paralleled only over lines of considerable length.

APPLICATION TO 11,000-VOLT CIRCUITS

Although the table was designed primarily to investigate the switch duty for the high-tension lines, it is adaptable for the investigation of the duties of the switches on the feeder circuits at substations fed from these lines. By attaching the short-circuiting lead including the 0.001-ohm shunt to one of the posts representing a substation a reading would be obtained indicating the current in case of a short circuit on the high-tension bus with all lines connected. Dividing the direct-current voltage, 1.27, by the current found, the actual resistance of the network to that point is obtained. From this point on, a simple calculation is resorted to. The impedance of the transformer bank is reduced to resistance for the table by the proper factor, and it is determined what the current would have been if this resistance had been inserted in series between the station binding post and the short-circuiting lead. This could have been done physically, if desired, by actually inserting such a resistance. As the current on the 11,000-volt side of the transformers would be ten times that on the 110,000-volt side, the new factor is 2,500. The direct-current value multiplied by this factor indicates the alternating current involved in a short circuit occurring on the 11-kv. system on or adjacent to this bus.

As an example, the full-table current for Towers was found to be 12.2 amp., indicating a network resistance of 0.104 ohm. At South Tower a 20,000-kva. transformer bank is contemplated, which at 7 per cent impedance between the 110,000-volt and 11,000-volt windings would be represented by 0.212 ohm resistance if added to the board. The total resistance involved is therefore 0.104 ÷ 0.212, or 0.316 ohm, which under a pressure of 1.27 volts would allow a current of 4.02 amp. direct current to flow. Multiplying by 2,500, we obtain 10,050 amp. alternating current as the duty which may be required of the 11,000-volt oil switches under the worst conditions. A similar calculation for North Tower with a 7,500-kva. bank with 8 per cent impedance indicates 4,240 amp. only, while at Claremont, with a 30,000-kva. bank, 21,450 amp. may be expected, assuming that these transformers will have 4 per cent impedance. The influence of the size and impedance of the transformer bank on these values is quite apparent.

AS THE CHARACTERISTICS OF THE TRANSMISSION SYSTEM ARE QUITE DEFINITELY FIXED, THE CONNECTIONS ON THIS TEST BOARD NEED NOT BE CHANGED

The low voltage used makes the contact resistance of the various connections a possible source of error. This was guarded against as much as practicable by extreme care during the tests to insure good contacts. "Advance" resistance wire was used because of its negligible temperature coefficient. The line shunts consisted of sections of "Advance" wire soldered between brass washers and strips of copper. When the wires representing certain lines were unduly heated a thermo-electric effect was noticed. It has been suggested that the use of manganin wire with the copper and brass would have reduced to a negligible quantity this source of error. The use of a higher voltage and higher resistance no doubt would lessen materially the chance of error from both sources. A limited distortion of the map would allow more room at certain centers now crowded on the board.

The general plan of the table was suggested by J. P. Jollyman, chief of the division of hydro-electric and transmission engineering for the company. Credit is due J. Mini, Jr., O. A. Knopp and A. J. Swank of the company's staff, and A. W. Copley of the Westinghouse Electric & Manufacturing Company for valuable suggestions and assistance.

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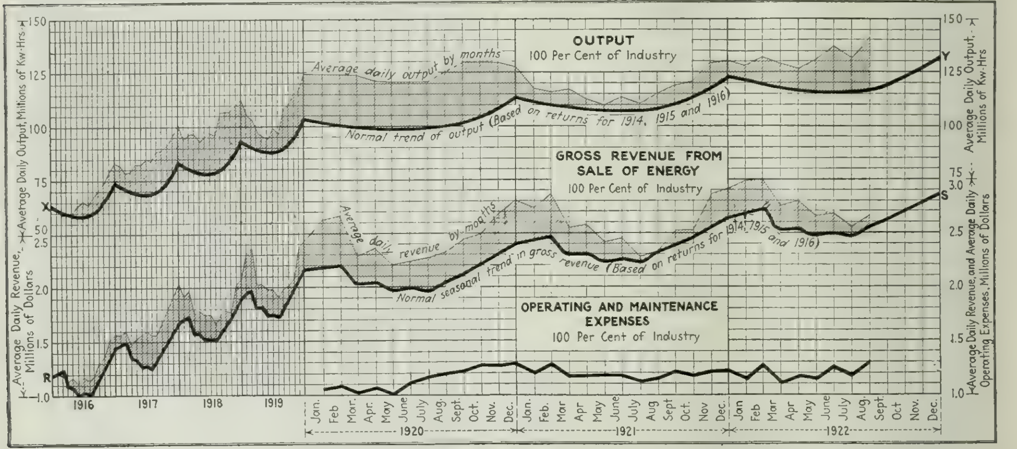
August Output Exceeds All Records



TWO new records for output were hung up by the electric light and power industry during August. Reports for the month received by the *Electrical World* from central generating and distributing companies representing 83 per cent of the installed generator rating of the country indicate that the average daily output was 141,467,000 kw.-hr., which exceeded the previous record made during June by 8,824,000 kw.-hr. In addition, the total output for the month of August was 4,386,000,000 kw.-hr., which exceeded the former high monthly figure set during June by 287,000,000 kw.-hr., and the output reported for August, 1921, by 22 per cent.

That the August output exceeded that of July is perfectly normal, but the fact that a record output should be reported at the very beginning of the fall and winter upward swing is something new in the electric light and power industry. Ordinarily the energy requirements of the country do not exceed those of the previous winter until November. The indications are, therefore, that the central generating plants of the country in the aggregate are going to be taxed to the limit to meet the electrical energy requirements during the coming winter, in spite of the addition of about 1,650,000 kw. of generator installation during the past year.

These record energy requirements during August may be attributed to three conditions—the unusual domestic building activity during the spring and summer, probably 90 per cent of which included the installation of electric lighting fixtures; the shortening day during August, and the widespread increase in the production of commodities during the month. Government reports indicate that there was not only in almost every industry an increase over production for the previous month, but in a great majority of cases the August production was the highest in many months and often the best recorded since the depression at the end of 1920. That

TABLE I—CENTRAL STATION RETURNS FOR THREE MONTHS

Month	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting)			Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting)				Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting)			OPERATING RATIO					
		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase			1922 Thousands of Dollars	1921 Thousands of Dollars	Per Cent Increase	Steam Plants 1922	Steam Plants 1921	Hydro Plants 1922	Hydro Plants 1921	Combined Systems of Steam and Hydro 1922	Combined Systems of Steam and Hydro 1921
June..	83	3,402,467	2,809,183	21.1	76	$61,314	$55,288	**10.8**	June.	62	22,770	21,848	4.2	54.2	56.9	26.4	28.1	44.9	48.5
July...	83	3,402,087	2,823,169	20.5	76	60,399	54,442	**10.9**	July.	62	23,002	21,556	6.7	55.3	56.8	27.9	28.5	46.1	48.1
Aug.	83	3,640,014	2,981,884	22 0	76	62,873	55,363	**13.5**	Aug..	62	24,912	22,288	9.0	56.6	54.2	26.8	31.4	48.8	50.7

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States			Percentage of Installed Ratings Represented	Atlantic States			Percentage of Installed Ratings Represented	North Central States			Percentage of Installed Ratings Represented	South Central States			Percentage of Installed Ratings Represented	Pacific and Mountain States		
		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase		1922 Thousands	1921 Thousands	Per Cent Increase
KW.-HR. OUTPUT:																				
June	82	242,700	200,343	21.2	83	1,194,012	978,178	22.1	82	1,113,428	917,708	21.3	62	167,420	140,425	19.2	95	684,907	572,529	19.6
July	82	227,799	193,144	17.9	83	1,180,488	970,398	21.7	82	1,114,357	911,543	22.3	63	166,374	142,407	16.8	95	713,069	605,677	17.7
Aug.	82	260,48[illegible]	210,540	23.6	83	1,275,838	1,026,392	24.3	82	1,170,080	972,623	20.2	65	179,467	151,441	18.5	95	754,140	620,888	21.4
REVENUE:																				
June	82	$5,791	$5,422	6.8	76	$22,351	$20,437	9.5	68	$19,018	$16,763	13.5	61	$4,138	$3,806	8.7	95	$10,016	$8,860	13.0
July	82	5,729	5,301	8.1	76	21,867	19,903	9.8	68	18,709	16,411	13.9	63	4,036	3,716	8.6	95	10,058	9,111	10.3
August	82	5,954	5,342	11.5	76	22,593	19,991	13.0	69	19,713	16,769	17.6	65	4,199	3,821	9.8	95	10,414	9,440	10.3
OPERATING EXPENSES:																				
June	53	$1,751	$1,937	−9.6	57	$7,693	$7,362	4.5	55	$7,730	$7,132	8.4	61	$2,179	$2,051	6.2	94	$3,365	$3,421	−1.6
July	53	1,783	1,765	1.0	57	7,769	7,361	5.5	55	7,923	7,175	10.4	62	1,961	1,966	−0.2	94	3,566	3,289	8.5
August	53	1,999	1,971	1.4	58	8,201	7,412	10.6	55	8,879	7,357	20.6	64	2,186	1,976	10.6	94	3,647	3,572	2.0

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months				Average for Previous 12 Months	
	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921	1922	1921
Steam Plants:																				
June	56.5	66.3	56.8	65.7	54.8	56.6	50.4	56.3	54.8	56.8	51.9	60.4	52.2	54.5	49.9	55.7	46.6	54.2	48.3	55.0
July	54.3	62.4	56.3	64.5	56.2	57.3	50.3	55.9	56.7	55.8	51.8	59.3	51.9	53.9	49.7	54.9	49.7	52.6	48.0	54.4
August	57.8	64.3	55.6	63.8	57.7	52.0	50.4	55.3	58.6	55.7	51.8	58.1	51.8	53.3	49.4	54.7	48.3	51.8	47.7	53.8
Hydro Plants:																				
June	36.5	37.0	33.8	43.1	26.9	26.1	19.9	23.4	21.3	20.5	22.6	22.4	32.0	27.3	36.5	34.8	25.1	20.0	29.6	26.1
July	40.6	49.9	34.4	43.8	24.5	22.1	20.5	23.4	20.5	26.0	22.6	22.9	50.2	47.8	42.1	39.6	28.2	28.1	27.3	26.9
August	35.1	39.8	34.5	43.6	23.6	22.7	21.2	23.6	26.0	25.9	23.2	23.2	37.1	33.8	42.2	39.9	27.5	31.3	27.6	27.5
Combined Systems of Steam and Hydro Plants:																				
June	48.8	58.7	51.9	52.4	48.7	51.0	45.8	49.8	51.4	53.7	48.3	55.2	43.7	49.3	43.0	45.8	31.9	38.0	35.8	40.0
July	53.2	56.7	51.6	52.1	51.3	52.0	46.7	50.0	54.8	56.3	48.9	54.6	41.2	48.4	42.9	46.1	30.5	33.6	35.3	39.0
August	58.9	64.4	51.6	52.0	53.3	59.8	47.5	51.3	58.1	56.6	50.3	54.5	43.8	45.2	42.8	45.7	31.1	35.3	34.6	38.2

such record performances could be registered by the electric light and power and other primary industries during the most critical month of the coal and railroad strikes speaks volumes for the stability of American industry as a whole.

One of the most encouraging features of the month in so far as the industrial power load of the electric light and power companies is concerned is the breadth of the increased industrial activity. It was not confined to a few classes of industrial power users, but seems to have been felt generally through the industrial community.

The gross revenue of the industry, while above that reported for July, was still under that of June, and about 12 per cent under that of last February, the month of peak revenue. It must be remembered that there is a certain time lag between the sale of electrical energy and the payment of bills by customers. There is no doubt that a very large portion of the gross income for September will be from the payment of the record electrical energy sales of August. The income from the sale of energy received during August is, however, about 13.5 per cent in excess of that received during August of last year.

A significant increase has taken place in the operating ratio of the companies reporting operations during the first eight months of the year. In January the operating ratio, or ratio of operating expenses to gross revenue from the sale of energy, was 45.7 per cent for companies operating steam-electric generating plants only. This figure has gradually increased until in August it was 56.6 per cent, the highest operating ratio for companies of this class since July of last year, but still some 9 per cent below the operating ratio of June, 1920, the peak of high prices.

Every section of the country reported increased output during August, it being most noticeable, however, in the intensely industrial centers and sections. Companies operating in the three Middle Atlantic States of New York, New Jersey, and Pennsylvania sold an average of 49,580,000 kw.-hr. per day, which was almost 4,000,000 kw.-hr. in excess of the sales during July and equal to 35 per cent of the entire amount of electrical energy sold daily in the country as a whole. The North Central States follow with an average daily sale of 46,020,000 kw.-hr. In the fifteen states composing these two sections 95,600,000 kw.-hr. were sold daily during August, or 67.6 per cent of the total energy sold in the country as a whole.

Five-Year Growth of Electric Utilities in Massachusetts Shown by Taxes

TAXES of utilities have been increased to such an extent that they must be reckoned with more and more prominently in fixing rate schedules for services. As an indication of this the total tax paid by twenty-two electric light and power companies (representing 68 per cent of this industry's valuation) in Massachusetts in 1921 has totaled $2,945,407 as compared with $1,445,530 in 1916. This shows an increase in the five years of $1,499,877, or 103.7 per cent, according to figures compiled from returns which were made by these companies to the New England Bureau of Public Service Information.

It is estimated that the total tax paid by the electric light and power industry in Massachusetts for 1921 will be $4,314,309, as compared with $2,006,997 for 1916, which will increase the above percentage of increase for the past five years from 103.7 to 114.9.

Table I—Statement of Revenue and Expenses in Merchandising Departments of Nine Central Stations Which Would Prevail If These Departments Were Operated as Separate Businesses. Year 1921

Year 1921	Company No. 1		Company No. 2		Company No. 3		Company No. 4		Company No. 5		Company No. 6		Company No. 7		Company No. 8		Company No. 9		Total of Nine Companies	
	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales
Revenue from merchandise sales	$2,578,278	100.0	$327,573	100.0	$393,284	100.0	$1,202,904	100.0	$601,276	100.0	$111,454	100.0	$848,227	100.0	$768,076	100.0	$383,077	100.0	$7,214,149	100.0
Cost of goods sold																				
Cost of merchandise	$1,928,643	74.8	$235,687	72.0	$281,025	71.5	$600,999	50.0	$418,484	69.6	$79,932	71.7	$609,832	71.9	$557,292	72.5	$293,320	76.6	$5,005,214	69.4
Storeroom salaries and exp.	41,832	1.6	9,042	2.7	20,008	5.1	50,344	4.2	16,341	2.7			8,989	1.1					146,556	2.0
Defective merch. replaced							4,986	.4											4,986	
Total cost of goods sold	$1,970,475	76.4	$246,350	75.2	$301,033	76.6	$656,329	54.6	$434,824	72.3	$79,932	71.7	$618,821	73.0	$557,292	72.5	$293,320	76.6	$5,158,377	71.5
Total cost of goods sold and installation	$1,970,475	76.4	$246,350	75.2	$301,033	76.6	$821,808	68.3	$436,927	72.6	$79,932	71.7	$618,821	73.0	$557,292	72.5	$293,320	76.6	$5,325,958	73.7
Gross profit	$607,803	23.6	$81,223	24.8	$92,251	23.4	$381,096	31.7	$164,349	27.3	31,522	28.3	$229,406	27.1	$210,784	27.5	$89,757	23.4	$1,888,191	26.3
Selling Expenses																				
Sales dept., sal. and comm.	$181,926	7.1	$25,439	7.8	$14,587	3.7	$76,350	6.4	$47,244	7.8	$16,022	14.4	$86,539	10.2	$17,256	2.3	$13,486	3.5	$478,849	6.6
Sales dept., supplies and exp.	123,383	4.8	3,904	1.2	13,064	3.3	37,824	3.1	9,208	1.5	2,698	2.4	11,660	1.4			10,376	2.7	212,117	2.9
Delivery dept., expense	84,333	3.3	2,323	.7	12,244	3.1	23,794	2.0	13,138	2.2	5,019	4.5	7,454	0.9			6,767	1.8	155,072	2.1
Store demonstrations			4,254	1.3	12,270	3.1	2,735	.2	486	0.1			373	0.04					20,118	0.2
Total selling expenses	$389,642	15.2	$40,900	12.5	$52,165	13.2	$169,151	14.1	$70,076	11.7	$23,740	21.3	$106,025	12.5	$17,256	2.3	$30,629	8.0	$899,584	12.4
General Expenses																				
Clerical salaries and expenses	$166,546	6.5	$24,691	7.5	$29,036	7.4	$43,334	3.6	$7,828	1.3			$25,902	3.1	Advtsg		$15,756	4.1	$380,399	5.3
Executive salaries and exp.	13,194	.5			5,617	1.4	12,619	1.1	6,133	1.0			25,431	3.0			4,312	1.1		
Advertising	100,000	3.9	871	.3	30,099	7.6	34,324	2.9	41,617	6.9	$16,066	14.4	24,949	2.9	$20,784		5,702	1.5	274,412	3.8
Employees' discounts							7,174	.6							Other details not given				7,174	0.1
Appliance repairs and service									15,065	2.5									15,065	0.2
Rentals of stores	195,061	7.5	16,950	5.5	8,628	2.2	60,933	5.1	30,000	5.0	3,000	2.7	28,733	3.2			6,000	1.6	349,305	4.8
Policy replacements of mdse.							6,238	.5											6,238	0.1
Insurance and taxes	14,160	.5			793	.2	7,188	.6					4,360	0.5			4,074	1.0	30,575	0.4
Expenditures on cancelled jobs							2,930	.2											2,930	
Uncollectible mdse. bills	23,929	.9	1,674	.5	600	.2	12,770	1.0	1,188	0.2			4,408	0.5					44,569	0.6
Non-payment recovered mdse	58,236	2.3					44,594	3.7											102,830	1.4
Total general expenses	$571,126	22.2	$56,713	17.4	$74,773	19.0	$232,104	19.4	$101,830	16.9	$19,066	17.1	$113,782	13.4	$170,312	22.2	$35,744	9.3	$1,375,452	19.0
Fixed Charges																				
Interest on investment	$64,132	2.5			$120		$84,470	7.0					$6,228	0.7	$3,334				$158,284	2.2
Interest on working capital	75,371	2.9			7,800	2.0													83,171	1.1
Total fixed charges	$139,503	5.4			$7,920	2.0	$54,470	7.0					$6,228	0.7	$3,334	0.4	$17,224	4.5	$258,679	3.6
Net profit—when asterisked (*) net loss	*$492,468	19.1	*$16,390	5.0	*$42,607	10.3	*$104,629	8.7	$7.56	1.3	*$11,284	10.1	$3,371	0.39	$19,882	2.6	$6,159	1.6	*645,523	8.9

Table II—Estimated Statement for Merchandising Departments of Nine Central Stations

Year 1921	Company No. 1		Company No. 2		Company No. 3		Company No. 4		Company No. 5		Company No. 6		Company No. 7		Company No. 8		Company No. 9		Total of Nine Companies	
	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales	Amount	Per Cent of Net Sales
(A) Revenue from merchandise sales	$2,462,278	100.0	$315,273	100.0	$378,534	100.0	$1,157,704	100.0	$578,776	100.0	$107,264	100.0	$816,427	100.0	$739,276	100.0	$368,677	100.0	$6,924,209	100.0
(B) Total cost of goods sold	1,970,475	80.0	246,350	78.3	301,033	79.5	*821,808	71.0	*436,927	75.5	79,932	74.5	618,821	75.8	557,292	75.5	293,320	79.5	5,325,958	76.9
(C) Gross profit	491,803	20.0	68,923	21.7	77,501	20.5	335,896	29.0	141,849	24.5	27,332	25.5	196,606	24.2	181,984	24.5	75,357	20.5	1,598,251	23.1
(D) Selling expenses	320,000	13.0	41,000	13.0	49,300	13.0	150,000	13.0	75,100	13.0	13,900	13.0	106,000	13.0	96,000	13.0	47,800	13.0	899,100	13.0
(E) Advertising	98,700	4.0	12,600	4.0	15,150	4.0	46,200	4.0	23,100	4.0	4,300	4.0	32,700	4.0	29,600	4.0	14,700	4.0	277,050	4.0
(F) Rent	123,000	5.0	15,750	5.0	18,900	5.0	57,800	5.0	28,900	5.0	5,370	5.0	40,900	5.0	37,000	5.0	18,400	5.0	346,020	5.0
(G) General expense (excluding advertising and rent)	266,300	10.8	34,050	10.8	40,950	10.8	124,000	10.8	62,500	10.8	11,530	10.8	88,400	10.8	79,400	10.8	39,700	10.8	746,830	10.8
(H) Total fixed charges	108,000	4.4	13,900	4.4	16,600	4.4	51,000	4.4	25,400	4.4	4,700	4.4	35,900	4.4	32,500	4.4	16,200	4.4	304,200	4.4
(I) Total expense (D+E+F+G+H)	916,000	37.2	117,300	37.2	140,900	37.2	429,000	37.2	215,000	37.2	39,800	37.2	303,900	37.2	274,500	37.2	136,800	37.2	2,573,200	37.2
(J) Net loss (C—I)	424,197	17.2	48,377	15.5	63,399	16.7	93,104	8.2	73,151	12.7	12,468	11.7	107,294	13.0	92,516	12.7	61,443	16.7	974,949	14.1

Note: (1) in item (A) deductions have been made equal to the estimated amount of the total carrying charges on deferred payment sales. (2) In item (H) the figure 4.4 per cent was obtained by taking the average of *only* the six (6) companies that reported fixed charges.

* Includes installation expense.

Central-Station Costs and Losses on Merchandise Sales*

An Analysis Embracing Nine Large Central-Station Companies, Being the Recent Report of the Merchandising Policy Committee of the Association of Edison Illuminating Companies

By JOHN F. GILCHRIST
Vice-president Commonwealth Edison Company, Chairman of the Committee

THIS report, following Mr. Gilchrist's recent paper before the French Lick Springs convention of the Great Lakes Geographic Division, N. E. L. A., is a further notable addition to the scant knowledge of the industry on the cost of merchandising electrical appliances by a central-station company. It presents the results of a careful study of the costs of nine large central-station organizations that together sold about $7,000,000 worth of electrical merchandise in 1921 and together lost $650,000. That is, their books would have shown this loss if their merchandising activities had been conducted on the basis of a separate business. The figures are reproduced here, and the committee discusses their significance and makes a strong plea for a unified system of accounting for retail sales that will take cognizance of the cost studies of the jobbers and the contractor-dealers and recognize the responsibility of the central station in its merchandising policies to the other branches of the industry.

LAST year some admirable papers dealing with the subject of electrical merchandising were presented. The very great interest shown in these papers indicated how live a subject the merchandising of appliances had become in many, if not most, of the companies. The discussion brought out the fact that in volume the business of selling appliances by the central-station companies was very good, and the results of an investigation, so far as could be estimated in a most careful way by one of the large companies, seemed to indicate that the output of electricity through the medium of these devices was probably considerably larger than had theretofore been generally thought.

Naturally, the conclusion was that what prevailed in one big community must prevail in others where approximately an equal amount of activity had been displayed in putting out this kind of apparatus. The discussion seemed to indicate, however, that while the gross sales of appliances were quite satisfactory, and the results from the standpoint of electricity sales equally so, the net results of the operation from a purely merchandising standpoint were quite unsatisfactory. Those companies selling a large volume of appliances, and knowing perhaps more than the others of the details of the costs of this business, were the most positive in their statements that there was something fundamentally wrong which interfered with the making of proper merchandising profits. This claim was so insistent, and it seemed to be a matter of such great importance, that a committee on merchandising policy was appointed charged with the task of investigating the business, particularly as conducted by members, and presenting a report for discussion at this meeting.

BUSINESS LARGE, PROFITS TOO SMALL

The committee finds that nearly all of the member companies are engaged in the merchandising of appliances, and apparently in almost every case there has been a very large growth of the business during the last four or five years, with indications of further acceleration, rather than otherwise. The committee has found a decided lack of exact information as to whether or not this business is profitable from a merchandising standpoint. The general opinion seemed to be that there was a small profit in it, but that in some articles at least there was not nearly enough gross profit, and that some relief would have to come from somewhere in this matter if the companies were to make a proper amount of profit.

There was, however, little or no information as to the cost of doing business, and information as to the gross profit had in no case which the committee learned of been studied in the average figures which prevailed for all articles sold, although there was more or less knowledge regarding articles which showed a particularly poor gross profit, and where efforts were being made to get an increase. Furthermore, on making inquiry, it soon became evident that few, if any, of the companies kept their figures in a way that enabled them to do more than estimate what their costs were, and such figures as were kept were kept on a different basis in nearly every company, so that it was quite difficult to make comparisons.

INVESTIGATED NINE COMPANIES

The first move of the committee, therefore, was to request the figures of the companies represented by the men on the committee, and make an effort to tabulate them upon a comparable basis for the purpose of learning, if possible, what the gross profits in the business and what the costs of doing business were. A simple, general classification was worked out, and by sending two men on a trip to visit most of the companies it was possible, through the courtesy of the accounting departments of these companies, to get out some figures which, though quite incomplete and therefore unsatisfactory, at least give a general idea of the situation.

These figures showed a gross business for the nine companies surveyed of more than $7,000,000 for the year 1921 and a total loss of approximately $650,000. It should be kept in mind in making the analysis of the figures that they had been made up in a way which attempted to show what the costs would have been had these businesses been run as separate merchandising institutions, and it is on this basis that we are dealing with the subject. The committee does not wish to convey the impression that, notwithstanding joint use with the central-station departments of general company facilities, there was such a loss as this, but believing that this business should stand on its own feet, from the standpoint of the interests of the company, and also in fairness to independent merchandising businesses which must make a profit in competition if they are to live, the committee has felt that the matter should be looked at in this way.

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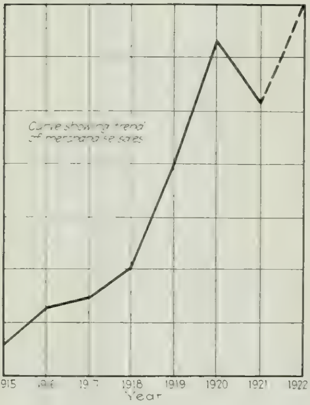
*Presented at the White Sulphur Springs (W. Va.) convention, Oct. 11-14.

The figures above referred to are set forth in Table I. The most important item in this table, and also, fortunately, the one which is probably the most reliable, is the figure which shows that the nine companies enjoyed an average gross profit of 26.3 per cent. This figure will doubtless be a surprise to many of the members, because while it is recognized generally by people who have made a study of the matter that the "spread" in electrical appliances is not sufficient to cover the cost of doing business at a reasonable profit, I think the general impression will be that this figure is much less than they expected to see, and it undoubtedly is so because to a certain extent what gross profits there were have been given away in price reductions and have been absorbed by storeroom charges and other similar expenses, which under many systems of accounting are added to the cost of goods before gross profit is computed. However, this is a figure which will probably interest you.



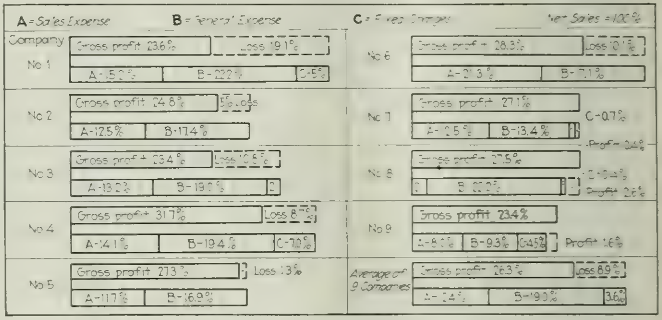


CHART NO. 1 (AT LEFT)—GROWTH OF MERCHANDISE SALES IN THE CASE OF ONE OF THE MEMBER COMPANIES SHOWS TREMENDOUS POSSIBILITIES. CHART NO. 2 (AT RIGHT)—THE WIDE DIVERSITY WHICH OCCURS IN THE RATIO OF SALES EXPENSE, GENERAL EXPENSE AND FIXED CHARGES

A STUDY BY COMPARISON

The first query which would naturally arise with most of us is what the expenses of doing business are, and that is something which cannot be taken directly from chart No. 1, as it was impossible to get at the figures in many of the companies, and consequently they are very incomplete and unreliable. However, incomplete as they are, they indicate an expense of more than 35 per cent as the cost of doing business, or a loss of approximately 9 per cent.

In studying this matter chart No. 2 has been prepared which is partially based on estimates, but probably is much nearer the correct figures than chart No. 1. In this chart the committee has first attempted to eliminate the extra charge made where goods are sold on a deferred-payment basis, as this difference applies to the cost of carrying the accounts and should not be figured in as part of the gross profit, particularly when several of the companies failed to make and charge for interest on money invested in stocks of merchandise and working capital, and nearly all of them omitted one or the other. In this second chart such items as selling expense, rent, advertising and general expense have been applied to all of the companies on the average basis which was found to prevail in three or four of the companies whose figures enabled them to get at these items most accurately, and in each case interest on money invested in stock and accounts was charged. This, as you will note, results in showing a total expense of 37.2 per cent in doing this kind of business, and as the elimination of deferred payment excess charges brings down the average gross profit to 23.1 per cent, this shows a loss of 14.1 per cent in doing this business—a loss which would have prevailed if the business had been charged with all of the costs that would have existed in an independent business. While, on account of the difficulty of getting dependable figures, it is known that there must be a considerable percentage of inaccuracy, a few members of the committee, if not all of them, believe that this percentage is quite as likely to be low as high, and I think there is no question in the minds of any one that the true figure would show a considerable loss.

The thing which these figures bring out most particularly is that a detailed classification of accounts especially adapted to the merchandising business, and especially designed so as to indicate the costs on the basis of what would prevail if it were a separate business, should be worked out and adopted by several of the companies engaged in this business, so that it may be possible to determine accurately what the costs of doing business are and, by having the figures on a comparable basis, to obtain average figures which will be reliable. Until this is done it will be impossible to agree with manufacturers or jobbers as to what "spread" is necessary between the list prices of goods and the cost, in order that expenses may be covered and a reasonable profit shown.

The reason why in establishing an accounting system it is particularly desirable to agree on one that is uniform and then have a considerable number of companies work their figures out on this basis is that if this is not done, there will always be a difference of opinion as to whether the cost arrived at by one com-

TABLE III—STATEMENT OF REVENUE AND EXPENSES IN MERCHANDISING DEPARTMENTS OF SEVEN CENTRAL STATIONS WHICH WOULD PREVAIL IF THESE DEPARTMENTS WERE OPERATED AS SEPARATE BUSINESSES FIRST EIGHT MONTHS, 1922

(Incomplete Data)

	Company No. 1		Company No. 2 (Seven Months only)		Company No. 3		Company No. 4		Company No. 9		Total of Companies Nos. 1, 2, 3, 4, 9		Company No. 6		Company No. 5	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
Revenue from merchandise sales	$1,922,514	100.0	$174,568	100.0	$242,700	100.0	$856,481	100.0	$215,508	100.0	$3,411,771	100.0	$68,205	100.0	$616,000	100.0
Cost of goods sold																
Cost of merchandise	$1,333,149	69.3	$129,213	74.0	$164,715	68.0	$422,707	49.4	$165,651	76.9	$2,215,435	65.0	$48,554	71.0		
Storeroom salaries and expenses	28,359	1.5	5,053	2.9	13,430	5.5	15,886	1.9								
Defective merchandise replaced	23,260	1.2					2,189	0.3					753			
Total cost of goods sold	$1,384,769	72.0	$134,266	77.0	$178,145	73.5	$440,782	51.5	$165,651	76.9			$49,307	72.3		
Total cost of installation							$104,691	12.2								
Total cost of goods sold and installation	$1,384,769	72.0	$134,266	77.0	$178,145	73.5	$545,473	63.7	$165,651	76.9	$2,408,574	70.5	$49,307	72.3		
Gross profit	$537,746	28.0	$40,302	23.0	$64,555	26.5	$311,008	36.3	$49,857	23.1	$1,003,467	29.5	$18,898	27.7	$223,000	36.2
Selling expenses																
Sales department salaries and commissions	$227,347	11.8	$15,926	9.1	$14,064	5.8	$78,419	9.2	$8,219	3.8	$343,975	10.0				
Sales department supplies and expenses	59,539	3.1	4,686	2.7	9,154	3.8	26,052	3.0	8,596	4.0	108,027	3.2				
Delivery department expense	76,929	4.0	1,302		7,276	3.0	11,213	1.3	4,262	2.0	100,982	2.9				
Store demonstrations	4,874	0.3	†		4,553	1.9	5,023	0.6								
Cash discount on sales							4,665	0.6								
Total selling expense	$368,688	19.2	$21,915	12.5	$35,046	14.5	$134,572	15.7	$21,077	9.8	$581,298	17.0			‡$207,000	33.6
General expenses:																
Clerical salaries and expenses	$139,439	7.2	$10,753		$17,048	7.0	$20,587	2.4	$10,396	4.8						
Executive salaries and expenses	8,156	0.4	10,753		3,720	1.5	7,926	0.9	3,269	1.5						
Advertising	57,675	3.0	2,897	1.7	19,703	8.1	40,643	4.8	3,520	1.6	124,438	3.6				
Employees' discounts							5,735	0.7								
Rentals	124,711	6.6	7,997	4.6	4,947	2.0	39,012	4.6	4,000	1.9	180,757	5.3				
Policy replacements of merchandise							2,506	0.3								
Insurance and taxes	8,010	0.4			529	0.2	1,924	0.2	1,834	0.9						
Expenditures on canceled jobs							2,517	0.3								
Uncollectible merchandise bills	15,563	0.8	781		400	0.2	9,077	1.1								
Non-payment recovered merchandise	20,712	1.1					16,203	1.9								
Miscellaneous							6,263	0.8								
Total general expenses	$374,266	19.5	22,428	12.9	$46,347	19.0	$152,482	17.8	$23,019	10.7	$618,542	18.1				
Fixed charges:																
Interest on investment	$19,932	1.0			80											
Interest on working capital	81,499	4.3			4,800											
Total fixed charges	$101,431	5.3			$4,880	2.0	$43,089	5.0	$8,062	3.7	$157,462	4.6				
Net profit or net loss	*$306,639	*15.9	*$4,040	*2.4	*$21,718	*8.9	*$19,134	*2.2	*$2,301	*1.1	*$353,832	*10.3			$16,000	2.6

* Loss † Included in advertising. ‡ Including general expense

pany or that arrived at by another company is the true cost, and for the reasons stated above it is obvious that precautions should be taken to see that no such differences of opinion exist.

Another matter which seems important to the committee is that the advice, at least in a consulting capacity, be obtained of some of the accountants who are familiar with the investigation of costs in connection with the businesses of the jobbers and contractor-dealers. The committee assumes that it is generally understood that these two bodies have been giving a great deal of attention to this matter of costs as applied to the merchandising of electrical appliances for several years past and have accumulated a great deal of information, which should be very valuable to us in the investigation we have under consideration, and not only that, but it should be borne in mind that as between the manufacturer and the ultimate consumer both the jobber and the retailer must be considered.

It is well enough for some of the large companies to say that they buy more than a jobber does and expect to buy at the same price, and also that it is necessary to buy at that price in order to resell with any chance of a profit, but only with relation to a very small amount of the whole business of the country will this prevail. The jobber is a very necessary link in the great mass of this business and is entitled to his cost and profit the same as we are. He must receive them to exist.

In closing this report some little discussion of the possible volume of this business may be enlightening. Business equal to $5 or $6 per year per electric light and power customer seems to be somewhere near the average, and there are numerous instances where double this amount is being done. In view of the way in which the business has been growing wherever any attention whatever has been paid to it, it would seem quite within reason that this business in a comparatively short time may amount to as much in gross volume as the business of furnishing electricity to residences—in other words, $20 to $25 per year per residence customer.

GENERAL CONCLUSIONS

Briefly summing up, the conclusions of the committee at the present time are as follows:

1. Central stations should conduct an appliance business.

2. This business should be done at a profit, after all charges have been made against it on the basis of costs that would prevail were it an independent business.

3. The business should be pushed vigorously.

4. Accounting should be done in such a way as to assume all charges being made which would ordinarily be made if a merchandising department were an independent concern.

5. A uniform accounting system should be adopted so that figures from the various companies will be comparable. Each company can then profit by the experience of the others.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

A Question of Copper

To the Editors of the Electrical World:

I have been very much interested in L. H. B. Sandwell's letter in your issue of July 29 and in subsequent correspondence on the above subject. In China one meets engineers from all countries and with all shades of opinion. American engineers here invariably insist on their usual standard of 110 volts for all schemes for electricity undertakings, and thereby at the outset impose a very heavy charge for mains on such systems.

The only excuse for this practice that I have been able to obtain is that "110-volt lamps are better and more efficient than those of 220 volts." Granted that in a closely regulated system where the drop in voltage is limited to, say, 3 per cent, the 110-volt lamp is superior to that at 220 volts, in actual practice, owing to the necessity of keeping capital expenditure on mains as low as possible, it is found that the percentage voltage drop in a 110-volt system is far greater than that on a 220-volt main, so that the lower efficiency of the high-voltage lamp is more than compensated by the greater percentage drop in pressure of the low-voltage system. Surely it is rather a near-sighted policy to keep to an inefficient low-voltage system on the plea that *today* the lamps are better, when in ten years or even less the 220-volt lamp will be as good as the 110-volt.

Another point of view to be considered is that of the companies operating the electrical utilities; they have to look for other sources of revenue besides lighting. There can be no question, in fact, that in a very few years the main income of electricity stations from private houses will be from other demands than lighting. Already in many places the cooking and heating load has become as valuable as the lighting load, and the main hindrance to the further development of electric cooking is the very high cost of mains and house service. This cost could be reduced to values that would be acceptable to the average householder if the 220-volt or 250-volt system were adopted.

The system I consider ideal is four-wire, three-phase, 440/250 volt, with the neutral grounded. Compare the cost of connecting up a 5-kw. electric cooker at 110 volts and at 220 volts (with one wire grounded and only 25 per cent of the area of the phase wire), and it will be seen at once that the price deters a potential consumer from adopting electric cooking.

Another point to be considered is that on the 380/220-volt, four-wire system motors up to 50 hp. in rating may be connected to the ordinary public supply lighting mains, which is impracticable on a lower voltage. I know of several cases where supply companies have been obliged to run extra mains at 440 volts to 550 volts for the use of motor consumers—something that could have been obviated had the 380/220-volt (or 440/250-volt) system been adopted.

In 1913-1914 I was instrumental in forming an international committee for the standardization of voltage, etc., in China and, in spite of opposition on the part of engineers accustomed to 110 volts, was successful in carrying a recommendation that the standard low-tension should be 440/250 volts, three-phase, four-wire. Unfortunately, I was not able to further the cause of standardization in China owing to some little troubles in which I took part on "the muds of Flanders," but there can be no doubt that American engineers would be better advised to advocate 380/220 volts or 440/250 volts in the Far East instead.

It would not be such an enormous undertaking to change to the higher voltage. Most 200/110-volt motors are delta-wound or single-star-wound and could easily be changed to 380/220 volts; nor is the changing of the low-tension side of transformers a great or expensive undertaking, certainly not in comparison with the enormous saving to be obtained.

There is no more fire risk involved in a 220-volt system than in a 110-volt system; in fact, there is probably less, as the first danger is found not so much in bad insulation as in faulty switches, bad contacts, too high a current density in wires and similar troubles, all of which faults are reduced as the pressure becomes higher. There certainly is a greater danger from shock, but, as you pointed out in a recent editorial, it is possible to pay too high a price for safety.

The general tendency of all modern engineering is toward higher pressures, and America is hindering her own electrical development by retaining the old and obsolete 110-volt system.

P. A. Williams,
Engineer and Manager Electrical Department.
Tientsin, China.

Where the College Instructor Falls Short

To the Editors of the Electrical World:

In the Sept. 23 issue of the *Electrical World* there is an editorial entitled "Blind Alleys in the Teaching Profession" in which I was very much interested. I should like to see the same subject discussed from still another standpoint. You speak of the young instructor who neglects his pupils for the sake of his own advanced studies, and of another who is so busy with his students or demonstration work that he altogether neglects his own education. The phase I should like to see discussed is that of the instructor who is doing sufficient advanced study and at the same time is not neglecting his students, but who has a natural limitation due to his failure to get perfectly good experience. In many cases an instructor who has shown some particular qualification for that kind of work during his junior and senior years upon graduation is offered and accepts an instructorship from his Alma Mater. Both his advanced studies and his teaching work are predicated entirely on a four years' college atmosphere. This may continue for a period of years, during which he becomes head of his department, and then he in turn selects a representative senior to be an instructor, who becomes head of the department and selects another senior, ad infinitum.

The natural result is a continuing departure from practical contact with the things for which students are educated, and the products of such an institution find a very wide difference between what they have studied and what they encounter when they enter the outside world. There should be an interchange between men in practical work and the colleges to get their ideas to the students, and there should be an interchange between the instructor and the practical world to get these same ideas into the instructor.

N. A. Carle,
Vice-President and General Manager.
Public Service Production Company,
Newark, N. J.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Methods for Checking Relay Connections

REVERSE power relays for the control of three-phase circuits must be connected so that with unity power factor on the line the current through each relay will be 30 deg. ahead of the potential. The proper method of accomplishing this can readily be determined in advance of the installation of the relays from a consideration of the type of connections employed on the generators and transformers of the system and the phase sequence.

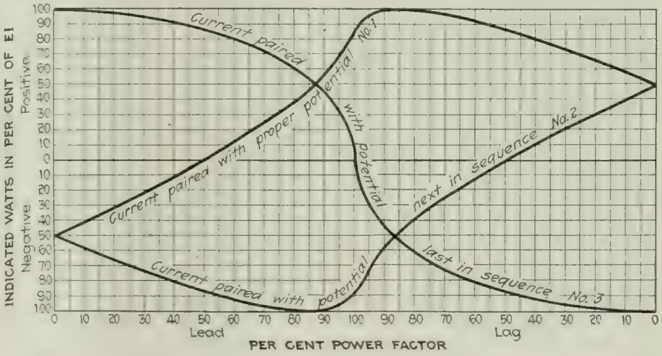
Occasionally, however, it becomes necessary to check the connections of a set of relays which are already in service. If the power factor of the line is known to be unity, the check can be made by using a single-phase power-factor meter, with the current coil in series with the current coils of the relay and the potential taken from the potential terminals of the relay. With correct relay connections the power-factor meter should indicate 86.6 per cent lead.

If the power factor is known to be between 50 per cent lag and 100 per cent, the connections can be checked by means of a single-phase wattmeter or watt-hour meter. Connect the current coils of the meter in series with the current coils of the relay and connect the potential coil to the potential terminals of each of the relays in succession. If the relay connections are correct, the highest wattage will be indicated when the potential leads are connected to the relay under test. It should be noted that both of the improper connections will always give negative readings of the wattmeter under the conditions assumed, and only the numerical value is to be considered. The above described methods have been recommended by one of the prominent manufacturers.

WATTMETER READING CORRESPONDING TO CERTAIN RELAY CONNECTIONS

Current	Potential	Watts	Per Cent *FI*
a	*A*	+ 196	+ 64
a	*B*	— 303	— 99
a	*C*	+ 116	+ 38
b	*B*	+ 116	+ 38
b	*C*	+ 196	+ 64
b	*A*	— 303	— 99
c	*C*	— 303	— 99
c	*A*	+ 116	+ 38
c	[illegible]	+ 196	+ 64

Another method of checking is to determine the phase sequence of the system by means of a phase-sequence indicator and trace out the wiring to see if the fundamental phase relationship exists. This method is independent of power factor, but requires the tracing out of both current and potential leads from the instrument transformers to the relays. This is sometimes impossible with the line in service, and it is not always wise to accept the markings on the leads as correct.



CONNECTIONS OF RELAYS ON POLYPHASE CIRCUITS CAN BE EASILY CHECKED BY THESE CURVES AND WATTMETER READINGS

A combination of the last two methods enables the relay connections to be checked under any power factor and without reference to any apparatus other than the relays themselves, since it is usually known whether or not the necessary leads are brought to the relays to make a correct connection possible. An explanation of the curves and an example will make this clear. Assume that the three potentials brought to the relays have the sequence *A-B-C* and that the three currents are *a-b-c*, where *A* and *a* are paired on one relay, *B* and *b* on on another, etc.

There are only three connections possible on any one relay, of which one is correct. Thus *A* and *a* might be paired, which is correct, *B* and *a* might be paired, or *C* and *a*. The indicated watts in each of these cases are given by the following equations:

$$W_{Aa} = EI \cos (30 \text{ deg.} \pm \theta), \quad (1)$$
$$W_{Ba} = EI \cos (150 \text{ deg.} \pm \theta), \quad (2)$$
$$W_{Ca} = EI \cos (270 \text{ deg.} \pm \theta), \quad (3)$$

where $\cos\theta$ is the power factor of the line and θ is taken positive for leading current and negative for lagging.

Equation (1) gives the indicated watts when any current is paired with the proper potential, (2) gives the indicated watts when paired with the potential second in sequence, and (3) gives the watts when the same current is paired with the third potential. These equations are plotted in the accompanying graph as percentage of *EI* for all power factors in the line and are shown as curves Nos. 1, 2 and 3 respectively.

The following readings were taken during a test where no power-factor control was possible: Phase sequence was determined to be *A-B-C*. $E = 111$ volts, $I = 2.76$ amp. Hence $EI = 306$. Wattmeter readings are tabulated in the accompanying table.

By referring to the curve sheet it is seen that the power factor on the line is 93 per cent lead and that relay *A* is connected properly. The other two relays are not connected properly and the correction can be made by interchanging the current leads to these two relays. Relay *B* should have current *c* and relay *C* should have current *b*. When this is accomplished the directional elements can be checked by inspection to see if the contacts are held open or closed, if the direction of power flow is known. Should the directional elements be wrong, this can be corrected by reversing at any one of the following places: potential terminals of the relays, current terminals of the relays or the current transformers, as circumstances dictate.

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Inspector of Substations.
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Campaign to Keep Power Plants Clean

AN INTENSIVE campaign on power-plant housekeeping conditions has been maintained for the last three years by the Central Illinois Public Service Company, according to J. Paul Clayton, vice-president. In general the engineer in charge of each power station is held responsible for the appearance of his plant and surroundings. Periodic inspections are made, and the reports on housekeeping conditions received are carefully followed.

At the Muddy power station the engineer in charge prepared a sign upon which was painted, "This is the dirtiest place in the whole plant." This sign was prepared on sheet metal, approximately 12 in. x 24 in. in size, and was made up with red letters on a white background. The engineer makes a daily inspection of the station and moves the sign from place to place as, in his opinion, the conditions warrant. An exceptionally clean and well-kept power station has resulted from this plan.

In the Kincaid power station a different method is followed. The engineer in charge divides his station into sections and certain men on each shift are made responsible for their respective sections. The engineer makes daily inspections of his entire plant. This scheme appears to be very satisfactory in that if any one of the men on duty neglects to care for his respective section the men on succeeding shifts naturally bring pressure of their own accord to bear upon the delinquent person.

The experience of the Central Illinois Public Service Company has proved that a well-painted station and equipment is a good inducement to employees to maintain a high housekeeping standard, and to that end the standard paint chart has been of material assistance. The paints are carefully chosen as to the use required, and the colors are chosen for appearance.

It is also found that a very beneficial effect on housekeeping conditions is gained by insisting that the employees in the power station maintain a neat and clean personal appearance. It is insisted that overalls shall be reasonably clean at all times, and the company has provided facilities for frequent washing of such apparel. To further assist in accomplishing this object, shower baths and sanitary facilities for employees in the station are provided. The direct benefit arising from a strict adherence to good housekeeping standards is clearly reflected in the operating efficiencies of these plants.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Fuses Tested for 66,000-Volt Transformers

Time Lag Great Enough to Obviate the Need to Consider It in Timing Relays—Vertical Installation Gives Lower Minimum Current, Shorter Lag and Better Operation

TESTS have been made on standard fuses for transformer primaries by the Pacific Power & Light Company to determine the minimum current at which a fuse will open the circuit and the time needed for it to blow on loads considerably in excess of this minimum. The experiments were made on 36-in. fuses with a glass-tube holder for 66,000-volt and 25,000-volt transformers. Other factors investigated were the effect of low temperature on minimum current and time required to blow, the effect of different methods of installing the fuse in the holder and the effect of the position of the holder—whether horizontal or vertical.

Two important facts stand out as a result of these tests. The first is that the current which a fuse will carry continually is much larger than might be supposed. A 1-amp. fuse installed on a 100-kva., 66,000-volt, three-phase transformer may hold up continuously under a load of 285 kva. In other words, this fusing gives short-circuit protection only and is of little value as overload protection. The second noteworthy fact is that the time lag of these fuses is great enough to make it unnecessary to consider it in the time setting of relays. A relay set for a time lag determined by conditions in the circuit it controls will always operate before the transformer fuse.

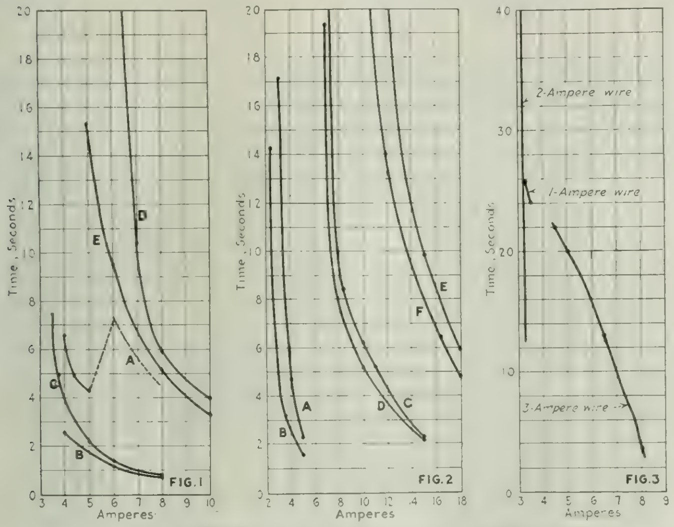
Since a stop watch could not accurately catch the small time intervals, a belt of adding-machine tape was run over a metal pulley at a constant speed of 1 ft. per second and a spark from a small induction coil was allowed to puncture the paper between a stationary brass knob and the metal pulley. The length of the punctures gave an accurate measure of the time needed to blow the fuse. For long intervals, however, a stop watch was used on account of the greater convenience.

The first series of tests were made at a room temperature of 82 deg. F. to 87 deg. F. on fuse wire taken from a spool found in stock from which the label had been lost but with a 3-amp. rating scratched on the spool. A 36-in. glass-tube holder was used and the ends of the wire were doubled for about 6 in. from each end. This was done so that the fuse would blow inside the tube rather than at the ends. The results are shown in curves A and B of Fig. 1, where the position of the fuse is horizontal in A and vertical in B, the time being an average of many trials.

TEMPERATURE EFFECT ON OPENING OF 3-AMP FUSE WIRE

Amperes	Temperature Deg. F.	Time, Seconds
7	23	30
7	17	50
7	20	34
10	26	8
10	26	8
7	80	25
7	80	24
7	80	36
10	80	6
10	80	6.5
10	80	6.5

The remarkable feature of these tests is the fact that in the horizontal position the fuse blows more quickly at 4 amp. than at 6 amp. and more quickly at 5 amp. than at 8 amp. This seems to be due to the fact that at the higher currents the entire fuse melts down to a flat ribbon which lies against the glass, thereby affording so great a heat-conducting surface that the fuse does not blow until the doubled ends outside the tube become hot enough to part. In both the 6-amp. and 8-amp. tests the fuse parted at the doubled end. In the horizontal tests at 4, 4.4 and 5 amp., and also in all the vertical tests, the fuse parted inside the tube.



TESTS ON 25,000-VOLT AND 66,000-VOLT TUBE FUSES AND 6,600-VOLT EXPULSION FUSES

Fig. 1—The time of fuse opening versus the current for a supposedly 3-amp. fuse with double ends is shown in A for the horizontal position and in B for the vertical. The break in curve A is due to the heat conductivity of the glass tube. Curve C is the same as A except that the fuse ends are single. Curve D is the horizontal position of a supposedly 6-amp. fuse, while E is the vertical.

Fig. 2—The relation between time of blowing and amperes for labeled fuses. Curve A is a 1-amp. fuse in the horizontal position and B in the vertical; C is the horizontal position for a 3-amp. labeled fuse and D the vertical; E is the horizontal position for a 6-amp. fuse and F the vertical position.

Fig. 3—Tests on 6,600-volt expulsion fuses indicate that the capacity for continuous-overload currents ranges from 25 per cent to 50 per cent. The three curves in this figure are for one, two and three-ampere fuse wire.

The results indicated that doubling the end of the fuse wire is a decidedly wrong procedure in the case of horizontally installed fuses. There is, however, no objection to it with fuses set vertically. Accordingly single ends were made standard practice and the remaining tests were made with fuses so inserted. Curve C, Fig. 1, is the same as curve A except for the doubling of fuse ends. Curve D represents a horizontal test on a fuse supposed to be of 6-amp. rating since, though the label was missing, this rating had been scratched on the spool. This same fuse in a vertical position is shown in curve E.

Tests on regular standard fuses with a known capacity placed in the 36-in. glass-tube holder are shown in the curves in Fig. 2. In all horizontal tests with single ends the fuse opens at the end outside of the tube, whereas the fuse opens near the top when placed in a vertical position. This would indicate that the proper way to install fuses is in the vertical position, since it gives a lower minimum current and a shorter time lag. Tests were also made at 100 per cent above rating, and current was left on for ten minutes. One standard fuse rated at 1, 2 and 3 amp. held ten minutes at 2½, 4 and 6 amp. respectively.

A comparison of the curves A, B, D and E in Fig. 1 with those in Fig. 2 shows that the fuses considered as 3 amp. and 6 amp. were really rated at 1 amp. and 3 amp. This shows the danger of taking the rating of a fuse wire from a mark on the spool rather than from the factory label and indicates the advisability of distinguishing fuse-wire spools before they leave general stores by a mark that cannot be lost or erased.

The next series of tests was made to determine the effect of extremely cold weather on the behavior of fuses. The fuses mounted in the 36-in. holder were placed in a 4-ft. length of 8-in. galvanized stove pipe, with lids fitted at the ends and the pipe surrounded by a freezing mixture. A thermometer was inserted through a cork midway of the length of the pipe, and the tests were made a half hour after the temperature had become constant. The results of a test on a 3-amp. fuse at low and high temperatures are given in the accompanying table. The difference in performance does not appear great enough to be important.

A few tests were then made on the present standard 6,600-volt expulsion fuses mounted in a holder as installed on the transformers. A number of tests showed that the largest current the fuse would carry continuously varied from 25 per cent to 50 per cent above rating. These results are shown in Fig. 3.

Tests were also made on 17,000-volt renewable cartridge fuses which showed that they would hold 50 per cent over rating for ten minutes and would blow at 75 per cent over rating in from forty-five seconds to one minute and three-quarters. A bad feature of this fuse is the inflammability of the pressed-paper cartridge. Great care must be exercised in refilling to keep the fuse in the middle of the cartridge. If the fuse is close to the cartridge at any point, the tube will burn through at a current below that for which the fuse is rated. R. M. FREEMAN,

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Explosion-Proof Electrical Equipment

A NUMBER of operators have installed flame-proof, or so-called explosion-proof, electrical coal-cutting outfits, under the impression that such equipment met all of the requirements of the Bureau of Mines. There are today in gaseous mines a large number of equipments that have not been approved by the Bureau of Mines and unless modified could not receive such approval. These equipments represent in part the product of manufacturers who have never submitted equipments for inspection or tests and in part types developed previous to the safety work of the bureau.

In order that all persons interested may appreciate the difference between a permissible equipment and one that has been built along similar lines but has not received the same inspection or been subjected to actual tests, the following points have been listed:

1. Permissible equipments are constructed in accordance with drawings held on file with the United States Bureau of Mines, and their design cannot be modified without due consideration of the effect of such changes on safety.

2. Permissible machines receive special attention while being manufactured. Most companies have special sheets to be filled out at the factory for each approved machine, calling attention to numerous points that need specific attention.

3. To be classed as permissible and to have an approval plate, a duplicate of the machine must have received a careful inspection by the Bureau of Mines and all permissible compartments must have successfully passed rigid tests in explosive mixtures.

4. Permissible compartments need to be subjected to actual tests to prove their mechanical strength. During the last two years three compartments as originally submitted failed in this respect, the explosion causing the casting to break in several pieces. These instances, representing the product of three manufacturers, indicate the necessity of test, and where failure occurs, of redesign, and they show also the danger of using so-called flame-proof compartments that have never been proved by tests.

5. Permissible compartments need to be subjected to actual tests in gas to prove their ability to retain all flames within the compartment. Experience in testing compartments has shown that designs appearing correct from a casual inspection will not pass the tests and that they need strengthening in one way or another. For example, one company submitted seven designs for a single compartment before it was successful in stopping all flames.

6. Permissible compartments must have no through openings into their interior. As originally submitted, most outfits have such openings. These are called to the attention of the manufacturer, who by special notation on drawings and factory inspection sheets does everything possible to avoid such oversight on equipments having the approval plate.

7. Permissible compartments should be properly closed—that is, all bolts should be securely fastened with nuts provided with lock washers or other equivalent means. Nearly every equipment when first submitted for approval is lacking in this respect.

8. Permissible compartments receive special attention with respect to entrance of all wires. This point is frequently overlooked in unapproved equipment.

9. The purchaser of permissible equipment having made a special effort to get the safest equipment procurable will take greater interest in seeing that it is properly operated and maintained.

10. Every permissible machine is provided with an approval plate. This plate not only tells the inspector that the equipment has received special attention as to safety, but calls his attention also to points that should be watched to keep it in safe condition. If the approval plate is missing, the machine is not a permissible outfit notwithstanding all claims to the contrary.

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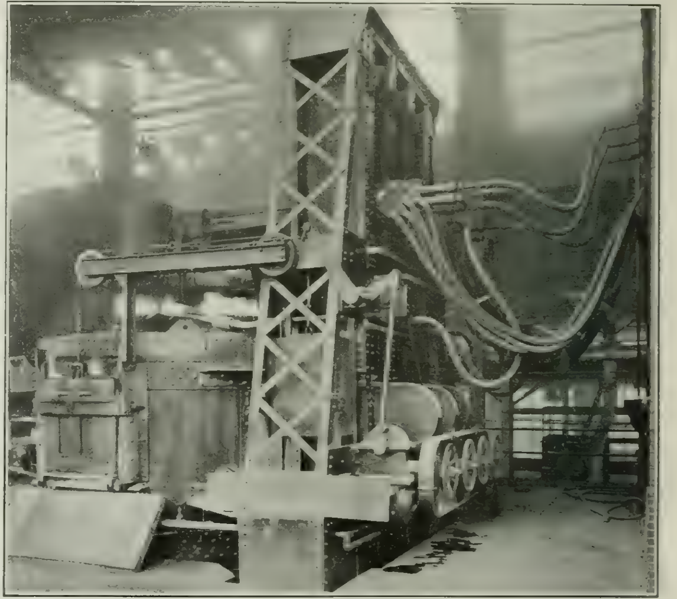
When to Use Acid and Basic Lined Furnaces

The query as to when an acid-lined furnace should be used and when a basic-lined is answered in different ways by various electric furnace users. One owner declares his belief in the acid operation under the following conditions: (1) When the phosphorus in the scrap is and always will be less than the sulphur required in any casting. (2) when the phosphorus in the scrap is and always will be less than the phosphorus required in any casting; (3) when the carbon and silicon contents vary over a wide range; (4) when close physical tests do not have to be met; (5) when power consumption and rate of operation are of prime importance, and (6) when very small castings are the sole output.

Basic operation, on the other hand, should be adopted: (1) When the sulphur in any scrap now or in future may go above the limits required for chemical or physical tests or requirements; (2) when the steel has to be made (for chemical or physical reasons) to a close carbon, silicon or manganese analysis; (3) when close or good physical tests have to be met; (4) when alloy steels are to be made in the furnace; (5) where steady load is essential, and (6) when refining of cast iron is to be considered.



STEEL PRODUCED IN THIS BASIC LINE FURNACE REQUIRED 585 KW.-HR. PER TON BASED ON RECORDS FOR A SIX-MONTH PERIOD

A prospective customer of an electric furnace, in looking over his available scrap supply, often feels that he can obtain all the scrap he requires of a sulphur and phosphorus content low enough (say below 0.04 per cent sulphur and phosphorus) to meet his requirements. The scrap market and the freight situation have, in the experience of many, only too often upset calculation, and the problem frequently arises of having a high sulphur and phosphorus scrap and a furnace which cannot eliminate these injurious elements. This has often meant one of three things—paying an excessive price for low sulphur and phosphorus scrap—a shutdown until proper scrap can be obtained, or bad castings and dissatisfied customers.

Assume that the above situation can be satisfactorily met. There is still the matter of requiring a low sulphur for special occasions, as, for instance, the making of a specially difficult casting where the foundry has its own particular problems and where a low-sulphur steel would be of particular value in helping out the foundry. This can only be done in a basic furnace.

It is much easier to control the carbon, silicon and manganese in the basic furnace. This means that specifications can be more easily met and rejections will be low. A good relation between the maximum stress and yield point and a good elongation with a relatively high maximum stress will also result. Refining can be done in the acid furnace to a limited extent, but it calls for skillful operation and is not reliable.

LOWER POWER CONSUMPTION IN ACID FURNACE

The acid operation gives a better power consumption in the relation of about 100 to 112, because there is practically no refining with this process. The refractory cost is also less, as raw material costs less.

If alloy steels are ever contemplated, a basic furnace is required. Manganese steels, for instance, so often required in the steel foundry industry, can be economically made only in the basic furnace. Other elements, particularly chromium, vanadium, etc., can be handled only in that furnace, and while the making of alloy steel castings may not be of immediate consideration, their use is becoming more general every day, especially for parts requiring uniform wearing qualities, resistance to shock and resistance to alternate stresses.

A basic furnace invariably has a steadier load than an acid furnace, for two reasons: (a) Higher secondary voltages are used in the acid to bring about more rapid melting; (b) the resistance of an acid slag is higher than the resistance of a basic slag, and therefore also requires a higher voltage.

In making small steel castings three important points must be kept in view: (a) Do not have the furnace of too large a capacity—install smaller units and more of them. For instance, when the castings do not exceed 10 lb. to 15 lb., a 1-ton furnace should be the maximum. (b) Hot metal is essential because of the necessity of pouring into shank ladles where the transfer losses and ladle losses are high and because of the number of pours required. (c) It must be easy to hold back the slag, and acid slag will keep back and separate more readily than basic slag. This does not mean that small castings cannot be made in the basic furnace, but it means that in foundries where castings weighed in ounces and others up to, say, 25 lb. are to be made the acid operation is easier and more economical.

A field for the electric furnace in the foundry which is growing rapidly is its use in the refining of cast iron. This is particularly applicable to the making of engine cylinders, high-pressure valves, piston rings and parts requiring uniform wearing qualities, and the practice now being adopted is to pass the molten pig iron from the cupola through the electric furnace for a refining period of from twenty to forty minutes. This gives a rapid desulphurization, elimination of occluded gases and accurate pouring temperature. These results will speak for themselves to the progressive foundryman who in the past has had trouble with sulphur in the coke, blowholes, and "hot" metal and "cold" metal. Only the basic furnace can be considered for this.

Waynesboro, Va. F. H. SWEET.

Cost of Substation Equipment

RECENT analyses of the complete costs of purchasing and erecting various high-powered substation equipment by an Eastern utility include various items of general interest, given in the accompanying table. The construction period in the main runs back about five years, the bulk of the costs given being incurred during the war. Although the costs attained are not intended to represent present equipment and construction outlays, they are complete as far as the actual local work goes and are at least of relative significance. In the substations involved railway and central-station service are provided.

COST OF SUBSTATIONS FOR BOTH RAILWAY AND GENERAL CENTRAL-STATION SERVICE

Cost of 15,000-kva. substation, outdoor type:	
Three 5,000-kva., 60-cycle, 66,000/13,200 2,300 volt transformers.	$33,800
Material, labor and transportation in erecting transformers	7,281
Seven three-phase, 13,200-volt reactance coils for feeders........	11,130
Material, labor and transportation in erecting reactances.........	3,260
Two direct-current 600-volt railway feeder panels with wiring.	2,952
Spray cooling pond for transformer service	1,199
Total	$59,623
Miscellaneous equipment for substation service:	
Two 1,500-kva., three-phase, 60-cycle, 13,200/2,300-volt water-cooled transformers, erected....	$8,620
One 6,600-volt lightning arrester and protective work on 2,300-volt regulator equipment......	1,557
Three 1,500-kva., three-phase, 60-cycle, 66,000/13,200/2,300 - volt self-cooling transformers, installed	30,617
One 6,000-kva., three-phase, 60-cycle, 66,000/13,200/6,600-volt water-cooled transformer, installed with oil and water system	25,181
One 3,000-kva. motor-generator set, 13,200-volts, three-phase, alternating current, and 600-volts, direct current, installed..	69,414

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

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Characteristics of Media for Lamp Reflectors

AS A GUIDE for the proper selection of media for shading, diffusing and redirecting light, some of the most important characteristics of the commonly used media are presented in the accompanying table. This was prepared by the committee appointed by the Illuminating Engineering Society to co-operate with fixture manufacturers. Of this committee M. Luckiesh was chairman.

RATINGS OF MEDIA IN RESPECT TO SEVERAL PHASES OF LUMINAIRE DESIGN
E, excellent; G, good; F, fair; P, poor, VP, very poor.

	Shading of Light Source	Diffusion of Light	Redirection of Light	Transmitting Efficiency	Reflecting Efficiency
Crystal glass			VP	E	VP
Etched glass...	VP	P	P	E	VP
Opal glass*					
1...........	G	E	F	F	G
2...........	F	G	F	G	F
3	P	F	F	E	P
Cased glass.....	G	E	F	G	G
Enameled glass....	F	F	F	F	F
Silvered glass....	E		E		E
Prism glass:					
Refracting....	VP		E	E	
Reflecting	F		E		E
Rippled glass.....	VP	VP	P	E	VP
Porcelain enamel..	E	F	F		G
Paint enamel	E	F	F		G
Polished silver..	E		E		E
Polished aluminum	E		G		G
Paper (dense) ..	G	G	F	F	G
Parchment	G	G	F	P	F
Mica (art) ..	G	P	P	P	P
Textiles (dense)...	G	G	F	P	F†
Plaster...	E	G	F		G

* Three grades of opal glass are assumed according to their ability to diffuse light, opal glass, 1, 2 and 3 having characteristics similar to those shown.
† For the lighter colors.

Refraction and total reflection have been utilized extensively in prismatic glassware with excellent control of the light. Since these principles involve the passage of light through clear glass, the absorption is low and the efficiency can therefore be of a high order.

With prismatic glass it is especially necessary that the light source be in the correct position with respect to the reflector, or the desired distribution of light will not be obtained. In general the light source must be small (approaching the theoretical point source) if accurate control of light is to be obtained.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Household Electric Refrigeration*

Investigation Shows Great Possibilities for Load Building—Better Servicing Facilities Must Be Provided—Comparison of Costs

By T. I. Jones

General Sales Agent Brooklyn Edison Company, Inc.

The potential value of the household refrigeration load has long been appreciated by central-station companies, but because of the high first cost of reliable machines, together with other problems of selling and maintaining the equipment in satisfactory operation, the introduction of this appliance has been comparatively slow. With a view to ascertaining marketing methods and making recommendations for increasing the sale and use of residential sizes of electric refrigerators a survey has been made of the present status of this business as it applies to the central-station industry.

One of the principal reasons why the electrically operated refrigerator has not achieved wider application and a larger market is because of the lack of organized methods for servicing. Like the automobile or any other highly developed piece of mechanism, a reasonable amount of care and supervision in operation is necessary to produce the best results. Unless some definite method of maintaining the machine after it is purchased is devised and effected, satisfactory results are difficult to obtain.

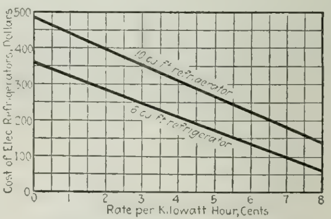
Refrigerating equipment now available is generally marketed in two ways. Either the mechanical apparatus is supplied and sold entirely separate from the cooling box, or the mechanical equipment and the box are manufactured and sold as a unit.

To ascertain correctly the practical operation of the modern household electric refrigerator as recently developed, a complete list of all sales of two of the principal types of machines within a given territory was obtained from the manufacturers, and from this list names were arbitrarily picked and a letter sent to each asking answers to the following questions: "What is the name of electric refrigerator?" "How long have you used it?" "Has it operated satisfactorily?" "What trouble have you experienced, if any?"

The 115 replies to this questionnaire which were received may be summarized as follows:

1—Average time in use.........19 months
2—Number in operation generally satisfactory 95
Number in operation with minor troubles 12
Number in operation generally unsatisfactory 4
Number entirely discontinued...... 4
3—Nature of troubles: Thermostat control out of order, motor trouble, odor of gas, leak in brine tank, belt had to be replaced.

Some of those who reported minor troubles have had the machine in use for two or three years. The manufacturers state that material improvement has been made in the refrigerator during the past year, and an analysis of the replies of those using machines bought within the past twelve months seems to show general satisfaction with their operation.



COST OF ELECTRIC REFRIGERATION

Price of appliance and rate per kilowatt-hour under which it must operate to equal cost of ice refrigeration at 60 cents per 100 lb. of ice.

It would seem from an analysis of these replies that the electric household machine has been sufficiently developed to warrant practical use with reasonable care of the machine. It cannot operate without maintenance, and this care is essential if the electric household refrigerator is to be in constant use.

If one were to list the advantages and disadvantages of the electric household refrigerator as at present developed, they might be recorded as per the list below:

ADVANTAGES

1—Better sanitary conditions.
2—Dry cold.
3—Pure ice for drinking purposes.
4—Quantities of food can be stored.
5—Economy in lessening food spoilage.
6—Convenience.
7—Saving in labor.
8—Does away with the ice man.
9—No uncertain time of the delivery of ice.

DISADVANTAGES

1—Present high cost of original equipment.
2—Uncertain servicing.

Enlarging on one of the advantages indicated, a study made by A. M. Greene, Jr., professor of mechanical engineering at Rensselaer Polytechnic Institute, Troy, N. Y., is significant. Harmful bacteria become inactive when temperature is less than 44 deg. F. dry air. The temperature in the average domestic ice box does not usually drop below 50 deg. F., so that bacteria is still active and food spoils. Professor Greene's test was made on 250 domestic ice boxes and showed that only 14 per cent of them operated with a temperature of less than 45 deg. F. "This demonstrates," says the professor, "that ice is not a reliable means of preserving food." That this has long been recognized is shown by the development of our present system of cold-storage warehouses using refrigerating machines which remove the heat and produce a dry temperature wherein bacteria are rendered dormant and foodstuffs kept and maintained in edible condition for indefinite periods.

Comparative Costs

The comparative cost of refrigeration by means of ice and by means of mechanical operation has, of course, a strong bearing on the marketing of the electrical machine.

Table I shows that for an apparatus of 6 cu.ft. capacity the annual cost of ice refrigeration is $58 as compared with a cost for electric operation with a kilowatt-hour rate

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*From a paper presented at the forty-first convention of the Association of Edison Illuminating Companies at White Sulphur Springs, West Va.

TABLE I—COMPARATIVE ANNUAL COST OF OPERATING ELECTRIC HOUSEHOLD REFRIGERATORS AND ORDINARY ICF BOX

	Ice Refrigerator	Machine No. 1	Machine No. 2 —		Machine No. 3	Ice Refrigerator	Machine No. 1	Machine No. 2 —		Machine No 3
			Type A	Type B				Type A	Type B	
Cubic contents, feet	6	6	6	5	7.5	10	10	10	9	8 5
Cost of cabinet or ice box	$100	$100	$100	. . .		$150	$150	$150	....	..
Cost of refrigerating machine	....	225	295	....			250	295	....	....
Cost of cabinet and machine	....	. .		$495	$550				$595	$650
Total cost of refrigerator complete	$100	$325	$395	$495	$550	$150	$400	$445	$595	$650
Operating cost:										
Interest on investment	$6.00	$19.50	$23.70	$29.70	$33.00	$9.00	$24.00	$26.70	$35.70	$39.00
Depreciation	10.00	32 50	39.50	49.50	55.00	15.00	40.00	44.50	59.50	65.00
Operating expense	42.00	30.00	30 00	30 00	30.00	54.00	35.00	35 00	35 00	35.00
Total annual cost	$58.00	$82.00	$93.20	$109.20	$118.00	$78.00	$99.00	$106.20	$130.20	$139.00
Rate of interest, per cent	6	6	6	6	6	6	6	6	6	6
Estimated rate of depreciation, per cent	10	10	10	10	10	10	10	10	10	10
Estimated annual consumption, lb and kw.-hr.	7,000	600	600	600	600	9,000	700	700	700	700
Estimated rate paid, cents per 100 lb. and per kw.-hr.	60	5	5	5	5	60	5	5	5	5

of 5 cents varying between $82 and $118, in accordance with different types of machines. This comparison is on the basis of ice at 60 cents per 100 lb. and takes into consideration interest on investment and cost of depreciation in both cases. For a 10-cu.ft. outfit the comparison is $78 for ice as against a variation of $99 to $139 for electric operation.

Considering the saving in food and the greater sanitary and convenience advantages of electric operation, this operating expense is by no means prohibitive. The difficulty will lie, therefore, not so much in the operating cost as in the large investment required for electric refrigeration, and before this appliance can come into general use its first cost must be materially reduced. With quantity production this difference will tend to disappear.

The curve shows the investment cost and kilowatt-hour rate for electric refrigeration at which energy must be sold to meet present cost of ice supply. With energy at 5 cents per kilowatt-hour, a 6-cu.ft. electric machine must be sold at $175 to equal the present ice cost, or a 10-cu.ft. refrigerator must be sold at $269.

A conference with the executives of the refrigerator manufacturers developed an interest by the manufacturers and an agreement on their part to reduce the price of the machines if the output could be materially increased.

VALUE OF LOAD

We now come to the value of the domestic refrigeration business to the central-station companies of this country. Table II shows the comparison of revenue derived from household electrical appliances. The kilowatt-hours used are based upon a record of actual use. If a special 5-cent rate, as has been suggested from some sources, were made for refrigeration business, this would reduce the revenue figure shown in the table from $64 to $40.

This table indicates rather clearly the desirability, other things being equal, of måking a serious attempt to develop this business. This will be further emphasized in our minds if we take into consideration two further facts:

1. No special additional investment is required to be in readiness to serve this type of apparatus as is the case with ranges, for instance.

2. The average maximum demand for household refrigeration purposes not being much more than 0.25 kw., and the number of kilowatt-hours used being comparatively large, the load factor of this business, in comparison with other household service, is exceptionally high and attractive.

The criticism, of course, will be made that the central station now has the greater portion of the ice-manufacturing business, and to encourage the sale of energy for household electric refrigerators will be merely transferring the income from one customer to another. While it is true that the greater bulk of our artificial ice manufacturing is now done by central-station power, it must also be borne in mind that the average rate to the central station for this service (usually high-tension) does not exceed 1¾ cents per kilowatt-hour, while the average rate (low-tension) for the revenue estimated in Table I is 5 cents per kilowatt-hour, showing a material margin in favor of the low-tension service. It is further pointed out that with electrical refrigeration the use will be much more extended than with local use of refrigeration by ice.

RECOMMENDATIONS

In view of the facts here presented and their bearing upon the development of additional attractive business of the revenue-producing type, the following recommendations are made:

1. That the central station encourage the sale of the electric household refrigerator as at present developed, it being understood that with this encouragement the manufacturers guarantee proper servicing conditions.

2. That a committee from this association or an individual investigator be appointed to continue the investigation of this subject, reporting from time to time the development of the appliance and calling to the attention of the apparatus manufacturers any general criticisms on their machine and service.

TABLE II—REVENUE FROM HOUSEHOLD ELECTRICAL APPLIANCES

	Maximum Demands Watts	Annual Consumption, Kw.-Hr.	Rate per Kw.-Hr.	Annual Revenue	Annual Revenue per Kw. Demands
Waffle irons	600	30	8c	$2 40	$4 00
Grills	500	34	8c	2 72	5 44
Heaters (radiant)	600	42	8c	3 36	5 60
Toasters	500	37	8c	2 96	5 92
Washing machines	300	25	8c	2 00	6 67
Percolators	400	42	8c	3 36	8 40
Irons	600	72	8c	5 76	9 60
Ironers (electrically heated)	3,000	360	8c	28 80	9 60
Vacuum cleaners	200	27	8c	2 16	10 80
Radiators	600	96	8c	7 68	12 80
Ironers (gas heated)	300	60	8c	4 80	16 00
Heating pads	50	15	8c	1 20	24 00
Fans	50	16	8c	1.28	25 60
Sewing machines	50	17	8c	1.36	27 20
Lamps (portable)	150	60	8c	4.80	32.00
Ranges	2,500	1,500	8c	120 00	48 00
Refrigerators	300	800	8c	64.00	213.33

Ten "Don'ts" in Using Electric Equipment

TO MINIMIZE the possibility of accidents or fires from electrical causes, City Electrician Israel Lovett of Omaha, Neb., has published the following precautions against careless handling of electrical equipment:

Don't fail to insist that your electrical contractor secures permit and inspection for any new electrical wiring. You help to pay the salaries of the inspectors; why not have something to show for your money?

Don't use pennies for fuses. There used to be a practice of hanging a monkey wrench on the safety valve. This has become unfashionable.

Don't use or handle electrical appliances such as vibrators, heaters, etc., while sitting or standing in the bathtub.

Don't leave the electric flatiron connected to the circuit and go to use the telephone, visit with the neighbors or to call at the grocery. It costs $100 for the fire department to make a "run" even for a smoking ironing board.

Don't use paper shades or other inflammable materials or decorations about electric lamps.

Don't use lamp cord wiring in your homes. It is unsightly and unsafe. The underwriters' committee which recently made a survey of Omaha stated that 40 per cent of the so-called electric fires originated from defective cords.

Don't permit "the handy man" nor the incompetent workman to do your wiring. There are some fifty licensed electrical contractors in the city, with the best lot of competent wiremen that have operated in Omaha during the past twenty years.

Don't forget that there are 365 days in every year in which to see that your electric wiring is in first-class shape. Fire prevention week is past, but there are fifty-one other weeks yearly when the same precautions can safely be taken.

Don't forget at any time that good, competent workmanship and first-class materials used in the installation of electric wiring make the best and safest job of work.

Don't overlook the fact that the electrical department is anxious to furnish service and will be glad to offer suggestions for your wiring job. Some of them may prove useful.

A Newspaper's Recognition of Utility Service

THAT the public and the press throughout the country are appreciating better than ever before the true value of the public utilities to a community is shown in a recent editorial appearing in the Kansas City *Journal*. It referred to the high quality of service rendered by the Missouri Gas & Electric Service Company in Lexington, Mo., and said:

"Apropos of the statement of the Lexington *Intelligencer* that that city gets the best public utility service in the country, the Missouri State Committee on Public Utility Information calls attention to this refreshing departure from the too prevalent disposition to minimize the value of public utilities to the community.

"Most Missouri cities, remarks the committee, are proud of their public utility service. It is good advertising for a town when its citizens boast of their public utilities. It means that service is good, business good, a contented and prosperous community, all of which has a most beneficial effect on visitors, intending locators, etc.

"The best boost a town can get is when its citizens can boast of their public utility services. A city may possess location, trade possibilities, etc., but if it lacks good electric, gas, telephone, street railway and water supply service, it cannot be a prosperous, contented community."

Merchandising Practice in Chicago

An Outline of a Central Station's Facilities for Selling $3,500,000 Worth of Electrical Appliances Yearly—Co-operation with Dealers

By JOHN F. GILCHRIST

Vice-President Commonwealth Edison Company, Chicago

THE merchandising business of the Commonwealth Edison Company is conducted with a view to doing a large volume of business at a profit. At the same time, a plan of co-operation with independent dealers is being carried out.

The company has one main shop in its office building in the "Loop" district in Chicago, utilizing some 25,000 sq.ft. of first-floor sales and window space, and perhaps half this amount of storeroom space in the basement.

In addition, the company maintains five branch stores in the outlying sections of the city, carrying full lines of stock, and nine stores are used as headquarters for washing machine, vacuum cleaner and electric phonograph salesmen.

The electric shops employ, roughly, ninety people in the shops, and in addition have two crews of outside salesmen aggregating approximately a hundred. The company's policy is that of making a direct profit on the merchandise which it sells and of co-operating with the independent dealers and shaping its policies so that they may compete and also make a profit. The company does a large amount of newspaper, magazine, billboard, general and street-car advertising; it endeavors to make a decided feature of its window displays, employing a trained window trimmer, and it uses other up-to-date measures for bringing people into its stores and giving publicity to its sales.

A factor in the latter is a coupon plan which is used most effectively. A simple coupon, known as a bill certificate, is inclosed with each of the 500,000 monthly bills. This, on being presented at any one of the shops within an average period of thirty days, entitles the one presenting it to a profit-sharing coupon good for an indefinite period and worth 3 cents in exchange for any of the company's merchandise, either in payment in full or in part. This plan results in bringing approximately 1,500,000 people into the company's shops each year.

The company endeavors continually to broaden its varieties of merchandise, but at least in the larger articles leans decidedly to concentration on one or, at most, two makes of each article, as it has been conclusively demonstrated that an attempt to extol the virtues of a variety of makes of an article scatters selling enthusiasm and loses sales.

The company hopes to sell during the current calendar year between $3,500,000 and $4,000,000 worth of electrical merchandise of the appliance nature, not including heavy and staple merchandise, such as cable, lamps and wiring supplies, which are handled in a separate department and which will amount to at least $1,500,000 per annum more.

CO-OPERATION WITH DEALERS

The company has for some time been endeavoring to co-operate with the independent dealers, and this has developed into a movement, somewhat in the nature of an experiment, that is being tried at the present time to promote cordial and mutually helpful relations between the central station and these dealers. The company, dealing with the members of the Electrical Contractors' Association of Chicago, some 125 in number, which assures a certain stability, extends to as many of the members as desire to avail themselves of it the privilege of receiving payment at their stores for the light and power bills of the company and of exchanging bill certificates and redeeming coupons to exactly dealers jointly with the central station in the advertisements of the latter. The result has been an increased interest in the business and an enthusiastic, cordial relationship which is doing much to assist in the distribution of merchandise in the community.

VIEW OF ELECTRIC SHOP IN COMMONWEALTH EDISON COMPANY'S MAIN OFFICE

the same extent as is enjoyed by the company's shops.

In addition to this, the company is holding at the present time a series of weekly dinners. These are attended by from seventy-five to a hundred people, three-fourths of them dealers and one-fourth of them representatives of the company. At these meetings subjects of interest with reference to the business are taken up. One or two meetings have been devoted to window trimming, a typical window having been erected in the dining room.

Making use of this, illustrations were given of how not to dress a window and how to dress one. Other features have been discussions of good lighting and poor lighting, lectures on merchandising by men of experience, papers and discussions on the proper amount of stock to carry and what the selection should be, sales demonstrations, with the necessary properties to give them a realistic turn, and with all the above the straightening out of any unsatisfactory policies as between the two bodies and the advertising of the

Such a policy will, in the writer's judgment, breed good feeling and pleasant inter-industry relations, and the immediate result at least will be that the central-station company will sell more rather than less merchandise, while the amount of electrical energy sold will be very materially increased.

What Other Companies Are Doing

Abilene, Tex.—Residents of this city celebrated the formal opening of the new power station of the Abilene Gas & Electric Company on Oct. 25. The new power station is owned by the American Public Service Company, being one of the central generating stations of this company in west Texas from which energy is supplied to a number of smaller towns within a radius of 50 to 100 miles. Martin J. Insull of Chicago was present and delivered the chief address of the occasion.

Grand Island, Neb.—On Oct. 5 the merchants of this city celebrated "Dazzling Dollar Day," in which the Central Power Company participated and sold during the day 235 one-burner electric hotplates. The company's special advertising feature was the operation of a radio outfit at its office which proved particularly effective in attracting the crowd.

Vermont, Ill. — The municipal electric distribution system here has been purchased by the Central Illinois Public Service Company, which has for a number of years owned a transmission line passing through the village. Payment for the distribution system is to be made entirely by furnishing street-lighting service. The company's revenue from the village will be approximately $10,000 a year.

Lake Geneva, Wis.—To the end that the women employed by the company may be better qualified to deal with the public in all matters relative to the company's operation, ten young women employed by the Southern Wisconsin Electric Company are making a tour of inspection of the company's entire property. The inspection will be made from time to time as convenient and will require in all about four days to complete.

Louisville, Ky.—H. M. Byllesby & Company announced that work on the expansion of the Waterside generating station of the Louisville Gas & Electric Company to a capacity of 91,000 hp. by the addition of a 27,000-hp. steam turbo-generator is progressing rapidly and that the new addition will be completed by the fall of 1923. The company's business is growing rapidly, the electric connected power load during the first nine months of 1922 increasing 9,301 hp., while residence and commercial lighting gained 3,719 kw.

Providence, R. I.—Eighty-six per cent of the employees of the Narragansett Electric Lighting Company eligible to subscribe to a recent issue of stock to employees signed a subscription blank, the total number taking stock being 460. About 75 per cent of the entire number of employees of the company are now stockholders, their total holdings approximating 5,500 shares, or nearly 2 per cent of the entire stock outstanding. The stock in the recent issue was offered to employees at $57.50 per share, or about $10 under the prevailing market price. The net payment actually works out at about $49 per share, owing to the allowance of all dividends accruing upon the entire subscription during the partial-payment period provided for employees' convenience.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Maintaining the Efficiency of Turbine Lubricating Oil.—C. H. Hapgood and F. R. C. Boyd.—The authors have summarized some of the previous articles on this and kindred subjects, discussing the principal types of oil-purifying equipment and giving the theory of the centrifugal oil purifier. They then consider the improvements made in modern centrifugal purifiers and their application to power-plant problems. They give data to show how these purifiers maintain the lubricating value of the oil.—*General Electric Review*, September, 1922.

Water-Power Situation in the St. Lawrence Region.—J. T. Johnston.—There is at present 6,077,427 undeveloped horsepower within 300 miles of Long Sault exclusive of the undeveloped St. Lawrence power. The author outlines the relation of the water power in the St. Lawrence region to that of the St. Lawrence waterway development. How the water powers must be developed in the future to take care of the increased demand for power is related.—*Canadian Engineer*, Sept. 19, 1922.

The Degasification of Boiler-Feed Water.—J. R. McDermet.—Fundamental laws governing the separation of dissolved gases from water by air-tension control are considered to the extent of their application to conventional types of feed water-heating equipment.—*Mechanical Engineering*, October, 1922.

Solving the Feed-Water Problem at New Orleans.—O. P. Adams and P. F. Hoots.—The 50,000-kw. plant of the New Orleans Railway & Light Company uses Mississippi River water for make-up with practically no trouble from scale or priming, although the boilers operate at high rating. This is accomplished by lime-soda-copperas treatment in a steam-heated tank and by using periodic water tests as a basis of correct treatment and scientific plant operation. The apparatus, procedure and test results are given in detail.—*Power*, Oct. 17, 1922.

Generation, Control and Switching

Erection and Tests on Large Single-Phase Generators.—F. Wüthrich.—A detailed description is given of the installation and the official tests of the single-phase generators for the Ritom railway power station in Switzerland. The ratings and some salient features of these generators are: Continuous rating, 9,000 kva.; one-and-one-half hour rating, 11,500 kva.; power factor, 75 per cent; voltage, 7,500/15,000 volts; frequency, 16⅔ cycles; speed, 333⅓ r.p.m.; safe runaway speed, 630 r.p.m.; efficiency at 8,600 kw. and power factor 100 per cent, 96.17 per cent. Four of these large Pelton-wheel-driven machines are now in operation and two more will be added shortly. A report of the methods and the results of the measurement of the various electrical characteristics of the generators forms a large part of this interesting paper.—*Brown-Boveri Mitteilungen*, September, 1922.

Operation and Maintenance of Alternating-Current Generators. — Ralph Brown.—After a generator is placed in service constant vibration, recurring temperature changes, short circuits and high-voltage surges tend to impair the qualities of the insulating material. Oil-soaked armature-coil insulation has a tendency to deteriorate rapidly, defective connections in the armature-field circuits may burn apart, and accumulations of dirt in vent ducts and on coils cause excessive temperatures. For these and other reasons it is highly advisable to inspect generators thoroughly at intervals of six months. The manner of making these inspections and the particular points to consider are outlined by the author.—*Power*, Oct. 17, 1922.

Transmission, Substation and Distribution

Present Status of High-Voltage Transmission of Power—Part I.—W. W. Lewis.—A general review of the present status of high-voltage power transmission in which the author discusses line insulation, corona, grounded neutral, protection and charging the line. A table is included listing the principal transmission systems of the world of 66,000 volts and above. In each case the name of the company is given with the normal system voltage, altitude of stations and frequency of system, it being stated also whether the neutral is grounded or not and the year in which the line was installed. Between the voltages of 66,000 and 220,000 there are thirty separate potentials represented in the list. It is obviously a hardship on the manufacturer to be compelled to develop lines of apparatus for all these voltages and the cost of so doing must be borne by the electrical industry.—*General Electric Review*, October, 1922.

PRINCIPAL TRANSMISSION CIRCUITS OF THE WORLD SHOW A GREAT VARIETY OF VOLTAGES ABOVE 66,000

The normal system voltage is defined as the highest rated secondary voltage of the step-up transformers supplying the system.

No.	Normal System Voltage	No.	Normal System Voltage	No.	Normal System Voltage
32	66,000	1	86,500	10	120,000
1	67,560	1	87,000	1	125,000
3	69,000	9	88,000	1	127,000
7	70,000	1	90,000	3	130,000
7	72,000	7	100,000	8	132,000
2	75,000	5	102,000	2	140,000
1	76,200	3	103,900	3	150,000
4	77,000	2	104,000	6	154,000
9	80,000	24	110,000	1	165,000
1	85,000	2	115,000	2	220,000

Protection from Loss by Breakdown of Electrical Equipment.—B. K. Spencer.—The author explains how the losses caused by breakdown of electrical equipment may be covered by insurance policies. Several examples of accidents to electrical equipment and the way that they were covered by policies are cited. A classification schedule showing the principal divisions for each class of apparatus is given.—*Industrial Engineer*, October, 1922.

Units, Measurements and Instruments

Cross-Coil Instruments for Alternating Current.—H. Kafka.—The author describes and investigates mathematically the cross-coil instruments of Siemens. These instruments contain a closed magnetic field in the air gaps of which are placed two movable coils. The equilibrium of the coils depends upon the vectorial relation between the currents flowing through the coils. Equations are derived for the balance between the torques, and a graphical method is shown, which makes it possible to determine the pointer deflection for any current relation. This method is explained practically by two examples, one for the measurement of the temperature of electrical machines, the other for a remote indication of small movements.—*Elektrotechnik und Maschinenbau*, Sept. 3, 1922.

Application of Contractometer to the Study of Nickel Deposition.—E. A. Vuilleumier.—The mechanical stresses of nickel as deposited were studied by plating the nickel on one side of a thin sheet of platinum and measuring the bending or contraction by means of a contractometer. It was found that the degree of contraction decreases when the deposit becomes more coarsely crystalline. There are a number of factors discussed that influence the structure of the deposit, such as metal-ion concentration, hydrogen-ion concentration, current density, temperature, etc. —*American Electrochemical Society paper, Montreal*, Sept. 21, 1922.

Illumination

Flicker Versus Equality-of-Brightness Photometry.—Dr. C. E. Ferree and G. Rand.—The causes of discrepancies between observations made by the "flicker" and the "equality-of-brightness" methods of comparing lights are discussed. It has been found that these methods agree if the eye is exposed the same length of time with both methods. The apparatus which the authors used to make the test is described. According to the data which have been collected, the authors have found that for various lengths or colors the rise of sensation to a maximum value is different for each color and for each intensity.—*I. E. S. paper, Swampscott, Mass.*, Sept. 25-28, 1922.

Motors and Control

Determination of Motor Size for Centrifuges. — S. Hopferwieser. — A mathematical treatise for the proper choice of the motor size for the drive of centrifuges, taking account of the torque, the acceleration energy and the intermittent heating. It is shown that for given conditions the motor size may be determined with sufficient accuracy from the root-mean-square output of the duty cycle. A practical example illustrates the use of the theoretical conclusions.—*Brown-Boveri Mitteilungen*, September, 1922.

Application of Electric Service to the Chemical Industry.—William B. Todd.—Some of the principal applications pointed out are motor drives, illumination, heating, transportation, electrolysis and electrical precipitation. The present field in each of these branches is considered and the advantages of applying electricity more thoroughly to the chemical industry are discussed.—*Chemical and Metallurgical Engineering*, Sept. 13, 1922.

New Development in Rolling-Mill Drive. — A. K. Bushman. — The new electric drive for the hot strip mill of the Trumbull Steel Company at Warren, Ohio, is described. This mill consists of a roughing train, having four stands of horizontal rolls, an intermediate train with two stands and a finishing train with four stands. It is a 14-in. continuous mill and is driven by a 600-volt direct-current motor, which develops 1,250 hp. at any speed between 175 r.p.m. and 350 r.p.m. through reducing gears. The speed-regulating control devices for the mill are described. — *Blast Furnace and Steel Plant*, September, 1922.

Heat Applications and Material Handling

Thermal Conductivity of Refractories.—W. A. Hull.—The relation of thermal conductivity to other properties of refractories is considered in this article, and an attempt is made to find out what place these properties will have in specifications for refractories. It may soon be expected, the author says, that conductivity will become a matter of specification for refractory materials for certain purposes.—*Chemical and Metallurgical Engineering*, Sept. 13, 1922.

Preparation and Mechanical Properties of Vacuum-Fused Alloys of Electrolytic Iron with Carbon and Manganese. — Robert P. Neville and J. R. Cain. —An extensive series of very pure alloys of electrolytic iron, carbon and manganese was prepared, the melting being carried out in a vacuum furnace, thus eliminating as much as possible the influence of the gases on the properties of the alloys. Reduction of area and elongation of pure iron were 82.5 per cent and 40.5 per cent respectively. With the addition of carbon these values were rapidly and regularly decreased. —*American Electrochemical Society paper, Montreal*, Sept. 21, 1922.

Electro-Pneumatic Grain-Discharging Plant.—A description is given of the pneumatic grain-discharging plant recently installed at the Meadowside Granary in Glasgow. The grain is released from the receiver by means of a mechanically operated tipper and passes through a 4,000-lb. automatic scale to band conveyors under the quay and thence to the granary, or by means of portable bands to the transit sheds. The air from the receiver to the exhauster passes through a filter and dust-collecting device before being discharged into the atmosphere.—*Electrical Times*, Sept. 21, 1922.

Electrophysics, Electrochemistry and Batteries

Effect of Single Impurities on the Electrodeposition of Zinc from Sulphate Solutions.—John T. Ellsworth.—A research setting forth the limiting value of each ordinary impurity which may be present in a zinc-sulphate solution without seriously affecting the cell efficiency. The presence of such impurities as copper, manganese, cadmius, iron, antimony, cobalt and cadmium oxide was investigated under conditions as near commercial practice as possible.—*American Electrochemical Society paper, Montreal*, Sept. 21, 1922.

Dielectric Hysteresis of Amorphous Insulating Materials.—Hikoo Saegusa. —Experiments were carried out to investigate seven amorphous insulating materials, namely, ambroid, paraffin, sulphur, paper, ebonite, glass and mica. The apparatus and method of procedure is described. The investigations cover time effect, residual charge, plastic dielectric hysteresis and stationary dielectric hysteresis. The results show that a good insulting material has a small hysteresis effect, small time effect and a small residual charge, demonstrating that such a material can be specified by studying the phenomena of each carefully. — *Journal of the Institute of Electrical Engineers of Japan*, September, 1922.

Traction

Development of Unified Power Supply and Distribution Systems in Chicago.—Ralph H. Rice.—Considerations which have established a power supply for electric railways unique because of its degree of reliability and low cost are related. The features of power contract and the engineering determinations embodied in the alternating-current and direct-current systems are given.—*Electric Railway Journal*, Sept. 23, 1922.

The Advance in Industrial Electric Traction.—Gordon Fox.—The general construction and motor arrangement of various types of small locomotives is described, illustrated by curves, photographs and line drawings. The most common practice with haulage locomotives is to suspend two or more motors from the axles by means of axle bearings on the motor, with a third point of suspension from the truck through a spring support.—*Railway Electrical Engineer*, September, 1922.

Mercury-Arc Rectifier for 5,000-Volt Direct Current. — M. Egg. — A short account of the recent successful operation of a rectifier rated at 1,620 kw. continuously for several days to deliver direct current of 300 amp. under 5,400 volts. — *Brown - Boveri Mitteilungen*, September, 1922.

Telegraphy, Telephony, Radio and Signals

Use of the Condenser in Subscribers' Telephone Circuits.—H. J. B. Chapple. —It is theoretically demonstrated that in removing the condenser from the telephone circuit the alternating speech current is reduced to about one-fifth of its former value. When this was verified experimentally short-circuiting of the condenser reduced the alternating voltage, and thus the current, to one-quarter of its previous value, the discrepancy being doubtless due to unsteadiness of the voltmeter readings, microphone resistance, etc.—*Electrician*, Sept. 15, 1922.

Commercial Radio Telephone and Telegraph Transmitting Equipment.—W. R. G. Baker and B. R. Cummings. —This is the first of a series of articles on commercial transmitting equipment. In this installment the authors explain the advantages of continuous-wave and interrupted-continuous-wave transmission and describe the essential elements of a standardized commercial type of radio transmitter for telephony, continuous-wave and interrupted-continuous-wave telegraphy. The circuits utilized in a 200-watt and a 1,000-watt equipment are briefly analyzed.—*General Electric Review*, October, 1922.

Miscellaneous

Technical Supervision of Plant Lubrication.—Allen F. Brewer.—Many industrial-plant superintendents fail to realize that lubrication is vital to efficient operation. One of the essential features in bringing about reductions in the cost of plant lubrication and upkeep is daily and thorough inspections, properly and logically carried out. In planning for inspections types of machines, manner of lubrication, extent of operation, intelligence of operators and locality should be considered. No phase of modern lubrication efficiency is more important than the development of lubricants suitable for specific conditions. The extensive research carried on by refining and lubricating engineers has proved many points in regard to grades of oils, compounds and greases best suited for all manner of conditions. Curves showing the coefficient of friction and the temperature and viscosity of new and of purified oil that has been filtered are included in the article.—*Industrial Management*, September, 1922.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

New York's Water Power

Governor Miller Denies Surrender of It to the "Interests"—Real Development Planned

REPLYING to the charge that he had delivered the water power of the State of New York to the "power interests," Governor Miller, who is running for re-election on a platform indorsing his view of hydro-electric development, told an audience in the Niagara district what water-power development means in tons of coal, what it means to the farm dweller in the extension of a system that can bring modern conveniences to every door and what it means to the city dweller in cheaper rates for light, heat and power.

"It is charged now," asserted the Governor, "that we have delivered the water power of the state to the power interests. What we have done has been to bring the power interests under the control and the regulatory powers of the state. They talk about development by the state itself. They have been talking that for more than a quarter of a century, and not one step has been taken to develop one kilowatt. They have not even made the initial study to make a guess at the hundreds of millions which the state would have to invest in that vast undertaking.

Politics Versus Service

"Water-power development has been a subject solely for political discussion. We have made it a problem to be solved, to render service to all the people of the state. The project is so vast that much time will be required to consummate it, but the fruits of the work done are nearer than people realize.

"The foundation has been laid for the development of the vast potential resources of the state, by private initiative, it is true, but under such safeguard and under such power of control and regulation as to insure the full benefit of the development to the public and to all of the public. Incidentally, apropos of the talk of turning over water power to the interests, by a simple provision municipalities are to have the preferential right to purchase for their citizens any water power developed, at a price to be fixed by public authority.

"Plans are already formulated for the beginning of these vast undertakings. A million potential horsepower on the interior streams, added to three millions potential power still undeveloped on the boundary streams, means a saving of from thirty to forty million tons of coal a year.

"It means light, heat and power for general distribution to all of the people of this state, the city dweller and farm dweller. It means cheaper light, heat and power. It means the great modern conveniences which electrical power brings. It means the drudgery of the housewife avoided or eliminated.

"So far from turning the water-power over to the interests, it means the greatest instrument to regulate and to control the public utilities, and, so far from creating trusts, it provides the instrument to 'bust' the trusts."

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Soft-Coal Lake Shipments

Requirements of North Central States Likely to Be Fully Met, but Hard Coal Scarce

INDICATIONS are that the soft-coal requirements of the North Central district, which includes Lake Superior and Lake Michigan ports, will be met, according to J. P. Pullman, president of the Wisconsin Utilities Association. Mr. Pullman bases his prediction upon the latest authoritative government compilations of coal receipts for this district, which he has just received.

"If soft coal should be received up to Dec. 15 at the same rate it has come in for the first fifteen days of October, the upper lake district will receive its average annual requirements," said Mr. Pullman. On hard coal, however, he said that the region would be 65 per cent short of annual requirements at the present rate of receipts.

The compilations show that the receipts of hard coal and soft coal via the lakes for the North Central States total 6,260,448 tons, which is 24 per cent of the average annual requirements. Last year the total receipts for the season were 21,677,513 tons. The Milwaukee district, which includes ports on the west and east shores of Lake Michigan, has received 2,034,319 tons. This is 29 per cent of the annual requirements, which last year were 6,914,358 tons. Receipts through the Sault Ste. Marie locks have been 3,294,218 tons, or 20 per cent of the yearly requirements; at Duluth and Superior they have been 1,987,052 tons, or 19 per cent of the yearly requirements, and in the Chicago district 931,311 tons, or 49 per cent of the yearly requirements.

"Soft coal prices are still high," said Mr. Pullman, "and will increase operating costs of utility companies more than a million dollars in the next five months."

Utility Stock Popular

Experiment by Canadian Company Brings Oversubscription for Securities Offered Customers

AN EXPERIMENT so far as Canadian light and power companies are concerned has been carried out by the Southern Canada Power Company of Montreal with marked success. Following the custom of the United States, this company offered its securities to customers in the various communities in which it operates through the employees of the company. The campaign was to continue for ten days as there are more than fifty municipalities in the eastern townships of Quebec covered by the company, and these were divided up into five districts under the supervision of the local superintendent, two thousand shares of preferred stock at a par value of $200,000 being offered. The demand was so great that at the end of the second day it was necessary to end the campaign with 2,300 shares subscribed for. The stock, of which there is a million dollars' worth outstanding, sells from $88 to $90 a share and pays 6 per cent dividend. The purpose of the Southern Canada Power Company in offering the stock was to interest its customers, who number about fourteen thousand, in the securities of the company which supplies them with light and power and thus build up good public relations. One employee made sixty-two calls in the two days and enrolled forty-eight subscribers for an average of three and one-half shares each.

The Southern Canada Power Company, with headquarters in Montreal, has three hydro-electric stations, at Drummondville, Sherbrooke and Foster, and a steam station at St. Johns, all in the Province of Quebec. It owns and controls the Compagnie de Gaz, Electricité et Pouvoir (St. Hyacinthe), the St. Johns Electric Light Company, the Brome Lake Electric Power Company (Waterloo), the Richmond County Electric Company (Richmond) and the Sherbrooke Railway & Power Company, Southern Canada Power Company, South Shore Power & Paper Company, Ltd., Eastern Townships Electric Company, Stanstead Electric Light Company, Burroughs Falls Power Company, International Electric Company of Vermont and Lennoxville Light & Power Company. In addition to the output from its three stations it also purchases power from the Montreal Light, Heat & Power, Consolidated, and the Shawinigan Water & Power Company. J. B. Woodyatt is the general manager of the company.

American Delegates to I. E. C.

In addition to C. O. Mailloux, Clayton H. Sharp, H. M. Hobart and C. E. Skinner, whose appointment to represent the United States at the meeting of the International Electrotechnical Commission to be held at Geneva, Switzerland, on Nov. 18, was recorded in the *Electrical World* last week, Schuyler Skaats Wheeler, Gen. George H. Harries, Frank V. Magalhaes and Clarence L. Collens, 2d, have been made delegates, and a ninth member of the committee may still be named. One of the most important topics to come before the Geneva meeting is the uniform rating of electrical machinery on a temperature basis, and an effort to arrive at an international ruling on this point will be made.

Great Western Power Installs Carrier-Current System

In a recent installation of wireless-telephone receiving and sending sets to facilitate communication between its generating stations at Big Bend and Caribou and its Oakland substation, the Great Western Power Company of San Francisco adopted the "carrier" system. The antennas at the three stations were placed near the 110,000-volt conductors, and by this means entirely satisfactory results have been obtained, notwithstanding that the dispatcher's office at Oakland is 154 miles from Big Bend and about 200 miles from Caribou via the transmission lines. Few previous attempts had been made to use carrier current over so great a distance, and much experimental work in the selection of wave lengths and similar details was necessitated. This was done under the direction of Dr. Leonard F. Fuller of Palo Alto.

A. M. E. S. Discusses Problems of Industry

A comprehensive report was presented by President S. L. Nicholson at a special meeting held during the regular fall conference of the various sections of the Associated Manufacturers of Electrical Supplies in New York in the week of Oct. 16. It took the form of a review of conditions affecting the organization of the electrical industry at the present time and of the work the Electrical Manufacturers' Council and the A. M. E. S. are undertaking through their various sections. The question of publishing statistics on production and sales in the electrical industry was discussed at length, as was the work of the Division of Simplified Practice of the Department of Commerce and the extent to which the electrical industry might benefit by co-operating with it. Mr. Nicholson also dwelt on the work of the tariff committee of the council and sketched the results which might be expected from the operation of the new tariff law, explaining in detail the basis on which the different branches of the electrical manufacturing industry are co-ordinating in the council.

There were present at this special meeting only the president and the chairmen of the sections, who gathered at the invitation of Mr. Nicholson for the purpose of considering in detail the work of the association as it affects all branches of the association and the industry jointly. C. L. Collens, 2d, of Cleveland, chairman of the census committee of the Electrical Manufacturers' Council, presented a report on the work of his committee containing suggestions for the revision of the 1923 biennial census form and discussed plans and possibilities for the compilation of statistics on production in accordance with the plan suggested by Secretary Hoover. Leslie Vickers of the National Industrial Conference Board also addressed the meeting.

Omaha Company Acquires the Union Power & Light

The properties of the Union Power & Light Company, operating in Iowa, South Dakota and Nebraska, have been acquired by the Continental Gas & Electric Corporation of Omaha, according to an announcement made by Rufus E. Lee, president of the latter corporation. The Union company was formerly controlled by a syndicate headed by the First National Bank of Omaha and Kountze Brothers, bankers, of New York.

The Union Power & Light Company is a consolidation of the Eastern Dakota Electric Company, Aberdeen Light & Power Company, Columbus Light, Heat & Power Company, North Platte Light & Power Company and the Southern Iowa Electric Company.

Power Club Standardization Advances

Well-Attended Meeting at Asheville Adds to List of Accepted Rulings, Terminology and Symbols—First-Hand Impressions of Foreign Trade Opportunities Are Given

At one of the best-attended meetings it has ever had the Electric Power Club, in session at Asheville, N. C., this week, made still further progress in outlining standards and recommended practices. While the meeting had not ended at the time this issue of the *Electrical World* went to press, action had been recorded in several matters.

Clutch-type, split-phase fractional-horsepower motors are no longer Electric Power Club standards. Nine standards of and specifications for brush shunts were adopted for reference to the Associated Manufacturers of Electrical Supplies to have them made joint standards. Seventy degrees was the maximum operating temperature adopted for switchboard copper buses, and ampere ratings of buses are to be based on temperature rise instead of on constant-current density. Other switchboard rating standards were also adopted, including a recommended practice of a series of interrupting-capacity ratings for oil circuit breakers and a partial list of standard nomenclature for breakers. Standard tray clearances and jar specifications for storage batteries for mining and industrial locomotives were adopted. The requirements for high-potential test guarantees for transformers of from 4,500 volts to 55,000 volts were amplified. The club adopted as standard practice outdoor construction for single-phase and three-phase self-cooled and water-cooled distribution and power transformers except for special purposes. A list of relay nomenclature was also adopted which will clarify terminology in relay work, and a series of graphic symbols for use on wiring diagrams was adopted for recommended practice. Some of the details of these new standards and practices will be printed in early issues of the *Electrical World*.

In his address before the club President R. J. Russell, Century Electric Company, pointed out how the work of the club in standardization has served to produce "quality" electrical apparatus. He showed the relation of quality and standards to the development of foreign business and urged the members of the club to adhere to standards and high quality in both domestic and foreign trade. Another point emphasized by President Russell was that a high order of competition be maintained. He pointed out that this can be done only when sales organizations are made up of men who are a credit to the industry. "The best men are carefully selected, technically trained men," he said, "and the best salesmen are not secured from competitors, for the best ones usually stay."

Europe and the Orient

At the dinner Wednesday evening James Burke of the Burke Electric Company discussed European conditions as he had observed them at first hand, and S. Glen Vinson of the Ideal Electric & Manufacturing Company gave a similar view of the Orient. Mr. Burke pointed out that American manufacturers need have no fear of foreign competition in this country, but that the American manufacturer will meet serious competition in the neutral markets of the world. Mr. Vinson saw a large potential market in the Orient. This can be developed only by intensive long-time selling effort on the ground with a manufacturer's own selling organization, but it will pay well in the end.

Another feature of the meeting was an address on the value of various advertising mediums by C. H. Clark of the Robbins & Myers Company. There were about ninety-five delegates at the meeting.

National Body to Defend Water-Power Act

Ex-Cabinet Members of Last Three Administrations and Well-Known Conservationists Agree to Safeguard the Public Rights on Which the Legislation Was Based

DECLARING that the principles of the federal water-power act passed in 1920 after fifteen years of discussion in Congress and of effort by the friends of conservation are under attack from various quarters and that the law itself is in danger, Philip P. Wells, formerly chief law officer of the United States Forest Service and later of the United States Reclamation Service, announced Wednesday that a national committee for the defense of the act has been formed.

Among the members of the committee are James R. Garfield of Cleveland, Walter L. Fisher of Chicago and John Barton Payne of Chicago, former Secretaries of the Interior; Henry L. Stimson of New York, Lindley M. Garrison of New York and Newton D. Baker of Cleveland, former Secretaries of War; David F. Houston of New York and Edwin T. Meredith of Des Moines, former Secretaries of Agriculture; Governors Henry J. Allen of Kansas, Joseph M. Dixon of Montana and John M. Parker of Lousiana; Gifford Pinchot, Republican candidate for Governor of Pennsylvania; Henry S. Graves, head of the Yale Forest School, until recently Chief of the United States Forest Service; Herbert Knox Smith of Connecticut, former Commissioner of Corporations; William Kent of California, former Congressman; Samuel Adams of Chicago, First Assistant Secretary of the Interior, 1911-1913; George W. Woodruff of Pennsylvania, former Assistant Attorney-General for the Department of the Interior; George C. Pardee, former Governor of California; Joseph Hyde Pratt, State Geologist and Mineralogist of North Carolina; Philip W. Ayres of Boston, forester of the Society for the Protection of New Hampshire Forests; Harris S. Reynolds of Boston, secretary of the Massachusetts Forestry Association, and other conservationists.

What the Act Assures

"It is significant," said Mr. Wells, secretary of the committee, "that the foes of the federal water-power act do not appear to include the large group of interests which are the main investors in and developers of water power. These formerly antagonistic interests now, as a rule, admit that the act is practicable and are willing to develop water power under its provisions.

"The State of New York has brought suit in the Supreme Court of the United States to have the water-power act annulled. The Federal Power Commission, administrator of the act, is, by a decision of the Comptroller of the Treasury, forbidden to spend the money appropriated by Congress for the employment of experts urgently needed for the proper administration of the act. Congress does not take up the very simple legislation necessary to cure this defect, but has given a vast amount of time to Henry Ford's proposal at Muscle Shoals, which violates every one of the principles of the act and gives to Mr. Ford, in addition, a vast subsidy from the federal treasury.

"If this proposal were accepted by Congress, every corporation which has or desires a water-power privilege would demand a lease on Mr. Ford's terms; and how could they be denied? The acceptance of his offer would be a deadly blow to the application of the principles of conservation to the use of water power.

"The water-power act of 1920 embodies those principles and thereby protects the public interest in securing full development without having to pay monopoly profits. It does this by requiring:

"(1) That every water-power lease shall be limited to a maximum of fifty years.

"(2) That the lessee shall pay the government a small rental for the power privilege when he builds his own dam and other works and a larger and fair rental when he uses works constructed by the government.

"(3) That the lessee must submit to regulation by state authority, or if there is no state authority, by the Federal Power Commission, of the services he renders and the prices he charges for light and power.

"(4) That any excess profits over a fair liberal return on the actual investment shall be made over to the public in the form of a reduced price for the lessee's works at the end of his fifty-year term.

"(5) That states and cities have first call on power sites.

"None of these requirements would be imposed under the Ford offer, acceptance of which by Congress would therefore be practically tantamount to a repudiation of the federal water-power act.

"That act is at once progressive and practical. It safeguards for all time public rights in the greatest of natural resources, but it is acceptable to investors in and to managers and promoters of water-power enterprises today."

Roosevelt, Taft and Wilson Men Unite

It is pointed out by conservationists that the old water-power laws were administered by the Departments of War, the Interior and Agriculture, whose heads now make up the Federal Power Commission. All living ex-Cabinet members, both Republican and Democratic, not now in federal office, who as heads of these departments stood for the principles of the water-power act of 1920 and contributed to its making, are members of the new committee. Of these men, Mr. Garfield was in the Roosevelt Cabinet, Colonel Stimson and Mr. Fisher in the Taft Cabinet, and Mr. Baker, Judge Garrison, Judge Payne, Mr. Houston and Mr. Meredith in the Wilson Cabinet.

Radio Tube Requiring No Batteries Announced

A four-element radio-receiving tube operating from an alternating-current source without either "A" or "B" batteries was described in an interesting manner by Dr. A. W. Hull of the research laboratory of the General Electric Company at a meeting of the Institute of Radio Engineers last Wednesday. The filament of this tube performs the double function of a cathode for the rectifier that provides the plate voltage and of a radiant heater for the pliotron cathode. The cylinder which surrounds the filament serves simultaneously as a pliotron cathode and as the anode of the kenotron rectifier.

The cathode is an equipotential surface so that alternating-current hum is inappreciable even with three stages in series. The combination of an equipotential cathode and a large cathode area results in unusually high amplification and detection constants, making the tube a practical radio-frequency amplifier.

The tube filament in one form operates at 5 volts and 2 amp. In this case the cathode is a nickel cylinder surrounding the filament, ⅛ in. in diameter by 1⅛ in. long, coated with barium oxide. The grid and plate are concentric cylinders surrounding the cathode. Another form, operating from an ordinary 110-volt lamp socket without transformers, has a cathode of similar material ½ in. in diameter by 1½ in. long. In the latter case the alternating-current power line energizing the filament may be the antenna.

The voltage amplification per tube is about four times that of the ordinary UV-201 tube at both radio and audio frequencies, this being especially significant in the case of radio frequencies. With resistance coupling the equipotential cathode tubes average sevenfold voltage amplification. A single tube is thus nearly equal to three UV-201 tubes.

Wisconsin-Minnesota Company Fears Old Rates

Application has been made to the Wisconsin Railroad Commission by the Wisconsin-Minnesota Light & Power Company for authority to readjust and increase its electric rates in forty-nine Wisconsin cities and villages affected by the recent Supreme Court ruling which held the "loop system" illegal. Request is made by the company for temporary relief pending determination of a new schedule. A new schedule of proposed charges is submitted for Eau Claire, Chippewa Falls and Menomonie. The company informs the commission that if it is forced to revert to the old rates its credit will be gravely impaired.

Copper-Producing Companies Seek Power

Arizona Mines Want License for Diamond Creek—Opposition from Boulder Canyon Project—Policy of Power Board May Be Influenced by Colorado River Commission

COMPETITIVE conditions among the copper producers are such as to make certain that the copper-producing companies of Arizona will do all in their power to obtain early action by the Federal Power Commission which will allow them to construct a large hydro-electric plant on the Colorado River. The second extension of the preliminary permit granted James B. Girand will expire March 19. Before that date, however, the Colorado River Commission probably will have recommended a policy for the utilization of the waters of the Colorado. This may have a bearing on the action which the Federal Power Commission will take, but the interests concerned will insist that the uncertainty be ended and definite action taken. It is understood that arrangements have been made whereby Mr. Girand will assign the license, when granted, to the copper companies.

The copper producers in Arizona must compete with those of Montana and Utah. The Montana producers receive power from the Montana Power Company at a low rate, and the company is in a position to add any amount that may be required to its power output by developing additional sites along the Missouri River and on the Flathead River. The Utah copper producers also are supplied with comparatively cheap power and in that state plenty of additional power from the Green River is in sight. On the other hand, the Arizona producers are depending on oil for fuel, and there is no certainty that it will not reach a price at which their operations will be curtailed seriously.

THE DIAMOND CREEK PROJECT

The Diamond Creek development, which is that covered by the Girand permit, was recommended by the engineers who studied the situation for the copper companies. These engineers found that the Arizona copper producers would be justified in incurring the heavy expense entailed to convey the power all the way from the Colorado River to Phoenix and to Clifton and Globe. As this probably will require a 220,000-volt installation, the cost is estimated at $34,000 per mile.

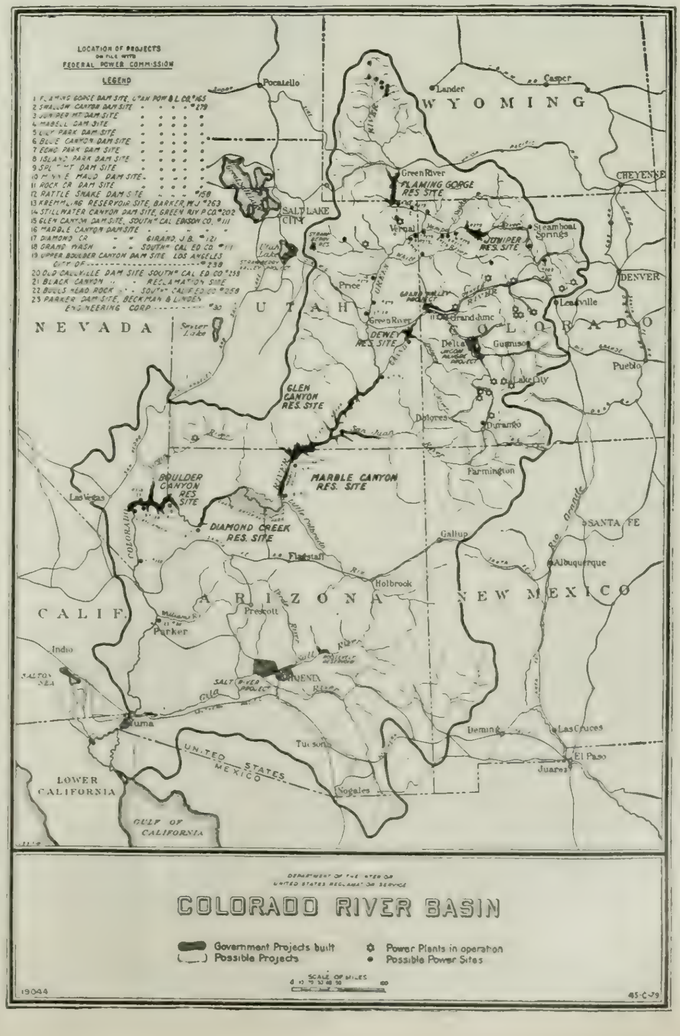
The Federal Power Commission was ready to issue the Girand license, but in view of very insistent objection on the part of those directly concerned with the proposed development at Boulder Canyon, who do not want to see this large market for power taken away from the 600,000-hp. development proposed at that point, it was decided only to extend the preliminary permit. The Secretary of the Interior, one of the members of the Federal Power Commission, is very much opposed to the Diamond Creek development, as is Arthur P. Davis, the Director of the United States Reclamation Service.

Some are of the opinion that a solution of the difficulty might be had in the construction of a 300-ft. dam at Black Canyon. Since the Southern California Edison Company is in a position to operate such a project in a more economical manner than could the copper companies, it is suggested that a project in the hands of that company at Black Canyon would meet the requirements of the copper companies, while the excess energy could be absorbed by the Southern California Edison. It also would be easier for that company to build up a market for the power during periods when the copper properties would not be operated.

Black Canyon is just as available from the railroad. Construction costs would be about the same, and it would be possible to obtain about 5,000,000 acre-feet of storage, while at Diamond Creek little storage capacity is available. This is of particular importance because the storage would reduce flood hazard.

Power Commission's Views on Revocation of Permits

At the next meeting of the Federal Power Commission two of the preliminary permits which the commission previously issued will be presented for revocation. This action is recommended because the permittee has failed to carry out those conditions of the per-



mit which require stream-gaging work and other engineering investigation.

The excuse offered by the permittee in one of these cases is that he has not as yet been able to interest capital in the development of the project and does not deem it wise on his part or think the commission should require him to spend several thousand dollars of his own money while the outcome of the financing is in doubt. He expresses the belief that the condition of the preliminary permit is a hardship.

The attitude of the Federal Power Commission is that the feasibility of the project depends to a large extent on the amount of water available and other facts which would be set forth by the engineering data required. The commission recognizes that no reliable investor will consider financing a project until the permittee can show convincing proof as to the availability of a satisfactory water supply and other fundamental facts.

The commission is anxious to prevent the tying up of water-power resources with those who are not in a position to carry out the development. For that reason if the permittee is not able or is unwilling to go to the expense of the engineering investigations which are essential to the intelligent development of a project, it is disposed to cancel the preliminary permit for a failure to comply with its terms.

Legal Penalties Will Not Be Included in Safety Codes

Clauses relating to legal penalties or to methods of enforcement will not be included in the safety codes approved by the American Engineering Standards Committee. This policy was established at a meeting of the committee in New York on Oct. 20. The action was taken on the suggestion of the safety code correlating committee, which acts in an advisory capacity to the A. E. S. C. in matters concerning safety codes.

It is the feeling both of the men engaged in the furtherance of standardization in industry and of practically all state officials that legal penalties for failure to conform with established state safety codes and methods of enforcement can best be decided by each state for itself.

October Financing Highest of Year

Electric light and power public utility financing, which was so active during the month of September, continued on the upgrade during October, when stocks and bonds of this type amounting to $91,694,750, the highest total of the year, were offered investors. This figure represents an increase of more than $37,000,000 over September, 1922, and more than $61,000,000 over October of last year. Long-term securities continued to predominate, and the largest single offering was the fourteen-million-dollar issue of the Consumers' Power Company. An especially interesting feature of electric light and power financing at the present time is the ability with which corporations are refunding, in advance of maturity, loans put out at high rates of interest by the issue of new securities at more reasonable rates.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN OCTOBER

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Offered at	Per Cent Yield
Milwaukee Electric Railway & Light Co.	$12,500,000	Forty-year	Refunding and first mortgage gold bonds, series B	To redeem outstanding funded debt, reduce floating debt, and for additions.	5	92¾	5.50
Virginia Railway & Power Co.*	1,250,000	Fourteen-year	First mortgage sinking-fund gold bonds of 1906		5	93	5.75
Wisconsin Public Service Corp.	5,495,000	Thirty-year	First lien and refunding mortgage gold bonds, series A	To acquire properties, refunding and other purposes	6	99½	6.05
American Gas & Electric Co. (New York)	7,500,000	Ninety-two-year.	Gold debenture bonds	To reimburse for properties and for other purposes	6	100	6
Daytona Public Service Co.	600,000	Twenty-year	First mortgage gold bonds	To retire bonds, pay notes and for extensions	7	100	7
Ohio Power Co.	6,132,000	Thirty-year	First and refunding mortgage gold bonds, series B	To reimburse in part for capital expenditures	5	93¼	5.45
Oklahoma Gas & Electric Co.	3,000-5,000 shares		Cumulative preferred stock		7	91	7 69
Penn Edison Co.	$525,000		Cumulative preferred stock	To retire funded debt and for extensions	8	105	7.60
Columbus, Delaware & Marion Electric Co. (Ohio)	1,374,000	Fifteen-year	First and refunding mortgage gold bonds		5†	96½	6.38
Metropolitan Edison Co. (Pa.)	828,750		Cumulative participating preferred stock	For additions and betterments	7	97½	7.18
McComb & Magnolia Light & Power Co. (Miss.)	50,000	Eighteen-year	Bonds		6	92½	6 75
Portland Railway, Light & Power Co. (Ore.)	1,000,000		Cumulative prior preferred stock, series A	To retire floating debt and for construction	7	98	7 14
Puget Sound Power & Light Co.	1,300,000		Cumulative prior preferred stock	To retire floating debt and for extensions	7	105	6.65
Consumers' Power Co. (Me.)	14,000,000	Thirty-year	First lien and unifying mortgage gold bonds, series C	To retire funded debt, for construction and for new property	5	92½	5.50
Dallas Power & Light Co.	1,000,000	Thirty-year	First mortgage and refunding gold bonds, series C		5	94	5.40
Southern California Edison Co.	10,000,000	Twenty-two-year	General and refunding mortgage gold bonds of 1917		5	95	5.40
Southwestern Gas & Electric Co. (Ark.)	2,500,000	Thirty-five-year	General mortgage gold bonds, series of Nov. 1922	To retire maturing securities and to pay floating debt.	6	90	6.75
Empire Gas & Electric Co.	1,100,000	Thirty-year	General and refunding mortgage gold bonds	To retire underlying securities and for extensions	6	96	6.30
New Orleans Public Service, Inc.	12,000,000	Thirty-year	First and refunding mortgage gold bonds, series A	For improvements, additions and working capital	5	90	5.70
United States Public Service Co. (Del.)	1,100,000	Twenty-five-year	First lien gold bonds, second series	For additions, retirement of floating debt and other purposes	6	97	6.20
United Water, Gas & Electric Co. (Kan.)	440,000	Nineteen-year.	First and refunding mortgage bonds of 1916	To reimburse company in part for capital expenditures	5	87	6.10
Western States Gas & Electric Co. (Cal.)	5,000,000	Fifteen-year	Gold notes, series A	For extensions and redemption of notes	6	96	6.40
Power Corporation of New York	5,000,000	Twenty-year	First mortgage sinking-fund gold bonds, series A		6½	100	6.50
Kansas Electric Power Co.	1,000,000		Cumulative preferred stock	To refund bonds, for acquisition of properties and for additions	7	92½	7.57
Total	$91,694,750						

* Norfolk & Portsmouth Traction Company bonds assumed by Virginia company.

† Stamped to bear interest at 6 per cent.

A. E. S. C. Appoints Committee on Pole Specifications

The American Engineering Standards Committee announces the appointment of a special committee to consider and make recommendations to it concerning the application of the American Electric Railway Association for approval as American standards of its specifications for wooden poles and tubular poles.

Twenty-one men, representing producers and consumers of both types of poles as well as the public, are on this committee, and it is expected that a report on the work of the committee will be made at a meeting of the executive committee of the A. E. S. C. in New York on Nov. 9. The chairman of the special committee is E. H. Clapp, of the Forest Service, Washington, D. C.

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Program for Joint Assembly of Meter Committees

All metermen and especially those from Kentucky and West Virginia are urged to attend the joint open meeting of the National Electric Light Association's meter committee and the Ohio Electric Light Association's meter committee to be held at the Hotel Gibson, Cincinnati, on Thursday, Nov. 23. The following program for this meeting has been drawn up:

Morning.—Welcoming address, W. W. Freeman, president East Central Division executive committee, N. E. L. A.; remarks, W. L. Wadsworth, national chairman; film, "Story of the Electric Meter," Sangamo Electric Company in co-operation with National Chamber of Commerce; address, S. C. Henton, past-chairman O. E. L. A. meter committee; "The Meterman, His Relation to the Central Station Organization," Fred Mort, Westinghouse Electric & Manufacturing Company.

Afternoon.—Microscopic exhibition and lecture, "Microscopic Structures," B. W. St. Clair, General Electric Company; "High Lights in Meter Development," W. F. Pyle, Duncan Electric Manufacturing Company; "Application of Potentiometers to Meter Department Work," I. Melville Stein, Leeds & Northrup Company; "Recording of Condenser Leakages in Power House," D. J. Angus.

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Utility Regulation Discussed by the Vice-president

Declaring that state and federal regulation of the essential services rendered by the country's public utility companies is a success and that no one would now think of abandoning this program or deny that it has improved conditions, Vice-president Coolidge, speaking before the American Gas Association at Atlantic City, went on to say that if the utility companies are so regulated as to meet public requirements and perform the greatest amount of service at the lowest cost to the people, the cause of such a result cannot be supplied from without, but must be supplied from within by the management themselves.

"The government cannot relieve the owners, operators and managers of responsibility for the success of their corporations from a financial point of view, nor insure to the public an adequate and economical service," he said. "Neither individuals nor corporations can rely on government sources for success. Unless they have within themselves the necessary elements to contribute to prosperity, prosperity will not prevail."

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Thirty-two Texas Towns Get More Electrical Energy

Texas' newest electric generating station, the big plant of the West Texas Utilities Company, a subsidiary of the American Public Service and Middle West Utilities Companies, began operating at Abilene on Wednesday, Oct. 25, and 2,500 residents of Abilene and officials and business men from the west Texas section participated in a celebration.

The new plant, which will give thirty-two west Texas cities and towns a greatly increased electric supply, they being connected with the plant by a 120-mile high-tension transmission line, represents an investment of approximately $5,000,000. In addition to the electric station, an ice plant having a monthly capacity of 6,000 tons will be operated.

Martin J. Insull, vice-president of the Middle West Utilities Company of Chicago, and other prominent officials of the company were present at the celebration, and addresses were made by him, by George McQuaid, director of the Texas Public Service Information Bureau, and by the Mayor of Abilene and others locally prominent.

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Rapid Progress on Louisville Extensions

Construction work on the addition of a 20,000-kw. unit to the Waterside generating station of the Louisville Gas & Electric Company is going ahead rapidly. This will increase its installed capacity to 68,000 kw. Extensions to the present structure to accommodate the new unit and auxiliary equipment will include a 100-ft. addition to the present turbine room and the widening of the switch galleries to the full 300-ft. length of the building. The unit now being installed will be completed by the fall of 1923, and room will be provided for another one.

Although the boiler room is not to be extended at this time, two new boilers are being installed, there being room in the present space for four more. A 250-ft. self-supporting steel stack with a diameter of 14½ ft. will also be built.

One of the most difficult construction jobs is the sinking of a condenser pit and connecting it with the intake and discharge tunnels to the river. This pit is to be 67 ft. long and 43 ft. wide with a floor 8 ft. below the normal pool level of the Ohio River. It will be constructed of concrete 4½ ft. thick reinforced with solid steel.

The need for this additional capacity may be gaged by the increase in power load for the first nine months of 1922, which is 6,950 kw. During this period the residential and commercial lighting increased 3,700 kw.

Brief News Notes

St. Joseph Abandons Municipal Ownership.—St. Joseph, Mo., has rejected a proposal to issue bonds to build and equip a new municipal electric lighting plant. The old plant is inadequate and out of date, and Mayor McIninich has informed the citizens that a yearly saving of $15,000 can be obtained by purchasing energy from the St. Joseph Railway Light, Heat & Power Company.

Ford May Electrify His Railroad.—An unconfirmed report that Henry Ford will electrify his Detroit, Toledo & Ironton Railroad as a result of his recent difficulty in transporting coal for its operation is current. According to this report, Mr. Ford contemplates generating electrical energy at the mouth of his mine, 200 miles from the terminus of his railroad, or at the mouth of nearer mines which he is said to mean to lease or purchase, and transmitting it to his railroad.

Ten Eggs Price of Kilowatt-hour.—In some parts of Germany the inhabitants have, as a result of the demoralization of the currency, reverted to barter in business transactions. This tendency is said to have reached even the electric supply companies, and at Auma, a fairly populous village, the Saxon Thuringian Power Company has announced its willingness to accept, instead of cash, ten eggs, 3 lb. of wheat flour or quarter of a centner (about 27 lb.) of potatoes for each kilowatt-hour of electricity consumed.

South Carolina's New Commission Hears Its First Electrical Case.—The South Carolina Railroad Commission was to hold a public hearing in Columbia yesterday (Nov. 3) on the petition of the Columbia Railway, Gas & Electric Company for authority to increase rates for gas and electricity. This case was the first of the kind to come before the commission since it was invested by the General Assembly this year with the duties of the South Carolina Public Utilities Commission, which was abolished. The Columbia company's proposed increases ranges up to approximately 17 per cent.

Charlotte to Have New Lighting System.—Notwithstanding that its contract covering the present lighting system at Charlotte, N. C., had still a year to run, the Southern Public Utilities Company began last week the installation of a modern street-lighting system in that city. The new equipment consists of type C "Mazda" lamps equipped with refractors to diffuse and distribute the light in the most effective manner. It is claimed that in the uptown district the volume of light under the new system will be three times that of the present system and that the lighting in the residential districts will also be much better.

United States Chamber of Commerce to Have New Home.—Contracts for the new building of the Chamber of Commerce of the United States in Washington have been let and work is to begin immediately. The building will be of the classic type of architecture, 158 ft. wide by 149 ft. deep and four stories in height. It will be occupied entirely by the Chamber of Commerce and will cost $2,500,000.

Boston Edison Applies for 20 per Cent Stock Increase.—The Edison Electric Illuminating Company of Boston has petitioned the Massachusetts Department of Public Utilities for authority to issue not exceeding 54,067 shares of additional capital stock at a par value of $100 per share, to meet the cost of additions to the property and other obligations. The proposed increase represents a 20 per cent addition to the present authorized capital stock.

Electric Bond & Share Company Gets Lycoming Edison.—The Electric Bond & Share Company of New York will take over the interests of the Lycoming Edison Company of Williamsport, Pa., which include the central station of that city and the electric railways of Williamsport, Montoursville and Jersey Shore. It has not been finally decided whether the holding company will operate these properties itself or give them over to a subsidiary, but it is thought that the Pennsylvania Power & Light Company, with general offices at Allentown, will add these plants to those which it now operates.

How a Pennsylvania Borough Got Electric Service.—Repeated efforts have been made by the borough of Freeburg, Snyder County, Pa., to obtain electric service, but each time the Pennsylvania Power & Light Company of Sunbury, from whose lines the borough expected to get this service, found that the number of subscribers did not warrant the necessary extension of its lines. Not willing to give up, the residents made another attempt, and this time they have been successful. They agreed to subscribe for $14,000 worth of the company's bonds, bearing 7 per cent interest, and their eagerness for electricity was such that the Borough Council passed the three readings of the franchise ordinance in one sitting without any discussion of rates.

German Electric Companies Seek Aid from Customers.—A Berlin correspondent says that the Bergische Electricity Supply Corporation at Kupferdreh, Westphalia, an important central-station company generating electricity at the mouth of a coal mine and supplying it over an extensive distribution system to large industrial enterprises, has asked its bulk customers to advance money for the extension of its works in the proportion of four-fifths from the customers to one-fifth from the central-station company. The customers are asked to contribute in proportion to their existing installations and will receive a 10 per cent rebate on their power bills in proportion to their contributions. Other generating companies are asking their customers who desire additional service to pay outright for the expenses, the only return offered being an increase of the rebate on the regular tariff.

Electricity in California Oil Fields.—Electrification of the oil fields of Kern County, Cal., is making rapid headway. In the Midway district, according to statistics published in a Los Angeles newspaper, approximately 3,000 wells are now producing, and of this number 900 are being pumped by electric motors. Electric drive is declared to be by far the most economical power, not only because of the reduced cost of operation, but also because of the increase in production by reason of the uniform speed of the motor. Indications are that within the next year or two nearly all the remaining wells will be electrified.

New Power Plant in South Manchuria.—The third power house of the Fushun Collieries (owned and operated by the South Manchuria Railway), work on which was started in 1920, has just been completed at a cost of $1,585,000. Previous to the installation of the new power plant the collieries had a generating capacity of 17,000 kw., which was almost wholly taken up. The new plant has a capacity of 12,500 kw., making the total almost 30,000 kw. The collieries are now prepared to supply Mukden with cheap energy in practically any quantity desired. United States Consul General Albert W. Pontius reports that in all South Manchuria, excepting the Fushun Collieries, the electrically generated power is only about 16,000 kw.

California Rate Case Record Contains a Million Words.—What is believed to be a record hearing before the California Railroad Commission was brought to a close recently when the taking of testimony was concluded in the rate and valuation case of the Pacific Gas & Electric Company. The proceeding occupied forty-two days of actual court sessions and the transcript contains more than one million words. In addition, 102 exhibits, some of them very elaborate, were presented. The Pacific company offered sixty-five, the municipalities served by the company six, the Farm Bureau Federation sixteen, the Railroad Commission twelve and miscellaneous consumers thirteen. The company's claim of total valuation is $170,711,271, including $33,000,000 of intangibles, such as water-right value and development cost. The historical cost of the plant was given at $112,827,000 and a reproduction cost under average prices for the five-year period 1915-19 was computed at $137,991,986. This figure includes additions and betterments since 1919 at cost. The company's final exhibit was an estimate of the total revenue and expenses for the current year, actual figures for eight months being given and estimated figures for the last four months of the year. Total revenue was given as $23,956,346 and total costs as $11,919,664, leaving a net revenue available for depreciation and return of $12,036,682.

Associations and Societies

New York Electrical Society Holds Four Hundred and Third Meeting.—The New York Electrical Society on Tuesday last held the third meeting since it rounded out its four-hundred mark. C. M. Ripley of the General Electric Company told of "What Electricity Has Done for Civilization."

National Personnel Association to Hold First Convention.—Industrialists, educators and personnel experts representing large business and manufacturing enterprises will engage in a three-day national forum, beginning Nov. 8, at Pittsburgh under the auspices of the National Personnel Association.

Quebec Electric Co-operative Association Elects Officers.—The annual meeting of the Electric Co-operative Association of the Province of Quebec was held in Montreal on Oct. 19 and the following officers were elected: Honorary president, K. B. Thornton; president, M. K. Pike; vice-presidents, J. B. Woodyatt, W. O'Brien, J. W. Picher, R. J. Beamont, F. J. Parsons and N. Simoneau; honorary secretary, L. C. Haskell. The Electrical Co-operative Luncheon, meeting at the same time, elected W. H. Winter honorary president, George Templeman president, P. Gregory vice-president and T. H. Chennell secretary.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Arkansas Utilities Association—Hot Springs, Ark., Nov. 7-9. R. P. Brown, Little Rock Ry. & Electric Co., Little Rock.
Electrical Credit Association (interstate convention)—Philadelphia, Nov. 10. J. W. Crum, 1328 Land Title Bldg., Philadelphia.
Ontario Association of Electrical Contractors and Dealers Toronto, Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.
National Association of Railway and Utilities Commissioners—Detroit, Nov. 14-17. J. B. Walker, New York Transit Commission, New York.
Electrical Manufacturers' Club—Hot Springs, Va., Nov. 15-19.
Electrical Credit Association, Central Division—St. Louis, Nov. 16-17. F. P. Vose, 1347 Marquette Bldg., Chicago.
Electrical Supply Jobbers' Association—Cleveland, Nov. 20-24. Franklin Overbagh, 411 S. Clinton St., Chicago.
American Society of Mechanical Engineers—New York, Dec. 4-8.
National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.
Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.
Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.
National Electric Light Association—New York, June 4-8.

Commission Rulings

Does the Term "Hydro-Electric and Other Companies" Include Municipal Corporations?—In granting to the town of Franklin the right to build a dam across the south branch of the Potomac River, the Public Service Commission of West Virginia overruled a contention that municipal corporations were not included in the act permitting "hydro-electric and other companies producing electric or other energy or power" to do certain things. The commission held that the Legislature did not mean thereby to exclude municipal bodies engaged in producing electricity for the lighting of their streets and furnishing light and power to their citizens.

Excess Cost of Fuel Purchased for Emergency Use Not an Operating Expense.—In appraising the property of the Midwest Power Company for rate-making purposes, the North Dakota Board of Railroad Commissioners refused to allow as an operating expense the excess cost of coal purchased in the East at prices higher than those prevailing for lignite in its operating territory, although it was alleged that this Eastern coal had been purchased for use in case of emergencies, such as a railroad tie-up, which would prevent the utility from obtaining coal from the local mine. The commission assumed that 15 lb. of lignite per kilowatt-hour represented fairly efficient operation, the local manager testifying that consumption for October and November averaged a trifle over 14 lb. per kilowatt-hour.

Rates for "Large Power" Examined.—In approving with one exception a revised rate tariff submitted by the Monmouth Lighting Company, a consolidation of many other companies among which the basic lighting rate had varied from 12 cents to 16 cents per kilowatt-hour, the New Jersey Board of Public Utility Commissioners defended the rate of 2 cents a kilowatt-hour charged the Jersey Central Traction Company, saying: "The only testimony submitted with regard to this matter is based upon the relative number of kilowatt-hours used by the traction company and the lighting company respectively. This is not the proper basis upon which to determine this charge. The charge to the traction company must take into account a sufficient proportion of two quite different elements—first, the proper proportion of the charges which are in proportion to the maximum demand upon the plant, and second, the proper proportion of the charges which vary in accordance with the kilowatt-hour output. By this method of computation, which is the only proper method for directly allocating costs, the demand charges against the railway company are much less than when the aggregate charges are divided in proportion to the number of kilowatt-hours used. There is still another factor which must be taken into account. If the Jersey Central Traction Company ceased operations, the cost per kilowatt-hour for operating the power station of the Monmouth Lighting Company would be increased with respect to current generated for other customers, the character of the load on the power station would not be so good, the efficiency would be reduced, the labor charges per unit of output would be increased, owing to the fact that the total amount of labor could not be reduced proportionately, and on the whole the discontinuance of the Jersey Central Traction Company would react to the disadvantage of those who now obtain electrical energy from the Monmouth Lighting Company. It might then become necessary to readjust the rates of the Monmouth Lighting Company and such readjustment would necessarily have to be on a higher plane."

Book Cost as Measure of Value.—In reducing the rates charged by the Western New York Utilities Company in five villages served by it the New York Public Service Commission used the book cost of the utility's property as the rate base, the books having been at various times examined by the commission, the intangible items having been fixed and determined by it and the value acquiesced in by the company, the company having from time to time acquired plants and developments already in operation and having within recent years largely reconstructed its properties, a large part of the present development having been constructed during very recent years when the cost of material and labor had reached its peak, and the books of the company having been correctly kept and definitely fixing the actual cost of the property. A return of 8 per cent was allowed the company upon the property valuation thus arrived at.

Individual Complaints Affecting Same Issues as Pending General Rate Investigation Cannot Be Heard.—The Massachusetts Department of Public Utilities, in Beaser vs. Edison Electric Illuminating Company of Boston, has denied a hearing to sundry complainants because of the general rate investigation under way affecting the company against which complaint is brought. "It is manifest," the commission says, "that it would not only be impossible for this commission, but also highly improper, to have formed any opinion whatsoever on this matter at this stage of the controversy. The statute imposes the duty upon this commission to decide such questions *after* hearing, and the hearing is far from being concluded. It would be a plain violation of our duties to attempt to formulate a decision, even unconsciously in our minds, at a point in these two cases where not only both sides have not been fully heard but where the complainants have not even completed certain important phases of their own case."

Recent Court Decisions

Federal Permit for Dam Not Needed Where Stream Above Site Is Not Navigable.—Affirming (in State ex rel. Abbott vs. Superior Court of Skagit County) an order of a lower court which authorized condemnation proceedings to insure the construction of a drainage canal and permitted dams to be built in the Higgins and Indian Sloughs, the Supreme Court of Washington declared that a permit from the federal government for the construction of the dams was not necessary, the streams not being navigable above the point where it was desired to erect the dams except possibly during periods of high tide. (209 Pac. 17.)*

Company Not Responsible for Act of Its Agent Unless It Is in the Scope of His Authority.—In Conine vs. Alabama Power Company damages were awarded in the trial court for the death of a man who, on the alleged assurance of the local manager of the company that there was no danger, picked up the end of a power wire severed during a fire and was instantly killed. The Supreme Court of Alabama has reversed the judgment and ordered a new trial on the ground that the count did not aver that the agent of the company was acting within the scope of his employment or authority when he told or permitted the victim of the accident to pick up the wire. A further count averring that the defendant company intentionally or willingly left a wire in the public street charged with a dangerous voltage was sustained and declared not demurrable as joining a charge of willful injury with a charge of simple negligence. (93 So. 22.)

Charter of Street Railway Mortgagor Held Not to Authorize Electric Light and Power Business.—The United States Court for the Eastern District of Tennessee in a suit in equity brought by the Commercial Trust Company against the Chattanooga Railway & Light Company to foreclose mortgages issued by the defendant found that a street-railway company incorporated to construct and operate a railway over a specified route which subsequently obtained an amendment to its charter under an act permitting street-railway companies to construct and operate electric light and power plants, but which did not by this amendment seek authority to construct such a plant, but sought only other powers covered by the same act, had no authority to build an electric light plant, and that therefore a mortgage executed by it covering after-acquired property did not cover the electric light and power equipment of the corporation's successor. (281 Fed. 856.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

D. W. Proebstel Chairman of Portland Section, A. I. E. E.

D. W. Proebstel, chairman of the Portland Section of the American Institute of Electrical Engineers for the coming year, is a well-known figure among electrical men of the Northwest, where he has spent the greater part of his time since his graduation from college. Leaving the Oregon Agricultural College in 1905 with the degree of B. S., he entered the testing department of the General Electric Company at Schenectady, N. Y., where he spent a year and a half. After several years with the Portland Railway, Light & Power Company as construction foreman, he entered the special civil service of the United States Engineers stationed in the Philippines. While there he had charge of the installation of electrical material used in the fortification work on Corregidor Island, Manila Bay. The summer of 1912 found him at Juneau, Alaska, as electrical superintendent for the General Electric Company, in charge of the installation of a hydro-electric plant for the Alaska Treadwell Gold Mining Company. Upon his return to Portland in 1913 he entered the employ of the Northwestern Electric Company, with which company he held various engineering positions until 1918. Since this time he has been with the Portland Railway, Light & Power Company, devoting his time principally to the redesign of 33-cycle equipment so that it will operate on 60 cycles.

D. W. PROEBSTEL

Mr. Proebstel's election to the chairmanship of the Portland Section of the Institute is the culmination of his many years of activity in association affairs in the Northwest.

C. A. Wallbrecht, electrical superintendent of the Pennsylvania-New Jersey Railway Company, has recently returned to this country after having spent six years on important electrical engineering work in Mexico and Central America.

E. W. Hake was recently appointed commercial manager of the Union Gas & Electric Company, Cincinnati, with jurisdiction over all the commercial work of that company and its subsidiaries. The electric appliance business which Mr. Hake formerly conducted has been acquired by the Union company.

H. P. Hevenor has joined the staff of Dwight P. Robinson & Company, Inc., as consulting engineer. He was until recently a member of the firm of Engel & Hevenor, Inc., where he specialized in track construction, taking part in numerous large projects in the East, Middle West and South. Mr. Hevenor is a member of several engineering associations.

L. W. Wallace, executive secretary of the Federated American Engineering Societies, has completed a coast-to-coast tour during which he set in motion plans for expansion of the federation. Mr. Wallace, who began his tour at New York City, was attentively heard by large gatherings of engineers in many cities, including Denver, San Francisco, Portland, Spokane and Duluth. The final events of the trip were two meetings in Columbus, Ohio, on Oct. 20.

John G. Barry, guest of honor at a dinner given last week in celebration of his appointment as a vice-president of the General Electric Company, was the recipient of unusual honors. About 175 men prominent in the electrical industry, particularly the railway branch, were present. Frank Hedley, president of the Interborough Rapid Transit Company, New York, was toastmaster. J. R. Lovejoy, vice-president of the General Electric Company; Daniel W. Smith of Detroit, Charles C. Pierce of Boston, Judge Daniel Naylon of Schenectady, Judge James H. Wilkerson of Chicago, and Gerard Swope, president of the General Electric Company, and other speakers paid tribute to his service to the industry. The valuable assistance which Mr. Barry has rendered to the electric railway through his work as a member of the executive committee of the American Electric Railway Association and as one of the three members of the finance committee was dwelt upon and also the great influence which he has exerted in the promotion of research and development along broad lines. The dinner was held at the Hotel Commodore, New York.

A. M. Frost Directs New Business Sales Program

A. M. Frost, who has been made sales manager of a newly created department of the San Joaquin Light & Power Corporation, has been with that company since 1911, when he became manager of the Paso Robles district for the Midland Counties Public Service Corporation, one of its subsidiaries. He was later transferred to Santa Maria as district manager, remaining in that position until August, 1914, going then to Selma as manager of that district. He left the services of the company in October, 1920, to enter business for himself, selling and installing electrical irrigation plants. The company secured his services again one year later for the position of Fresno district manager. In his new duties he will have charge of the sales program of the company in connection with new business. This work will take him into the various districts served by the San Joaquin company and the Midland Counties Public Service Corporation, where, in an advisory capacity, he will work in connection with the managers of the districts in promoting the sale of electrical energy. His long experience in dealing with the public makes him well qualified to handle the broader duties of his new position.

A. M. FROST

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John Stephen Worley, consulting engineer and a member of the firm of Worley & Black, accountants, New York City, is discontinuing his practice to join the staff of the University of Michigan in the capacity of professor of transportation and railroad engineering, a post recently created by the board of regents of the university. Mr. Worley will retain his interest in the firm of Worley & Black. He has been connected with a number of railroads as a construction and motive-power engineer and served for eight years as a member of the engineering board of the Interstate Commerce Commission, being for a year its consulting valuation engineer. Mr. Worley was born in Missouri

Professor de Margerie Arrives in America

Emanuel de Margérie of the University of Strasbourg, French exchange professor in applied science and engineering, has arrived in this country to take up his work for the academic year 1922-23 in seven leading technical schools. Professor de Margérie, who succeeds Prof. Jacques Cavalier, has been for many years in close touch with numerous American geographers and geologists, having made his first visit to the United States in 1891. In 1912 he was one of the foreign guests invited by the American Geographic Society to participate in its transcontinental excursion. Prof. de Margérie is director of the Geological Survey of France, besides holding many other posts of honor, such as vice-president of the French National Research Council and of the committee on historical and scientific undertakings of the Department of Education, member of the French Institute of Anthropology and associate editor of the "Annales de Géographie." He has won distinction in the public service and as a teacher and writer. The work through which his name has become most widely known is his French translation of Edward Suees' masterpiece, "Das Antlitz der Erde," the publication of which absorbed more than twenty years of his life. During the world war, as secretary of the geological section of the committee appointed in Paris to study the problems of frontier adjustment, he prepared a series of maps issued by that body and a special report on the Sarre coal field.

Professor de Margérie has already begun work at Columbia University, where he is lecturing on applied geology especially as applied to topography. Other institutions at which he will lecture are Harvard, Cornell, Johns Hopkins, Yale, Massachusetts Institute of Technology and the University of Pennsylvania.

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George B. Heron is superintendent of the municipal electric light and power plant at Titusville, Pa., replacing Fred C. Johnson.

N. Charles Burke, Towson, Md., has been appointed general counsel to the Maryland Public Service Commission by Governor Ritchie, to succeed William C. Bruce, resigned.

R. T. Lowndes, who was vice-president, treasurer and manager of the Clarksburg Gas & Electric Company, Clarksburg, W. Va., has also taken over the presidency of the company, replacing Nathan Goff.

A. R. Cheyney has resigned from the Bureau of Engineering, United States Navy Department, to enter the firm of Cheyney & Weschler, consulting engineers in the electric utility and industrial fields, with offices at Washington, D. C. Previous to becoming associated with the Navy Department in 1917, Mr. Cheyney was a general engineer with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Before joining the Westinghouse company he spent eighteen years in the engineering department of the Philadelphia Electric Company, where he obtained a wide range of constructing and operating experience. Mr. Cheyney has always been active in the work of the national engineering societies, being a fellow of the A. I. E. E. and a member of the N. E. L. A. and the A. S. M. E.

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K. B. Thornton Honorary President of Quebec Society

K. B. Thornton, general manager of the Montreal Public Service Corporation and chief consulting engineer of the Montreal Tramways, was recently made honorary president of the Electrical Co-operative Association of the Province of Quebec for the year 1922-23. Mr. Thornton was president of the association for two years. Some years ago he was associated with J. G. White & Company, New York, as chief engineer of the operating department and later with the Canadian Light & Power Company of Montreal, Quebec, in the capacity of chief engineer and operating manager.

K. B. THORNTON

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C. J. Campbell is now treasurer of the municipal electric light and water plant at Carmen, Okla., replacing George Redmond.

Andrew M. Lockridge, formerly with the Hamilton Beach Manufacturing Company for four years as salesman, is now connected with the Pacific States Electric Company in southern California.

Major Frederick Pope, first vice-president New York Steam Corporation, and E. B. Powell, consulting engineer with Stone & Webster, Inc., sailed Oct. 28 on the Majestic to make a study of recent developments in European power-plant practice. They expect to visit England, France and Germany, returning to this country early in December.

Dr. Capen Chancellor of Buffalo University

Dr. Samuel P. Capen, formerly of Washington, D. C., was installed as chancellor of the University of Buffalo on Saturday, Oct. 28, having resigned his post as director of the American Council on Education. Foster Hall, the new million-dollar chemical laboratory of the university, which was dedicated the day preceding the inauguration, is specially designed to meet the peculiar needs of the steel, dye, electrochemical and hydro-electric industries on the Niagara frontier and in western New York, which more and more are relying upon men of university training for important technical and administrative positions. Dr. Capen has been active in the educational relations of the National Research Council and during the war served on committees that aided the War Department in organizing the higher institutions of the country to make the most effective contribution to the nation.

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C. H. McKnight is now chief engineer with the Scranton Electric Company, Scranton, Pa., replacing John A. MacFarland.

E. L. Kenney, formerly connected with the Cleveland office of the Century Electric Company, St. Louis, has been appointed to the position of district sales manager at the Rochester (N. Y.) office.

Mark C. Smith, formerly associated with the Westinghouse Electric & Manufacturing Company at Cleveland, has been appointed district sales manager of the motor department of the Ohio Electric & Controller Company. Mr. Smith's headquarters are in Chicago.

George Henry Knutson has assumed personal charge of the Chicago office which Messrs. Spooner and Merrill, consulting engineers of Grand Rapids, Mich., have recently opened. Mr. Knutson, who was formerly with the Harris Trust and Savings Bank, will fill the rôle of resident partner.

Arthur L. Mullergren, consulting engineer, Kansas City, Mo., has been retained by the city to prepare the report, estimates, plans and specifications and supervise the construction of the municipal electric light plant and distribution system and the electrification of the water-pumping plant.

D. C. Ketcham has joined the teaching staff of the Central Station Institute conducted by the Commonwealth Edison Company of Chicago in order to enable the institute to handle more adequately the increased amount of work connected with the employees' courses offered this year. Mr. Ketcham since his graduation from the Clarkson College of Technology in 1917 has been associated with several public utility and manufacturing concerns. He brings to the staff experience obtained not only in technical work—research, design and testing—but in the promotion of sales as well.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic
Problems of the Producer and Distributor, with Market Reports, Trade
Activities, Foreign and Construction News

Waste and Loss in the Fuse-Plug Situation

Why the Educational Carton Idea Has Not Progressed—How It Will Benefit the Electrical Industry—Why It Deserves Active Support

By W. W. Merrill
Vice-President Chicago Fuse Manufacturing Company, Chicago

SOME time ago an interesting innovation was introduced into the fuse business by the adoption of a new plan of packing fuse plugs in cartons of convenient size for retail sale, these cartons bearing educational advertising intended to guide the householder in the proper use and replacement of the fuses. It was believed that the sale of fuse plugs in these cartons in a quantity sufficient to provide a reserve supply would influence the consumer to buy and carry a stock of them for emergency use, thereby improving the character and profit of the dealer's business and relieving the central-station companies of some of the cost and burden of trouble service on blown fuses.

Four of the principal manufacturers of fuse plugs adopted the educational carton package and are now selling them this way when desired. The cartons are of different sizes and contain different quantities of fuse plugs, according to the judgment of the individual manufacturer.

Thwarted by Price Cutting

The value of this method of packing and selling fuse plugs to the householder has not been appreciated and accepted generally by the industry. Soon after the introduction of this consumer's carton the prices of fuse plugs suffered a severe cut. Certain manufacturers who had not adopted the new method of packing reduced their price to less than the cost of production. This naturally resulted in a very chaotic condition so far as the sale of plugs was concerned and had the effect of slowing up the sale of the special packages, which are more expensive to produce and which have to be sold at a higher price.

These plugs are an absolute staple and are sold on a strict price comparison. Therefore manufacturers have naturally been trying to devote themselves to the production and sale of other goods that pay a profit and to avoid the fuse-plug orders, since every thousand sold have been the cause of a direct loss. But fuse plugs are required by the consumer, and the distributor has naturally demanded them along with other fuse lines and at competitive prices.

W. W. MERRILL

Under conditions such as these it has been impossible to carry forward the plans for selling the idea of the educational cartons to the industry and to the public. The trade has objected to the carton because it adds slightly to the cost of the articles and it does not yet see the advantage of merchandising them in that way. As a result 90 per cent of this business is still being filled in bulk, the fuse plugs being packed fifty in a carton and five hundred in a package, and the profitable, constructive, progressive purpose which the consumer's carton represents is thwarted for want of widespread demand and trade support.

There are too many manufacturers of fuse plugs, and the keen competition which has grown out of this situation has degenerated into a fierce fight that has sacrificed for every producer the very considerable profit which should result from the size of the industry. This is bad enough, but the electrical industry is suffering another loss of no small importance in the fact that this lack of profit has halted a project which had as its objective a very needed reform in fuse practice—the want of which is today costing the central stations of the country a tremendous sum and leading to a vast amount of inconvenience and dissatisfaction among the consuming public. The dealer will not aid the restoration of a proper price on fuse plugs, but the central station should give thought to it and express a positive sentiment.

Benefits in Sight

When the householder buys his fuse plugs from the dealer in convenient lots of four or five or ten, packed in a distinctive box of handy size which may be kept on a shelf and easily found when a fuse blows, and when the carton will tell him exactly what to do in replacing it and provide whatever he requires at the moment that he needs it, there will be a tremendous reduction in the number of service calls because of fuse trouble which the central station will have to make and for which it will have to pay. And because it is far easier to screw in the right fuse plug than to use a substitute the hazardous practice of using blanks or pennies will be reduced by just that much.

Moreover, the dealer will sell fuse plugs in unit quantities that will pay a more adequate profit on the cost of the sale than the present method of selling single plugs out of a bin. And the jobber will benefit in turn.

The aggregate of such household reserve stocks throughout the country would move a tremendous volume of fuse plugs out of the warehouses and represent a transaction by no means small. The change-over to this more sensible and efficient system of selling fuse plugs to the home would develop slowly, but it is an end greatly to be desired by the entire industry, and it merits the attention and the support of all fuse manufacturers, jobbers, dealers, contractors and central-station executives.

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What the Tariff Act Means to the Industry

The New Rates of Duty Applying to Electrical Manufactures and Material—How Electrical Importations Into the United States Were Increasing—The Value of Protection

BY JOSEPH MCELROY, 3D

Export Sales Manager for Pass & Seymour, Inc.[*]

EVERY one is more or less familiar with the debate over the Fordney-McCumber tariff bill, which was finally enacted into a law in September, 1922. Every one, however, is not so familiar with the details of this act and just how it affects his individual business.

The electrical men of this country should be very much interested in the law and in the protection it affords the industry in view of the threatened imports from other manufacturing countries. The best guide to just what the tariff actually means to the individual manufacturer will be found in the following list of duties that apply to the different articles or groups of articles:

Paragraph Number	Article	Duty, Per Cent
212	Porcelain insulators, white or brown	60
	Porcelain insulators, colored	70
216	Carbon products	45
316	Insulated wire	35
320	Storage batteries and parts	40
328	Metallic conduit	35
339	Electric hollow ware, enameled, 5 cents per pound plus	40
	Electric hollow ware, aluminum, 15 cents per pound plus	70
	Electric hollow ware, other metal	60
368	Electric meters	50
399	Articles composed chiefly of metal	40
909	Varnished or oiled cambric, 3 cents per square yard plus	20
915	Treated tape	35
	Non-metallic conduit	35
1401	Molded insulation, composed chiefly of asbestos	25
1439	Molded insulation, composed chiefly of rubber	30
1441	Molded insulation, composed chiefly of shellac, opal or synthetic phenolic resin	30

It is the general belief that these rates on the various commodities listed will afford proper protection to the industry, but if it shall be proved by experience and by the price of articles that may be imported from abroad that these rates are not sufficient for the needs of the industry, then the act provides that the Tariff Commission of the United States may hold a hearing, examine the facts in connection with a specific case that may be laid before it and take steps to have the duty increased. That is, if in the judgment of the commission, after a review of the facts, the duty should be increased, it may recommend to the President that these duties be increased and he has the power under the new act so to increase the duty up to the extent of 50 per cent.

HOW IMPORTS INCREASED

It is doubtful if many people are aware of the value of the electrical merchandise that has been imported into this country during the past year. The figures which I have in my possession showing the total imports through the port of New York are confidential, and I cannot disclose their exact value in dollars and cents; but I can say that for March and April the imports were practically of the same value. In May, however, there was an increase of more than 25 per cent and in June the imports show an increase of over 100 per cent over March or April, while for September they show an increase of more than 400 per cent over March or April. It is quite fair, however, to assume that the imports for September were swollen owing to the fact that the new tariff act was about to be put into effect. Nevertheless, the figures show that electrical articles were coming into the United States and that the volume was increasing and that the industry needed protection of some sort if it was to grow and prosper.

The electrical industry of Germany is one of the leading branches of manufacture in that country, and owing to the exchange situation German manufacturers are able to export electrical merchandise at prices which are ridiculous when translated into terms of American money. Japan is also a large manufacturer of electrical products with a very cheap labor cost and is therefore in a position to export her products, not only to the United States, but to many other countries.

Despite the fact, however, that Japan has this cheap labor, the latest figures I have obtained from Germany show that Germany exported to Japan during the year 1921 about $41,000,000 worth of general merchandise. Comparing these figures with those for the period before the war, we find that in 1921 German exports to Japan were 25 per cent greater than before the war. I cite this to show that Germany is able, on account of the exchange situation, to export miscellaneous products to Japan under today's conditions, and if this is so, she would in the absence of a reasonable protective tariff have all the more chance of flooding the United States with electrical products, among others, and doing great injury to our industry.

In Japan a new electric firm has recently been established, a combination of the Siemens-Schuckert Works, the Siemens-Halske A. G. and the Furokawa concern. This establishment intends to manufacture electrical material using German patents and German experience. The German firms are going to furnish the necessary help, such as skilled labor, foremen and engineers. Here is another reason for a protective tariff for the American electrical industry.

VALUE OF PROTECTION

Every one regards the tariff act as a very complicated document, but if special attention be directed to the paragraphs that apply to the electrical industry, the electrical manufacturers will know without difficulty just how much or how little protection their product is getting. As a word of further explanation, I would call attention especially to paragraph No. 399, "articles composed chiefly of metal," with a duty of 40 per cent. This paragraph takes in the bulk of the articles made by electrical manufacturers, and it is possible that experience will show that a slightly higher rate of duty is needed. This, however, is a subject for careful watching and possible action.

In conclusion, I would call the attention of those who are inclined to hold up the example of "free-trade England" as showing that prosperity may be achieved under a policy of free trade and no tariff to words spoken in 1919 by Reginald McKenna, Chancellor of the British Exchequer. Said Mr. McKenna:

"The experience of the war has

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[*] Mr. McElroy is also a member of the tariff committee of the Electrical Manufacturers' Council and chairman of the committee of the Electrical Manufacturers' Council to confer with the Department of Commerce on export and import statistics.

shown that the strength and safety of the British nation, in the time of peril, lie in the possession by this nation of the power to produce its requirements from its own soil and its own factories, rather than in the possession of values which may be exported and exchanged for products and manufactures of foreign countries."

And our own Abraham Lincoln, in discussing the problem as it applies to America, said:

"I do not know much about tariff, but I know this much. When we buy goods manufactured abroad we get the goods and the foreigner gets the money. When we buy goods manufactured at home we get both the goods and the money."

Survey of Business Conditions

Austrian Electrical Machine Market Is More Active

In a survey of Austrian conditions for August, Consul Carol H. Foster, at Vienna, states that the electrical and other machine industries were working at higher capacities during that month than for a number of months preceding. Exports have increased, especially in certain lines going to Russian markets. German competition was felt.

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Sales of Radio Apparatus in Cuba Expected to Improve

Owing to the lack of adequate broadcasting facilities, radio sales in Cuba have not kept pace with the progress of radio in the United States, says Assistant Trade Commissioner Livengood, Havana, in a report to the Department of Commerce; but recently a high-power sending center has been established in the capital and the market for small receiving sets is expected to widen rapidly. This station has not yet made arrangements to supply broadcasting service, but it will do so soon. The apparatus of the company operating this station, which has a capacity of 500 watts, is an exact duplicate of that used by the New York Telephone Company in its Walker Street station. Test messages from the new Havana station have been heard as far away as Princeton, N. J.

As in all tropical countries Cuban enthusiasts have met with difficulty because of "static" disturbances. In spite of all obstacles, however, a considerable number of Cuban amateurs have been experimenting in receiving messages and one or two in transmission. In order to receive from United States stations apparatus of the more expensive kind is necessary. With such sets messages have been received from Memphis, Detroit, Pittsburgh, Jacksonville, Wichita, Kansas City and Schenectady. Messages from Atlanta have been most successfully received in Havana.

Havana dealers are well equipped to supply radio apparatus in anticipation of broadcasting from the new Havana station. Interest in radio matters is thoroughly active, and when facilities such as those of the United States are available the merchants believe that Cuba will offer a fine market for this class of merchandise.

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Delinquent Electric Accounts Are Still Heavy

Reports on delinquent accounts as obtained from the National Electrical Credit Association indicate that the Central Division for September, 1922, had the heaviest amount of any section as compared with September, 1921. Although there was a gain of 102 such accounts over August, 1922, the average amount was reduced from $135.10 to $112.04. Collections in the Chicago area vary from sixty to seventy-five days, and jobbers are reporting still further delay in payments.

The New York Division in September reduced standing accounts from the previous month to 109, but the average amount increased $18. The August accounts for 1922 increased 208 over August, 1921, and the average account was reduced $31.

The other territories had only a few changes. In New England, while the number of accounts increased, the average values were decreased during both these months compared to 1921. The Pacific Coast division reported a decrease of eleven accounts for September, 1922, over 1921, but an increase of $75 per account. The accompanying table presents a picture of the credit conditions in this industry.

LIST OF DELINQUENT ELECTRICAL ACCOUNTS

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
August, 1921	657	$101,140.35	153.94
August, 1922	773	104,433.30	135.10
September, 1921	664	95,962.87	144.55
September, 1922	882	98,818.80	112.04
New York:			
August 1921	370	62,758.00	169.00
August, 1922	578	79,764.00	138.00
September, 1921	431	56,571.00	131.00
September, 1922	530	78,739.00	149.00
Philadelphia:			
August, 1921	246	25,332.55	102.98
August, 1922	258	37,013.70	143.46
September, 1921	243	34,676.26	142.70
September, 1922	264	39,050.19	147.92
New England:			
August, 1921	62	11,929.57	192.41
August, 1922	63	9,491.30	150.65
September, 1921	98	12,688.69	129.47
September, 1922	124	13,045.43	105.20
Pacific Coast:			
August, 1921	17	3,271.30	196.54
August, 1922	21	3,450.23	154.77
September, 1921	30	2,488.63	82.95
September, 1922	19	3,002.57	157.95

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Orders Cars to Western Roads to Relieve Shortage

In order to relieve the car shortage in the West and meet the demands of shippers for greater transportation facilities, the car service division of the American Railway Association last week ordered railroads operating east of Chicago, Peoria and St. Louis to return at once all box cars now on their lines which are owned by carriers in the Northwestern, Central Western and Southwestern districts. The order calls upon these carriers to send such cars at once to Western roads.

In the territory east of Chicago Peoria and St. Louis and west of Grand Rapids, Detroit, Toledo, Cleveland, Youngstown, Pittsburgh and Wheeling loading of all box cars belonging to Western railroads is ordered discontinued and these cars must be moved West empty.

Use of these box cars for local loading is ordered discontinued by the car service division in the territory surrounding Grand Rapids, Detroit, Toledo, Youngstown, Pittsburgh and Wheeling, as well as all territory east of those points. Where cars in that territory can be loaded consigned to Chicago, Peoria, St. Louis or other Western junction points or points beyond permission is granted. Any cars, however, for which through loading is not immediately available must be moved empty to the West. This order of the car service division is the most drastic ever issued and was promulgated for the purpose of aiding in the movement of the tremendous business which is now being offered to the railroads in the West.

New England Collections Take Seventy to Eighty Days

In the face of great activity on the part of wiring contractors, New England jobbers report unusually poor collections this month. Leading distributors declare that many accounts are running beyond reasonable limits because of the absorption of contractors in figuring new jobs and putting through work in progress. Jobbers' credit departments are in consequence spending a disproportionate amount of time on this branch of the trade, and as there is less industrial business than normal, no grass can grow under the credit man's feet at present.

Railroad buying is not in large enough volume to help much, although such accounts are being very promptly settled, as are central-station accounts. Seventy and eighty days are more commonly required for settlement of average accounts than last month. The situation appears sound enough fundamentally, barring the above neglect of the jobbers' bills.

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Gas-Filled Lamp Prices Reduced 20 per Cent

Recently manufacturers of incandescent lamps announced a readjustment in list prices of substantially all sizes of type B and type C lamps, which became effective on April 1. These reductions amounted to approximately 10 per cent, and the reductions in prices affected particularly commercial and residential customers, with a maximum reduction of 12½ per cent on types used in the residential field.

On Oct. 1, the manufacturers of incandescent lamps announced another reduction in prices. This latest reduction applies principally to gas-filled lamps, the consumption of which is increasing rapidly, particularly in the commercial and industrial fields. The reduction in price varies from 14 per cent to 28 per cent, amounting to an average reduction for all gas-filled lamps of approximately 20 per cent.

◆

Electric Material Handling Equipment in Demand

After a long period of dull business, the market for electrical equipment for material handling is showing a decided improvement, and one large organization specializing in this work reports that its sales are running 300 per cent ahead of last year.

Inquiries from both domestic and foreign customers are improving, and quickened activity in the industrial field is leading to the purchase of more battery-operated trucks and tractors than has been the case for many months. It would be incorrect to describe the situation as undergoing a boom, but conditions are much healthier in this field. In the factories there is at present considerable difficulty in obtaining an adequate supply of labor.

Deliveries tend to lengthen, also, in raw material and supply parts used in the assembly of trucks and tractors. Designing engineers are studying the problem of material handling with unusual care, and the outlook is more favorable for the wider use of such equipment in American industry.

◆

Prevailing Conditions Affecting Cost and Volume

Volume of Business.—Volume of business for the week ending Oct. 25 was $9,564,000,000, or $280,000,000 less than for the preceding week. This decline is noted in spite of the fact that the current week contains six business days, while the preceding week, owing to the inclusion of Columbus Day, contained in many cities only five business days. The decline is in accordance with the customary recession after the mid-month week.

Failures.—Decided decreases in the number of failures in the various sections of the United States for last week have brought the total of failures reported to R. G. Dun & Company down to 357 from the 442 reported for the previous week. The reductions were especially noticeable in the South and West. The total for the corresponding period a year ago was 437.

Bank Clearings.—Last week's bank clearings, although less than the previous week's total, largely exceed those of a year ago and are only slightly smaller than the amount reported for the same period of 1920. With an aggregate of $7,315,213,000 at twenty cities in the United States, as reported to *Dun's Review*, this week's clearings show a gain of 27.9 per cent in comparison with the $5,718,291,000 of last year and are but 0.9 per cent below the $7,384,428,471 of the same week of 1920.

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Export Figures in Error

As a result of a typographical error the table of electrical exports for August which appeared on page 851 of the issue of Oct. 14 omitted certain of the figures making up the total value of industrial electrical locomotives and of "other motors." The figures should read $10,462 and $29,938 respectively.

◆

Elimination of Premiums Helping Steel Market

Leading steel-trade authorities are of the opinion that the various markets for steel products will continue in satisfactory condition for many months to come. They state that there is more stability at present than there has been in several months and that the trade is running along its regular channels as a result of the elimination of so-called premium prices on numerous products.

Until two or three weeks ago some of the smaller makers of certain products were able to exact premiums over the regular quotations from the consumers, who were anxious for the products. Now, however, these premiums are disappearing, and leading steel authorities insist that this is a healthy sign for the industry.

As in the past, however, the consumers are not giving much of their business to the companies which made them pay premiums recently, and are showing a preference for the old-line companies which continued to quote at their regular levels but could not accept the business heretofore because they could not meet the needs of the consumers with regard to the date of shipment.

◆

The Metal Market

Transportation Difficulties Continue to Trouble Producers—Price Tendencies Are Upward

The metal market has been generally quiet during the last week. Transportation difficulties continue to trouble producers and consumers alike, and it may be some weeks before the various embargoes are lifted. The undertone in practically all of the metals continues strong, with price tendencies in an upward direction.

The market is quotably unchanged from the prices of last week. Practically all producers have been willing to sell at 13⅞ cents throughout the week, but have done only scattering business at that level. Some of those who were willing to sell at low prices have done a satisfactory business, but the total sales have probably not been more than half the average weekly business of August and September. Consumers report their mills operating to as near capacity as the labor supply and transportation conditions will allow. As stocks of copper are down to normal, producers and dealers alike are inclined to be bullish over the market prospects for the next few months.

Foreign sales were better during the last week than for several weeks. Prices were not quite so satisfactory, however, owing to competition between independent producers and the Copper Export Association. Despite the fall in the mark, Germany is still taking some copper.

Forward deliveries have commanded the same prices as have been asked for spot. Some business has been placed for the first quarter of 1923, but it is not yet large.

NEW YORK METAL MARKET PRICES

	Oct. 25, 1922 Cents per Pound	Nov. 2, 1922 Cents per Pound
Copper		
Prime Lake	14.00	13.87½
Electrolytic ..	14.00	14.00
Casting .	13.45	13.45
Lead, Am. S. & R. price	5.75	5.75
Antimony .	5.25	5.25
Nickel, ingot	36.00	36.00
Zinc, spot	6.50	6.50
Tin, Straits.	32.20	32.20
Aluminum, 98 to 99 per cent	19.10	19.10

OLD METALS

Heavy copper and wire	11.00–11.25	11.00–11.25
Brass, heavy	5.75–6.25	5.75–6.25
Brass, light	5.25–5.50	5.25–5.50
Lead, heavy	4.62½–4.75	4.62½–4.75
Zinc, old scrap.	3.00–3.37½	3.00–3.37½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

BUSINESS in the electrical market continues its steady gait, with no important price changes. Stocks are ample in most lines. In the Eastern territory contractor-dealers are busy with many wiring jobs. Manufacturers report better business than last year. Central stations show improving business.

New York

Jobbers and Manufacturers Are Optimistic About Future Business—Crystal Decorated Fixtures Active

Jobbers and manufacturers are optimistic about future business, reporting unusually heavy demand for most lines of hollow ware and heating appliances. Wire business had an unusually good week and prospects in this line are thought to be good for some weeks in the future. The better grades of fixtures are selling best. Radio equipment sales are improving.

Motors.—Smaller sizes are in better demand. There is little business being done by the second-hand dealers. During the last few days of the week several large orders for the smaller sizes were placed with a firm in eastern New Jersey.

Fixtures.—The better grades of fixtures are again taking the lead. Those decorated with cut and colored glass are in much demand. Holiday buying is in evidence.

Lamps. — Christmas-tree outfits are being heavily stocked by the jobbers in anticipation of unusually large buying.

Chicago

Prices Tending Upward—High Tension Business Still Energetic—Wire Demand Active

With the recent advances in the cost of raw materials, together with the scarcity of freight cars for deliveries, prices on most of the "bread-and-butter" items of the electrical industry are either firm or increasing. Dealers' stocks on wire and staples are in fair condition, but the conduit situation still remains unclarified. Some independent manufacturers have advanced the price on conduit, and jobbers express a feeling that the other firms will do so shortly.

Reports received from manufacturers of high-tension equipment indicate that orders are still being placed. Shortage of the newly approved type of safety switch has caused some annoyance to builders.

Wire.—The call for wire is steady but prices have an upward tendency. In 5,000-ft. lots the No. 14 rubber-covered wire sells for $6.35 to $6.40 per 1,000 ft. Dealers' stocks are in fair condition.

Flexible Armored Conductor.—Market for this conductor has decreased slightly, but prices vary from $44 to $45 per 1,000 ft. in lots of 5,000 ft. Stocks are normal.

Conduit.—Several independent manufacturers have advanced the price of conduit two points following the price increases in steel. Car scarcity is still affecting stocks of dealers. Normal demand for pipe is good, and the ½-in. black conduit is quoted between $55 and $57 per 1,000 ft. in lots of 5,000 ft.

High-Tension Equipment.—Prices in this field are also tending upward owing to advanced costs of raw materials. One company reports sales of two 110,000-volt, 15,000-kw. steel-tower outdoor substations for the West, four 66,000-volt, 900-kw. substations for the Southwest and five 33,000-volt substations ranging from 600 kw. to 1,200 kw. for the East. Another firm states that its sales in 70,000-volt fuses have been active.

Safety Switches.—The new Chicago ordinance requiring each new switch installed after Oct. 1 to have an integral test block has created some confusion to jobbers, because most switches have not been designed with this feature, and also because stocks are low. But manufacturers are rapidly shipping these new switches, since the demand is very active.

Lamp Cord.—Only a few jobbers have noticed any increase in the sale of lamp cord corresponding to the sale of appliances. Good grades of the No. 18 cotton-twisted cord sell for $20 per 1,000 ft., while the silk parallel in the same size is available for $29 per 1,000 ft.

Cleveland

Washing Machines Are Active—Dealers Catching Up in Stocking of Heaters—Radio Better

Business conditions have been spotty. Washers are active, and prices of some of the standard makes have advanced slightly. Preparations for an active holiday season have stimulated appliance sales appreciably.

Heaters.—Milder weather and a consequent lessening in demand has permitted dealers to recover their stocks. Dealers plan an exceptional holiday and winter trade. Stocks are being built up accordingly.

Washers.—A more active week is reported by both jobbers and dealers and stocks have been reduced.

Radio Equipment.—The trade is again optimistic. Sales have been fairly active and the demand for fall delivery assures a profitable season.

Boston

Flexible Armored Conductor Active—Electric Truck Sales Improving—Radiators Moving Well

Little change is apparent this week in the volume of trade, which tends gradually toward larger totals as the fall advances. Contractor-dealers are extremely busy and central-station outputs are growing. Industrial buying from jobbers is quieter. Manufacturers are generally doing better than last year.

Prices are firmer on sockets, and steel products are showing an upward tendency. Building permits to Sept. 1, 1922, in Boston totaled $41,268,831, compared with $17,961,748 for 1921. Labor conditions are much improved. Jobbers' stocks have been reduced in most lines to a point where frequent ordering for replenishment is necessary, though some slow-moving material is probably in oversupply. Contractor-dealer collections are poor, owing chiefly to the great activity of the construction business.

Wire.—Rubber-covered wire "holds the fort" as the best seller. In 5,000-ft. to 25,000-ft. lots No. 14 sells at $6.25 per 1,000 ft., prices being open above this. Weatherproof is moving slowly at 17 cents base, and bare is very dull except for occasional sales for radio aërials on a 16-cent base.

Flexible Armored Conductor.—Good business is reported in this material, with satisfactory stocks and firm prices. No. 14 single-strip is quoted at $44.20 per 1,000 ft. in 1,000-ft. to 2,500-ft. lots.

Industrial Electric Trucks.—Business is much improved over last year, and overseas orders are showing signs of life. Battery and motor deliveries are still reasonably good, and field representatives of tractor manufacturers are getting more inquiries.

Sockets.—Prices advanced Monday to the following case-lot quotations: Pulls, 35 cents net, keys, 20 cents, and keyless, 18½ cents. In some quarters rumors of longer deliveries are heard, but so far no shortage has affected the local trade to any extent.

Loom.—Trade has dropped off sharply from the limited districts which have lately been in the market for this material, probably on account of a slowing down of construction in northern sections as the colder weather approaches.

Appliances.—Radiators are moving well and stocks are much improved over a few weeks ago. Washers, cleaners and flatirons are selling with fair steadiness. Domestic refrigerating equipment has slackened off as usual at this time. Portable lamps are making a fine record for this fall's trade.

Radio Equipment.—Stocks are heavy, although occasionally it is difficult to obtain parts of advanced design if of very recent production. The public is buying more intelligently, and trade is in larger volume than in previous weeks, speaking broadly. High-grade broadcasting service helps the Boston market, and of late the programs show a vigorous effort to build interest through football and better-grade musical radio, with varied service through many hours of the day.

Atlanta

Lighting Fixtures Selling Briskly—Electric Range Sales Are Better—Conduit Shipments Improved

There has been no particular change in general conditions in the Southeast during the past week. The price of cotton continues to climb, the latest quotation being 24.35 cents, and this is having a very stimulating effect in the rural communities. The electrical business is good and the outlook bright. There is a great improvement in deliveries and jobbers are bringing stocks back to normal.

Lighting Fixtures.—These are selling briskly owing to the extensive building activities in this section, and jobbers have ample stocks on hand to meet the demands. Both the commercial and residential types are moving, with the tendency toward the more expensive fixtures.

Electric Ranges.—The movement has picked up considerably, jobbers reporting excellent sales, particularly in Florida. The reduction in the cooking rate of one of the largest central stations in the Southeast is causing increased sales of this specialty in the territory served by it. Shipments and deliveries are good and jobbers have satisfactory stocks on hand.

Portable Lamps.—Jobbers report a satisfactory movement, with stocks only fair. Prices are approximately 15 per cent under those of last year, and while dealers are anticipating continued good sales, they are cautious in the placing of orders. Shipments of stocks are satisfactory.

Wire.—The movement continues very good. Stocks were depleted a month ago, but improved deliveries have allowed them to be brought up to normal. No recent price changes are reported.

Rigid Conduit.—A brisk movement continues and while shipments have improved, they are insufficient to meet the demand. No recent price changes are reported.

Storage Batteries.—The demand for truck and vehicle batteries has doubled itself within the past sixty days, with the result that stocks are wholly inadequate. The call for radio batteries is satisfactory, with sales on the increase. Stocks in the latter item are fair.

St. Louis

Radio Sales Are Better—Quiet Business in Ranges—Curling Irons Selling Actively

Business in larger apparatus is becoming quite active. The various power companies are large buyers because of rapid growths of system loads, and steel companies and other industrials are expanding at a very encouraging rate. Motor sales are being increased by demand from industrials converting from isolated power systems to central-station service. Substation equipment is also active.

Radio.—A recent radio show and more favorable atmospheric conditions have brought demand back to a very active status, and jobbers and dealers have on hand good stocks of apparatus and parts.

Flashlights.—Normal retail demand exists, and dealers are placing orders for their holiday supplies. Local stocks are in excellent shape. The focusing spotlight is proving very popular, though the regular two-cell tubular attracts the bulk of the demand.

Ranges. — Business in the smaller localities is reported fair. In St. Louis sales are extremely quiet. No extensive campaigns have been conducted for two years or more.

Air Heaters.—Seasonable weather is producing an exceedingly attractive volume of sales, both wholesale and retail.

Heating Pads.—Sales are good, with stocks conservative but ample. Hospitals are good buyers, but the principal demand now is in the home.

Curling Irons.—Heavy demand continues and some difficulty is experienced is maintaining stocks. Even the smallest dealers carry them and report fine business. The largest call is for irons retailing at $5 to $7.

Denver

Fuses Are in Demand—Lamp Price Reduction Stimulating Sales—Fair Wire Stocks

Steady improvement is being shown in nearly every branch of the electrical business here. Construction activity is holding up. Money is accumulating in the banks. There is little non-employment.

Grain and fruit crops are moving well and the beet-sugar campaign promises to be profitable although shorter than usual. The "five hundred thousand in 1930" campaign is bearing fruit, according to reports just made by the local central-station and telephone companies on the basis of their increase in service contracts.

Fuses.—Renewable elements or links are in demand by the largest industrial users. Sales on cartridge containers, stable plug fuses, 10-amp. to 30-amp., lead, with an ample supply at $3.50 per 100.

Lamps.—Recent reduction in price has stimulated sales of higher-wattage lamps. Special window displays, including factory exhibits, have added interest. Christmas-tree sets are being stocked plentifully in anticipation of greater demand than last year.

Wire.—Price is keeping up, with increased demand and fair stocks on hand. No. 14 rubber-covered is quoted at $7.50 per 1,000 ft. in quantity orders and $8 in lots of 500 ft. to 5,000 ft.

Conduit.—An increase of two points, effective on the first of the week, brings the price of ½-in. black up to $65 in 1,000-ft. lots and ¾-in. black to $81. Stocks are still short with some jobbers.

Portland-Seattle

Continued Building Activity Has Created Heavy Demand for Wiring Supplies—Washers Active

Reports for the district indicate that business generally is better than it was a year ago. Lumber production continues to be from 5 to 10 per cent above normal. Both new business and shipments continue to be appreciably below production, largely owing to inability to secure cars for shipments to the East, but partly also to decreased demand in certain sections. Building continues to be very active. Depositors' accounts at the banks are greater than a year ago. The shipment of grain to market is still hindered somewhat by the hopes of the farmers that higher prices will prevail later. The labor situation is in better shape than it was a year ago, and reports indicate that there will be less forced lack of employment in this district during winter than for some time past. Electrical jobbers report business continuing in good shape. Continued building activity has created a heavy demand for wiring supplies, and the demand for electrical equipment in the sawmills also continues active. The trend of prices is generally upward, although no marked changes are reported for the past week.

Ranges.—The demand for electrical ranges is very good, and prospects for the coming season are excellent.

Washers and Ironers.—The sale of electrical washing machines throughout the district has exceeded in many cases the expectations of the dealers, with a consequent shortage in some lines.

San Francisco

Shipments from East Are Improving—Ranges Selling Better—Fan Season Was Excellent

Newly constructed districts are proving fertile fields for household appliances. Shipments from the East are improving. Back orders caused by big orders before expected price advances are nearly all cleared except in one or two steel lines. Collections are still very slow.

Ranges.—Electric range demonstrations in interior towns continue. They are particularly successful in smaller towns. Apartment-house business in larger cities shows comparatively slight improvement in present sales. Owners and architects show increasing interest and each new job requires more sales than educational effort.

Fans.—Checking up the past season shows it to have been excellent. Nearly all local stocks were well cleaned out and the market was fairly steady. The exceedingly hot weather in the interior was helpful.

Salt Lake City

Shortage of Several Popular Makes of Vacuum Cleaners Has Developed —Irons Active

A recent storm in the Intermountain region has brought needed relief to farmers and stock growers, insuring the sprouting of winter wheat and facilitating the digging of root crops. The harvesting of the fruit crop is about completed. Prices have been fair and thousands of carloads have moved out of the state. Retail business is noticeably improved.

Vacuum Cleaners.—A shortage of several popular makes has developed, the factories being behind in their orders. The demand is good, with prices steady.

Air Heaters.—There is just enough crispness in the air to stimulate sales. The sizes priced at $8.50 and $12 move best. Stocks are in good shape.

Hollow Ware.—Stocks are good, in some items excessive. Demand is very light with promise of a "pickup" with the approach of the holidays.

Flat Irons.—The good selling that has characterized the entire season is being maintained, with an excellent turnover in the number priced at $5.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Bates Expanded Steel Truss Firm Is Increasing Capacity

The Bates Expanded Steel Truss Company, 208 South LaSalle Street, Chicago, is adding a new section, 90 ft. x 120 ft., to its factory in East Chicago. Walter Bates, general manager, speaking to a representative of the *Electrical World*, declared that this increase in capacity was necessary because of the present brisk rate of business.

The total number of poles sold up to Oct. 28, 1922, is ahead of the number sold for the entire year of 1921. With the cost of materials below the 1920 basis, Mr. Bates said that this year's business would be the best year the company has known.

Plans for a galvanizing department to be situated in the East Chicago plant are now being drawn up. This is to be part of the company's 1923 program, which will include the erection of plants in both England and France for export trade.

Electrical Material Company Regroups Merchandise

By moving from 618 West Jackson Boulevard to 158 West Lake Street, Chicago, the Electrical Material Company has been able to gather its entire line of merchandise into a four-story building. A. F. Henderson, sales manager, stated to a representative of the *Electrical World* that this change went into effect May 1 in order to bring the company's products all under one roof, although the new floor space has not been increased. Commenting on business activities, Mr. Henderson declared that while the main volume of business was good, the collections were still troublesome. Delinquent accounts varied from seventy-five to ninety days. Besides functioning as jobber and distributor, this concern also acts as agent for nine manufacturers.

Bungalow Fixture Company Moves to New Plant

The Bungalow Fixture Company, Los Angeles, manufacturer of electric lighting fixtures, recently has moved to its new plant at 818 Flower Street. Officials of the company say that additional machinery will be installed in this plant which will more than double the present capacity.

Conlon Electric Washer Wins Patent Decision

The appeal of the Gillespie-Eden Corporation in the case of the Conlon Electric Washer Company, Inc., vs. the Gillespie-Eden Corporation et al., involving questions of validity and infringement of one of the Conlon company's patents, was heard by the United States Circuit Court of Appeals in Chicago on Oct. 25. The decision in the United States District Court sustained infringement by the defendants. The patent, which pertains to the use of a friction clutch in reversing-cylinder washing machines, is of great importance to the Conlon company and its licensees, the Hurley Machine Company, and the Fosston-Carpenter Company, and the case is being followed with unusual interest by competitive manufacturers.

Wilson & Daum Company Suffers Fire Loss

The Wilson & Daum Company, Pittsburgh, occupying a portion of the buildings at 211-213 Market Street for an electric lighting-fixture business, sustained a fire loss of about $60,000 on Oct. 16, when the structures were partly destroyed. The company plans to rebuild.

Cleveland's Fifth Electrical Home Is Opened

That electrical homes are becoming increasingly popular is evident in the opening of Cleveland's fifth home on Sunday, Oct. 29. Interest in the success of the "home electrical" movement is not limited to the electrical industry, however. Stores, realty men, architects, bankers and other interests have indorsed the Electrical League's efforts to educate the public to a keener appreciation of appliances and things electrical. Success has attended each venture and the sale of service has been promoted.

The first electrical home to be exhibited in Cleveland was experimental. During the time it was shown to the public it enjoyed an attendance of 34,354 and was sold in the last week of the exhibit at the price of $37,000.

The second home was valued at $48,000 and was sold in the second week of the exhibit, which entertained 34,790 visitors.

The third home was valued at $17,000 and was sold during the second week. There was an attendance of 13,965.

The fourth home was sold the fifteenth day after its opening for $40,000. Attendance was reported as 25,000.

The fifth and most recent home exhibits additional features, one of which is an indicating wattmeter which shows the cost of operating appliances in cents per hour. This device receives a great deal of attention from the visitors, since the monthly service bill is an unforgettable factor in the thought of every visitor at the homes. Knob control switches with a master switch in a bedroom are featured. The most modern methods of illumination are employed. Wired furniture, including a wired bed, is included. Convenience outlets and appliances and devices for all purposes are in numbers. Permanent wall heaters are popular, and much interest is accorded to the electric fireplace in the living room. The exhibition will close Nov. 26.

Approximately one-third of the 25,000 visitors at the fourth electrical home at Cleveland were most impressed with the convenience outlets and the electric range.

Compilation of questionnaires in which visitors were asked to check the electrical feature of the home which pleased them most shows that 34.1 per cent chose convenience outlets, 31.2 per cent the range, 21.1 per cent lighting effects, 13.8 per cent "elexits," 7.9 per cent the illuminated house number, 10 per cent the automatic door switch, and

6.1 per cent the tumbler switches. In marking preference for prizes the range again led the list, with the electric dishwater second and the washing machine third.

Automatic Electric Heater Firm Appoints William A. Moody

William A. Moody has been appointed representative in northern California for the Automatic Electric Heater Company, Warren, Pa. Mr. Moody was formerly connected with the electric range and water-heater department of the Pacific Gas & Electric Company, San José division. His headquarters will be 63 Second Street, San Francisco, and his time will be devoted to the handling of his firm's glue pots, solder pots, vulcanizers and electric heating appliances.

States Company Moves Winding Department

The States Company, Hartford, Conn., manufacturer of central-station testing apparatus, line switches and other specialties, has moved its winding department to 73 Francis Avenue, Hartford, in order to provide space for handling additional business at its main plant.

Radio Manufacturers Hold First Show in Chicago

The first radio manufacturers' show in Chicago was held Oct. 14-21 at the Coliseum, with an average daily attendance of 4,000 visitors. About one hundred manufacturers, including all the well-known companies, exhibited their latest equipment.

The booths were tastefully decorated with a center illuminated mural painting which gave the show an artistic touch. Demonstrations were given daily by "Francil," radio wizard, and a broadcasting service was established for the week. Much interest was shown in built-in cabinet units and "loud speakers."

Westinghouse Factory Busy at Springfield, Mass.

Business is improving steadily at the East Springfield (Mass.) factory of the Westinghouse Electric & Manufacturing Company, activity being specially marked in filling orders for automotive sets. The Hupp Motor Company, Detroit, has recently placed an additional order with the company for 20,000 starting and lighting outfits, and at present part of the factory is operating at night.

Production for the fall and winter radio apparatus trade has gone through well, and while this demand is less active than automotive ordering, equipment is already being turned out for next year's market. Delivery conditions on the railroads are hampering the plant somewhat, but this situation is not expected to be of long duration.

Interesting Electrical Exhibits at Southern Textile Show

The extent to which electrical and associated mechanical apparatus enters into the equipment of a modern cotton mill was effectively displayed in the exhibits at the fifth Southern Textile Exposition held at Greenville, S. C., Oct. 19 to 25. Two large floors were given over to the displays, the first containing the machinery for cotton spinning and weaving and the second the equipment that forms an auxiliary part of the textile operations.

Among the exhibitors of electrical apparatus were the General Electric Company, Westinghouse Electric & Manufacturing Company, Holtzer-Cabot Electric Company, Westinghouse Lamp Company, National Lamp Works of General Electric Company and Allis-Chalmers Company, with several other makes of equipment shown in the exhibits of Southern agents and mill supply companies. Among the exhibitors of mechanical equipment and supplies were the McClave-Brooks Company, Lunkenheimer Company, SKF Industries, Inc., American Vulcanized Fibre Company, Rogers Fibre Company, Standard Fibre Company, Hyatt Roller Bearing Company, Detroit Graphite Company, Link-Belt Company, Fafuir Bearing Company, Morse Chain Company, Texas Company and Clipper Belt Lacer Company.

In many of these exhibits modes of equipment and special applications in textile-mill processes were shown. The entire exposition was larger and more complete than those heretofore held in the South. The interest was evidenced through a large daily attendance of mill executives and their superintendents.

Johns-Pratt Company Announces Sales Appointments

The Johns-Pratt Company, Hartford, Conn., announces the appointment of L. F. Carleton as district sales manager of the electrical division, with office in the Boatmen's Bank Building, St. Louis.

W. S. Gordon, for the past twelve years with the molding department of the Bakelite Corporation, has been appointed sales manager of the Molded-products division of the Johns-Pratt Company. Mr. Gordon will make his headquarters at the factory in Hartford and thus keep in close touch not only with the sales but with the factory production of the molded products.

American Bosch Magneto Sales Reported Increasing

The American Bosch Magneto Corporation, Springfield, Mass., reports that orders in hand assure a plant production for November substantially in excess of the October volume, with the further prospect that the December operations will be still larger. Heavy orders booked from manufacturers engaged in production for the coming spring trade have brought about an upward revision of schedules. General sales for October are reported as in excess of the September mark, though it is anticipated that the branch and agency business will experience a seasonal drop for a time, following the usual course. A reorganization of the manufacturing force and office staff is expected to increase efficiency in each department.

Faden Electric Appointed Hotpoint Distributor

The Faden Electric Company, 186 West Lake Street, Chicago, has been added to the list of distributors for the Edison Electric Appliance Company. L. M. Kean, recently with the Hotpoint Company, has joined the Faden concern and has started a sales campaign to stimulate this line of appliances. Michael W. Loehr, general manager, speaking to a representative of the *Electrical World*, declared that during the past two weeks his sales on open air heaters totaled 274, with the result that he has been obliged to replenish his stock. With a threatened scarcity of coal in the coming winter, Mr. Loehr felt that the demand for this type of appliance would be excellent. He also said that the call for other types of appliances, including toasters and percolators, had been active.

The Kohler Company, Kohler, Wis., manufacturer of enameled sanitary ware, farm-lighting plants, etc., is asking bids for a four-story addition to its present plant. This will be used largely for producing enamels and will be equipped with special crushing, grinding and other equipment. Walter J. Kohler is president.

The Art Lamp Manufacturing Company, 6 North Franklin Street, Chicago, manufacturer of electric lamps and fixtures, is taking bids for a new two-story plant at Michigan Avenue and Thirteenth Street, which is estimated to cost approximately $50,000.

The Robbins & Meyers Company, 30 Church Street, New York City, manufacturer of fans, motors, etc., with a plant at Springfield, Ohio, has issued bonds for $3,000,000, a portion of the proceeds to be used for extensions, additional working capital, etc.

The Standard Underground Cable Company, Westinghouse Building, Pittsburgh, will build a one-story addition to its plant at Sixteenth and Pike Streets. Plans have been drawn by the W. G. Wilkins Company, Westinghouse Building, engineer.

The Steinmetz Electric Motor Car Corporation, Kate Avenue, Baltimore, has preliminary plans under consideration for the establishment of a new plant at Syracuse, N. Y., for the manufacture of electric motor trucks. Dr. Charles P. Steinmetz, chief engineer General Electric Company, Schenectady, is inventor and one of the heads of the company.

Foreign Trade Notes

WIRELESS SYSTEM PLANNED BY JAPANESE POWER COMPANY.—Application has been filed by the Daido Electric Power Company of Nagoya, Japan, according to *Commerce Reports*, for permission to establish a wireless system. The company proposes to operate this wireless system primarily in connecting the various stations of its electric light and power system, but its use may be extended eventually to the general public, if sufficient demand should arise.

PROPOSED EXTENSION TO TRANSMISSION LINES IN NEW SOUTH WALES, AUSTRALIA.—A bill has been introduced in the New South Wales Parliament authorizing the supply of electricity from the government power plant at Port Kembla to the country as far south as Kiami. The cost of the transmission lines is estimated at £24,000.

ELECTRIFICATION OF THE RIPOLL-PUIGCERDA RAILWAY, SPAIN.—Negotiations have practically been completed, for equipping the Ripoll-Puigcerda Railway in Spain for electrical operation. The hydro-electric station will be located at Escaldas in Andorra, at the junction of the Great and Little Balira Rivers, where it is estimated that 30,000 hp. can be developed.

ELECTRIC TRAVELING CRANES FOR WELLINGTON, NEW ZEALAND. — Tenders will be received by the Department of Public Works, Wellington, New Zealand, until Jan. 9 for electric traveling cranes for loads up to 27 tons for the Waikato power scheme (Section 58).

PROPOSED ELECTRIC PLANT FOR EL OCTOAL, NICARAGUA, S. A.—An electric generating plant to supply electricity for private residences is planned for the town of El Octoal, Nicaragua, South America.

MEXICO A POSSIBLE FIELD FOR SMALL LIGHTING PLANTS.—Owing to the development of a number of local industries in Mexico, this republic may offer a favorable field for small lighting plants. Among the towns which are in the market for small lighting plants is Puerto Vallart, Jalisco.

ELECTRICITY SUPPLY SCHEME FOR ASHBURTON, NEW ZEALAND. — The ratepayers have authorized the Electric Power Board to raise a loan of £296,500 in connection with an electricity supply scheme.

STATE ELECTRICITY COMMISSION PROPOSED FOR NEW SOUTH WALES, AUSTRALIA.—A proposal for the establishment of a State Electricity Commission similar to the commission developing the Victorian brown coal area at Morwell is under consideration by the Minister for Works in New South Wales. It is proposed to establish hydro-electric plants at Burrinjuck and on the north coast of the state and extensive data have been collected by the Public Works Department in regard to hydro-electric power. Various organizations in the southwestern part of the state are urging the government to proceed with the Burrinjuck project, which will cost about £350,000.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An exclusive agency is desired in Spain (No. 4,094) for low-power and high-power electric motors.

Purchase or an agency is desired in Canada (No. 4,150) for wireless receiving sets with apparatus and parts. Catalogs are requested.

PROPOSED POWER SCHEME AT LITHGOW, AUSTRALIA.—Tentative plans, it is stated, are under consideration by the Railway Commissioners, Sydney, New South Wales, for the construction of a power station in or near Lithgow in connection with a power scheme to supply electricity for lamps and motors throughout a large area of the western district.

PROPOSED ELECTRIC RAILWAYS IN ITALY.—The Società Anonima Industriale Ferroviaria has been granted a concession for the construction of an electric railway from Bribano to Sedico and Agordo. The cost including equipment is estimated at about 9,458,897 lire. The construction of an electric railway from Domodossola to the Italian border, to cost about 11,243,397 lire, is contemplated by the Società Subalpina di Imprese Ferroviaria.

ADDITION TO ELECTRIC PLANT AT BEIRA, EAST AFRICA.—The Town Improvement Commission of Beira, Portuguese East Africa, according to *Commerce Reports*, has decided to increase the present electric power plant by 300 hp. Tenders for furnishing the necessary machinery, it is understood, will be called for in the near future.

PROPOSED ELECTRIC PLANT AT KEDIRI, EAST JAVA.—A project outlined for lighting the city of Kediri (a city of about 30,000 population) by the Algemeene Nederlandsch Indische Electriciteit Maatschappij of Soerabaya, *Commerce Reports* states, calls for the installation of a small electric power plant.

New Apparatus and Publications

ELECTRICAL HEATING DEVICES.—The Russell Electric Company, 340 West Huron Street, Chicago, has recently placed on the market several new "Hold-Heet" electrical heating devices, including a space heater, an electric pad and an automobile wheel warmer.

SOCKETS.—Harvey Hubbell, Inc., Bridgeport, Conn., has issued a leaflet describing the Hubbell "Unit" system for industrial light and power purposes. The company is also distributing a four-page leaflet entitled "Put It Over," describing the Hubbell "3193" a "Te-Tap" for fixture or pendant.

FOOD CHOPPER.—The John E. Smith Sons Company, 50 Broadway, Buffalo, is distributing catalog No. 15 covering the "Buffalo" meat, food and vegetable chopper, the "Buffalo" bread slicer, etc.

LIFT TRUCK. — The Lewis - Shepard Company, 568 East First Street, Boston 27, is distributing a leaflet describing the "Jacklift" master truck.

AUTO-CRANE. — The Byers Machine Company, 300 Sycamore Street, Ravenna, Ohio, has issued a leaflet describing its "Truckrane," which is the Byers auto-crane model "1" with special base accommodating mounting on a motor truck.

PIPE-VISE STAND. — The American Pipe Tool Company, 123 South Jefferson Street, Chicago, is distributing a circular describing the "American" improved portable pipe-vise stand.

MOTOR. — The Baldor Electric Company, 4351 Duncan Avenue, St. Louis, has issued bulletin No. 4, covering its type "M" polyphase squirrel-cage motor.

PORTABLE INSTRUMENTS.—The Weston Electrical Instrument Company, 13 Weston Avenue, Newark, N. J., announces a new line of new small portable instruments for use on alternating-current circuits, known as the "Western Jr." This group comprises wattmeters, voltmeters, ammeters and milliammeters, which are described in bulletin No. 2,006.

ELECTRIC GLUE POT. — The Russell Electric Company, 340 West Huron Street, Chicago, has recently developed a "Hold-Heet" electric glue pot.

New Incorporations

THE WES-LON LIGHT & POWER COMPANY, Londonderry, N. H., has been incorporated with a capital stock of $30,000 to generate and distribute electricity in the towns of Mount Holly, Weston, Jamaica and Londonderry. The incorporators are H. N. Williams and others.

THE WARRINGTON (PA.) TOWNSHIP LIGHT, HEAT & POWER COMPANY has been chartered with a capital stock of $5,000 to supply electricity in Warrington township. Charles E. Stees is treasurer.

THE WELLSVILLE (PA.) LIGHT HEAT & POWER COMPANY has been incorporated with a capital stock of $5,000 to furnish electricity in Wellsville, Charles E. Stees is treasurer.

THE STONINGTON (ME.) ELECTRIC LIGHT & POWER COMPANY has been organized with a capital stock of $20,000 to generate and distribute electricity in Stonington. The incorporators are Allston M. Hatch, Edwin H. Johnston and Percy T. Clarke, all of Stonington.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BELLOWS FALLS, VT.—Steps have been taken by the Bellows Falls Merchants' Association to secure a new lighting system for the business district.

RUTLAND, VT.—The Vermont Hydro-Electric Corporation contemplates extensions in its hydro-electric plant, including the installation of a 1,250-kw. generator, a 1,500-hp. waterwheel, etc.

HOLYOKE, MASS.—The Municipal Gas and Electric Department has asked the city government for authority to issue $80,000 in bonds to finance the construction of a combination service station, storage building and garage.

REVERE, MASS.—The Suburban Gas & Electric Company has issued stock for $417,000, part of the proceeds to be used for extensions and improvements.

NAUGATUCK, CONN.—The Connecticut Light & Power Company has purchased the Ober property on Naugatuck Avenue.

NORTH GRANBY, CONN.—The Hartford Electric Light Company contemplates extending its transmission line to North Granby.

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Middle Atlantic States

AMHERST, N. Y.—The Tonawanda (N. Y). Power Company will extend its transmission line here. A lighting system will be installed on the Niagara Falls Boulevard, near the Buffalo city line.

AMSTERDAM, N. Y.—The Public Service Commission has granted the Adirondack Power & Light Company permission to extend its system in Schuyler and Little Falls.

BROOKLYN, N. Y.—Plans for the proposed woodworking plant of the estate of S. Weinstein, 100 Richardson Street, to be erected at Meserole Avenue and Calyer Street, at a cost of $500,000, include a power house.

MASSENA, N. Y.—The Massena Electric Light & Power Company has filed notice of increase in capital from $150,000 to $225,000 for proposed extensions.

OGDENSBURG, N. Y.—The Ogdensburg Power & Light Company has filed notice of increase in capital from $150,000 to $200,000 for expansion.

PLATTEKILL, N. Y.—The Public Service Commission has given its approval of the installation of an electric distribution system in Plattekill by the Central Hudson Gas & Electric Company, Poughkeepsie.

SALISBURY, N. Y.—The Public Service Commission has authorized the Utica (N. Y.) Gas & Electric Company to extend its electric lighting system into Salisbury.

UTICA, N. Y.—Arrangements have been made whereby the Utica Gas & Electric Company will purchase electricity from the Northern New York Utilities, Inc., Watertown, the service to start next June. The Utica company will erect a transmission line from its Washington Street plant to the Oneida County line near Boonville, a distance of about 28 miles, where it will connect with the lines of the Northern New York Utilities.

NEWARK, N. J.—The Public Service Electric Company will break ground at once for an addition to its Point-No-Point generating plant to cost about $1,050,000.

BETHLEHEM, PA. — The ornamental lighting system will be extended on West Broad Street to Pennsylvania Avenue.

CHARLEROI, PA.—New electric equipment will be installed by the Electric Alloy Steel Company, including one 500-kw. generator, and two other generators of approximately the same rating, 800-hp. and 500-hp. motors, controlling devices and auxiliary apparatus.

GALETON, PA.—The Galeton Electric Company, recently organized, contemplates the installation of a system for local service.

HARRISBURG, PA.—A power house will be constructed in connection with a municipal incinerating plant, to cost about $80,000. S. F. Hassler is commissioner in charge.

LANDISBURG, PA.—The Sherman's Valley Electric Light, Heat & Power Company, Loysville, has acquired properties of the Spring Township Electric Company and the Landisburg Electric Company. Extensions and improvements will be made to the systems.

LICKDALE, PA.—The Blue Mountain Electric Company, Bethel, plans to install an electric plant in Lickdale

PHILADELPHIA, PA. — The Mifflin Chemical Company, Delaware and Mifflin Avenues, contemplates building a power plant at its works.

ST. JOHNS, PA.—The Pennsylvania Power & Light Company will extend its transmission line from Harwood to St. Johns for service to the Wilkes-Barre & Hazleton Railways Company.

STATE LINE, PA.—The West Penn Power Company is preparing plans for a substation in State Line, to furnish service to the Monongahela Power & Railway Company. A 132,000-volt steel-tower transmission line will be erected from Washington to Charleroi, where a main switching plant of 80,000 hp. capacity will be built.

BROOKLYN, MD.—The Arundel-Shope Brick Company, Pier 2, Pratt Street, Baltimore, will build a power house in connection with its proposed local brick-manufacturing plant.

CAPON SPRINGS. W. VA.—John S. Scully, Jr., Winchester, Va., will build an electric power plant in connection with the development of local property for a summer resort.

GREENVIEW, W. VA.—The Greenview Coal Company will install electric power and other equipment at its local properties. E. G. Watkins is president and engineer.

HUNTINGTON, W. VA.—The United States Engineer Office is preparing plans for a power house at the Ohio River Dam, to cost about $32,000. Bids will soon be asked.

WHEELING, W. VA.—A power house, electric pumping plant and other electric equipment will be installed in connection with extensions to the municipal waterworks to cost about $1,000,000. J. N. Chester, Union Building, Pittsburgh, Pa., is engineer.

NORFOLK, VA.—Bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until Nov. 10, for lighting fixtures for the United States Veterans' Hospital.

RICHMOND, VA.—The Fiber Board Container Company will build a power house in connection with the rebuilding of its plant, recently destroyed by fire with loss of about $100,000.

WASHINGTON. D. C.—Bids will be received by the Chief of Engineers, United States Army, Munitions Building, until Nov. 20, for 2,980 water-tight lighting fixtures. (Advertisement 94.)

WASHINGTON. D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Nov. 13, for 4,800 dry batteries. (Circular 13100-1CP.)

North Central States

LORAIN, OHIO—The Lorain County Electric Company will begin work at once on an addition to its power plant to cost, including equipment, about $300,000.

CRAWFORDSVILLE, IND.—Bids will be received by the City Clerk until Nov. 6 for the construction of a power plant, 40 ft. x 60 ft., and 200-ft. radial brick stack, to cost about $50,000. H. C. Carroll, 511 Traction Terminal, Indianapolis, is engineer.

INDIANAPOLIS. IND.—The Merchants' Heat & Light Company has received permission to issue $267,000 in bonds and $87,000 in capital stock, part of the proceeds to be used for extensions and improvements.

INDIANAPOLIS, IND. — The Central Indiana Power Company, successor to the Merchants' Public Utilities Company, is negotiating for the purchase of a controlling interest in the Indiana Railways & Light Company. It is proposed to consolidate the systems.

LOGANSPORT, IND.—The United Public Service Corporation, Rochester, has acquired the property of the Logansport Utilities Company. A transmission line will be erected from Rochester to Logansport and other improvements made, to cost about $150,000.

MEROM, IND.—Tentative plans are under consideration for the installation of a municipal distributing system, to cost about $15,000.

MONTEREY, IND. — The Valparaiso (Ind.) Lighting Company has been granted permission to acquire the system of the Monterey Light & Power Company. Extensions will be made in the system.

SOUTH BEND, IND.—A one-story power house will be built in connection with a five-story hospital extension to be erected at the Epworth Hospital and Training School, to cost about $350,000. Schmidt, Garden & Martin, 104 South Michigan Avenue, Chicago, are architects.

WINCHESTER, IND. — The Citizens' Heat, Light & Power Company contemplates extensions to its power plant and will erect transmission lines to Modoc and Losantville. Permission has been secured to issue $125,000 in capital stock to finance the work.

CHICAGO, ILL.—Plans have been completed by Shepherd & Hovey, consulting engineers, for the installation of an ornamental lighting system on Fifty-fifth Street, consisting of ninety-one 600-cp. units, to cost $23,991. Bids for a street-lighting system on Sixty-third Street between South Park and Stony Island will soon be asked.

MAYWOOD, ILL.—The contract for the construction of an electric lighting system in Maywood, it is reported, has been awarded to the Kelly Construction Compnay, Eau Claire, Wis. The work includes the laying of 74 miles of conduit for cables and 2,000 poles for electric lamps with fixtures, etc.

MURPHYSBORO, ILL.—The Murphysboro Water Works, Electric & Gas Light Company contemplates doubling the capacity of its electric plant, to cost about $250,000. The work will include the erection of a new power station, installation of two new boilers and additional generating units.

ELKHART LAKE, WIS.—The Badger Public Service Company contemplates erecting a transmission line from Belgium to Oostburg, service to be furnished from the Belgium plant. The construction of a transmission line to Adell is also under consideration.

IRON RIVER, WIS.—The Iron River Water, Light & Telephone Company plans to install a generator to replace the one destroyed by fire, causing a loss of about $1,500.

JANESVILLE, WIS.—The extension of the ornamental lighting system on South Jackson Street from Pleasant Street to Western Avenue is under consideration by the City Council.

MANAWA, WIS.—Plans are under way by the Little Wolf River Lumber Company for the erection of a high-tension transmission line from Manawa to Iola via Ogdensburg to supply electricity to all three towns from its power plant at Symco.

MARINETTE, WIS.—Extensive improvements and extensions will be made in the local distributions system in Marinette and Menominee, Mich., to cost about $400,000.

PHILLIPS, WIS. — The property of the Phillips Light, Water, Heat & Power Company has been purchased by the Flambeau Service Company, Park Falls. The plant, it is understood, will be remodeled.

STURGEON FALLS, WIS.—The Peninsular Power Company, Iron Mountain, Mich., has purchased a site where it will build a dam for its proposed hydro-electric plant at Sturgeon Falls. The company will soon begin work on the erection of an electric transmission line from here to a quarry about 5 miles distant.

GLEN LAKE, MINN.—The Hennepin County Supervisors will take bids at once for a local power plant for county service, to cost about $210,000. Sund & Dunham, Essex Building, Minneapolis, are architects.

MUSCATINE, IOWA.—Plans are being drawn for a municipal electric plant and distributing system and the electrification of waterworks pumping station, to cost about $350,000. Arthur L. Mullergren, 555 Gates Building, Kansas City, Mo., is consulting engineer.

SIOUX CITY, IOWA.—The Sioux City Gas & Electric Company has issued $3,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

WHITTEMORE, IOWA.—Plans are being considered for an addition to the municipal electric plant, with improvements in present station.

BROOKFIELD, MO. — The Brookfield Electric Light Company is being reorganized under the name of the North Missouri Power Company. Improvements involving an expenditure of about $150,000 will be made to the plant.

CLAYTON, MO.—The West St. Louis Water & Light Company, it is reported, contemplates improvements to its plant, to cost about $260,000.

PARIS, MO.—The proposal to issue $57,000 in bonds for improvements to the water, light and ice plants will be submitted to the voters on Nov. 27. W. P. Rollins & Company, Railroad Exchange Building, Kansas City, Mo., are engineers.

PHILLIPSBURG, KAN.—The plant of the Phillips County Light & Power Company was recently destroyed by fire, causing a loss of about $20,000.

Southern States

LEXINGTON, N. C.—The Rodrain Electro-Metallurgical Company, Salisbury, will build a power plant in connection with its proposed reduction mill here, to cost about $500,000.

EHRHARDT, S. C.—The People's Utility Company, recently organized, plans the installation of a local substation and distributing system.

GRAYSVILLE, GA.—Gray Brothers are planning to install an electric generating unit at their cornmeal mill to furnish electricity to surrounding territory. The dam will be raised and rebuilt.

KNOXVILLE, TENN.—The Duncan Machinery Company is making inquiries for a generator, engine and other electric power equipment.

MEMPHIS, TENN.—Bids will be received by the Board of Commissioners of the Memphis Artesian Water Department until Nov. 24 for construction of superstructures for new water supply and for furnishing and installing machinery, including a coal and ash-handling system, three low-head centrifugal pumps of 9,000,000 gal. daily capacity, directly connected to reaction water turbines; two "Unaflow" engine-driven generator sets (directly connected) and switchboards. Fuller & McClintock, 170 Broadway, New York City, and Produce Exchange Building, Kansas City, Mo., are engineers.

SEARCY, ARK.—The Arkansas Power Company has been granted a light and power franchise and will install a local system. Power will be furnished from the plant on the Little River.

YAZOO CITY, MISS.—Bonds to the amount of $150,000 have been authorized for extensions and improvements in the electric system, water and sewer plants.

LAFAYETTE, LA.—The local plant of the Lafayette Sugar Refining Company, New Orleans, was recently damaged by fire, causing a loss of about $300,000, including machinery, power house, etc. The plant, it is understood, will be rebuilt.

NEW ORLEANS, LA. — The General American Tank Car Company, 111 West Monroe Street, Chicago, will build an electric power plant in connection with its proposed local steel car plant, to cost about $500,000.

GOLTRY, OKLA.—Bonds to the amount of $15,000 have been authorized for the installation of an electric lighting system.

MUSKOGEE, OKLA. — The Oklahoma Fabric & Rubber Company will build a power house in connection with its proposed local plant, to cost about $1,000,000. Officials of the Allentown Tire & Rubber Company, Allentown, Pa., are reported to be interested in the new organization.

OKLAHOMA CITY, OKLA. — The New State Ice Company will install an electric plant in connection with proposed extensions to its ice and refrigerating plant, to cost about $250,000.

SAND SPRINGS, OKLA.—Arrangements are being made by the Sand Springs Power, Light & Water Company for the installation of a 10,000-kw. steam turbine together with additional units of Wickes vertical boilers. The company plans to install one 10,000-kw. steam turbine unit each year for the next three years.

CANTON, TEX.—The installation of a municipal electric light plant, to cost about $16,500, is under consideration.

CORSICANA, TEX.—Plans have been prepared for the installation of an ornamental lighting system (consisting of ninety standards) on Beaton and Eleventh Streets.

EASTLAND, TEX. — Plans have been approved by the Oil Belt Power Company to double the capacity of its electric power plant on Leon River near Eastland. Extensions will also be made to its electric transmission system.

RAYMONDVILLE, TEX.—Plans are under way for the installation of a municipal electric light and power plant.

WHITEWRIGHT, TEX. — H. Brodhead and associates of Whitewright have been granted a franchise to erect an electric transmission line along the Bells-Whitewright public road and the Bells-Savoy road to furnish electricity for lamps and motors to residences and towns adjacent to the roads

Pacific and Mountain States

ABERDEEN, WASH.—Plans are being prepared for a lighting system on Heron Street to cost about $18,000.

OLYMPIA, WASH. — The Washington Water Power Company has acquired the property of the Okanogan Power Company. Extensions and improvements will be made to the system.

TACOMA, WASH. — According to an announcement by Commissioner Ira S. Davisson, work on plans and specifications for the Lake Cushman hydro-electric project of the city of Tacoma will begin immediately upon the completion of the steam plant on the water front. Plans will be prepared for the entire project, although it is planned to install only one unit at the present time, which will include a power plant at the dam with a transmission line into the city, to cost about $3,000,000.

VANCOUVER, WASH.—Plans are being prepared for extensions and improvements in the street-lighting system.

BEND, ORE.—The Bend Water, Light & Power Company contemplates building a hydro-electric plant to develop 106,000 hp. on the Deschutes River, for which bids will be asked early in the spring. The work will include a concrete dam 270 ft. high, power house, penstocks, transmission lines, turbines, generators, etc. V. H. Reineking, Spaulding Building, Portland, is engineer.

CANBY, ORE.—The City Council, it is reported, will receive bids about Nov. 14 for an electric lighting system. J. H. Ballneg, 5-12 Hancock Street, Portland is engineer.

GRANT'S PASS, ORE. — The Beaver Portland Cement Company, Portland, contemplates the construction of a power plant in connection with its proposed cement mill, to cost about $1,000,000, with railroad line, etc.

PORTLAND, ORE.—The installation of 200 street lamps is under consideration, and bids will be taken in January. J. H. Mann is commissioner of public utilities.

ALHAMBRA, CAL.—The Southern California Edison Company will build a distributing equipment plant, comprising four main buildings and general machine and repair shop, to cost about $750,000.

BERKELEY, CAL.—Bids, it is understood, will soon be asked for the installation of an ornamental lighting system on University Avenue, consisting of 151 electroliers, maintained by underground conduits. C. L. Hugguns is city engineer.

MADERA, CAL. — The Madera Sugar Pine Company will build a power plant at its local mills.

MARTINEZ, CAL.—The Pacific Gas & Electric Company plans to build a local substation. The transmission system from East Pinole to Herdlyn will be rebuilt.

OAKLAND, CAL.—The Down Town Association is preparing plans for the installation of an ornamental street-lighting system on Broadway, Telegraph and San Pablo Avenues, totaling about 100 standards.

GREAT FALLS, MONT.—Plans are being considered for extensions in the street arc-lighting system on Central Avenue.

NEIHART, MONT. — Considerable electrical equipment will be installed in the proposed 450-ton concentrating plant to be erected by the American Zinc, Lead & Smelting Company, 120 Broadway, New York, at its Silver Dike properties, to cost about $350,000.

DENVER, COL.—The refrigerating and cold-storage plant to be installed in the new meat-packing plant to be erected by the Mountain States Packing Company, Union Stock Yards, Denver, to cost about $2,000,000, will be equipped with electrically operated machinery.

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Canada

POWELL RIVER, B. C.—Plans are being prepared by the Powell River Company, Ltd., for the erection of a plant, to cost about $200,000. R. Bell-Irving, Powell River, is architect.

VANCOUVER, B. C.—The False Creek Lumber Company contemplates the rebuilding of its mill and power plant, recently destroyed by fire with loss of $225,000.

PAISLEY, ONT.—The construction of a power plant, including a dam, on Little Saugeen River, to cost about $60,000, is under consideration. A. James, 36 Toronto Street, Toronto, is engineer.

SHEDDEN, ONT.—The installation of an electric light and power distribution system in Shedden, including a transmission line from St. Thomas, to cost about $40,000, is under consideration.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 10, 1922)

1,431,719. Water Vaporizer; S. Brown, Chicago, Ill. App. filed Dec. 27, 1921. Water vaporized by electric lamp.

1,431,733. Speed-Controlling System for Motors and the Like; H. N. Hurd, Buffalo, N. Y. App. filed July 14, 1919. Independent prime movers for respective motors.

1,431,738. Motor-Operated Control Apparatus; P. F. Shivers, Ludington, Mich. App. filed July 26, 1920. Adapted for operating with master switch automatically moved between predetermined limits.

1,431,818. Electric Switch; A. L. Kitchens, Bagwell, Tex. App. filed Feb. 28, 1922. Device for dimming electric lights.

1,431,825. Electric Resistance Heater; H. G. Lemoine, Paris, France. App. filed July 18, 1921. Electric house-heating furnace.

1,431,859. Dry Battery; S. Yai, Tokyo, Japan. App. filed Jan. 13, 1921. Flange holds insulating material in place.

1,431,865. Cable Telegraphy; H. Angel, Brooklyn, N. Y. App. filed June 7, 1919. Automatic ocean telegraphy based on multiplex system using three-unit code characters.

1,431,914. Pressure-Indicating Device and Alarm Signal; E. J. Dashner, Belmont, and C. H. Flint, Newton, Mass. App. filed May 11, 1920. Electric indicator for automobile oil-circulating system.

(Issued Oct. 17, 1922)

15,469 (reissue). Thermionic Voltmeter; R. A. Heising, East Orange, N. J. App. filed July 30, 1919. Input circuit of thermionic rectifier connected between terminals across which voltage is to be measured.

15,471 (reissue). Automatic Telephone Trunking System; A. M. Malmberg, Chicago, Ill. App. filed Dec. 1, 1921. Trunking systems in which talking circuit is completed over different path from that used in selection of called line.

1,431,925. Desk Stand; E. A. Bohlman, Chicago, Ill. App. filed May 27, 1918. Means for supporting switch hook and associated parts of telephone desk stand.

1,431,927. Ignition System for Internal-Combustion Engines; W. C. Brinton, Jr., Kennett Square, Pa. App. filed July 10, 1919.

1,431,947. Coil-Winding Apparatus; M. E. Gysel, Wilkinsburg, Pa. App. filed Dec. 13, 1917. Adapted for applying windings to interior of hollow cylindrical core.

1,431,948. Control System; F. D. Hallock, Pittsburgh, Pa. App. filed Jan. 16, 1920. Time-element device interrupts the motor circuit if controller is in intermediate position.

1,431,952. Dynamo-Electric Machine; R. E. Hellmund, Swissvale, Pa. App. filed Jan. 26, 1917. Four motor-generators combined in one frame.

1,431,953. Apartment-House Range; M. Henoch, Laporte, Ind. App. filed Jan. 5, 1921. Compact electric range with two plates and oven.

1,431,957. Ozone Generator; E. L. Joseph, Westminster, London, England. App. filed July 19, 1920. Watertight container immersed in cooling tank.

1,431,961. Arc Shield; W. H. Kempton, Wilkinsburg, Pa. App. filed July 25, 1918. Made of carborundum, Portland cement and asbestos.

1,431,984. Trolley Pole; W. Schaake, Pittsburgh, Pa. App. filed Nov. 25, 1918. Trolley pole made up of wooden sections.

1,431,993. Heater; H. E. Strunk, Ontario, Cal. App. filed Aug. 13, 1917. Reflector-type heater when upset with automatically point upward.

1,431,995. Signaling Apparatus and Circuits; J. G. Toomey, New York, N. Y. App. filed April 24, 1919. For selectively signaling over telephone lines.

1,431,997. Induction Heater; M. Unger, Pittsfield, Mass. App. filed Nov. 1, 1921. Apparatus for heating metallic tires or rims.

1,432,003. Instrument for Locating Defective Coils in Electric Machines; J. B. West, Syracuse, N. Y. App. filed July 25, 1917. Test circuit-making contact with commutator compares current in successive coils.

1,432,006. Electrical Protective Device; O. Wortmann, Wilkinsburg, Pa. App. filed July 12, 1917. Circuit interrupter connected between rectifier and transformer controlled by potential drop across anodes.

1,432,009. Wrapping Machine; E. H. Angier and W. M. Wheildon, Ashland, Mass. App. filed March 10, 1917. Tire-wrapping machine.

1,432,022. Circuit Connection of Electron Discharge Apparatus; R. A. Heising, East Orange, N. J. App. filed Oct. 11, 1916. Alternating current used for heating tube filaments.

1,432,025. Reserve Cell; W. Hoppie, Newark, N. J. App. filed March 9, 1920. Cartons containing activating material crush between electrodes when cell is to be used.

1,432,029. Connector; C. E. Myers, Wilkinsburg, Pa. App. filed March 2, 1917. Plug-and-socket type connector and switch.

1,432,034. Wrapping Machine; P. Pierce, Chicago, Ill. App. filed Sept. 15, 1920. Tire-wrapping machine.

1,432,038. Commutator; T. C. Russell, Chicago, Ill. App. filed March 4, 1922. Improved process for making commutators.

1,432,064. Electric Heater Element; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed June 27, 1917. High-temperature resistors for electric heating.

1,432,118. Combination Ignition Tester, Spark Intensifier and Grounding Device; O. R. Nordgren, Watertown, S. D. App. filed Jan. 26, 1920.

1,432,124. Apparatus for Sterilizing Liquids; H. B. Rudd, Mansfield, Ohio. App. filed July 26, 1920. Purifying liquids by destroying any bacteria by passing electric current through it.

1,432,133. Electric Heating System; R. Sudiah, New York, N. Y. App. filed Aug. 2, 1917. Resistance heaters for street-car and automobile seats automatically turned on when passengers sit down.

1,432,164. Portable Electric Light; J. T. Drufva, Long Meadow, Mass. App. filed May 28, 1919. Obviates accidental lighting of lamp.

1,432,220. Electrode; A. O. Tate, New York, N. Y. App. filed July 30, 1921. Electrode structure for use in apparatus for treating cloth by electrolysis.

1,432,250. Printing Telegraph Projecting Machine; W. J. Kahl, New York, N. Y. App. filed Feb. 9, 1920. Telegraph ticker with apparatus for projecting message onto screen.

1,432,343. Electric Clip; M. Krokavetz, Cleveland, Ohio. App. filed May 16, 1921. Pair of insulated jaws with strip of conducting material attached.

1,432,346. Electrical Indicator; C. O. Lorenz, Port Arthur, Tex. App. filed Nov. 21, 1917. Automatically indicates level of liquid in distance tanks.

1,432,347. Electric Battery Cell; A. S. Lhyne, Bridgeport, Conn. App. filed May 16, 1921. Provides more efficient size of flashlight battery.

1,432,348. Electric Lantern; A. S. Lyhne, Bridgeport, Conn. App. filed Aug. 25, 1921. Two-day cell light.

1,432,354. Radio-Signaling Apparatus; W. H. Nottage, Chelmsford, England. App. filed March 30, 1921. Based on Wheatstone-bridge principle.

1,432,384. Method and Appparatus for Indicating the Geographical Location or Movement of Bodies; W. W. Conners, Elizabeth, N. J. App. filed June 12, 1919. Control of navigation by electromagnetic waves.

1,432,411. Electrode; J. H. Payne, Jr., Schenectady, N. Y. App. filed April 21, 1921. Grid electrodes for electron discharge devices.

1,432,417. Dry-Cell Construction; O. E. Ruhoff, Madison, Wis. App. filed Nov. 14, 1918.

1,432,434. Heating Unit; C. C. Abbott, Pittsfield, Mass. App. filed May 5, 1919. Cylindrical core of insulating material wound with resistance conductor.

1,432,435. Electric Terminal; C. C. Abbott, Pittsfield, Mass. App. filed Aug. 23, 1921. Method of making electric connections.

1,432,438. Radio-Telegraphic Coupling; J. Bethenod, Paris, France. App. filed Feb. 16, 1922. Relates to coupling between antenna and high-frequency alternating-current generator.

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Our Interest in Immigration

MEN of industry who employ labor are beginning to realize that they are intimately concerned with the immigration situation. To most it has been all abstract—just a matter of theory that each one thinks he himself fortunately need not worry about.

But projected from this background are some facts of very pressing practical importance. In a word, the present trend of immigration is beginning to restrict the supply of common labor to American industries, and this affects us all.

IMMIGRATION first began to assume the proportions of a national problem in this country in 1861. In that year 91,918 immigrants came to our shores. They were of a high character, 98 per cent of them being composed of Scandinavians, Dutchmen, Germans, English, Irish, Scotch. They were as a class thrifty, industrious, orderly, productive, useful citizens who melted well into our population.

But the Teutonic, Scandinavian and Anglo-Saxon peoples no longer migrate. They have gradually won more liberty and prosperity at home and emigration among them has dwindled. Meanwhile oppression and poverty have produced unrest among the Slavic and neighboring peoples—Russians, Poles, Hungarians. So they have come to America in steadily increasing numbers until in 1890 the Slavs composed 83 per cent of our entire immigration, then totaling 455,302. And, having less education and less experience with freedom, the Slav is weaker in intelligence, initiative, stability and productive value to America.

IN BRIEF, there is the story. America continually needs labor, because our industries are steadily expanding. Our one million increase in population does not meet the demands of our farms, mines, factories and construction. Immigration must provide this, unless electrical manufacturers are to be short-handed and electrical utilities hampered in their construction projects—other industries suffering in the same way. We see the urgency and force of this in the recent action of the Steel Corporation in raising wages in the hope of drawing labor from other work.

For the "per centum law," now in control, is a failure. It is decreasing the volume of immigration without improving its quality. And immigration has ceased to bring us the kind of labor that we must have. Immediate relief is imperative.

We must have a permanent constructive policy toward immigration that will solve this problem in both its social and its economic aspects. We must find a way to select the class of immigrants we need that our ideals, our institutions, our industries and our national development may be protected. We must distribute them where the labor is required. Meanwhile we must strive to make the use of electricity increase the productive capacity of the labor that we have.

August F. Hockenbeamer

Originator of the movement for the popular sale of electric utility securities to consumers and a leader in developing good public relations and sound financial policies.

TO ADVANCE a policy that both improves public relations and insures adequate financing is a distinct contribution to the electrical industry. No questions have had greater thought than these, and the fact that the new policy has been adopted by most public service companies in the United States is proof of its merit.

August F. Hockenbeamer, vice-president and treasurer of the Pacific Gas & Electric Company of San Francisco, has proved his sound financial and economic sense in a general way in the various important positions he has held both in the East and the West. But in 1914 his financial acumen focused itself upon a particular policy. This policy is that of the direct sale of public utility securities to consumers and employees. For a long time Mr. Hockenbeamer had pondered upon the problem of the financing of the Pacific Gas & Electric Company. He knew that during the initial steps of such a company it could be financed easily by the mortgage system, but he knew too that there is a limit to borrowing money on this basis. So he conceived the plan of junior financing—that is, financing by means of acquiring creditors among the customers of public utilities. He saw immediately that to make shareholders of the consumers of the Pacific Gas & Electric Company would establish a fine sense of co-operation between the utility and the public besides furnishing the capital necessary to carry out the former's increasing activities. He tested his plan with the California Telephone & Light Company. It proved a success. Within two years' time the most important companies in the East as well as the West had adopted it with unqualified success.

The man to whose fertile brain is due this idea had a training suitable to such an inspiration. He was born on March 6, 1871, in Logansport, Ind. In this railroad town he spent his youth. From the beginning he was interested in the business aspect of railroads. After a public school and business college education he went to work in the Logansport office of L. F. Loree, division engineer for the Pennsylvania lines. Here he began at the bottom of the ladder as office boy and messenger. In six months he was promoted to the position of stenographer, and from that time he advanced to more important places until at the age of thirty-one he was chief clerk to the division superintendent at Richmond, Ind. He then became assistant engineer of maintenance of way for the Baltimore & Ohio Railroad. His next move took him to New York City as assistant to Mr. Loree, now the president of the Delaware & Hudson Railroad. But this important position did not hold him long. The banking house of N. W. Halsey & Company recognized his sound financial sense and made him its expert on railway investments and corporate properties. In his fifth year with Halsey & Company they sent him to San Francisco as their agent in the financing of the Pacific Gas & Electric Company. This utility saw in Mr. Hockenbeamer the same brilliant business ability which had been manifest to Halsey & Company. Its managers made him a tempting offer. He accepted, and for the last fifteen years the West has claimed him as one of its financial leaders.

Under the policy inaugurated by Mr. Hockenbeamer the Pacific Gas & Electric Company has extended its activities enormously, and under it also many companies throughout the East and the West are establishing a better relationship between the public and themselves, thereby bringing about a healthier economic condition. For this reason Mr. Hockenbeamer has won national recognition.

Editorial Comment

Electrical World, November 11, 1922
Volume 80 Number 20

Financial Market Favorable for Refunding

ELECTRIC public utility financing reached its highest point for the year in October, when approximately $100,000,000 was offered to investors. An interesting feature of recent financial operations has been the large amount of refunding made possible by an attractive money market. No sane utility operator wants to be hampered by a 7 per cent bond or 8 per cent note issue if either or both can be replaced with a 5 per cent security, even if a premium must be paid to holders whose bonds are retired.

It is not always appreciated how important a part interest plays in utility operations. In a great many cases the cost of money exceeds the cost of labor, and a saving of one or more per cent in the cost of money affects earnings more than economies in station operation and is just as welcome as a rate increase. For example, the refunding operations of a large public utility last week will save approximately $92,000 in annual interest charges. If the unexpired period of the original security were ten years, the total saving would approximate $1,000,000. No wonder, then, that utility operators should be besieging the offices of bankers at this time. With so favorable a money market there should be a long waiting list.

Court and Commission Decisions on Partial Facts Are Dangerous

ONCE more a legal decision based on only a part of the facts arises to complicate the inductive co-ordination problem. In this instance the Nebraska State Railway Commission bars a 13,200-volt line from the highway on the ground that it would prove a menace to a railway signal system. On the record in the case it is difficult to see how the commission could do otherwise. Again, it is difficult to see how the Supreme Court could do otherwise than uphold the right of the commission to make such a decision when that right was questioned on an appeal. Both the Supreme Court and the commission have apparently done the only thing that the record in the case justifies, so that no criticism of their action can be voiced.

The whole difficulty lies in the handling of the case. A practice has grown up in some sections of the Middle West of allowing contractors and promoters to project and build lines that, after construction, pass into the hands of others. The promoters are acting within their legal rights in the cases that have been observed, but naturally they have no interest in the future of the lines that will lead them to do more than is required to put the circuits in operation and get their money. In the particular case under notice the promoters and expectant builders of the line brought the most vital question in the whole inductive co-ordination problem before the commission and into court. The commission decision was rendered and the case appealed to the Supreme Court before the utility interests of the state had become cognizant of it. The decision, if followed to its logical conclusion, would indicate that power circuits can be barred from the highways, and as a result extension of electric service would be seriously curtailed in the State of Nebraska. The railway case was well presented, but so far as the record shows no attempt was made to bring into it as witnesses men able to show that the power and signal systems could be co-ordinated and operated so that there would be no menace to railway operation. That it has been possible to do this in other cases was not shown, nor was it shown that there are hundreds and possibly thousands of miles of such construction in daily operation in the United States. Neither was there any indication that if railway electrification is to come in this country every mile of track controlled by block signals must operate under conditions as severe as if not worse than those involved in the case in point. It is a serious question whether the railway company in raising the issue has not embarrassed railway electrification just as seriously as the distribution of electrical energy to commercial customers.

As a practical matter there is no reason why such a case should be allowed to go to the lengths that this one has reached. Every power company should be in intimate touch with the inductive co-ordination work of the National Electric Light Association and the situation in its own locality, and when such a case as this begins it should be found prepared to bring all the knowledge of the subject available to the parties at interest so that a fair presentation can be made. Better yet, if the various central-station organizations are alert, such matters can be settled without resort to the courts or commissions.

Penalties of Inadequate Rates

LAST spring Secretary Hoover in a statement to the Interstate Commerce Commission on the economic function of the railroads stressed the importance of keeping utilities financially strong and unhampered by public prejudice or governmental bias. He asserted "that unless we have a quick resumption of construction the whole community—agricultural, commercial and industrial—will be gasping from a strangulation caused by insufficient transportation the moment that our business activities are resumed." The prediction then made has come true, for the country is now face to face with the greatest car shortage in the history of railroading. Lack of transportation is at the bottom of most of the present troubles. Coal, wheat and other commodities cannot be moved expeditiously, and industry is handicapped at the very time when it needs transportation most.

That railroad facilities have not been expanded everybody knows, but the railroads have been unable to increase their trackage, cars and locomotives because they lack credit, and want of credit is traceable to low earnings, and low earnings in part at least are attributable to inadequate rates. Time and again the country has been admonished not to starve its railroads, but the warning apparently has gone unheeded. State public service commissions, which are not so far removed from public opinion as the Interstate Commerce Commission, have been quicker to sense the dangers of financial starvation, with the result that, so far as electric light and power companies are concerned at least, relief, although at times tardy, has been vouchsafed and the industry has continued to expand and to care for the increased demands for electric service. In this respect the state public utility commissions have shown themselves more far-sighted and responsive than the Interstate Commerce Commission. Unfortunately, however, between the Interstate Commerce Commission on the one hand and the Railway Labor Board on the other the railroads are having a hard time. Theoretically that was not the intention. The idea was that the I. C. C. would assure honesty in finance and justice to the shipper and to the railway industry, while the Labor Board would assure justice to the workers. Practically, however, the combination does not work out that way, and while such a situation may serve as a horrible example to state public utility commissions, it is destroying the railroads and harming all industry. What we need and must have is transportation, and the quickest way to obtain this is to re-establish the credit of the railroads so that they can raise money with which to purchase rolling stock.

Power-Factor Correction on Small Transmission Systems

TOO many utility properties are constructed by pure rule-of-thumb methods. The engineer who has had to take a number of small properties and put them together into a fairly large group with transmission lines tying the various units together is in a better position to appreciate the force of this statement than any one else, because he has so often seen the methods used which make for a minimum of original investment and a maximum of operating and depreciation expense. In many cases the means employed to overcome operating troubles display such a lamentable lack of knowledge of the elementary principles of engineering on which design is based that the situation would be laughable were it not so serious. The chief difficulty is a lack of engineering knowledge to guide the owners of the property in an intelligent reduction of both investment and operating costs.

In an article in the last issue of the *Electrical World* Fred C. De Weese discusses the elementary principles underlying one of the puzzling problems that arose in handling a small system in which a few communities were tied together with transmission lines of low voltage but fair length. A few years ago small systems of this kind where they existed carried small power loads and the power-factor situation was not of great importance. Today such systems are called upon frequently to take on motor loads in a single installation that are a respectable fraction of the total system capacity. The immediate result is an apparent inadequacy of line capacity and a scramble to build heavier lines, which often do not afford an improvement in accord with the price paid. Mr. De Weese points out clearly some simple methods by which the power-factor correction needed for a small transmission system can be ascertained and how data for an intelligent decision as to the best and least expensive way of making this correction can be had. The curse of mathematical complexity has led a great many operators of small systems to assume that the subject of power-factor correction is a closed book except to the big systems. Mr. De Weese shows that this need not be the case.

The Problem of Glare, and Its Need for Investigation

THE recent drive for higher illumination as an aid to industrial efficiency has necessarily brought with it serious consideration of the question of glare, since one cannot obtain intense illumination without the use of numerous and powerful sources. Now, glare is a thing of many phases. Originally, in studying the matter, attention was chiefly directed upon the intrinsic brilliancy of the source, a factor of dominating importance when one passed from mild illuminants like the gas flame to incandescent lamps, gas or electric, of high brilliancy. More recently it has been fully recognized that the quantity of light flux independent of intrinsic brilliancy is very important, and still more recently close attention has been directed to contrast in brightness between the source and its background. For the first time in the Illuminating Engineering Society's code for industrial lighting these several factors have been taken into sufficient account and so tabulated that illuminants can be roughly evaluated with respect to their capacity for producing what in general terms we denominate glare. The data, of course, are frankly empirical, and the tabulations represent merely somewhat educated judgment as to the existence or nonexistence of glare.

The thing to which we particularly wish to direct attention is the need of further investigation of the whole subject, particularly since these preliminary values are likely to arouse considerable discussion when it is attempted practically to apply them. The problem is mainly a physiological one of great intricacy to which observational values based on general impressions apply only with many reservations. Further, the fact is that the three factors of glare here noted are not in truth independent variables. The ultimate physical fact is the concentration of visual energy in the image on the retina, with a further limitation due to the absolute value of this area as compared with the light-receiving elements upon which it falls. Beyond this the matter of contrast is far from being wholly clear of the other phenomena, and all of them depend on a factor which is only intrinsically involved in the matter of background, and that is the particular state of adaptation of the eye. Inasmuch as the retinal sensitiveness varies enormously under different conditions, the background effect may or may not have large significance and the data available are as yet somewhat imperfect. With all these limitations the tabular view of illuminants brought out in the I. E. S. code is of great practical value in classifying the rough facts, which it does from the observational standpoint in a rather complete and satisfactory way. The why and wherefore of the sensation effects here correlated can be ascertained only after considerable research, but in the larger aspect the glare tables of the code are likely to prove of immense importance in the promotion of better and safer lighting. There is much which we do not know about the theory of vision, yet it does not take much astuteness to discover when a source of light is also a source of discomfort, and therefore inevitably a source of inefficiency and of possible serious harm.

Why Pay Rental for Wire Crossings Over Railroads?

IT IS difficult to understand on what theory some railroad companies proceed in demanding rentals and privilege liability clauses in wire-crossing agreements when the wire crossings are made over tracks at points where highway crossings exist. It is particularly difficult to see any reason in such a course in cases where there are no power-line structures on the railway right-of-way and the only encroachment, if such it may be called, is the suspended conductors over the tracks within the highway limits. Yet the demand is being made, and in some cases the power companies are signing such agreements and putting themselves in the position of asking favors from the railroad company.

There are two situations involved. One is where a power line with a private right-of-way crosses a railway at a point where there is no highway. In this case the power company is probably in the same position that it occupies when dealing with any property owner whose property it desires to cross. The second situation is where highway crossings exist and the power company is operating under regularly granted franchises authorizing it to use the highways. Either case may be complicated by the desire of the power company to place structures on the railroad right-of-way. Generally, in case of real necessity, this can be avoided. Such crossings are governed in most states by commission or legislative action, and the liability of the power company for carelessness that endangers railroad operation is pretty well established. Under such conditions there is no reason why the railroad should be allowed to demand special permits, liability assumptions and rentals.

In this connection a decision of the New York Supreme Court, Appellate Division, rendered July 6, 1920, in an action brought by the New York Central Railroad against the Middleport Gas & Electric Company, is interesting. The railroad objected to the public service company crossing its right-of-way with a three-phase line, notwithstanding that the power company had no poles on the railroad's right-of-way and that its wires were suspended thirty feet above the rails. The court found for the defendant, asserting that the railroad had no greater rights and privileges than those granted by its charter and that the use of the highway for the transmission line in no way interfered with the operation of the railroad, which, even if the structure crossing its lines imposed on it an additional burden, must yield to public convenience.

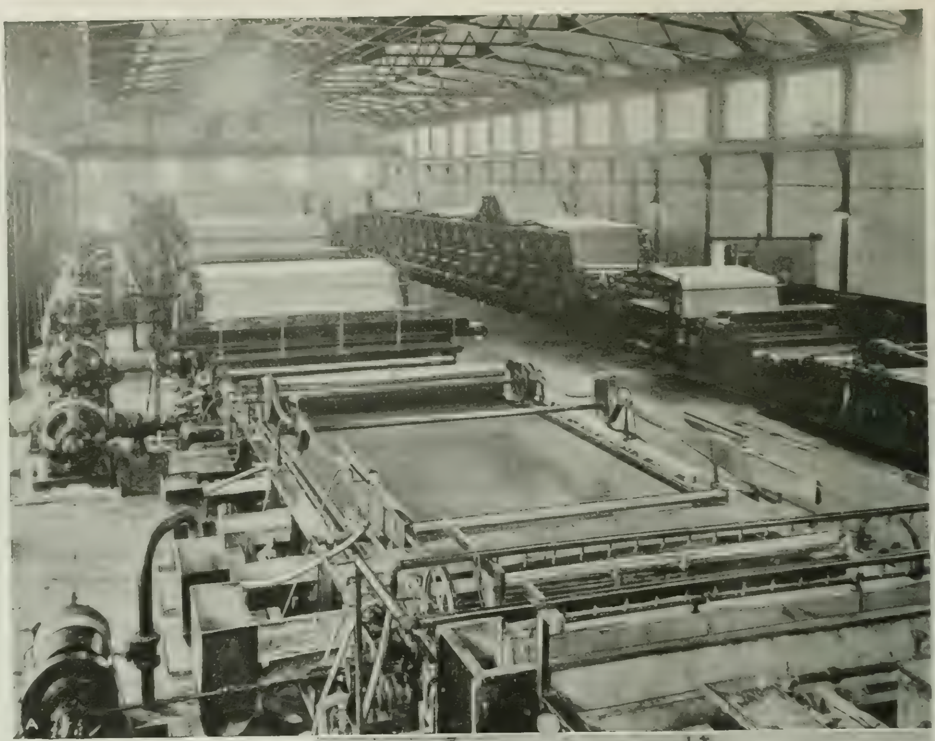
It will be well for central-station executives to scrutinize all crosssing agreements with the utmost care. In addition they should keep National Electric Light Association headquarters informed of the things demanded in such agreements that the establishment of harmful precedents may be halted.

Daylight Variations and Effect on Electric Lighting Demand

IT HAS long been realized by every operator of an electric system that a dark day means heavily increased demand, that a sudden storm may cause a heavy rise in load to come on with great rapidity, and that in general the character of the weather and the call for lights are very closely related. Some companies indeed go to the pains of keeping an actual daylight recorder in service, showing graphically the weather conditions every day in the year, and gain thereby a considerable insight into the probabilities of unexpected calls for service. Under exceptional conditions, such as sudden storms and pocketing of city smoke in the canyons formed by buildings, load has been known to rise at the rate of 1,000 kw. a minute, and the call for desperate activity at the generating stations is so acute that any means of foreseeing trouble is an important aid in continuity of good service.

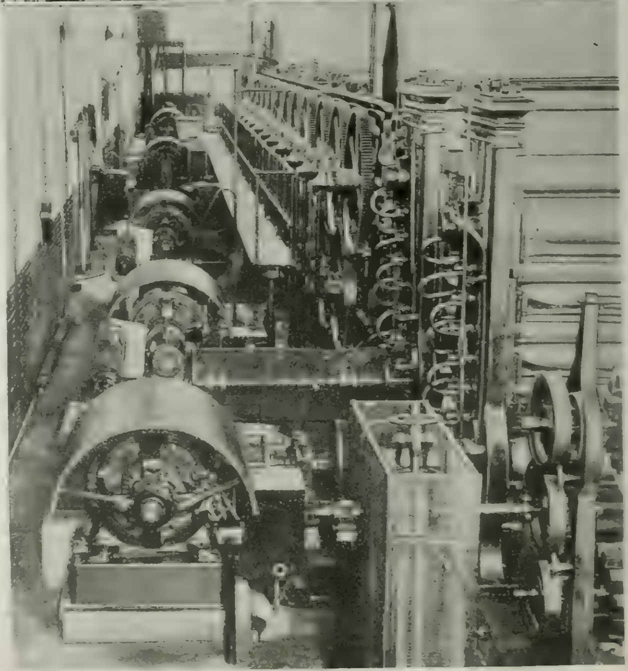
Some exceptionally important data on this subject have been collected by the Potomac Electric Power Company, Washington, D. C., which show the actual fall in exterior illumination with the resulting demand for added lighting. While most of the data are for summer conditions, the winter results must be reckoned as fairly similar in kind—at times very like but more impressive in degree. The particular correlation which impresses one as being of direct practical applicability is that between the foot-candles of illumination in the open and the average call for added artificial lighting. An approximate survey with a photometer compared with the demand records at the station showed that whenever the illumination in the open fell below 1,500 foot-candles a rise in demand was evident, the rise being greater as the illumination fell below this figure. This minimum corresponded to about 360 foot-candles at a west window at 4 p.m. and to about 9 foot-candles six feet away from the window. This condition is absolutely typical of the average office. Near the window the natural illumination is brilliant even when the sky brightness is considerably reduced, but as this brightness falls the gradient within the room seems to increase, so that at ten or fifteen feet inside the windows the illumination has fallen to a very low figure. Even 9 foot-candles, which one ordinarily thinks of as brilliant lighting, is painfully low when it results from a sudden cutting down of the daylight illumination, for it deals with an eye light-adapted to an intense degree and consequently slow in adjusting itself to rapidly increasing darkness. The practical value of illumination at which there is sudden demand for more light is sometimes referred to as the psychological darkness, although it might better be called a physiological darkness, since it is the effect of sudden decrease in upsetting the visual functions. This experimental value of brightness was correlated with the work done in the Weather Bureau, where a constant record of solar radiation is kept, and the data here obtained checked excellently with the photometric readings.

The important feature of the investigation from a practical standpoint is in the possibility it discloses of giving advance knowledge of a drop in illumination likely to pass below the psychological limit, so that due preparations can be made for meeting the demand for light. Where recording instruments can be placed at strategic locations, interesting opportunities are afforded for forecasting the light requirements.



Sectional Drive Invades Paper Industry

THE electric motor finds an ideal application in the paper industry. The size of the machines, the speed control, the power demand and the production process are all elements which favor the motor drive. The wood pulp mixed with water and other liquid constituents is formed in a sheet on the table shown in the upper foreground. It then passes through rolls where various finishing operations occur such as drying, sizing, trimming. These rolls must have adjustable speed control and sectional drive and yet must have fixed speeds relative to each other, so that motor control apparatus is needed which is very sensitive. This condition, combined with the large amount of power required to drive the rolls, has led to new advances in control engineering. The pictures show views of the book paper machines in the plant of the West Virginia Pulp & Paper Company at Tyrone, Pa.



Simplification of Paper Mill Drive Control

A Development in Electric Drive Which Has Produced a Refinement in Motor Control and Regulation Applicable to Many Other Industries — Utilizes the Principle of Differential Frequency

ELECTRICITY has proved to be adapted for power for paper production because of its inherent advantages in generation, distribution and control and because of the superior qualities of the mill equipment developed to utilize the power. The paper mill industry, like the steel industry, requires continuous production, few workmen, an enormous capital investment in plant and machinery and a large area of floor space with applications of large amounts of the energy at widely separated locations. In addition, because of the production process, a refinement in energy control and speed regulation is required to as great a degree as in any other industry excepting possibly the silk mill factories.

The paper business is among the first six industries in this country. In twenty years the number of paper mills in the United States has increased 40 per cent, and the 1,600 mills now installed have a capacity which has changed from 2,800,000 tons in 1899 to 8,700,000 tons in 1920. The per capita increase in the production of paper between 1895 and 1920 is 142 per cent; of pig iron, 91 per cent; of coal, 80 per cent. This great development has been brought about both by the increased use of paper and by the discovery of new uses for paper. More than eleven and a quarter billion copies of newspapers are now printed annually in this country.

Up to about 1900 paper mills were driven by steam engines through the agency of line shafts, belts, gears and pulleys. This type of drive involved a frictional loss of from 15 to 25 per cent of the energy of the engine, utilized a very large amount of floor space, involved dangerous hazards to the workmen, required a very great amount of maintenance and was limited in magnitude, speed and control. The electric motor invaded the field and today several mills have installations of more than 15,000 hp. each and there is a tendency to increase the size of new mills.

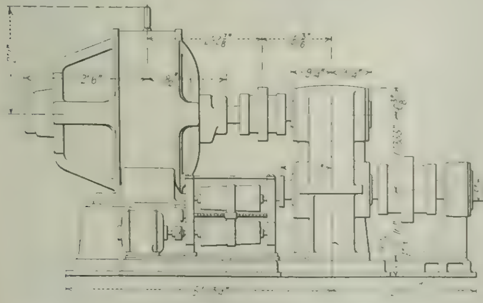


FIG. 1—TYPICAL DIMENSIONS OF A GEAR-DRIVE UNIT WITH SPEED-CONTROL MECHANISMS

Three-phase alternating-current motors are used almost universally except on the paper machine itself. For the pumps, Jordans and clippers the squirrel-cage induction motor has been found suitable, although the wound-rotor type is also used. For beaters, conveyors and large calenders the wound-rotor type of induction motor is popular, although recently the synchronous motor has been used with success to drive grinders and Jordans. It also has proved useful for the motor-generator sets used to supply direct current for the motors driving the paper machine.

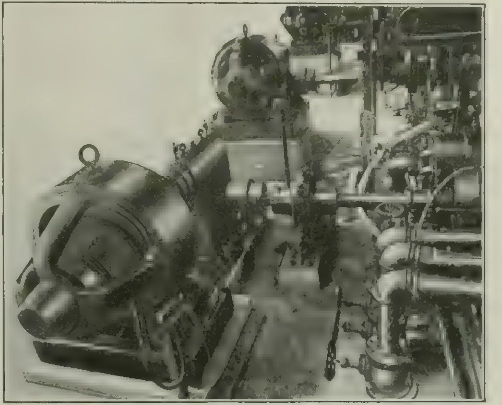


FIG. 2—A DRIVING-MOTOR UNIT MAY BE ARRANGED FOR DIRECT CONNECTION OR FOR STRAIGHT LINE OR RIGHT ANGLE GEAR DRIVE, DEPENDING ON SPACE AND SPEED REQUIREMENTS

The application which proved the great stumbling block in electrifying the paper mill was that to the paper machine. This machine consists of massive sections as shown in frontispiece, each section having an individual driving motor either directly or through gears. From a production standpoint it is necessary to control the relative speed of the driving motors within a fraction of 1 per cent, and in addition the whole mill must operate at different speeds, which are adjusted to the type of paper being made. These paper machines operate twenty-four hours a day for six days a week, and a shutdown may involve a production loss of from $5,000 to $15,000 for each day of lost operation. The maximum operating speed of a mill is about 1,200 ft. per minute and the minimum 200 ft. per minute. The limiting element in increasing the speed is the time required for forming the paper sheet before it enters the rolls and driers.

As the sheet of paper passes through the paper machine, it is dried and rolled, and the driving motors must be controlled to prevent the sheet being spoiled through its tendency to shorten or to lengthen because of temperature changes, variations in the grade of the paper and variations in load brought about by changes in bearing friction, paper thickness or paper breakage. The solution of this control problem is one of the finest examples of the ingenuity and inventive genius of American engineers.

Because of the speed and control requirements the direct-current motor is best adapted to sectional drive. The war gave impetus to its development so that three distinct systems are now available—the Westinghouse and General Electric in this country and the Harland system in Canada. These different systems all use the direct-current driving motor but differ in the mechanical arrangements of the control system. In each system, however, corrective operation of the control is brought about by a tendency to a change in the relative speed of the mill sections.

Tyrone Plant Typical

As a typical example of the development of the sectional drive of one manufacturer, the paper mill of the West Virginia Pulp & Paper Company, at Tyrone, Pa., will be used. This mill has a 98-in. 250/500-ft. per minute Fourdrinier book machine with a sectional drive involving about 400 hp. in motors; and a 166-in. 250/500-ft. per minute Pusey & Jones book machine having a 600-hp. sectional drive installation. The whole mill has about 4,000 hp. in motors, each of the five Jordans being driven by a 175-hp. synchronous motor and the sixteen beaters being driven by wound-rotor induction motors.

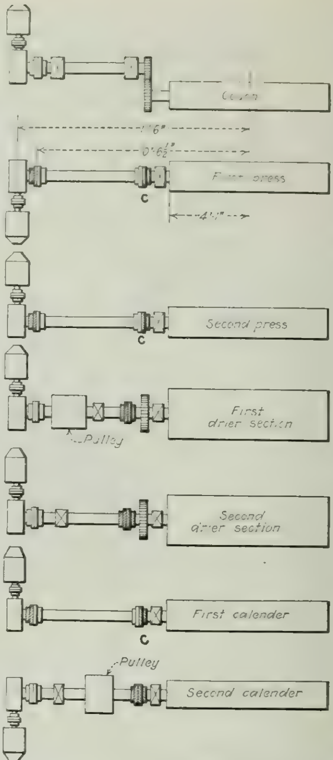


FIG. 3—A PAPER MACHINE WITH SECTIONAL DRIVE USING RIGHT-ANGLED GEARED MOTORS

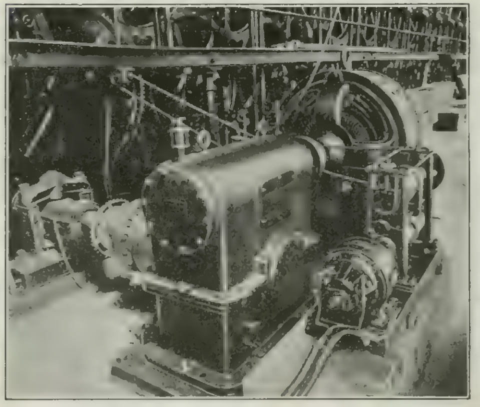
About three years ago the Westinghouse Electric & Manufacturing Company made an installation of sectional-drive control equipment on a Crocker-Wheeler motor installation at the plant of the Gould Paper Company at Lyons Falls, N. Y. Following this development, a complete installation was made for the two machines at the Tyrone plant. In line with a policy of simplification and improvement, within the past few months the control equipment on the 98-in. machine has been completely remodeled, and this latest type is being used on new installations.

The motors used in sectional drive are adjustable-speed, interpole, direct-current, shunt motors having both armature and field control. The starting torque requirement is very severe, and the motors must be designed with this in view. Upon starting, relays are used to give full field and armature resistance control. The drier motors may have dynamic braking in some installations and the calendar motors may be reversible. The motors may be directly connected or geared. In the Tyrone plant a right-angled worm-gear drive is used with Timken roller bearings.

A synchronous motor-generator set with directly connected exciter is used for the direct-current power supply for each paper machine. A motor-operated field rheostat in the field of the generator gives armature voltage control, and the exciter furnishes a constant-voltage direct-current supply for the driving-motor fields, which also have field resistance for control.

The armatures of all the motors are connected in parallel to the main direct-current buses, and through push-button control stations and the motor-operated field rheostat the voltage of this bus may be adjusted to give a required speed for the machine which is determined by the machine operator.

All motors on a machine adjust themselves to the speed required to conform to the load and applied voltage, but it is extremely difficult to design seven motors sufficiently similar in characteristics to change their speeds in the same ratio as armature voltage change and impossible to secure fixed relative speeds if



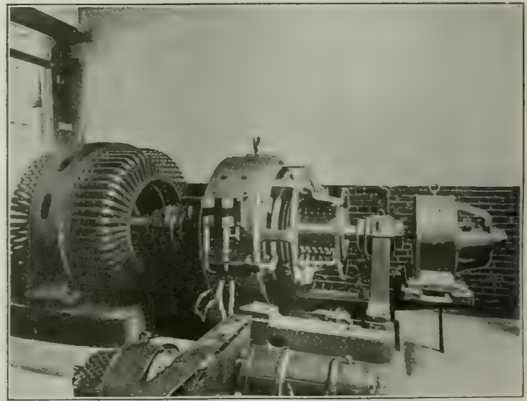
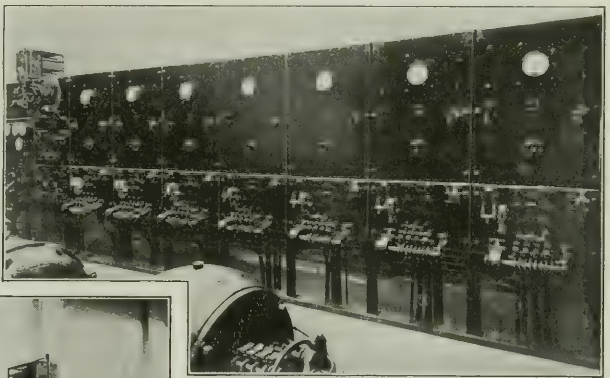


FIG. 4 (LEFT)—A DRIVING-MOTOR UNIT SHOWING CONE-PULLEY SPEED-ADJUSTING DEVICE AND SECTION COMMUTATOR SWITCH. FIG. 5 (RIGHT)—IN THE FOREGROUND IS A PART OF THE MASTER COMMUTATOR SWITCH WITH ITS DRIVING MOTOR. IN THE REAR IS THE SYNCHRONOUS MOTOR D.C. GENERATOR SET AND EXCITER FOR SUPPLYING ENERGY TO ONE PAPER MACHINE

TABLE I—INSTALLATIONS OF THE HARLAND ENGINEERING COMPANY IN CANADA

Company	Location	Machines	F.P.M.	Product
Laurentide Co.... . . .	Grand'mére	Two 166-in.	1,000	Newsprint
Belgo Paper Co., Ltd...	Shawinigan Falls	One 232-in.	800	Newsprint
St. Lawrence Paper Mills, Ltd..... .	Three Rivers	Two 166-in.	1,000	Newsprint
Interlake Tissue Mills, Ltd..........	Thorold	One 148-in.	100, 500	Tissue and bond
Howard Smith Paper Mills, Ltd.	Crabtree Mills	One 92-in.	80, 400	Book and bond
Provincial Paper Mills Co., Ltd....	Port Arthur	One 148-in.	100, 500	Book and bond

the paper changes in thickness between machine sections. The problem was difficult because the relative speeds could not vary more than one-tenth of 1 per cent if continuous production of paper was desired. It was attacked by designing an automatic field control for each motor of the machine. The control mechanism for changing the field was the paper-machine unit itself; that is, a change in the speed of one unit relative to the speed of the other sections would actuate the electric control system so as to bring the speed of the individual unit motor back to synchronism. Fig. 2 shows a driving motor geared to the slow-speed shaft of a paper-machine unit. In the frontispiece illustration on page 1032 are shown the motors connected to the different units of the 166-in. machine at Tyrone. Fig. 3 shows a typical paper-machine layout with gear drive.



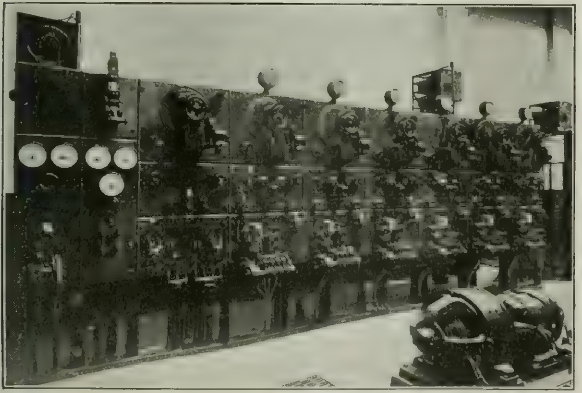


FIG. 6—VIEWS OF SWITCHBOARD PANELS FOR SECTIONAL DRIVE PAPER MACHINES

Upper view shows the new control board and the lower view the old. A marked simplification is noted on the new panel. The lower section of each driving motor panel on the new board contains the motor-starting resistance control, which is similar in the two systems. At the extreme left is the panel on the motor-generator power supply set. On each driving motor panel on the new board the field rheostat is locked in position and no movable parts appear.

Figs. 1 and 4 show views of a unit drive with the control equipment designed to secure a slight adjustment in the fixed speed of the unit relative to the others. A sprocket-and-chain arrangement from the motor-drive shaft is connected to the top cone pulley. This in turn is belted to another cone pulley, which in turn is connected to the automatic speed-control mechanism. A shift of the belt by means of a hand-operated device changes the relative speed of the top and bottom cone pulley, and this in turn actuates the automatic control mechanism to obtain a change in the speed of the motor driving the unit. This cone-pulley device is usually used when the paper machine is driven at several operating speeds and gives a range of about 30 per cent relative speed change.

The older type of automatic control indicated in Fig. 7, designed to care for incidental speed changes caused by the passing sheet of paper and successfully operating on the 166-in. machine at the Tyrone mill, has several contacts and moving parts. The small master-frequency generator is driven by a direct-current motor which is in parallel with the section-driving motors, and this small frequency generator requires alternating-current excitation. A section-frequency generator is driven by each section-driving motor through the cone-pulley speed-control set. The section contactor switch is a synchronous-type relay and makes contacts in one direction or the other when there is a difference in frequency between the section generator and the master generator. Upon the closure of the contacts a motor-operated rheostat in the field of the section-driving motor is energized and the field current varied to change the speed of the driving motor until the frequency generators are in synchronism. Thus in making paper the control will care for any changes in the relative speed of the sections. For each of the mill speeds this control is able to maintain automatically a fixed relative speed between sections. A master push-button station controls the starting and stopping of the paper machine and section push-button stations are used to control the starting and stopping of each unit of the machine.

In the newer type of control, illustrated in Figs. 2 and 8, the mechanical arrangement of the paper machine, adjustable-speed control and cone-pulley device are undisturbed, but the automatic control has been simplified greatly. The lower-cone pulley on each unit is connected to a rotating commutator switch (see Fig. 4), consisting of segmental rings, part of each ring being an insulator and part a conductor, and brushes. A portion of a similarly constructed master rotating commutator switch (see Fig. 5) is connected to the unit switch, and these two switches are in shunt with the shunt-field resistance of the driving-motor unit (see Fig. 8). Other portions of the master commutator switch are similarly connected through other segments to other unit commutator switches in shunt with the field resistances of each of

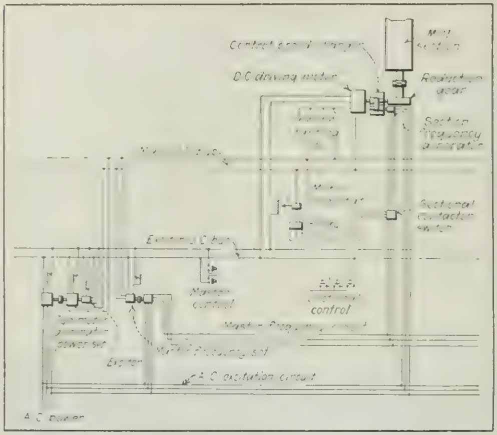


FIG. 7—SCHEMATIC DIAGRAM OF OLD CONTROL SYSTEM

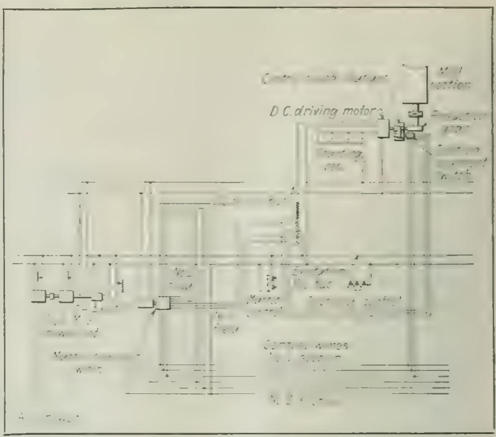


FIG. 8—SCHEMATIC DIAGRAM OF NEW MOTOR CONTROL SYSTEM

the other driving motors. The master commutator switch is driven by a direct-current motor whose armature is in parallel with those of the driving motors of the paper machine. Each unit commutator switch is driven by its individual paper-machine section through the cone-pulley device. Any change in speed of a unit of the paper machine thus causes a change in the relative positions of the segmental rings on the master switch and unit switch. This change in displacement is utilized to short-circuit or insert more resistance in the field of the unit-driving motor, depending on the direction of the speed change, and this causes the unit-driving motor to change its speed until synchronism again exists between segment displacements on the commutator switches. Several segments are used on each unit switch and the master switch in order to bring about a gradual change in field resistance. By a proper preliminary adjustment for each unit-driving motor the control circuits are arranged so that automatic speed of adjustments occur should the unit of the paper machine either decrease or increase its speed relative to the other units. The current carried in the control circuit is very small, and the speed of the commutator switches is on the order of 100 r.p.m., so that reliable operation can be obtained. The accuracy of the control is such that the relative speed change is limited to one-twentieth of 1 per cent. A comparison of the switchboards (Fig. 6) indicates the remarkable simplicity in the control system, and the solution of this problem has made possible the adaptation of the same principles and equipment to other industrial production processes where fixed relative speeds are required.

Marconi Radio Concession in Portugal and Its Colonies

THE Department of Commerce reports that the Portuguese government is authorized by a recent bill to contract with the Marconi Wireless Telegraph Company, Ltd., for a system of radio telephone and telegraph stations in Lisbon, the Azores, Madeira, Cape Verde and Angola, and Mozambique. The bill provides that this authority must be exercised within three months from date of approval so that all installations may be complete within four years. The Marconi company must bind itself to organize a Portuguese Radio Telegraph & Telephone Company, the board of directors of which shall be composed of six members, five of whom shall be Portuguese citizens. At least two-thirds of the capital of the new company shall be reserved for subscription in Portugal.

TABLE II—TYPICAL INSTALLATIONS OF THE GENERAL ELECTRIC COMPANY

Company	Location	Machine	Sections	Date
Crown Williamette Paper Co.	West Linn, Ore.	164-in. Bagley & Sewell	9	November, 1920
Bagley & Sewell, No. 1 (for Ontario Paper Co	Thorold, Ont.	164-in. Bagley & Sewell	9	November, 1921
Bagley & Sewell, Nos. 2, 3, 4 and 5	Three Rivers, Canada	164-in. Bagley & Sewell	9	April, May, June, August, 1922
Kimberly & Clark, No. 1	Niagara Falls, N. Y.	196-in. Pusey & Jones	9	1920
Kimberly & Clark No. 2	Niagara Falls, N. Y.	196-in. Pusey & Jones	9	On order
Mead Pulp & Paper Co., No. 1	Chillicothe, Ohio	152-in. Pusey & Jones	8	1921
Mead Pulp & Paper Co., No. 2	Chillicothe, Ohio	152-in. Pusey & Jones	8	1921
Spanish River	Canada	162-in. Pusey & Jones	8	1921
Consolidated Water, Power & Paper Co.	Wisconsin Rapids, Wisconsin	162-in. Beloit	10	July, 1921
P. H. Gletfelter Co.	Spring Grove, Pa.	170-in. Black & Clewson	..	On order
Kalamazoo Vegetable Product Co.	Kalamazoo, Mich.	164-in. Bagley & Sewell	..	On order

TABLE III—TYPICAL INSTALLATIONS OF THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

Company	Location	Machine	F.P.M.	Date
Abitibi Power & Paper Co.	Iroquois Falls, N. Y.	150-in. Pusey & Jones	400 800	May, 1921
Arrowhead Mills, Inc.	Fulton, N. Y.	144-in. Rice, Barton & Fabs	50 200	June, 1921
West Virginia Pulp & Paper Co.	Tyrone, Pa.	98-in. Fourdrinier	250 500	September, 1921
West Virginia Pulp & Paper Co	....	166-in Pusey & Jones	250 500	September, 1921
Brown Co.	Berlin, N. H.	136-in. Bagley & Sewell	400/1,200	On order
Riverside Fibre & Paper Co.	Appleton, Wis.	116-in. Beloit Iron Works	150 600	On order
Washington Pulp & Paper Corp.	Port Angelus, Wash.	164-in. Bagley & Sewell	400 1,200	On order

Meaning of Inductive Co-ordination*

Consideration of the Conditions Which Are Encountered on Power and Telephone Systems in Actual Operation and Suggestions for the Practical Handling of the Problem

By J. C. DAMON
Engineer West Penn Power Company

THE problem of inductive interference is a mutual one, for power service and telephone service must be rendered to the same public at the same places, and the cost of both will be paid by the same ultimate consumers. In many new parts of the country there would be no use for telephones were the power lines taken away, and, on the other hand, telephones are so necessary to the operation of power systems that some large power companies maintain telephone systems of their own which compare well with the smaller public exchanges. In at least one state the largest single bill paid to the telephone company is paid by the power company.

The ideal basis for a co-operative solution would be that which a well-informed manager of both interests would adopt. Since both interests are not under one manager, the best which can be done is for both sides to become thoroughly well informed on the problem in all its aspects and to co-operate whole-heartedly. Since the fields of force cannot be escaped, engineers must work to control their effects.

ELECTRICAL PHENOMENA MET IN PRACTICE

Every conductor carrying a current or having a potential different from its surroundings is accompanied by a field of force. It takes energy to build up this field, and when it disappears energy is given back. This field of force can be visualized as in Fig. 1 for a straight conductor far removed from other objects. The magnetic field indicated by the concentric circles is proportional to the current, and the dielectric field indicated by the radial lines is proportional to the potential. This field theoretically extends to an infinite distance, but the intensity of either field in such an ideally simple case as that illustrated is inversely proportional to the distance from the conductor.

For every change in the current or potential a corresponding change occurs in the accompanying field. Every conductor within this field is affected by the change. This effect is called induction and is the basis not only of noise in telephones, but of every useful application of electricity which we know, except possibly electrolytic and heating actions, and these, if not dependent upon the surrounding fields, are nevertheless always accompanied by them. Without this induction, no transformer, motor, generator, condenser, magnet or vacuum tube would operate. The potential induced on a conductor through the dielectric field is opposite to that of the conductor inducing it. Any change of current in a conductor because of the accompanying change of magnetic field tends to cause an opposite change of current in any parallel conductor. These laws of nature are inescapable, but they can be partly controlled, and herein lies the real problem of ways and means of overcoming inductive interference.

There are two possible lines of attack:

1. To reduce or neutralize the fields of force.
2. To reduce or neutralize the induced potentials caused by a given field of force.

Fig. 2 illustrates the fields surrounding two parallel conductors carrying equal and opposite currents. In this case the fields are concentrated between the wires, but tend to neutralize each other, so that relatively little field exists at a distance. The closer the wires are to each other the more complete is the neutralization of the fields.

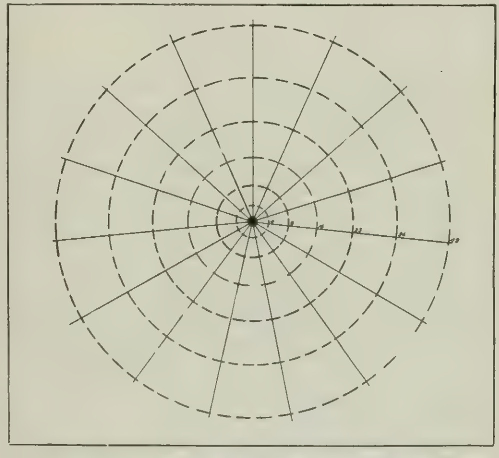


FIG. 1 — THE MAGNETIC FIELD AROUND A CONDUCTOR UNDER IDEAL SIMPLE CONDITIONS IS INVERSELY PROPORTIONAL TO THE DISTANCE FROM THE CONDUCTOR

The potentials induced in the two wires of a telephone circuit by a power circuit will be in the same direction and therefore would neutralize each other in the circuit if they were exactly equal in all respects. Because of the spacing of telephone wires they are in different parts of the field and usually have slightly different induced potentials which do not neutralize. A much more complete neutralization can be obtained by interchanging the relative positions of the two wires at intervals within the field, and this is the principle of transpositions.

A telephone conversation is a complex electrical phenomenon carried over the wires by waves of electricity in many different frequencies. Voice range (including harmonics) goes from about 100 cycles to 4,000 cycles per second, but the important range in the telephone is

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*Paper presented at the fifteenth annual convention of the Pennsylvania Electric Association, Bedford Springs, Pa., Sept. 6-9.

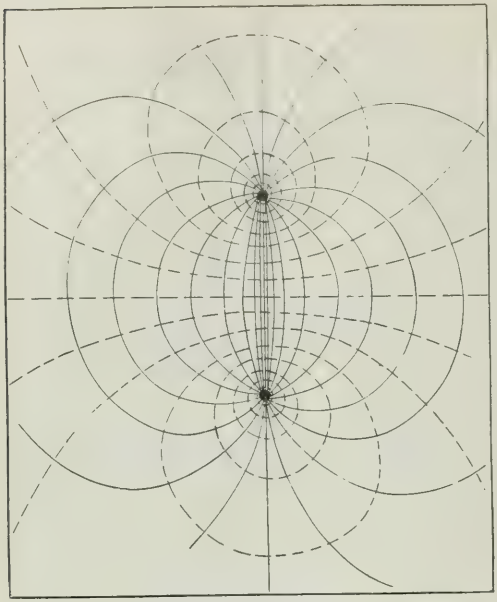


FIG. 2—FIELD OF FORCE SURROUNDING TWO CONDUCTORS CARRYING EQUAL AND OPPOSITE CURRENTS

from 200 cycles to 1,200 cycles per second. Any electric waves in this range induced in the telephone circuit and not neutralized will affect the quality of the voice, and if of sufficient intensity will make the conversation unintelligible.

To give an illustration of the magnitude of the currents used in telephoning, the current of an ordinary electric light is sufficient to make an audible noise in two or three million receivers of the usual type and in many more of the sensitive radio type. The inductive problem therefore involves very minute currents compared with those used in power circuits.

The ordinary transmission frequencies of 25 cycles and 60 cycles do not come in the voice range, and if power circuits involved only pure sine waves of these frequencies, the inductive-interference problem would under normal conditions be confined to telegraph and other low-frequency circuits. A pure sine wave would be represented as in Fig. 3. Sine waves of different frequencies combine with each other and make waves which are not sine waves. For instance, a pure sine wave and its third harmonic can be combined in different ways, two of which are illustrated in Fig. 5. In one case a flat-top resultant wave is caused and in the other a peaked wave. With different phase relations waves shaped still differently would result.

In a three-phase system—and this covers most transmission today—there are three fundamental waves traveling in three wires which reach their maximum at successive times as illustrated in Fig. 4. The algebraic sum of the three waves is always zero in a balanced three-phase system, and therefore they tend to neutralize each other. Such a transmission system of three sine waves with algebraic sum equal to zero would be perfectly satisfactory and effective for the transmission of power and would cause virtually no field of force which could disturb telephones. Unfortunately in the present state of the art and with materials available such pure sine waves cannot be maintained in any power system. For this reason power companies have often been accused of needlessly and wantonly disturbing telephone communication by harmonics which they did not need or use.

Harmonics come principally from three sources:

(a) Details of machine design, such as slots, pole edges, commutation, etc.

(b) The iron in transformers, especially when worked at high densities.

(c) Arcs as in arc lamps, electric arc furnaces, etc.

Practically only odd integral harmonics occur. These are observed up to the thirty-fifth, but are of very small magnitude above the nineteenth or twenty-first. The harmonics up to the thirty-fifth are shown in Table I for 60-cycle and 25-cycle systems. All the 60-cycle harmonics come within the voice range, and all the 25-cycle harmonics except the third do likewise. Only the fifth to the twenty-first harmonics of 60 cycles and the ninth and higher harmonics of 25 cycles come in the more important range for telephones.

There are other factors which determine the importance of various harmonics. The telephone receiver now in common use is not equally sensitive to all frequencies. Considering a 60-cycle system, the telephone receiver is fourteen times as sensitive tó the third harmonic as to the fundamental and 110 times as sensitive to the ninth harmonic. Its maximum sensitiveness comes between 900 cycles and 1,000 cycles.

Another important factor is that under like conditions the current induced in a parallel circuit by a given current is proportional to the frequency. That is, if a current of 1 amp. in a power circuit at 60 cycles would induce 1 milliampere in a neighboring circuit, then 1 amp. at 900 cycles would induce fifteen times as much current, or 15 milliamperes, in the same neighboring circuit. This, taken with the sensitiveness of the receiver, would make the effect on the receiver 1,700 times as great as that produced by a current of 1 amp. at 60 cycles.

In a three-phase system the triple harmonics—that is, the third, ninth, fifteenth, etc.—are especially important. The triples of all three phases are in phase (as is shown for the third harmonic in the small waves of Fig. 5) and reinforce each other instead of neutralizing each other.

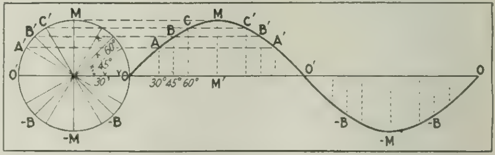


FIG. 3—THE PURE SINE WAVE

The ordinates represent time and the abscissas voltage or current, as the case may be. The part OO′O represents one cycle. In a 60-cycle system OO′O would be one-sixtieth of a second and the wave would be the fundamental of that system. just as in music the waves of higher frequency are called harmonics (the wave of double frequency would be the second harmonic and that of three times the frequency the third harmonic and so on).

In an isolated neutral three-wire, three-phase system the triple harmonic currents have no return path and are therefore limited to the small current to charge the electrostatic capacity of the system to ground, but third harmonic potentials appear out on the line. In this case, therefore, there will be little magnetic induction but there may be some dielectric induction. On the other hand, with a three-phase, four-wire system or with more than one grounded neutral there is a good return path through the neutral, and triple harmonic currents will flow with relatively low voltage, causing magnetic induction but little dielectric induction. Unneutralized currents and voltages like the triple harmonics are called residuals and are the main sources of induction. There are other causes of residuals, such as unbalanced loads, unbalanced capacity of line wires to each other and to ground, unbalanced inductance and unbalanced resistance.

The power man can do relatively little with existing systems to reduce the residuals and their fields of force except to maintain the system in good balance and in good order, but as changes are made and the system is added to he should be on the watch to improve his conditions. He should specify close adherence to a sine wave at all loads for his generators. Just how close will depend upon the type and speed, but manufacturers can in many cases do better than the requirements in this respect. Transformers should not be worked above normal voltage and as far as possible should use delta connections so as to shunt out triple harmonics. Where three-phase transformers are used star-connected with grounded neutral the core type tends to suppress triple harmonics and is therefore preferable to the shell type, but in spite of this a third winding, connected in delta, may be needed to suppress triple harmonics satisfactorily.

TABLE I—THIRD TO THIRTY-FIFTH HARMONICS FOR 25 CYCLES AND 60 CYCLES

Harmonic	60 Cycles	25 Cycles	Harmonic	60 Cycles	25 Cycles
Third	180	75	Twenty-first	1,260	525
Fifth	300	125	Twenty-third	1,380	575
Seventh	420	175	Twenty-fifth	1,500	625
Ninth	540	225	Twenty-seventh	1,620	675
Eleventh	660	275	Twenty-ninth	1,740	725
Thirteenth	780	325	Thirty-first	1,860	775
Fifteenth	900	375	Thirty-third	1,980	825
Seventeenth	1,020	425	Thirty-fifth	2,100	875
Nineteenth	1,140	475			

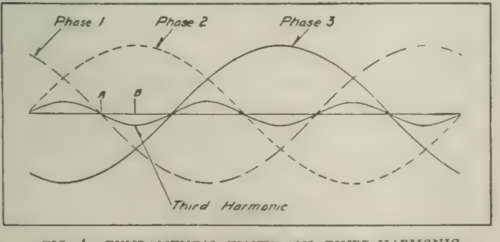


FIG. 4—FUNDAMENTAL WAVES AND THIRD HARMONIC IN A THREE-PHASE SYSTEM

The triples of all three phases are in phase and reinforce in place of neutralizing each other.

The configuration of lines should be chosen to give as good balance as possible. Uniform spacing of conductors throughout the line is always desirable. For single-circuit lines the equilateral triangle gives the best balance, and flat spacing with two wires on one side of the pole and one on the other is the worst. The isosceles and right triangle spacings are intermediate. The separation of the wires has little influence on the effect of residuals, but does influence the field owing to balanced components. Excessive spacing should therefore be avoided, but there is no object in crowding the wires together. Grounded sky wires have a shielding effect on residuals, but they may in some cases unbalance the capacity of the different wires so as to increase the residuals.

Transposing the power line does not itself reduce the effect of residuals, but such transpositions tend to balance the line and in this way to reduce the residuals. It is therefore advisable to have at least one "barrel" in each transmission line of any length, but frequent transpositions are not necessary. A "barrel" is where each wire successively occupies all three positions for equal distances. Two transpositions will, therefore, give a "barrel." Where telephone lines parallel power lines the transpositions in the two lines should be coordinated. For double-circuit lines the best configuration is to have each circuit vertical. The middle wire may be offset either way from the vertical without detriment as shown in A (Fig. 6). The balance of different configurations of double-circuit power lines will be the best, and therefore give the lowest residuals, if the phases are cross-connected as shown in B (Fig. 6). Within the length of a parallel with a telephone line the cross-connection which will give the least inductive field may be different from that shown in B (Fig. 6), but it will vary with the other conditions.

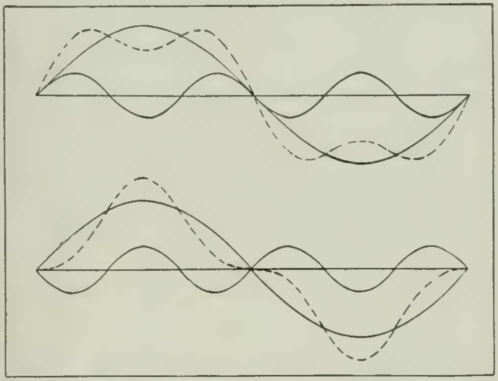


FIG. 5—TWO OF THE WAYS IN WHICH A PURE SINE WAVE AND ITS THIRD HARMONIC CAN BE COMBINED

When the power man has taken all the precautions he reasonably can, the fields of force going out from his lines will be very small compared with the energy he is transmitting, but they will still be very powerful compared with the fields of force going out from telephone lines, and it will be possible with instruments and arrangements now known to detect them many miles away. These fields of force cannot be eliminated or avoided, but fortunately their effects can be neutralized.

If a telephone circuit were perfectly and uniformly balanced as to resistance, inductance, capacity and insulation, and transposed so that the average location of the two wires were the same, it would be immune to external fields. It is only by approaching quite closely this ideal condition that telephones are operated over lines strung on the same poles with very high-voltage transmission lines.

Perfection is not attained by human agencies, and therefore consideration of the effect of various factors will be enlightening. Resistance balance can be commercially obtained to a very close degree as the art of wire manufacture is highly developed. It requires some supervision over the making of joints and the use of uniform wire. It is not sufficient to have the total resistance of the two wires the same, but the distribution of the resistance must also be the same. The inductance of the two wires of a circuit is usually the same provided that they are of the same material and are not unequally exposed to outside magnetic material. The capacity of each wire depends upon its distance from other wires, ground and grounded objects. It is, therefore, harder to control, but can be balanced by uniform spacing and sufficient transpositions. Getting insulation balance is largely a question of getting the insulation resistance sufficiently high. It is necessary to have the distribution of the insulation resistance the same, as well as the total insulation resistance of each wire.

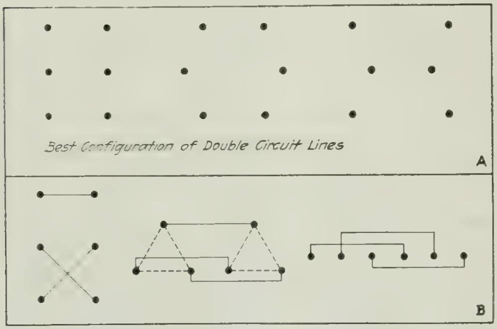


FIG. 6A — BEST CONFIGURATION OF DOUBLE-CIRCUIT LINES; FIG. 6B—CROSS-CONNECTION OF PHASES ON DOUBLE CIRCUIT LINES THAT ARE BEST AND GIVE LOWEST RESIDUALS

Terminal apparatus, loading coils, etc., connected into the circuit must also be balanced in the same respects as the lines. These can be subjected to routine tests in manufacture and are not suitable for use unless properly balanced. On subscribers' circuits some arrangements are in common use which are not balanced, and ground connections are made which do not connect to neutral points. These circuits are not immune to outside fields, but fortunately are usually short and little exposed. They are not suitable circuits for use where exposed to interference. The induction in telephone circuits is roughly proportional to the length exposed to an outside field, to the strength of the field, to the frequency of alternation of the field, to the spacing of the wires of the telephone circuit and to the unbalance of the telephone circuit. The last two items are controllable only in the telephone system.

If only two wire metallic circuits connecting two stations together were in use, the problem of inductive interference would be relatively simple, but the amount of wire required to serve the subscribers on this system would be enormous. For this reason phantom circuits are used and telegraph circuits are operated over telephone lines. Four telephone wires will make two metallic circuits and one phantom as illustrated in Fig. 7.

The two metallic circuits are called side circuits, and the circuit obtained from the middle or neutral points of impedances or transformers across the side circuits is the phantom. By connections through impedance coils or transformers and condensers from these same neutral points to ground two telegraph circuits can be obtained. By putting impedances or transformers across the phantom circuit a third telegraph circuit can be obtained. Thus four wires will permit three conversations and three telegraph circuits, which, if quadruplexed, would mean six telegraph messages each way, all at the same time. If high-frequency carrier currents are used for telephoning, the number of telephone conversations can be multiplied three or four times. All these messages will go through without interference or getting mixed up, provided everything is balanced and properly adjusted. Such achievements are wonderful and reflect great credit on the ingenuity and ability of the telephone engineers. They also show that it is entirely feasible to maintain close balance and thorough transposition systems in telephone lines, for such schemes will not work without them. On the other hand, observe how completely a system like that covers the range of frequency which has been involved in power supply systems these many years. The telegraph is affected by the fundamental and lower harmonics and the telephone by the other harmonics up to quite high ones, and then it is but a step to the frequencies employed for the carrier currents.

Covering such a field, the logical place to neutralize outside disturbances is in the telephone circuit. There are very great advantages in doing this, for at the same time the effect of atmospheric electrical disturbances, induction from other telephone lines, induction from telegraph lines and noise from the many uses of one circuit are all cured at the same time.

The separation of the wires of a telephone circuit in accordance with standard practice on a ten-pin arm is desirable because it keeps down the electrostatic capacity between the wires and helps transmission. However, the induction being proportional to the spacing, it is one of the most important contributing causes of interference. The pole-pin circuit has one and a third times as wide spacing as the other circuits and should pick up that much more noise. The spacing of a phantom circuit is equivalent to the distance between the centers of the side circuits, which is 24 in. The phantom should therefore be expected to be twice as noisy as a 12-in.-spaced side circuit under like conditions of balance.

It is therefore evident that whenever so many thousand or hundred noise units are reported as created in a telephone line by power lines it is necessary to know in addition the balance of the telephone line and whether it is a side, a phantom or a pole-pin circuit.

Having seen that there are two sides to the inductive-interference problem, it is worth while to review the practical handling of it. In the past court records and commission rulings on such cases fill volumes, and the decisions range from one extreme to the other. Very little constructive progress has been made in this way, but today the National Electric Light Association and the largest telephone interests are getting together in a manner that bids fair to radically improve these conditions.

The greatest constructive work toward the solution of the inductive-interference problems up to the last year was that of the California Joint Committee of

Power and Telephone Interests, whose final report was published in 1919. The technical work of this report was enormous. A large share of it was done by the splendid organization of the American Telephone & Telegraph Company, and the final draft of the report was largely drawn by these engineers and in the spirit which grew up against the court and commission method of settling problems. This report is summarized under seven guiding principles for preventing interference:

1. Avoidance of close proximity.
2. Elimination or suppression of harmonics.
3. Limitation of residuals.
4. Reduction of intensity of induction by favorable arrangements of conductors.
5. Neutralization of induction by co-ordinated transposition systems.
6. Balancing of metallic communication circuits.
7. High-grade construction and care in the operation and maintenance of power circuits.

Principle 1 above is emphasized by the statement: "By no other means can complete freedom from interference be obtained." While not detracting from the excellence and value of the report in general, this is a wrong guide. The same people want and will have both services at the same place, and if they come over long distances they must often follow the same routes. In the ideal case shown in Fig. 1, the fields of force are reduced in proportion to the distance from the conductors, but in the more complex practical cases the inductive effects vary under different conditions from inverse proportion to the distance to inversely as the third power of the distance. Taking an average, or inversely as the square of the distance, it is evident that the benefit of separation falls off rapidly. With 10 ft. separation a further separation of 10 ft. would quarter the inductive effect, but when 1,000 ft. away it takes a further separation of 1,000 ft. to get a like reduction. Miles of separation of long parallels will not give complete freedom from interference unless other conditions previously outlined are fulfilled. If these other conditions are fulfilled, wide separations are not necessary, even though desirable.

In many cases the only avenues of approach to the consumers of both services are the highways and both must use them. To make separation the primary principle of the solution of the inductive-interference problem is to fly in the face of progress, for the tendencies of the times are to greater density of population and more universal service. Joint-pole construction and not separation will be the line of future development, and economic forces are already pressing hard in this direction.

The second and third principles are to be applied wholly to the power systems. The fourth and fifth involve both systems and serve to emphasize the fact that the problem is mutual. It must be noted, however, that the telephone systems have not made the slightest change in their configuration or spacing for the reduction of interference, notwithstanding the fact that phantoms which now pick up the most noise because of double spacing could be so arranged as to have an equivalent of nearly zero spacing.

The sixth principle is the only one applying to the communication system alone, and the telephone engineers have made thorough studies and developed wonderful methods for measuring the factors involved. They get marvelously close balance on some of the longest circuits. However, in many cases of inductive interference this factor is wholly neglected. The power man in his own interests should understand the importance of balance in telephone circuits and see that it is not neglected wherever his circuits are concerned in inductive interference. Not only the circuit as a whole should be balanced, but each section of the circuit should be balanced within itself. It is both futile and unjust to make expensive changes in power circuits for a small reduction of interference when a large reduction could be obtained at less cost by balancing the telephone circuit. The telephone circuit using one wire and ground is 100 per cent out of balance and is not suitable for use in regions where the public is to have power service. The seventh principle as stated applies only to power circuits, and the text gives as the reason for this principle the severe momentary disturbances in communication circuits during abnormal conditions in the power circuits. It can easily be appreciated that the telephones, which are operated by a few thousandths of a watt at the most, can hardly be made immune to the thousands or even hundreds of thousands of kilowatts that can surge unbalanced in a large power system under abnormal conditions. For this reason, as well as for the protection of his own service, the power man should spare no effort to prevent such conditions and to limit their duration when they are unpreventable.

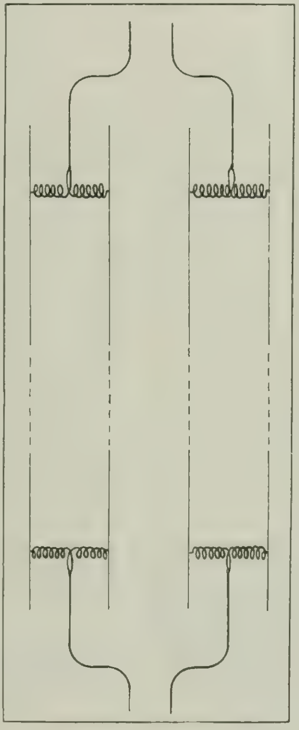


FIG. 7—METHOD OF MAKING UP PHANTOM TELEPHONE CIRCUIT

There is no less obligation, however, upon the telephone men to use equal care in the construction, operation and maintenance of their circuits. The one-sided statement of the seventh principle has prevented it from accomplishing the greatest good.

The fact that inductive interference problems must be mutually solved is being more clearly recognized every day, and the joint work now being done by the National Electric Light Association and the American Telephone & Telegraph Company bids fair to give courts and commissions much relief and to solve the problems as they primarily must be solved—by the engineers of the two interests. The closer the touch maintained between the power and the telephone engineers the more easily will the difficulties be overcome.

Transmission-Line Construction in Japan

As One Result of the Rapid Development of Water Power the Art of Transmission Has Become Highly Specialized—Thirteen Lines, Four Carrying 154,000 Volts, Will Serve Tokyo and Osaka

By **ERNEST V. PANNELL**
Engineer British Aluminum Company, New York

PROBABLY no country in the world is converting potential water power into electrical energy at so great a rate as Japan. Water-power rights are vested in the state, and the various prefectures have authority amounting to a veto at the discretion of the governor; nevertheless these facts have not acted as a hindrance to the free and logical development of natural resources. As an illustration, one large power company supplying the city of Osaka is already operating four plants producing 40,000 hp. and is developing nine other sites which will yield 250,000 hp. additional, most of these sites being now under construction and scheduled for operation within the next two years. This system is one typical of at least half a dozen power networks in a similar state of development.

In general the watershed which forms the Sierras of Japan lies along the northern shore of the island and the industrial cities are on the south. Chief among the latter are Tokyo (population 2,500,000) and Osaka (population 1,500,000). Power developed in the mountains is therefore carried across the central plain in a southerly direction to the seaports and the centers of industry, and the transmission-line art has been highly developed. The following are the principal systems operating high-tension transmission lines to supply the two principal cities:

	Kv.
TOKYO	
Tokyo Electric Light Company	154
Keihin Electric Power Company	154
Inawashiro hydro-electric development	110
Gumma Electric Power Company	110
Katsuragawa hydro-electric development	77
Kinugawa Electric Power Company	77
Fuji Gasu Power Company	66
OSAKA	
Nippon Electric Power Company	154
Daido Electric Power Company	154
Ujigawa Power Company	77
Taisho Water Power Company	77
Kansai Water Power Company	77

The four 154-kv. lines mentioned above are now under construction, together with a power line of similar voltage in the island of Formosa, this figure of 154 kv. having been adopted as a standard. Transmission distance for the longest lines does not generally exceed 150 miles, but, with the present tendency to interconnection, a great number of power sources and receiving points are tied into a network so that the average distance of transmission is reduced. Any group of public utility corporations may be compelled to merge where it is in the interest of the general public, the decision in such a case being given by the Department of Communications. This is a federal department of considerable authority and also of considerable utility because it is concerned with railroads, telephones and telegraphs and also with power transmission. The department can therefore co-ordinate conflicting interests in such matters as telephone interference and crossing construction; indeed, the first-mentioned consideration has been responsible for the wide use of delta high-tension connections or, alternatively, of a relatively high resistance in the ground connection of a Y system.

In addition to the groups of systems above mentioned, extensive power networks are in operation or under construction in the islands of Kiushiu, Shikoku and Formosa. The Shikoku power centers are expected to be tied in with a 400-mile superpower network linking Osaka with Moji and there connecting with the Kiushiu systems. In the near future also a very extensive power development on the Shinano River will be made by the Imperial Japanese Railways, now in course of being electrified. This will involve transmission at 154 kv. and at lower voltages also.

GOVERNMENT SUPERVISION EXISTS

Pole and tower line design is based upon the recommendations of the Department of Communications not only as regards crossings but in relation to the entire line, whether on private right-of-way or not, and all designs have to be submitted to the department as well as to the local prefecture for approval. The loading assumptions are of two kinds, depending upon whether or not the district is subject to sleet: (a) Wind load of 20 lb. per square foot on projected area of wire, no sleet; (b) wind load of 10 lb. per square foot on projected area of wire, ¼ in. sleet.

In districts where sleet does not prevail it is seen that a higher wind load is calculated upon. For the conductors a maximum stress of one-half the ultimate figure is allowed, with the following minimum specifications for tensile strength:

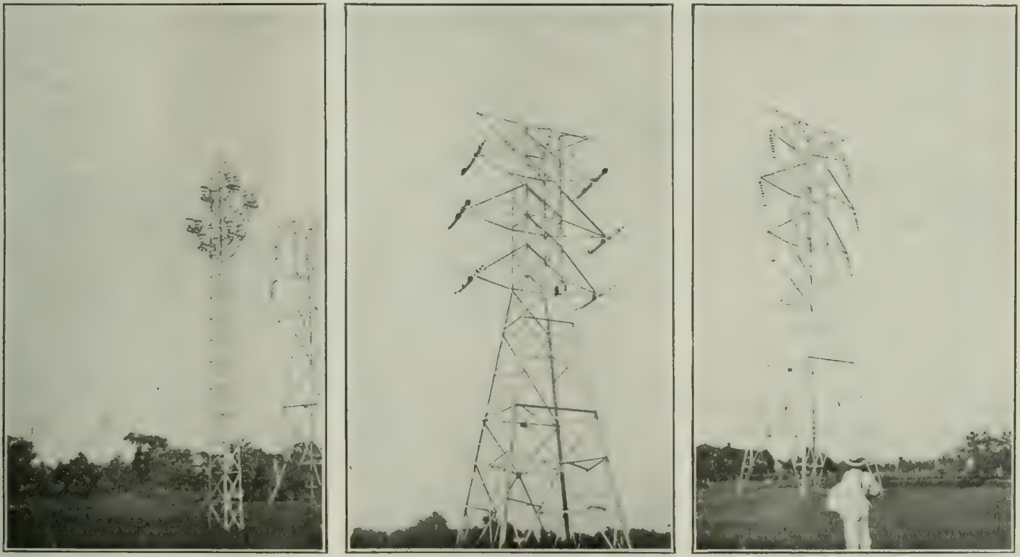
	Lb. Per Square Inch
Copper, hard-drawn	50,000
Copper, annealed	30,000
Aluminum	23,000
Iron	50,000

Steel-cored aluminum is being extensively used on practically all the new power lines, especially in the mountain districts where the corona disruptive voltage is low. The tensile strength of this material varies with the make-up of the cable from 40,000 lb. to 50,000 lb. per square inch. Investigation is now being made by the department with a view to establishing its properties. There is a tendency not to string aluminum-steel conductors as tightly as copper because a small sag can be realized with a lower tension and tower steel can be saved. At the same time there are many long river crossings where it is desirable to work up to 50 per cent of the ultimate tensile strength of the cable.

Wooden-pole lines are extensively used, the most typical construction consisting of two poles braced together with steel channel cross-arms and three pin-type insulators for a single 77,000-volt circuit. The spans are from 300 ft. to 400 ft. and the poles are guyed at angles. A special design for crossings is required by the Department of Communications. In this case there are two insulators for each wire. A short additional length of cable is tied to the extra insulator and securely joined to the main cable on each side of the pole about 3 ft. out. In this way if an insulator flashes over and the wire is burned off, it cannot fall in the road, because the other insulator will hold it. The same construction is used both for highways and railroad crossings. For wooden poles the design loading calls for a wind pressure of 24 lb. per square foot of projected surface at right angles to the line, with a safety factor of five on the pole.

Present construction is of steel in nearly every case, and for 110 kv. and more suspension insulators are used, but there is a strong tendency to perpetuate the use of pin-type insulators for line voltages up to 77,000. Tower steel is fabricated in Japan, but a number of orders are placed with American concerns because in most cases their designs are better. In Japan the shops are not laid out especially for tower work, but for general structural designs; consequently they are not equipped with the templates and shearing and punching machinery for the many small members required in a transmission tower. For the same reason Japanese towers use a number of gusset plates and what would be considered in America unnecessary members. The subject of transmission-tower design is being very carefully studied in Japan, and a series of experimental tests on full-size designs is being carried out at the Kyoto Imperial University under the supervision of Prof. E. Aoyagi.

Insulators are made in Japan by the Nippon Insulator Company, at Nagoya, the historic center of the porcelain industry, and by the Shofu Insulator Company at Kyoto. Both of these companies produce the metal-cap form of suspension unit in addition to the large pin-type units for 66 kv. and 77 kv. Most units are of white finish, as it is believed to be easier to locate a defective insulator by its discoloration. A large number of insulators are imported from America, and it is a common thing to see American and Japanese insulators hung on different circuits on the same tower. No grading shields have yet been employed, but experiments have been made with a ring-shaped device, and it will probably be used on one of the 154-kv. lines now being built. Insulator hardware is made in Japan, but there is a certain amount of dissatisfaction resulting from the use of malleable iron fittings, and Japanese shops are not as yet equipped for drop-forging these products. The climate of Japan is for the most part very moist, and galvanizing has therefore a very short life. In many parts of the country it would be better to paint the towers and fittings, because the rapid deterioration constitutes a distinct hazard.



LEFT—STEEL TOWERS ARE GUYED TO WITHSTAND ABNORMAL STORM CONDITIONS ON THE LINES OF THE TOKYO ELECTRIC LIGHT COMPANY. CENTER—A TOWER FOR A 6-DEG. HORIZONTAL ANGLE ON THE LINE OF THE INAWASHIRO POWER COMPANY HAS 50-LB. BALANCING WEIGHTS. RIGHT—ANCHOR TOWERS ARE USED EXTENSIVELY ON THE LINES OF THE INAWASHIRO POWER COMPANY

One feature of the line design used is well known to all engineers who have been concerned with construction in mountain districts. The steep profiles necessitate in places towers at widely different elevations involving a "pull-up" at the lower suspension point. "Tie-down" insulator strings have been used on the lower tower at such locations, but the usual troubles have been experienced with flashing over and rapid deterioration of the lower insulator, so that the tendency now is to use weights at such a point, in this way maintaining the flexible characteristics of a suspension insulator line. The same procedure has been adopted where a suspension tower is used for small deviations from alignment to prevent the insulator swinging in and grounding the wire on the tower frame. Indeed, in one case weights are now in use after the towers have been modified by the addition of an extra bracket for us with tie-down insulators.

Construction work in the field is influenced by the fact that for the most part the terrain is swamp or mountain. For this reason and because the standard of proficiency is very low among the laborers towers are built up from the ground piecemeal, three men being able to complete a 4,000-lb. tower in a ten-hour day if the conditions are good. The stubs are, of course, set first, generally in concrete. Most of the tower lines run across the paddy fields, which are in a semi-liquid condition during most of the year, and this condition, together with the frequent earthquakes, has been responsible for the subsidence of foundations on some of the older tower lines. This has been corrected by guying in several places to patent anchors driven deep enough to reach solid ground. In some more serious cases the tower members have been braced with timber as a reinforcement against distortion.

Some Towers Assembled on Ground and Hoisted Into Place

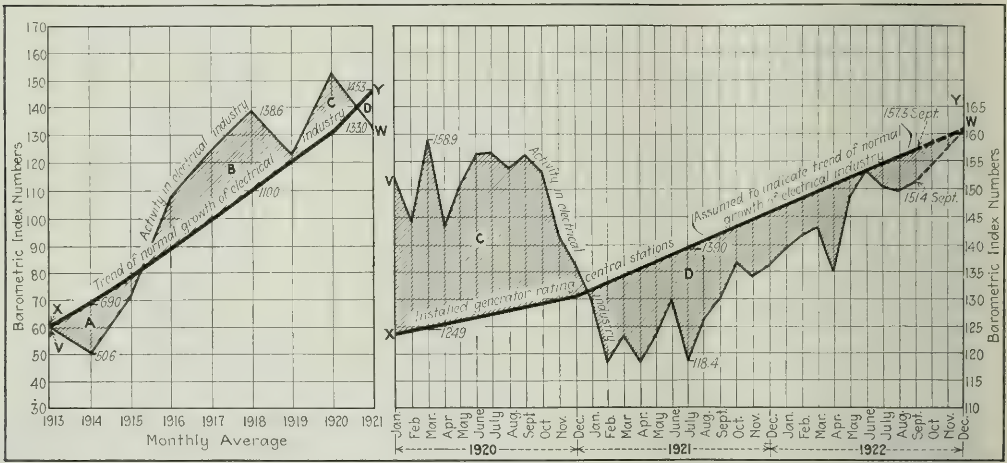
In a few isolated cases towers have been assembled on the ground and afterward hoisted into place. Owing to the difficulty of using a team or a truck, a capstan has been set up and the fall of the lifting tackle connected to it. Then a dozen men have taken the capstan bars and raised the tower to the sound of the invariable chanty. A windlass has been used for wire stringing, but the result has not been so satisfactory, and it is more usual to strain up entirely by manual tension with the usual tackle and dynamometer. As a field crew consists of at least twenty-five to thirty men, there is plenty of power available of an unskilled type and at a comparatively low cost.

The illustrations printed with this article relate to a double-circuit 110-kv. line recently built from Kanai to a point near Tokyo, a distance of 83 miles. The average standard span is 600 ft., with a river crossing of 1,300 ft. Six conductors and two ground wires are installed, with a 10-ft. vertical spacing. Five different types of tower are employed for horizontal angles of 6 deg., 15 deg., 30 deg., angle suspension and tangent and angle anchor towers. The weight of the towers varies from 5,700 lb. to 13,000 lb. Most of the footings are concrete.

Settlement of Strikes Brings Industrial Progress

INDEX figures upon which the "Electrical World Barometer of Business Conditions in the Electrical Industry" is based indicate that September activity within the industry as a whole was the highest since June, the record month of 1922. The continued coal and railroad strikes took their toll from American industry during July and August, but early September witnessed the termination of both of these retarding forces, and there was a subsequent increased activity in many primary industries during the later part of that month.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



The "Electrical World Barometer" indicates that during the month of September business conditions in the electrical industry, taken as a whole, showed an increase of 1.4 points in the barometer scale as compared with August. The electrical industry as a whole during September was operating at 5.9 points below what would have been the point of seasonal demand if growth in the industry had been normal. In August it was operating at 6.0 points below the point of normal demand.

It must be remembered, however, that the electrical industry is essentially a growing industry. The fact, therefore, that activity in the industry during September was virtually the same number of points below the point of normal demand as in August does not necessarily mean that production and sales of electrical energy, machinery and supplies were on a par with those of August. During this one-month period thousands of new customers, both lighting and power, were undoubtedly added to the central-station lines, thereby increasing the market both for electrical energy and for apparatus. This increased market must be considered as to a large extent permanent.

Changing Two-Phase System to Three-Phase

T-Connected Auto-Transformer on Buses Allows Easy Transition as Existing Equipment Wears Out—Interconnections in Two-Phase Machines Must Be Removed

By J. F. PRITCHARD
Electrical Engineer, Kansas City, Mo.

ALTHOUGH three-phase service prevails in the larger number of communities in the United States, there are still a great many installations, particularly in the smaller towns or cities, where it has not been possible to change installations that date back to a day in the development of the industry when two-phase service was a common thing. A real problem faces the companies, brought on by the developments which at the present time seem to have made the three-phase system all but standard. Manufacturing processes are being refined, and the tendency to cheapen these processes by eliminating a large number of types of apparatus that belong to the older developments is either making it difficult to get needed apparatus promptly or in some cases is imposing an extra cost because apparatus is not considered standard. This is a natural tendency in industry forced by economic considerations. This article offers a suggestion for changing two-phase systems to three-phase that does not involve scrapping of present investment except as it wears out in the natural course of service. The method has been successfully used in several cases and is worth careful consideration.

THE advantages of a three-phase over a two-phase system for transmission, distribution and utilization of power are too well known and recognized to necessitate reviewing here. Undoubtedly a large number of power companies now operating two-phase systems have contemplated changing to three-phase but have abandoned the idea after the first consideration of what appeared to be a large investment in new equipment, extensive new construction, new temporary feeders, rewinding machines and other items. It is the purpose of this article to describe a plan for changing a system from two-phase to three-phase with a minimum of expense and no interruptions of circuits or temporary work.

This system was developed and first used under the supervision of the writer in connection with the conversion of the electric power system at Ardmore, Okla., to three-phase. It was subsequently used under similar conditions in the municipal plant at Ottawa, Kan., under the direction of Prof. George C. Shaad of Kansas University. However, since each case presents individual problems, it is the purpose of this paper to discuss in a general way the conversion of a representative plant of this nature, rather than to describe in detail any particular set of conditions.

TWO T-CONNECTED AUTO TRANSFORMERS ARE THE BASIS OF SCHEME

The principle of the plan consists of interconnecting the two-phase buses with a pair of T-connected auto-transformers. The original two-phase buses can be represented in Fig. 1, where the letters on the bus diagram correspond to those on the vector diagram, the system consisting of two single-phase voltages, *AB* and *CD*, at a phase displacement of 90 deg. By interconnecting the two-phase buses with the T-connected auto-transformers we have the condition shown in Fig. 2. The 50 per cent point of voltage *AB* is connected to the 86.6 per cent point of voltage *CD*, throwing the two voltages into such phase relation as to produce a three-phase system between points *A*, *D* and *B*. We therefore have the condition in which we have a two-phase system *AB* and *CD* and a three-phase system *ABD* on the same four busbars. It should be noted that this applies only to an independent two-phase system, and that if the phases are already interconnected, as, for instance, at their midpoints, as is the case with some generators, they must be disconnected before the phases can be T-connected, for it is evident that the two phases cannot be interconnected at point *E* if already interconnected at some other point.

What is true of the relation of phases on the station buses of course also applies to the feeder circuits and primary distribution circuits throughout the system. The result is that by the employment of the above device a power company operating a two-phase system is in a position to take on three-phase power loads as easily as two-phase. By soliciting nothing but three-phase business and by changing the existing installations to three-phase as they need replacement or as other occasion makes possible, the entire load can be gradually converted to three-phase, on the completion of which the distribution feeders corresponding to bus *C* can be removed from the entire system, leaving a straight three-phase system.

TRANSITION CAN EXTEND OVER SEVERAL YEARS

The period required for such a transition can extend over several years if necessary, as it involves no temporary work and at any step in the conversion the system is left in an efficient operating condition.

In case it should be desired to take a three-phase installation from an existing two-phase bank of transformers, a teaser transformer with an 86.6 per cent tap must be provided and the secondaries T-connected. In case it is desired to hasten the transition to three-phase or in the case of an obstinate installation which cannot be cut over to three-phase, a transformer bank can be provided as shown in Fig. 3 with T-connected primaries and connected directly to the three-phase primaries.

With the arrangement described, since the main transformer needs only a 50 per cent tap, an ordinary transformer can be used as the 50 per cent point is usually brought out on the secondary side and can easily be brought out on the primary if necessary by drilling the case and inserting a bushing. Only the teaser with the 86.6 per cent taps need be provided. Whether this combination is connected directly to the two-phase system through the 100 per cent taps or to the three-phase primaries as shown in Fig. 3, the secondaries can be interconnected as indicated to give both two-phase and three-phase service from the four secondary wires. When the entire load on a transformer bank has been changed over to three-phase, feeder *C* in Fig. 3 can be removed and the bank cut over to straight three-phase operation.

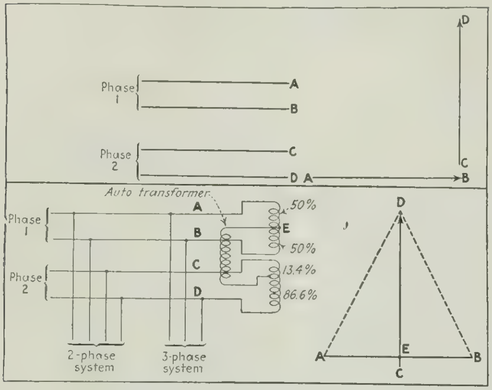


FIG. 1—TWO-PHASE BUS AND VECTOR RELATIONS OF THE PHASES
FIG. 2—METHOD OF INTERCONNECTING TWO-PHASE BUSES WITH AUTO-TRANSFORMER TO SECURE THREE-PHASE SERVICE

Since for the same load the current per conductor in the three-phase system is only 15.6 per cent greater than that in the two-phase, it will seldom be the case that larger conductors will be needed either in the primary or the secondary lines, while the fourth conductor removed from the entire system can be credited to the cost of conversion and will offset to a great extent what small investment may be required for new equipment. After all the power transformer banks have been cut over to straight three-phase operation or their primaries T-connected as shown in Fig. 3, the fourth conductor can be removed to the station on each feeder circuit, and the next step is to eliminate the fourth busbar, *C* in Fig. 2. This can be very easily accomplished by the judicious choice of T-connected transformer capacity through which the station buses are interconnected.

ORDER IN WHICH CONVERSION CAN BE EASILY MADE

Assuming first that the total station capacity is made up of generating units of different capacities, the first set of T-connected bus-tie transformers should have a capacity equal to that of the smallest generating unit. After enough three-phase load has been added to the system or converted from two-phase to load up this set of bus-tie transformers, they should be replaced by a set whose capacity equals that of the next larger generating unit, and the first set connected directly to the terminals of the smallest unit, making a three-phase machine of it.

The switchboard panel for this unit then can be worked over and the machine connected directly to buses *A*, *B* and *D* in Fig. 2. Working over the panel requires very little time or expense, as it is only necessary to remove the fourth cable and reconnect the meter circuits. Care must be taken, however, to connect the synchronizing circuit to phase *AB*, as this will be the only phase common to both the two-phase and three-phase systems. After the second set of bus-tie transformers has become well loaded with the three-phase load, they in turn should be connected to the terminals of the unit of like capacity and replaced with a set corresponding to the next larger unit. In this manner each machine is in turn converted to a three-phase unit and connected directly to buses *A*, *B* and *D*, while at any time during the transition any combination of generating capacity will supply both the two-phase and three-phase components of the load. Assuming now all of the units to be of the same capacity, the first bus-tie installation should have a capacity equivalent to that of a single unit, and the second may consist of two similar banks in parallel. Other combinations of generating units will suggest other arrangements of bus-tie transformers.

AUTO-TRANSFORMERS PERMIT SERVING TWO AND THREE-PHASE SYSTEMS SIMULTANEOUSLY

During the transition new three-phase generating units may be added to the buses, and it may be possible to carry the entire load on the three-phase units as the T-connected bus-tie transformers will function in the opposite direction and supply whatever two-phase load still remains unconverted, due regard being paid to the relative capacities of the bus-tie transformers and the remaining two-phase load.

If the plan is carried out as above described, the last two-phase machine will have been converted to a three-phase unit at the same time that the fourth wire has been completely eliminated from all the feeder circuits, and the fourth bus, *C* in Fig. 2, can then be removed, leaving a straight three-phase system throughout. The transition as above outlined will involve very little expense and no temporary work or new construction. It will also involve no interruptions whatever of any of the circuits, and it has the further advantage of being flexible in that it can either be hurried to completion or made a gradual development covering an extended period of time, the system being able to remain indefinitely in a normal operating condition at any step of the transition.

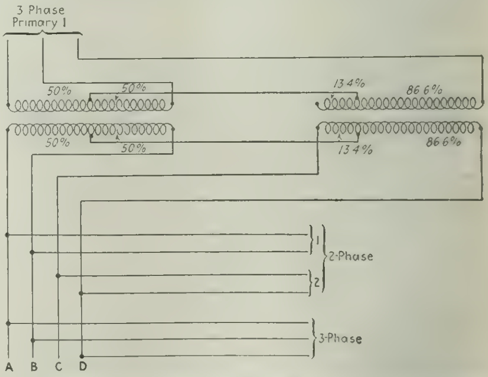


FIG. 3 — METHOD OF SECURING EITHER TWO-PHASE OR THREE-PHASE SERVICE ON CUSTOMER'S INSTALLATION IN A TRANSITION STATE BETWEEN THE TWO CLASSES OF SERVICE

Hence no company has an excuse to retain an antiquated two-phase system of generation and distribution.

Anticipating the Complaint

Virginia Railway & Power Company Finds that the Investigation of Any Unusual Consumption of Energy Before the Bill Is Rendered Virtually Eliminates Errors in Meter Reading and Pleases Customers

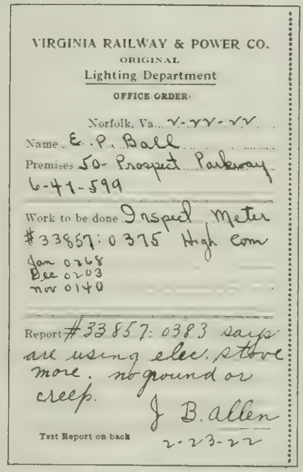
By **G. H. SMITH**
Commercial Manager Virginia Railway & Power Company, Norfolk, Va.

THE war period and the general readjustment that followed forced upon public utilities, particularly those in the metropolitan centers, many problems in overcoming irregularities developed during those times. Probably in no branch of the industry was this condition more forcibly brought to attention than through meter readings, which it frequently seemed to the customer did not accurately represent consumption. Generally speaking, conditions reached a point where the mutual confidence between the utility's customers and the company was in jeopardy.

The Norfolk situation did not differ from that in other cities, and it provided a difficult problem to solve. The inauguration of a new system was a formidable undertaking. However, after careful thought, a plan was adopted which we feel prevents in a great measure what is commonly known as a "high bill." At least, it places the company in a position where it can intelligently discuss the matter with the customer, should he or she feel that the bill is unnecessarily high.

My reason for stating the case in this manner is that we, in a measure, "anticipate the complaint." Having had in use numerous forms for the checking, inspecting and testing of meters, both gas and electric, it was deemed advisable not to modify these forms, but to use them in a slightly different manner and in several additional departments. The forms and order blanks which are in daily use are shown here.

The form shown in Fig. 1 is nothing unusual, except that it is the one used to cover request for information from one department to another. Fig. 2 shows the bill with the report attached sent to the consumer after an investigation has been made. After this investigation the amount of the bill can be easily determined by those whose duties include service at the complaint desk, the several steps of routine involving the meter-reading department, the inspection or service department, the bill-making department and the commercial department.



VIRGINIA RAILWAY & POWER CO.
ORIGINAL
Lighting Department
OFFICE ORDER

Norfolk, Va. 2-22-22
Name E. P. Ball
Premises 50- Prospect Parkway
6-41-599

Work to be done Inspect Meter #33857: 0375 High com
Jan 0268
Dec 0203
nov 0140

Report #33857: 0383 says are using elec. stove more. no ground or creep.
J B. allen
Test Report on back
2-23-22

FIG. 1—FORM USED FOR ORDERING INVESTIGATION OF UNUSUAL CONSUMPTION

The first step quite naturally takes place in the meter-reading department, whose duties cover the monthly indexing of meters. In fact, the first step is with the meter reader himself, who has instructions that before leaving a consumer's premises he shall make a subtraction to show the amount of service recorded by the meter. On finding that there has been an increase or a decrease in excess of 50 per cent as compared with the preceding month, he again checks the meter index to verify its correctness. At this point nearly all incorrect readings are eliminated. To show that a second examination was made, he places a mark directly after the index, which in turn is noted by the checkers when the books are turned in to the meter-reading office.

The second step is the supervision given the readings in the meter-reading department. The duties of the inspectors here are to analyze the account, studying it from previous records, noting the appliances in service or the nature of the service, and then governing their action accordingly. Should the account, after the meter-reading department's work has been done, appear to be of a nature that would attract the special attention of the consumer, the form shown in Fig. 1 is used. This is prepared in triplicate, one copy being held as a record and two copies forwarded to the inspection department. On this form are written the consumer's name, address, account number (for future identification), meter number and the nature of the information desired, with the omission, however, of any information pertaining to the index as turned in by the meter reader. Orders of this kind are forwarded to the superintendent in charge of the inspectors. The territory of these inspectors is localized in accordance with the work performed during the previous day by the meter readers. Upon completion of the investigation one copy of the order is forwarded to the commercial department and the other returned to the meter-reading department. This practice acts as a check on the work of the inspector himself.

While the inspector is at a consumer's premises his duties are to inform the consumer of the reason for his visit and to ask such questions as will enable him to assist in determining the cause for the increase or decrease. This inspection service again eliminates a great number of meter-reading inaccuracies. The copy of the order delivered to the commercial department is filed so as to make it readily accessible for explanation to the consumer later and for reference in connection with releasing the bill.

So as not to cause delay between the meter-reading department and the billing department, the route books covering the district are forwarded to the billing department. Previous information and marks, however, on the route book indicate that an inspection order is in process of being executed, and the account bearing such marks is set aside. Before releasing it the previous three months' meter readings are listed on the reverse of the bill stub. When the district has been checked, such bills are forwarded to the commercial department. This necessitates the matching of the miscellaneous orders or reports with the bills released by the billing department, and experience has taught us that invariably there is an inspection report for each bill received. The employee or complaint clerk in the commercial department then checks the data contained on the bill and on the reverse side of bill stub, comparing them with the data contained in the inspector's report. This makes it an easy matter to determine whether the bill is properly prepared.

On completion of inspection in the commercial department, the form shown in the lower left hand corner of Fig. 2 is attached to the bill. This bears the date of the inspector's visit and states that in so far as meter readings are concerned the bill as prepared is correct. It likewise invites the consumer, should he be unable to trace the cause for the increase or the decrease, to get in touch with the commercial department, which will follow the matter further. In a majority of cases, however, when the consumer visits the commercial department or makes his request by letter, the data in hand (in the inspector's report) are sufficient to convince the consumer that the amount billed is for service rendered.

In case the consumer is not satisfied and believes that the meter is faulty, there is no hesitancy on the part of the company to issue a test order. Employees making the test are trained so as to be able to discuss the conditions with the consumer while they are on his premises. This final inspection nearly always convinces the consumer that the company's effort has been in their mutual interest, and usually the matter ends to the consumer's satisfaction.

In spite of the evidence to the contrary, there are, however, a few consumers who feel that the company's work is on its own behalf alone. In these instances we take advantage of a city ordinance which provides for a test of the meter by the city's superintendent of electrical affairs. This brings into the transaction a neutral party, whose decision determines the company's course.

It has been found that the practice described above has added little or no expense to the operating departments; in fact, a close analysis would probably show that it is a "money saver" as well as a "public pleaser."

The several steps in the process reduce the complaints to a point where very few ever reach the city authorities for a report from the city inspection department. The practice followed regarding the installation of properly approved meters is likewise helpful. Service of this kind is maintained by the city, the company paying a testing fee. All meters bear the official stamp of the city before they are installed.

A great many letters have been received commenting on the company's practice. One of these, received from a very prominent consumer and now in the company's files, is as follows:

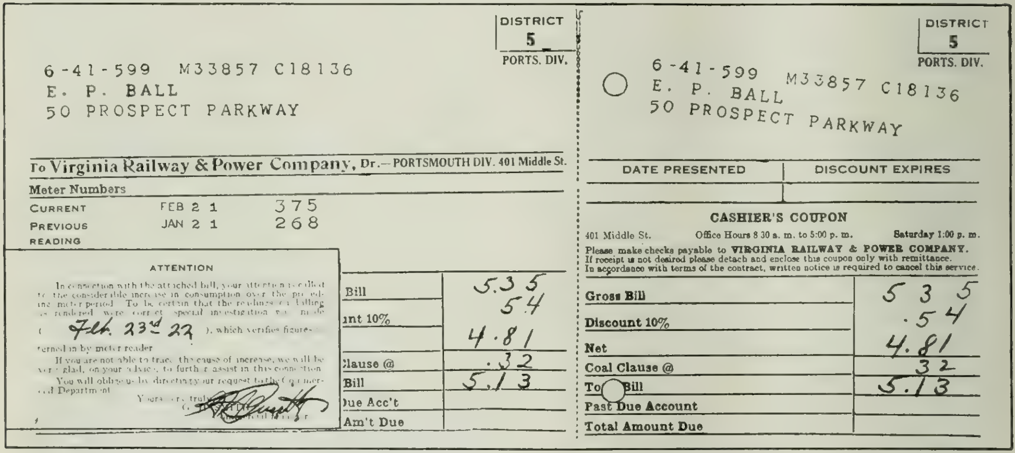
"In connection with your bill for electric service, the amount was not unexpected—an unusual report from the consuming public—as we had a great deal of sickness during the month and auxiliary heating equipment was installed. I am particularly interested in your practice and can readily understand why a company should inspect for a low consumption; but the practice in this instance is doubly interesting as it differs from what has been my experience elsewhere in the past."

Another letter from a customer reads:

"The inclosed large light bill with notation attached deserves favorable comment. This month, and once last spring, before and after our furnace was in use, we used in our home an electric heater, and naturally our light bill was larger. In both instances your meter reading was checked unsolicited; also an inspector was sent out to find leakages, if any. In each case the inspector found the reason already known to myself.

"The average consumer would expect a public utility company to chase up a decrease in bills, but the writer wishes to acknowledge the equal readiness shown to check up an increased bill."

The theory of this practice is that the best kind of defense is a strong offense. When the consumer recorded appears to be amiss an investigation is made by the company and the facts are determined before the bill is rendered. This materially affects the customer's attitude and position, for if the explanation is not satisfactory, it is squarely up to him to supply further information.



DISTRICT 5
PORTS. DIV.

6-41-599 M33857 C18136
E. P. BALL
50 PROSPECT PARKWAY

To Virginia Railway & Power Company, Dr.—PORTSMOUTH DIV. 401 Middle St.

Meter Numbers		
Current	FEB 21	375
Previous Reading	JAN 21	268

ATTENTION

In connection with the attached bill, your attention is called to the considerable increase in consumption over the preceding meter period. To be certain that the readings on billing as rendered were correct, special investigation was made (Feb. 23rd 22), which verifies figures turned in by meter reader.

If you are not able to trace the cause of increase, we will be very glad, on your advice, to further assist in this connection.

You will oblige us by directing your request to the Commercial Department.

Yours very truly,
Commercial Manager

Bill	5.35
nt 10%	.54
	4.81
lause @	.32
Bill	5.13
ue Acc't	
Am't Due	

DISTRICT 5
PORTS. DIV.

6-41-599 M33857 C18136
E. P. BALL
50 PROSPECT PARKWAY

DATE PRESENTED	DISCOUNT EXPIRES

CASHIER'S COUPON

401 Middle St. Office Hours 8 30 a. m. to 5:00 p. m. Saturday 1:00 p. m.

Please make checks payable to VIRGINIA RAILWAY & POWER COMPANY.
If receipt is not desired please detach and enclose this coupon only with remittance.
In accordance with terms of the contract, written notice is required to cancel this service.

Gross Bill	5 3 5
Discount 10%	.5 4
Net	4.81
Coal Clause @	3 2
Total Bill	5.13
Past Due Account	
Total Amount Due	

FIG. 2—BILL WITH REPORT ATTACHED SENT TO CUSTOMER AFTER METER READING HAS BEEN VERIFIED

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Dielectric Loss and Breakdown

To the Editors of the Electrical World:

When alternating voltage is applied to a dielectric the resulting current leads the voltage in phase by less than a quarter of a period. The current may thus be considered as consisting of two components, one in phase and the other in quadrature with the voltage. But the trouble is that, with the composite insulating substances used in practice, neither of these components may be predetermined or bears any known relation to the constants of the substance as determined by continuous-current measurements. The charging component is not determined by the dielectric constant, nor the watt component by either the insulation resistance or any known law of dielectric hysteresis. These several properties are, in fact, so intimately and obscurely related to each other that up to this time no satisfactory theory has been found to account for the behavior of insulators under alternating stress.

One fundamental property of most insulators, which may be readily observed, is a promising starting point for research paths into this interesting field. When continuous voltage is applied, the charging current does not die out rapidly as required in a circuit with fixed constants, but decreases slowly, sometimes over a period of minutes, finally reaching a constant value determined by the insulation resistance. There is apparently a progressive penetration or soaking in of voltage, causing a slow charging current. Evershed has studied the curves of this type for various substances and offers an ingenious explanation which involves the conductivity and motion of water in capillary fibers in the insulation. No effort has been made, however, to extend this conception to the case of alternating voltage, in which, obviously, the short period of cyclic reversal applies to only the briefest initial portion of the continuous-voltage charging curve.

Maxwell suggested that dielectric hysteresis and the losses in insulation are due to variations in the values of dielectric constant throughout the mass of the insulator. Others have attempted electromechanical explanations, involving oscillating systems of different degrees of damping within the molecules of the dielectric. No one of these, however, accounts for the observed facts except in an approximate way.

At the moment there is a tendency to minimize the importance of dielectric hysteresis as a factor in insulation losses and to ascribe the phenomena of loss and breakdown to simple conductivity. In its simplest form this idea is that the conductivity varies throughout the mass of the insulator and that the current density is, therefore, greater in certain regions. Under voltage local heating results with further increase of conductivity. If the heat is dissipated fast enough, the temperature does not rise and the current is limited. With unchecked temperature rise the effect is cumulative, resulting in a "hot spot," further conductivity and breakdown.

This view is most attractive in its simplicity, and it accounts for some of the conspicuous facts, as indicated by the paper by Hayden and Steinmetz in the issue of Oct. 21, page 865. But the matter is by no means so simple as this. It does not require much study of the properties of composite insulators to realize that insulation resistance, power factor, charging current and loss vary from sample to sample in the most erratic way. High dielectric loss and high resistance may go hand in hand, and so far, comparison of observations of the quantities mentioned, through a wide variety of materials, has not yielded any suggestion of a rational relationship. However, two definite facts are slowly emerging from the few disconnected efforts being made in this field. One is that an insulator approaches breakdown, not suddenly, but relatively gradually, through a period in which the dielectric losses, either locally or generally, are greatly increased with corresponding elevation of temperature. The other is the great influence of moisture in its relation to temperature in increasing loss leading to breakdown.

While in the final stages temperature undoubtedly plays an important rôle, the evidence does not yet indicate that we may leave dielectric hysteresis out of account. It appears that in pure insulators, free from fibrous ingredients, the dielectric hysteresis loss, long supported by theory, is still the important factor. In composite insulators materials are introduced which, in the presence of water and temperature, form paths through the structure of such great conductivity as to overshadow the phenomena pertaining to pure dielectrics.

JOHN B. WHITEHEAD,
Professor of Electrical Engineering.
Johns Hopkins University,
Baltimore, Md.

Failure of Insulation

To the Editors of the Electrical World:

I consider the article by Messrs. Hayden and Steinmetz on "Insulation Failure," printed in the *Electrical World*, Oct. 21, page 865, a very valuable contribution to the subject. The idea that insulation failure may be directly attributable to high temperature will open up new methods of attack in research work. There are two questions that have occurred to me that perhaps the authors can answer:

1. It is pointed out in the article that "the disruptive strength of built-up material does not increase proportionally to the number of layers or thickness, but at a materially less rate." In accordance with the thermal theory, does this hold if the applied voltage is sufficiently high to cause the insulation to fail before any appreciable amount of heat can be dissipated by conduction, convection or radiation? That is, the time would be so short that practically all of the generated heat would be stored in the parts of the insulation that are highly stressed. It would seem, then, that the disruptive strength would be in proportion to the thickness.

2. If the thermal principle holds, why not place some insulating material in a thermos bottle or similar container, so as to prevent the escape of heat, then apply comparatively low voltage, just enough to heat the insulation continuously? Such voltage would be very much below that which would ordinarily be considered as needed for breakdown. It would be very interesting to note whether or not the insulation would then fail.

While the Nernst lamp glower fails to be an insulator when subjected to high temperature, it does not necessarily follow that all of the various kinds of insulations are similarly affected.

C. J. FECHHEIMER,
Research Engineer.
Power Engineering Department,
Westinghouse Electric & Manufacturing Company.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Ornamental Street Lighting in Lima, Ohio

RESIDENTIAL STREETS ADEQUATELY LIGHTED BY STANDARDS EVERY 100 FT. EQUIPPED WITH 250-CP. LAMPS

GRADUATION of candle-power, mounting height and spacing in accordance with the requirements of the individual streets is a feature of the new ornamental street-lighting installation at Lima, Ohio. The system is one of the most complete and up-to-date in the country and cost approximately $250,000. It comprises 1,245 units, extending over 16.2 miles, and covers the entire downtown business section of the city and four principal residence streets. It includes an underground system for ornamental posts operated from a turbo-generator equipment in the municipal pumping station through constant-current 6.6-amp. regulating transformers. Petitions have been circulated by property owners for several extensions.

In the public square the posts are 15 ft. high, with 1,000-cp. lamps with special refractors, throwing the light toward the center of the square. On the main business streets they are 13 ft. 3 in. high, with 400-cp. lamps. On the minor business streets and in the residence sections the height of the posts is 12 ft. 3 in., and they are equipped with 250-cp. lamps. In the downtown business section the standards are spaced 50 ft. apart. In the rest of the system the spacing is 100 ft. Throughout the system the plan of opposite spacing was adhered to. Much time and thought were devoted to the height, spacing anl location of standards and are the result of observations in all the principal cities of the Middle West, supplemented by data collected by considerable correspondence with other cities of the United States. Despite the usual pleas of property owners for changes of locations for individual posts, the Director of Public Service insisted upon the posts going in as laid out. As all now acknowledge, this has resulted in a uniformity of illumination which greatly increases the efficiency and beauty of the system.

In the installation steel-taped lead-covered cable was used for the underground system, while single-conductor rubber-covered and braided cable was used for the post wiring. Westinghouse-Cutter "Continental" posts were selected, equipped with "sol-lux" tops and "monax" diffusing glassware. The lamps for 400 cp. and upward are operated through auto-transformers in the capitals of the posts, and the 250-cp. lamps are equipped with "Regent" repeating film sockets.

The system, which is divided into ten circuits, is operated from a turbo-generator, supplemented in reserve by an engine-driven 150-kw. generator in the city pumping station, through ten 34-kva. constant-current regulating transformers. Two circuits, extending throughout the system, including street and alley intersections and the intervals between them, are on all night. The remaining light circuits are turned off at midnight. During December, 1921, the consumption was 57,000 kw.-hr., while in June, 1922, it was 33,200 kw.-hr.

A disconnecting pothead is installed in the base of each post, which in the event of a post being accidentally broken automatically disconnects the broken post, short-circuits the line and leaves the rest of the lamps burning.

The alley intersections are lighted by special brackets attached to the corners of the buildings and operated from the underground system through safety coils. By this new installation the necessity for unsightly overhead equipment has been eliminated, thus adding greatly to the appearance of the streets, hitherto cluttered up with overhead pole-line equipment.

ELMER MCCLAIN,
Formerly Director of Public Service,
Lima, Ohio.

Maintenance Periods for Oil Circuit Breakers

THE desirable interim between successive overhaulings of oil circuit breaker equipment was discussed informally at a recent meeting of the New England System Operators' Club. Opinions differed considerably as to the necessities of this work.

One large company located outside New England which was represented at the meeting tests oil switches every six to eight weeks, the tanks being removed, contacts inspected and insulators cleaned at the time. Regardless of the type of switch used, the cleaning crew includes this inspection in its routine visits to plants and substations. The troubles found are mainly of a minor nature, such as dirty insulators, occasional sparking and now and then a loose contact. Bus insulators are cleaned at the same time. In view of the hazards of this work and accidents which have at times accompanied it, the company is considering extending the interval between inspections.

Another large system overhauls its oil switches annually. Those which are subjected to severe shock at any time are overhauled immediately after the shock. Nothing of enough importance to warrant as many as six inspections a year has ever been found wrong with switches that have not performed other than their ordinary functions. The switches are cleaned as often as necessary to keep them in proper appearance and condition, whether weekly or monthly depending on the amount of construction or other work being done in the plants which would cause them to be coated with dirt and create a hazard.

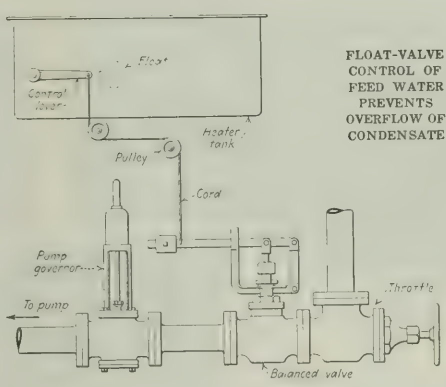
ACCESSIBILITY IMPORTANT IN OIL-SWITCH DESIGN

Operating engineers at the meeting generally agreed as to the importance of prompt inspection and overhauling of oil circuit breakers after severe trouble is experienced. The importance of accessibility in switch design, in order to give the operator requisite information as to the alignment of fixed and moving contacts, condition of contacts and other features, was emphasized. Some of the older designs of switches which are lacking greatly in convenience of interior access have operated several years without taking down, one installation of 66,000-volt oil circuit breakers being cited as operating successfully for five years after overhauling, but it was not considered good practice to allow such protracted periods to elapse between overhauls. Another operating company favors inspection of feeder switches which are opened only occasionally, about once in six months, if there are no severe short circuits. Switches on generators which are opened daily or every few days are examined every three months to insure proper condition of contacts. The frequency of inspection depends somewhat on the service rendered. The discussion brought out the importance of frequent cleaning wherever switches are in dusty locations.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Irregular Action of Feed-Water Pumps Overcome by Simple Device

TO PREVENT the loss of turbine condensate through the overflow of feed-water heater tanks caused by the hot-well pumps supplying water to the tanks at an irregular rate, the Galveston-Houston (Tex.) Electric Railway Company used the float-valve control to regulate the speed of the boiler-feed pumps in its Webster station. This station is equipped with hot-well pumps of the volute type, which are able to handle considerably more water than necessary. Consequently they will discharge a large amount of water, thoroughly draining the hot wells and all connecting water piping. This creates a partial vacuum in the feed-water heater, and as the vacuum tends to lower the head which the hot-well pumps are discharging against, additional water is pumped up by the other hot-well pump, which quite frequently causes the heater to overflow.



FLOAT-VALVE CONTROL OF FEED WATER PREVENTS OVERFLOW OF CONDENSATE

The float and external control lever used are on the same side of a fulcrum pin, and a ½-in. flexible steel cable passing through several suitably arranged metal pulleys forms the connecting link between the control lever and a balanced valve at the feed-pump throttle. A positive stop is also placed under the lever of the balanced valve to prevent the feed pump from shutting down entirely and losing its priming when the lever is in its lowest position. By having this stop drilled and tapped inside and screwed down on a small stud bolt so that the stop can be raised or lowered, considerable flexibility of operation can be obtained. A pump governor is also placed on the pump side of the balanced valve to prevent the pump from building up a pressure which would cause the relief valve to operate, and also to protect the pump and connecting piping should it be necessary to close all the feed valves.

When using this method it is desirable to regulate the feed-water valves by hand. The valves are adjusted according to the amount of water each boiler is evaporating, and the peculiarities of each boiler must be considered. Very little change in the setting of the valves will be required, regardless of changes in load, if the boilers are kept pulling together. This is comparatively easy in an oil-burning plant equipped with steam-flow meters. At this station it has been possible to run from one shift to another without touching anything but the make-up water valve, although a variable interurban and street-railway load is carried. Of course, a change is imperative at night when the light load makes it necessary to cut out boilers.

The fireman regulates the make-up water valve by the water level in the boilers when the control lever is at its central position. As the amount of makeup required is fairly constant, this setting, if anywhere near correct, will run for several hours with only a slight increase or decrease in the boiler-feed water level. With this method the boilers, turbines, condensers, etc., should be considered as forming a closed loop so that the rate of flow is entirely automatic.

It might seem that complications would arise due to sudden changes in the load, but such is not the case. If a heavy peak occurs, the boiler-water level is lowered slightly and will continue to remain in that position until the peak is over. This is due to the fact that more water is making the trip around the loop, which is an added safeguard against the boilers forcing water over to the turbines while operating under heavy ratings. When the load returns to normal the boiler-water level will pick up to one-half glass, or whatever it is set at. It would seem from this that the most desirable characteristics of a high-grade feed-water regulator are here combined in a very simple way.

This method is not recommended to displace feed-water regulators, but is suggested for trial in stations having heater troubles similar to those already mentioned. Under such conditions it will improve the feed-water temperature and will prevent the loss of condensate. It is entirely automatic. It is cheap and very easy to install and is applicable to any medium-sized power station having surface condensers and open feed-water heaters.

This scheme was suggested to the writer by C. W. Brown of the Stone & Webster engineering department as a means to overcome the trouble stated and is really an adaptation of the well-known marine control of feed water.

R. E. Gleason,
Assistant Chief Engineer,
Galveston-Houston Electric Railway,
Houston, Tex.

Testing A.-C. Watt-Hour Meters in Bulk

Labor-Saving Equipment Used in Manufacturer's Laboratory Suggests Conveniences Applicable to Utility Meter Department —Routine Tests Standardized

The large number of meters passing annually through the test of the factory with which the writer is connected has put such a premium upon labor-saving methods that some of the methods used may contain suggestions for the central-station man responsible for testing many hundreds or perhaps thousands of meters yearly.

The first requisite of a commercial testing department is adequate means for maintaining the standards of comparison. In our laboratory standard cells used with the potentiometer are employed as a primary, the cells being sent frequently to the Bureau of Standards at Washington for verification or correction. Timing is accomplished by an electric clock operating from a vibrating reed, making it possible to determine time down to one-fortieth of a second. The secondary standards are watt-hour meters kept in perfect calibration by comparison with our primary standards. The secondary standards are mounted on the test racks and compared directly with the product under examination.

The order of testing pursued is as follows:

1. Meters are carried from the assembly department to the laboratory on hand trucks, with covers in place to shield from dust and protect meters against accidental injury. A 2,000-volt breakdown test is applied between windings and base.

FIG. 1—POWER-FACTOR ADJUSTMENT BY ZERO METHOD REQUIRES MINIMUM TIME

FIG. 2—AUTOMATIC SWITCH RELEASE AND ONE-HAND MANIPULATION OF TEST PLUG SAFEGUARD OPERATOR

FIG. 3 — TWO SWITCHES SUFFICE FOR TWO POWER-FACTOR AND TWO LOAD TESTS

2. Power-factor adjustment or "quarter-phasing" is performed, to insure accuracy on loads varying from zero to 100 per cent power factor.
3. Meters are first inspected for defects, then adjusted for full load and light load accuracy.
4. Time run, to develop and magnify any residual errors.
5. Second check of power factor and speed under varying load.
6. Final breakdown test between meter base and windings, to check condition of meters after passing through testing department.

The outfit used in the 2,000-volt ground or breakdown test is shown in Fig. 2. To insure safety, the tester is required to hold the main-line switch closed while making the test. This is done by a cord held in one hand, the switch being immediately opened by a spring upon release of the cord. This occupies one hand, and the other hand is used in manipulating the test plug.

The power-factor adjustment, shown in Fig. 1, is accomplished by using a zero method, the meter being placed on a test rack below a master meter. The operator connects the current coils of the two meters in series and the potential coils in multiple. The circuits of the testing rack may be adjusted to yield an exact quarter-phase relation between the current and the voltage. With rated load passing through the meters and rated voltage impressed on the potential coils, the operator adjusts a rheostat until the master meter gives a zero indication. He then adjusts the resistance in the compensating windings of the meter under test until a condition of no rotation is obtained. When the proper adjustment is attained, the resistance is soldered to give a permanent connection. Fig. 4 shows the circuit diagram for the quarter-phasing rack. This provides for testing meters at different commercial voltages through appropriate switching and transformer connections as detailed. The load is taken from a straight potential transformer and the voltage from a multi-tap transformer giving 110, 220 and 440 volts. The power-factor adjustment is by a rheostat connected across an autotransformer, the handwheel being shown at the left of the testing rack in Fig. 1.

After the quarter-phasing operation is complete, the meters are set

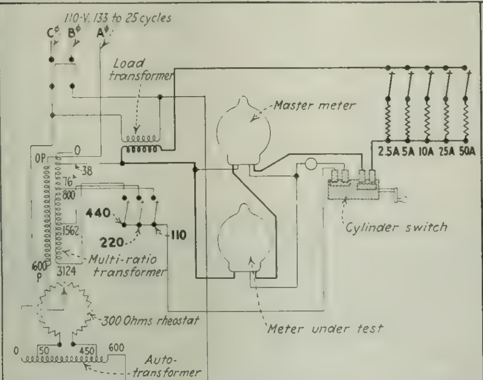


FIG. 4

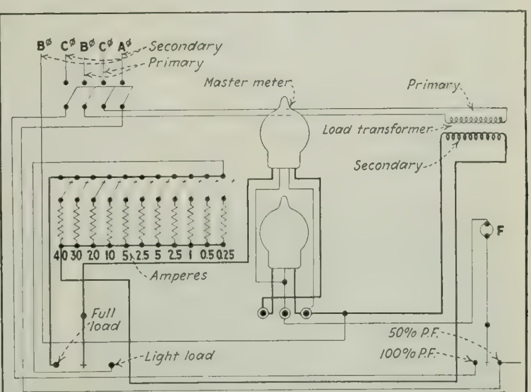


FIG. 5

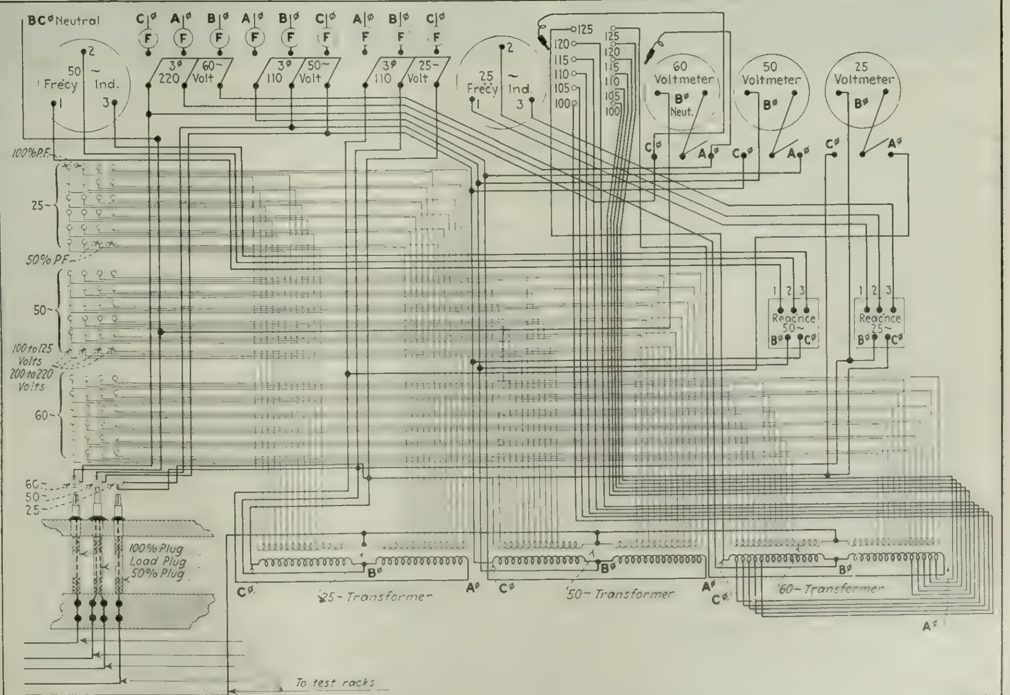


FIG. 6

FIG. 4 — QUARTER-PHASING RACK PROVIDES DIFFERENT VOLTAGES FOR TESTING METERS. FIG. 5 — WIRING OF SPEED TEST PANEL FOR VARIED LOAD AND POWER FACTOR. FIG. 6—WIRING DIAGRAM OF PLUG BOARD SHOWN IN FIG. 7

up in the racks shown in Fig. 3. Here a thoroughgoing visual inspection is made and the speed at light load and full load is compared accurately with a master meter installed just above the meter under test. Under both load conditions the test is made at 50 per cent and 100 per cent power factor. The wiring diagram of these test panel units is shown in Fig. 5. The load values are obtained by a series of knife switches cutting in and out resistance as indicated. These are not adjusted except when changing from one capacity meter to another. The two power-factor and light and full-load readings, four in all, are obtained by the simple process of manipulating two single-pole, double-throw knife switches, one for each hand. A four-pole switch at the top of the panel connects the testing rack to the main testing panel of the laboratory. The central station which uses the above testing arrangement will find it flexible and adapted to quick manipulation whether a large number of meters of one capacity or a group of varied ratings be tested.

In inspecting meters for loose screws, proper train ratio, etc., the operator blows out accumulated dust by compressed air before replacing the cover. Pipe connections for this service are provided between each pair of test racks.

On account of the range of frequencies, voltages, etc., for which meters are built, an unusually complete main distributing test board (Fig. 6 and Fig. 7) was built. The former gives the diagram of connections for this board. This board supplies energy to the testing racks where the speed adjustments are made. It consists of a group of vertical panels, each of which represents a testing rack, and appropriate receptacles in groups according to frequency. The insertion of plugs into the receptacles gives the desired energy characteristics at the test racks connected with the plugs. Beginning at the top of the board, the frequencies are 25, 50 and 60 cycles. Referring to one of the vertical panels, the two left-hand rows give the potential connections at 50 per cent power factor. The horizontal rows give different voltage steps. The testing rack has four leads from the main panel which are plugged into the board by one double-contact and two single-contact plugs. The double-contact plug is used for load connection, three receptacles being provided for this plug, or one for each frequency, and located at the bottom of the panel. The two other plugs are for the 100 per cent and 50 per cent power-factor connections. The set-up illustrated in the photograph (Fig. 7) is as follows:

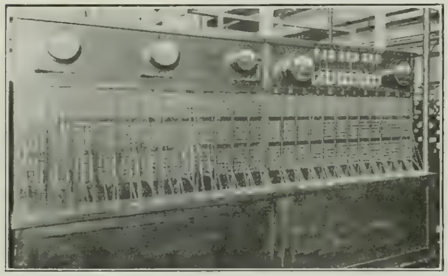


FIG. 7—SYMMETRICAL PLUG BOARD SERVES TEST PANELS WITH REQUIRED ENERGY CHARACTERISTICS

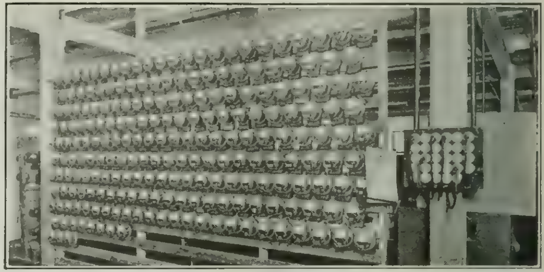


FIG. 8—GROUP OF METERS UNDERGOING A TWENTY-FOUR-HOUR RUNNING TEST ON THE TIME-RUNNING RACK

On the first panel at the left the load circuit is connected to the 60-cycle receptacle. The potential circuits are in the 60-cycle group on 220 volts. In the second panel the load circuit is on the 25-cycle receptacle and the potential circuits are in the 25-cycle group on 100 volts. In the third panel the load circuit is connected to the 50-cycle receptacle and the potential circuits are in the 50-cycle group on 125 volts. For central-station use the test board shown in Fig. 6 and Fig. 8 could be simplified and reduced in size as local conditions of voltage and frequency permitted.

A group of meters undergoing a twenty-four-hour running test on the time-running rack is shown in Fig. 8. The laboratory has a present capacity for testing 2,000 alternating-current watt-hour meters per day, allowing a time run of twenty-four hours per meter. J. HENRY HODDE,

Superintendent Testing Laboratories.
Sangamo Electric Company,
Springfield, Ill.

Steps Taken to Standardize Rating of Arc-Welding Apparatus

AT PRESENT a prospective purchaser of welding equipment is bewildered by the confusing claims concerning special merits of different machines on the market, and unless he has had previous experience in welding he has no basis for judging the relative advantages of the several types. Recognizing the need of a standard method of rating such apparatus, H. M. Hobart, chairman of the electric arc-welding committee and also a member of the standards committee of the American Institute of Electrical Engineers, appointed a small sub-committee under the chiarmanship of W. Spragen to draw up preliminary standards for arc-welding apparatus.

The tentative draft has been completed and submitted to the A.I.E.E. and the standards committee. The rules have been possible through an agreement by the manufacturers that continuous loading for one hour by means of a suitable resistance at full-load current gives the same temperature rise as an all-day operation in service by manual manipulation with the same current. Other valuable information which will be of assistance to the purchaser is contained in these rules. The sub-committee will co-operate with the A.I.E.E. standards committee in completing this work and in fact has had from the outset the guidance of F. M. Farmer, chief engineer of the Electrical Testing Laboratories.

These rules have been issued in bulletin form by the American Bureau of Welding and are considered tentative for a period of one year, after which time they will be modified or adopted as standards.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Selling $2,000,000 of Stock in One Day

How Employees of the Baltimore Company Were Organized to Take Subscriptions and Collect Payments for 20,000 Shares of Preferred Stock in Record Time

WHAT is probably one of the most remarkable customer-ownership campaigns yet recorded in the central-station industry was conducted last summer by the Consolidated Gas, Electric Light & Power Company of Baltimore. In this campaign it sold $2,000,000 par value of its 7 per cent cumulative preferred stock to customers in one day's time. The sale is of particular interest because of the fact that the stock was sold entirely by the personal efforts of employees in lots of not more than five shares to any one customer.

How the company's personnel was organized and co-ordinated through the various departments so as to handle without a hitch such a volume of stock subscriptions in so short a time is told by W. T. Biedler, manager investment department of the Baltimore company. The methods adopted should be extremely valuable to other central-station companies in planning and carrying out similar programs. Mr. Biedler describes the sale as follows:

In 1915 the company first offered to its customers, on the partial-payment plan only, common stock at the market price, and it had by May, 1922, 5,711 common stockholders and 2,970 preferred stockholders. The number of local shareholders at this time was 4,621, 3,612 owning common stock, and 1,009 owning preferred stock. On June 22 this year the company offered $2,000,000 of 7 per cent cumulative preferred stock, to be sold through its employees to its customers at par, or $100 per share, cash or on the partial-payment plan.

The chief item of work in the issuing of the stock lay in obtaining signed subscriptions from a large number of subscribers and in collecting the remittances accompanying the subscriptions. To avoid the embarrassment entailed by a large oversubscription, the demand from the employees and their friends for the stock was tested by a preliminary survey, in which employees who volunteered to obtain signed subscriptions made requests for shares to be allotted them. It was found that upward of 43,000 shares were requested by more than 800 employees. These employees were then constituted employee-agents for the purpose of this subscription, and to each was allotted a definite number of shares for which to obtain subscriptions. It was not deemed necessary prior to or during this campaign to use newspaper "ads" or any other form of publicity other than an information sheet on the preferred stock and some pertinent facts about the company which were given to the employees. As the wide scope of the subscription necessarily required the efforts of a large number of employee-agents, plans were carefully made in detail to insure smooth operation.

Organization of Employees

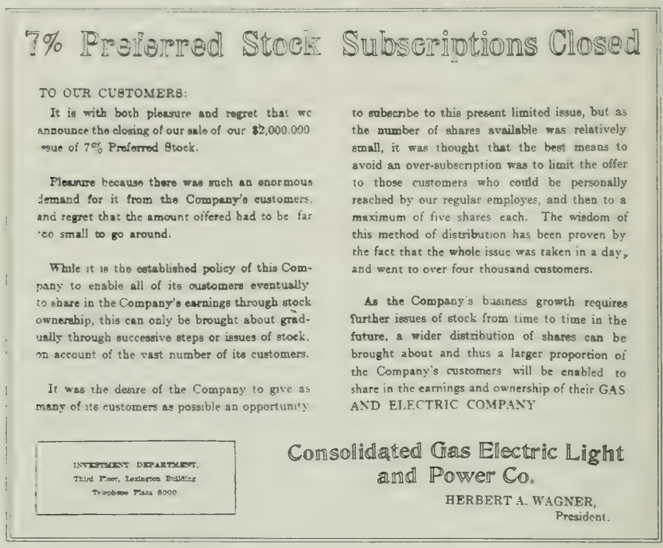
The plan employed was the organization of the company as a sales body along the regular lines of organization, with department heads supervising the work of team captains. All employees were grouped into teams according to regular departmental lines, and reporting and distributing information was done through the regular routine of the company. The plan was introduced to the employees at a dinner given by the management to department heads about ten days prior to the date of subscription. At this dinner the organization of the employees into eleven sales divisions was explained. The manager of the investment department served as chairman of the general sales committee, consisting of the general heads of each sales division, and was responsible for the operation of the plan. Employees received subscription blanks, information sheets on the preferred-stock issue and sets of instructions.

It may be noted here that the team captains turned in signed subscriptions and remittances direct to representatives of the investment department stationed at the various buildings of the company. This freed department heads of all detail work and allowed them to devote their time to the supervision of the employee-agents. The method of organization and paper work provided was found to operate smoothly. More than $1,000,000 in cash was received, and signed subscriptions for the entire issue of 20,000 shares were turned in on June 22 and 23.

It was found necessary to limit the maximum number of shares that any one customer might subscribe for to five, in order to accomplish the wide distribution desired with the limited number of shares available.

The stock was offered at $100 per share flat, both for cash and on the partial-payment plan, dividends and interest to accrue from July 1, 1922. The stock offered is a cumulative preferred stock, part of a total preferred issue of $7,000,000, back of which there is $14,610,200 (par value) common stock outstanding.

The terms of the installment payment subscription were $10 per share down and $8 per share per month. Interest at the rate of 7 per cent per annum is allowed on payments. Subscribers have the privilege of paying up in full at any time, making advance payments at any time, and, under certain conditions, of canceling their subscriptions. The company issues a fully-paid stock certificate for a number of shares equivalent to the amount actually paid in, with the proviso that at the date of cancellation of the subscription as to all or a part of the shares covered by it a subscriber will be charged for shares not to be taken up with the difference between the subscription price and the last recorded sale on the Baltimore Stock Exchange prior to the date of cancellation. Any remaining balance after this adjustment will be refunded in cash, or the purchaser may pay such additional sum as will entitle him to a full share. In the event of the death of a subscriber his properly constituted representative may continue the monthly payments or may elect to exercise the refund option.



7% Preferred Stock Subscriptions Closed

TO OUR CUSTOMERS:

It is with both pleasure and regret that we announce the closing of our sale of our $2,000,000 issue of 7% Preferred Stock.

Pleasure because there was such an enormous demand for it from the Company's customers, and regret that the amount offered had to be far too small to go around.

While it is the established policy of this Company to enable all of its customers eventually to share in the Company's earnings through stock ownership, this can only be brought about gradually through successive steps or issues of stock, on account of the vast number of its customers.

It was the desire of the Company to give as many of its customers as possible an opportunity to subscribe to this present limited issue, but as the number of shares available was relatively small, it was thought that the best means to avoid an over-subscription was to limit the offer to those customers who could be personally reached by our regular employes, and then to a maximum of five shares each. The wisdom of this method of distribution has been proven by the fact that the whole issue was taken in a day, and went to over four thousand customers.

As the Company's business growth requires further issues of stock from time to time in the future, a wider distribution of shares can be brought about and thus a larger proportion of the Company's customers will be enabled to share in the earnings and ownership of their GAS AND ELECTRIC COMPANY

INVESTMENT DEPARTMENT,
Third Floor, Lexington Building
Telephone Plaza 8000

Consolidated Gas Electric Light and Power Co.

HERBERT A. WAGNER,
President.

ADVERTISEMENT ANNOUNCING CLOSE OF SUBSCRIPTION

Employees were paid a commission of $2.50 for the first share and $1 per share for each additional share subscribed for by the same person, or, in other words, the commissions were $1.50 per subscriber and $1 per share.

The one advertisement run in the daily papers of Baltimore announced the closing of the subscription and was inserted on June 23, the day after the sale was completed.

The campaign resulted in about 5,400 subscribers taking the entire issue of 20,000 shares in one day. Of these 2,338 were cash subscribers and 3,049 installment subscribers. Thus the company more than doubled its number of stockholders in Baltimore in one day as a result of the wide distribution of this issue through a large number of employee-agents. The statistics of the results are given in table herewith.

A number of the subscriptions taken on the installment-payment plan have since been converted into cash subscriptions and the stock certificates issued. Approximately 2,200 of the partial-payment subscribers remain on the books of the company. This represents about 40 per cent of the total number of subscribers.

Commissions aggregating $26,631 were paid to 897 employees, the average commission earned being $29.79 per employee and the largest $161. The average selling cost in commissions was $1.33 per share. Including total expense of printing, clerical help, etc., it is estimated that the approximate cost will average around $1.72 per share.

During the week following the campaign an average of over 225 persons per day visited the offices of the investment department in the company's main office building. Most of these wished information and desired to enter subscriptions for stock. Unfortunately few shares were available. One customer insisted that he would not buy anything but "brand-new stock" and "did not want any second-hand stock offered him." Another customer, who had been a street-car conductor for twenty-two years in Baltimore, remarked that he wished to invest in the preferred stock of the company as he had held some of the common stock for a number of years. His route passed the company's twenty-one story office building and he had said to himself every morning as he passed it on his first run, "Well, she's still there, so my money is safe."

	Number of Shares			Number of Subscribers		
Share Lots	Employees	Customers	Total	Employees	Customers	Total
1 to 5	1,149	17,174	18,323	528	4,748	5,276
6 to 10	506	20	526	56	2	58
11 to 24	376	...	376	22	...	22
25	750	25	775	30	1	31
Total	2,781	17,219	20,000	636	4,751	5,387

The two problems involved in the subscription were, first, to prevent an oversubscription and, second, to insure a wide distribution of shares. These were solved by individual allotments based on a preliminary survey of reports of prospective customers turned in by the employees who volunteered to participate in the sale, and by limiting subscriptions to a maximum of five shares to any one customer.

The result of this short-lived campaign has served to indicate to the management of the Baltimore company the great possibilities of financing through the encouragement of customer ownership. In this campaign less than 5 per cent of the company's customers were approached or had any intimation whatever of the company's intention to sell stock, for the sale was not advertised. The two-million-dollar issue would have been subscribed many times over had subscriptions not been limited to five shares and sales confined to one day.

Director Puts High Values on Public Relations

FRIENDLY relations between the public and the utility companies aid regulatory commissions in supervising service and adjusting rates of utilities, Carl Wilde, director of service of the Public Service Commission of Indiana, told members of the Indiana Sanitary and Water Supply Association at their recent convention.

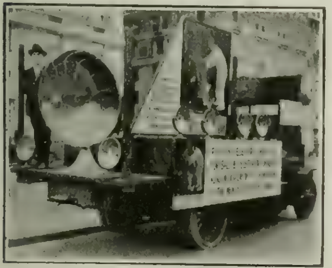
"No service," said Mr. Wilde, "however adequate from a mechanical or technical standpoint, can be acceptable and satisfactory to the public service unless the relations between the public and the utility are such that there is courtesy and forbearance on one hand and confidence and forbearance on the other.

"Most utilities are corporations and most of them have a monopoly in their territory. The public, because of an indiscriminate damning of corporations and monopolies generally by a certain type of public speaker and a particular species of periodical, have come to look askance upon any organization to which those two terms can be applied. It is the utilities' duty to remove this false impression, to show by practical demonstration that properly regulated monopoly is the ideal situation in the utility field and that a corporation can be as courteous and as conciliatory as an individual.

"Friendly relations between the public and the utilities are for those reasons as greatly to be desired as the giving of superlative service, and if the public service commission in the administration of its duties can aid in the slightest toward bringing about such proper public relations, its work in that respect will do more toward solving present-day utility problems than any other work to which it can set its hands."

An Outdoor Demonstration of Electric Heaters

FOLLOWING its policy of advertising and promoting the use of electrical appliances wherever possible, the New York Edison Company is this fall demonstrating electric heaters in an unusual manner. The Simplex Electric Heating Company has made a duplicate of its regular "Sunbowl" heater, 4½ ft. in diameter with a demand of 10.5 kw. The heater is mounted on one of the Edison company's 5-ton trucks, and energy for the heater is supplied from an "Exide Ironclad" battery loaned by the Electric Storage Battery Company.



ELECTRIC HEATER WITH 10.5 KW. DEMAND SHOWN ON CITY STREETS

The truck with the heater is run about the city streets from 8 a.m. until 9:30 p.m. From time to time it is parked at desirable locations and large crowds collect to examine the unusual source of heat. The radiator will throw a beam of heat for 25 to 40 ft., and it is interesting to watch people on the sidewalk turn around when they feel the blast of heat strike them. In many instances humorous incidents have occurred. Dozing chauffeurs when hit with the heat beam make a rapid awakening, with the thought that their car is afire, while street cleaners think that their bags of papers have become ignited. At one place the truck drew up alongside a butter and egg store and a fair crowd gathered. Soon the proprietor came rushing out, figuratively tearing his hair and urging that the chauffeur move the appliance as it was melting the butter in his show windows.

This method of advertising has proved so successful that the New York Edison Company expects to use it for other appliances. For instance, during the summer months electric fans can be operated on the truck and at other times washing machines can be displayed and demonstrated on the street.

Service Companies Should Not Generate[*]

Day Is Fast Coming When the Manufacture of Electrical Energy Will Be the Specialty of the Producing Station, Which Will Sell at Wholesale to Local Utility Companies

By Samuel Ferguson
Vice-president Hartford (Conn.) Electric Light Company

IN ANY country or section of a country the progress and prosperity of its population can only be maintained if due attention be paid to natural conditions and if the people recognize and adapt themselves to changes in these conditions. Those who continue to work in the selfsame manner year after year and have faith that because it was best in their father's time it must be best today are bound to be quickly outdistanced by those who are capable of revising their methods to conform with changes of conditions which develop with so much more rapidity than most of us realize. This is particularly true in the electrical industry.

Industry in New England

New England is primarily an industrial community today, owing to the fact that before the days of the economical use of coal the multitude of its streams and water powers gave our fathers a natural advantage over other sections of the country in having a cheaper and more abundant source of power. Industries were located at available water powers all over New England, and the availability of the power was as a rule the determining factor in the selection of a location. For years the streams furnished sufficient power for our factories, and during that period our population acquired a degree of mechanical skill which enables us still to maintain our industrial position even after we have outgrown our streams and have come to be dependent on the coal fields of Pennsylvania for our power.

Evolution of Power

In the early days the waterwheel was very simple, though inefficient as compared with present-day standards, and as the factory was built around it, it was looked upon as one of the fundamental necessities of a manufacturing establishment. When steam engines were added to supplement the inadequate water power, the power plant naturally was still looked upon as the most necessary of all factory tools, and a factory without a power plant was an incomprehensible idea. During the past twenty years, however, this view has undergone a radical change, and today the leaders of practically all industries using power recognize that their shops can be better operated by purchased power, manufactured and distributed by the local electric company, than by an endeavor to operate a relatively small plant at each factory and conduct the manufacture of power as a side line to the manufacture of the particular line of goods on which the full attention of the management is concentrated.

Central Station the Outgrowth

This period of twenty years has seen this idea grow from a radical innovation and experiment until it has reached the state of a firmly accepted economic fact. It is simply a case of reaping the benefits of specialization and co-operation. Factories in every town have benefited and local electric companies, through the increased load used for twelve instead of three hours, have been able to develop to a stage of economical production not otherwise possible.

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[*] Paper read before the annual convention of the Connecticut State Chamber of Commerce at Hartford.

Today conditions are again changing owing to the advance in the art of power manufacture. At the present time turbines which five years ago were looked upon as marvels of economy are far surpassed by efficient modern units of 20,000 hp. and 30,000 hp. However, few communities have sufficient load to justify the local electric company in installing such large units, and consequently there has recently grown up a practice of three or four communities being served from one power plant. While this is a step in the right direction, it does not go far enough. The manufacture of power is an art in itself and should be undertaken by those willing to make it their sole business. The business of manufacturing power should be entirely divorced from all problems of retail distribution and sale.

NEED OF SPECIALIZED PRODUCTION

I recognize that this is a radical idea because the power plant today is looked upon as the most important tool of an electric company, but I believe I am right when I say that an electric company whose primary function is to furnish satisfactory service to the public has no more business to operate a power plant than has a manufacturer of typewriters, drop forges, machine tools or any other commodity. Just as the electric companies have shown the manufacturers that they can purchase to better advantage than they can make their power, so must they in turn realize that they are mixing two radically different businesses when they endeavor both to furnish service to the public and to manufacture power.

I am firmly convinced that the maximum economy and reliability will not be accomplished until a single power-manufacturing company is created which shall take over and operate as a unified whole the power plants of the state which are now integral parts of the electric companies. Each electric distributing company would then purchase all its power at prices regulated by the state utility commission and would be free to concentrate its full attention and energy on its particular field of action, namely, the service of the public.

In order to supply their respective communities the principal electric companies of Connecticut have invested in power houses approximately $30,000,000. If they continue to develop independently, $15,000,000 more will probably be required in the next five years to keep pace with the requirements of the state. If, on the other hand, the principal plants can be controlled and operated by a single manufacturing company and all be connected by high-tension lines, there will be required less than one-half this amount of money for construction purposes, and the cost of power will be reduced by the saving of the fixed charges.

UNIFIED CONTROL

Moreover, with unified control of operation, the plants of maximum efficiency will always be operated to capacity instead of following the present practice, with every plant in the state operating twenty-four hours per day, which means loaded to only 20 per cent capacity for half the time. This saving alone would be more than sufficient to pay the fixed charges on the interconnecting lines. Such a company could readily absorb the surplus water power that now goes to waste for many months of the year.

Connecting the systems is not enough. The state needs a manufacturer of power whose business will be that and that only, and when this fact is realized to a sufficient degree, then will come the maximum efficiency in power production, and the public served by the electric distributing companies will greatly benefit. The day of electric service companies operating power plants is passing now just as truly as the day of the power plant as a necessary adjunct to a factory passed five or more years ago.

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What Other Companies Are Doing

Sioux City, Iowa.—The Sioux City Gas & Electric Company, the majority of whose outstanding stock is owned by United Gas Improvement Company, is acquiring the electric generating plant and distribution system of the Sioux City Service Company, thus placing the entire electric light and power and gas business in Sioux City under one ownership.

Milwaukee, Wis.—Nearly $200,000 worth of electrical goods, ranging from electric sockets to washing machines, were placed on display and demonstrated to thousands of interested persons at the electrical show in conjunction with the fourth annual Food and Household Exposition from Oct. 23 to 29. This was the largest display of its kind ever held in this part of the country, representing thousands of the prominent makes of electrical appliances of seventy-five different manufacturers and dealers. Forty-five of these were local manufacturers or dealers in electrical appliances.

Montpelier, Vt. — General improvement in the granite industry is reported by the Montpelier & Barre Light & Power Company to Charles H. Tenney & Company, managers, Boston. During September the motor load increased by 459 hp. and there was a gain of sixty-eight lighting customers in this territory. Line extensions are being made and the outlook for better conditions is marked.

Jackson, Mich.—Surveys of meters, wiring, stoves and appliances are being made in all Michigan towns served by the Consumers' Power Company. Wherever necessary minor repairs are made and advice on major ones is given. The inspectors have been especially trained for this kind of work and are having a first-hand opportunity of finding out what the general public thinks of their utilities and of how they use them. They have found that the majority of consumers favor this co-operation and appreciate it.

Texas.—A course of study in the economics of public utilities has been inaugurated at the School of Commerce of the Southern Methodist University, Dallas, Tex., with a class of about seventy-five students. The course will comprise a series of lectures by a number of men prominent in the electric light and power industry in this section. The opening lectures will be "Interurban Railways," by James P. Griffin of the Texas Electric Railway Company, and "Electric Power and Light," by C. W. Davis, general manager of the Dallas Power & Light Company. These cover the phases of construction, operation and management. Later lectures will include similar topics, as well as matters of financing, regulation and accounting. The adoption of this course is another recognition by the colleges and universities of the need for more accurate knowledge of public utility problems.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

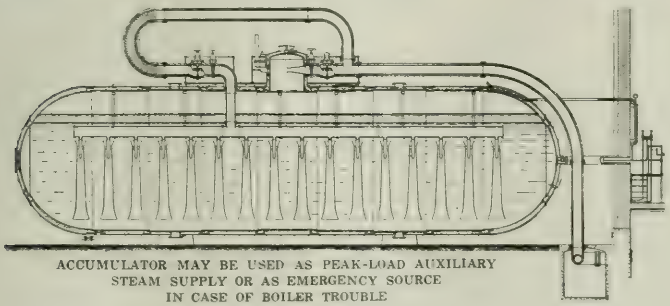
Generation, Control and Switching

Transformer Troubles in the Golpa Power Station.—W. PETERSEN.—Investigations of the cause of repeated failures on some three-phase, 17,000-kva., 6,300/110,000-volt transformers were made by the author, and it was found that the origin of these troubles was in the quick-breaking oil switches installed between the transformers and the outgoing lines. A detailed theoretical proof is developed, showing that in case of a quick rupture oscillations of between 3,000 cycles and 4,000 cycles may be established, which in turn are very liable to be the cause of considerable overvoltages. Oscillograms taken at the station under artificially made short circuits between two phases and corroborating fully the theory revealed the high frequency oscillations. It was estimated that the resulting overvoltage was about 250,000 volts. These tests were repeated several times during a period of several weeks and showed in every case the same results.—*Elektrotechnische Zeitschrift*, Sept. 28, 1922.

Use and Operation of Automatic Hydro-Electric Stations.—A discussion as to how the automatic station has solved the problem of developing small water powers, covering the types of stations, operation of a plant, protective devices and economies resulting from its use. One of the most important features of this type of station is the protective equipment applied to prevent damage to the machine in case of trouble. These troubles and their remedies are briefly outlined.—*Power*, Oct. 3, 1922.

Hydro-Electric Development and Steam Equipment

Steam Accumulator.—P. MÜLLER.—Steam storage tanks in connection with intermittently operating steam-consuming machines like steam hammers, mine hoists, etc., are well known and widely used. The new steam accumulator system which is described is connected directly to the high-pressure steam line and operates on the principle of storing steam in water under increased pressure or releasing it under decreased pressure. A carefully adjusted valve between the boilers and the accumulator opens to admit steam if the pressure rises and releases steam if the pressure falls below a determined minimum. The storage tank may stand pressure variations of several atmospheres and may equalize the steam consumption within limits up to one to four or steam volumes between 5,000 kg. and 20,000 kg. It is possible in that way to use the accumulator as a peak-load auxiliary steam supply or as an emergency steam source in case of boiler trouble. The power station at Malmö, Sweden, makes an interesting use of such an accumulator. The plant derives its energy from a hydro-electric station, and in a substation near Malmö a steam turbo-generator is installed with this accumulator. Under normal operating conditions the generator runs idle as a power-factor-improving motor; but if there is any trouble on the line from the hydro station, the turbo set, driven temporarily from steam in the accumulator, assumes the generation, and the boilers, which are kept always under pressure, are fired to supply steam for the set. Enough steam is supplied from the accumulator to keep the turbo set running until the boilers are ready to deliver steam.—*Elektrische Kraftbetriebe und Bahnen*, Sept. 24, 1922.


ACCUMULATOR MAY BE USED AS PEAK-LOAD AUXILIARY STEAM SUPPLY OR AS EMERGENCY SOURCE IN CASE OF BOILER TROUBLE

Transmission, Substations and Distribution

Graphical Calculating Method for the Voltage Regulation of Long High-Voltage Transmission Lines.—E. SCHÖNHOLZER.—A short historical development of the Le Roy-Blondel series, with its graphical representation, is given, and based upon these a complete and extremely exact transmission characteristic diagram is constructed. It is explained how this vector diagram may be used for all possible line conditions, and a numerical example is taken to illustrate its use. The example is the three-phase, 110,000-volt, 230-km. transmission line from Seira to Barcelona, Spain, transmitting at present 25,000 kw. It is possible to read from the diagram directly the wattless compensating energy in kilovolt-amperes which is required to keep constant potential at the end of the line at a given load and power factor. The technical and economical advantages of a transmission line which is well regulated and fully compensated are pointed out.—*Schweizerische Techniker Zeitung*, Nos. 6 to 9, 1922.

Mechanical Properties of Commercial Iron.—ZAY JEFFRIES and E. S. ARCHER.—Definitions of various terms used in the art of testing materials are given with a discussion of how various circumstances surrounding the tests affect the results on annealed bars of common structural metals. — *Chemical and Metallurgical Engineering*, Oct. 4, 1922.

Points to Observe When Diagnosing Brush Troubles.—E. H. MARTINDALE.—The first of a series of five articles intended to analyze the causes and effects of evidence of brush trouble and the remedies that can be applied under a wide variety of operating conditions. In the first article a chart is reproduced that covers all of the common troubles and serves as a practical guide in studying them.—*Industrial Engineer*, October, 1922.

Units, Measurements and Instruments

Instruments Needed in Maintenance Work.—J. M. WALSH.—Practical suggestions on maintenance work in a factory to maintain the most up-to-date and efficient conditions possible in the equipment are pointed out. A complete set of electrical measuring instruments should be in the hands of the chief electrician. The most important of these are alternating-current and direct-current voltmeters and ammeters, current transformers, thermometer, photometer, Veeder counter, tachometer and spring balance. A lighting survey to check voltage and determine the intensity of illumination and the distribution and location of the sources of light, a motor survey covering a careful examination of every motor and a line survey covering an investigation of the different power and lighting mains and services throughout the plant should be included in the routine work.—*Industrial Engineer*, October, 1922.

Physical and Electrical Properties of Slate.—MERTON O. FULLER.—The main objects of the tests reported in this bulletin were to determine the physical properties of a so-called electrical slate and its special suitability for use in the electrical industries. The specimens were free from ribbons, had a fine, even grain, dense, compact structure, smooth cleavage and were freshly quarried. The article is thirty-four pages long and contains numerous tables, photographs and line drawings. In the tables are given the following tests: Chemical analysis, specific gravity, porosity, tensile strength, compression, flexure, toughness, hardness, coefficient of expansion, test to determine temperature at which cracks develop and ohmic resistance. The manner in which each of these tests was made is explained.—*Bulletin of the Fritz Engineering Laboratory, Lehigh University.*

Illumination

Lighthouse and Light-Vessel Illumination.—S. G. Hibben.—An extended investigation of the physical and practical aspects of lighthouse and light-vessel illumination has been made by the author, who presents data on the relative visibility under varying conditions. After a brief review of this type of lighting the structure of modern types of lamps is discussed and illustrated. The specialized requirements of the various classes of service are analyzed and the application of the illuminants for these are pointed out.—*I. E. S. paper, Swampscott, Mass.,* Sept. 25-28, 1922.

Why Miners' Portable Electric Lamps Require Safety Devices.—L. C. Ilsley.—Several tests have been conducted in investigating the safety of the miniature electric bulb to demonstrate the danger of using these bulbs in explosive mine atmospheres unless the current that energizes the glowing filament be in some manner interrupted in case the glass surrounding the filament is broken. In fifty-five tests in which the naked filament was exposed either at the beginning or after smashing the bulb, fifty-one ignitions resulted. The bureau discourages the use of any modifications in lamps that interfere in any way with their proper operation.—*Series No.* 2371, *Bureau of Mines.*

Motors and Control

Multi-Motor Drive for Paper Machines.—W. Stiel.—The author describes several American and European methods of a multi-motor drive for paper machines. Using direct-current or induction motors for the individual drives, special synchronizing arrangements have to be employed to enforce a uniform speed of the different motors, for which purpose a number of regulating systems are available, such as tachometer dynamos, a combination of a differential gear and a regulating motor, an auxiliary synchronous motor, etc. In every case two belt-connected counter cones permit a change of the speed adjustment for each drive. A number of advantages are claimed for the individual drive, such as the omission of unreliable clutches, savings in floor space, no belting, higher economy (up to 20 per cent saving), greater accuracy of the maintenance of uniform pull on the paper, etc.—*Bulletin of Association Suisse des Electriciens,* September, 1922.

Utilization of Electric Power About the Blast Furnace.—Gordon Fox.—The processes about the blast furnace which require power are analyzed under the general headings "blowing," "pumping," "material handling," and "accessories." The article deals primarily with applications of the electric power to these processes, questions as to generation, conversion or distribution receiving mention only as they affect this application. Car dumpers, ore bridges, transfer cars and skip hoists are considered under "material handling."—*Electric Journal,* September, 1922.

Effect of Frequency Changes on the Characteristics of Polyphase Induction Motors.—J. K. Kostko.—A change of frequency affects all characteristics of a motor, but mainly the heating and power elements (maximum and starting torque and maximum power). The author shows that for any one of the power elements the ratio of values at two different frequencies depends only on the ratio of these frequencies and on a simple function of the motor constants. With the aid of curves that are given it is possible to find these ratios without any calculation.—*Electrician,* Sept. 15, 1922.

Heat Applications and Material Handling

Alloy Castings from Electric Furnaces.—L. J. Barton.—The manufacture of nickel, chromium and chrome-nickel steel in the electric furnace as carried on in the Pacific Coast region is considered. Their production, properties and the methods of applying heat treatment is explained.—*Iron Age,* Sept. 28, 1922.

High-Speed Welding of Small Parts.—E. H. Hubert.—Spot welding is finding increasing application as a substitute for riveting, staking and other methods of this nature. In this article a description is given of the semi-automatic electric spot-welding equipment used in the plant of the E. N. Garrison Manufacturing Company, Bridgeport, Conn., with an explanation of the procedure whereby 1,000 welds an hour are made. This process is applied to the manufacture of steel grease cups.—*Industrial Engineer,* September, 1922.

Electrophysics, Electrochemistry and Batteries

Electrolytic Oxidation of Isoeugenol.—Alexander Lowy and C. M. Moore.—A method for the preparation of vanillin by the electrolytic oxidation of isoeugenol was investigated. A series of experiments, using sodium hydroxide as the electrolyte, were conducted, and in every instance a negative yield was the result. Vanillin itself was found to oxidize readily electrolytically, and even if formed by electrolytic oxidation it would be immediately carried over into other products. Following the experiments it was concluded that if vanillin is produced by the electrolytic oxidation of isoeugenol, a totally different condition must prevail. Statements made in textbooks that vanillin can be prepared by this method should be modified or corrected.—*American Electrochemical Society paper,* Montreal, Sept. 21, 1922.

Electroplated Zinc and the Diffusion of Electro-Deposits Into Zinc.—Walter G. Traub.—Experiments were made to determine the cause of the disappearance of certain metals that had been deposited on zinc. The results indicate that copper, brass, gold and silver are diffused into zinc, whereas nickel, which does not diffuse, can be used as a preventive against diffusion of other metals deposited over it.—*American Electrochemical Society paper,* Montreal, Sept. 21, 1922.

Traction

Rhaetian Railway Completes Electrification.—The operation of this Swiss road, which includes a network comprising 248 miles in the very mountainous canton of the Grisons, Switzerland, with many tunnels and heavy grades, was made possible only by electric power. The grades and tunnels over the different parts of the system are described.—*Railway Electrical Engineer,* September, 1922.

Experience with Chicago Track.—Charles S. Holcomb.—The types of construction used since 1907 and which have given very good results are described. The few changes in details found necessary to meet heavy duty are related, and the weighted life of track and special work and the relation between traffic and rail wear are given.—*Electric Railway Journal,* Sept. 23, 1922.

Telegraphy, Telephony, Radio and Signals

The Mercury Arc as an Audio-Frequency Oscillator.—Yasusi Watanabe.—This is a report of the experimental study of the mercury-arc method of producing sustained oscillation of radio audio-frequency. The arrangement of the apparatus is similar to Vreeland's oscillator, except that a magnetic field excited by direct current is necessary. With no magnetic field the oscillation is nothing but the oscillatory discharges of a condenser resulting from the fluctuation of the cathode spot of the mercury pool. On closing the magnet coil circuit, the nature of oscillation is immediately changed from electrical to mechanical, and the frequency of the ionic oscillation cannot be controlled by the constants of the oscillation circuit as in the case of Vreeland's oscillator.—*Journal of the Institute of Electrical Engineers of Japan,* September, 1922.

Radio Telephone for Power-Station Intercommunication.—R. C. Denny.—Wireless provides emergency means of connecting the remotely situated power stations and construction camps with the operating headquarters when pole lines have been destroyed. The general problem is outlined and the advantages obtained from radio communication in this field are pointed out.—*Journal of Electricity and Western Industry,* Oct. 1, 1922.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

Visual Illusions

By M. Luckiesh. New York: Van Nostrand Company.

If seeing were believing, the readers of this most entertaining volume would be suitable candidates for the psychopathic ward. As the author himself remarks, "Seeing is deceiving"; and while the eye plays true with the consciousness in a great many instances, it falls into habits of unqualified mendacity with an ease which could not be reckoned a credit either to nature or human nature. In fifteen interesting and also remarkably well-illustrated chapters Mr. Luckiesh manages to get together an amount and variety of information regarding optical illusions which is altogether astonishing to one who has never studied them.

The subjective character of color and color contrast is continually being illustrated in the study of luminous objects. Not only does the eye retain a visible memory of its experiences for perhaps several hours past, but it also carries a memory of contrast quite impossible to be overcome. Two mercury arcs at the ends of a photometer bar in a dark room generally look rather a good bluish-white. Extinguish one of them and light an incandescent lamp in its place and the tube turns bright green, while the incandescent lamp glows orange. Turn out the incandescent lamp and turn on the mercury tube and both tubes stay persistently green.

The consideration of the lighting of solid objects which Mr. Luckiesh gives is one extremely well worth studying by artists and architects. Many an admirable relief has been spoiled by unskillful lighting, which can flatten the most beautiful tracery into barely visible mediocrity. The applications of lighting in these fields have long been a special province of Mr. Luckiesh and his treatment of them is most effective. Altogether the book is a very interesting and admirable exposition of a most curious subject and will add materially to its author's already high reputation as a specialist in the lighting art.

LOUIS BELL.

The Diagnosing of Troubles in Electrical Machines

By Dr. Miles Walker. New York: Longmans, Green & Company. 150 pages, illustrated.

One expects to find an adequate and thorough treatment of this subject by Dr. Walker. Years of experience as a designer in this country and in England and other years of teaching and consulting experience at the University of Manchester have admirably fitted him for the task.

The book is based on this experience of thirty years and incorporated the following sound advice: "First find out the facts; see the thing yourself; let your conclusions be drawn from ascertained data and not from supposition." The scope of the book is very wide, covering the breakdown of insulation, overheating, low efficiency, regulation, balance, commutation, the use of vectors and of the oscillograph as applied to alternating-current and direct-current motors of all types. The illustrations and engineering data and the methods outlined are good for all makes of machines. The volume is a welcome contribution from an authority, written in a very logical and interesting manner. It is the type of book that every electrical engineer will find valuable and interesting.

Electrical Engineering Testing

By G. D. Aspinwall Parr. New York: E. P. Dutton & Company. 692 pages, illustrated.

This book is well arranged as a reference book on electrical engineering and in many institutions could be used as a textbook for test work. A large number of tests are arranged to cover the field of meters, resistance measurements, insulation, alternating-current circuits, magnetic circuit and phenomena, besides transformers and both direct-current and alternating-current machinery.

Each test is arranged with a brief discussion of the theory pertaining to it and the relative advantage of the test. A list of the apparatus required is given together with a diagram of the connections. The required observations are described, and a suggested arrangement of data makes it easy for a student to form the habit of careful and orderly work. Where desirable, suggestions for manipulation are included. A valuable portion of each test, which in many cases could have been amplified, is the suggestion of deductions for the student to make from the observations. For some experiments these are definite, while with other tests the suggestions are very general, but in any case they encourage the student to study the results and particularly the curves obtained.

These brief guides for the tests quite naturally take the larger portion of the book, but nearly 200 pages are devoted to other very valuable information. Several pages are devoted to the proofs of common formulas to be used by the student as a check of his work. More than a hundred pages are utilized to describe apparatus used for tests, explaining the principles involved. Various types of instruments, dynamometers, etc., are described. Some of this apparatus is specially constructed, which makes the description more desirable.

Another valuable section is the tables which give conversion factors, squares, reciprocals, logarithms, etc. There are also tables giving the properties of copper and other alloys, these alloys being of English manufacture. The index is well arranged and materially increases the value of the book for reference work.

R. G. WARNER.

Properties of Electrically Conducting Systems, Including Electrodes and Metals

By Charles A. Kraus. New York: The Chemical Catalog Company, Inc. 408 pages, 70 illustrations.

This book is one produced in the Monograph Series of the American Chemical Society and gives a complete treatment of ionic conducting systems. Metallic systems are included because of the intimate relations existing between the phenomena in metallic and electrolytic systems. An empirical treatment has been selected because the author cannot reconcile all the phenomena with any of the theoretical hypotheses extant.

The author classifies conductors, solutions and solvents and briefly gives the fundamental conceptions of electricity, matter and the ionic theory. The conductance of solutions and the form of the conductance function in their effects and as affected by materials, viscosity, solvents, temperature and concentration are admirably treated. The discussion of homogeneous and heterogeneous ionic equilibria covers the ground very thoroughly.

One of the most interesting portions of the book is that devoted to a critical and constructive discussion of the various theories relating to electrolytic solutions. The author points out that strong and weak electrolytes do not conform to the same law, that the hypothesis of complete ionization of electrolytes lacks experimental support and that the conductance changes in electrolytes with concentration percentages and has a variable behavior in low-capacity solvents. He concludes that elements of truth exist in each theory, but that work must still be done to rationalize the complete theory.

Books Received

Electric Transients. By C. E. Magnusson, A. Kalin and J. R. Tolmie. New York: McGraw-Hill Book Company, Inc. 190 pages, illustrated.

Advanced Laboratory Practice in Electricity and Magnetism. By Earle Melvin Terry. New York: McGraw-Hill Book Company. 258 pages, illustrated.

Connecting Induction Motors. By A. M. Dudley. New York: McGraw-Hill Book Company. 244 pages, illustrated.

Pulling Together. By John T. Broderick. Schenectady, N. Y.: Robson & Adee. 141 pages.

The Origin of Spectra. By Paul D. Foote and F. L. Mohler. New York: The Chemical Catalog Company, Inc. 241 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

Lack of Personnel Hinders Power Board Valuation

Evaluation of the properties of the Niagara Falls Power Company by the Federal Power Commission apparently has been suspended. When the work was started it was understood that the object was as much to determine what is involved in the evaluation of such a plant under the proposed accounting regulation of the commission as it was to determine the actual value of this particular property.

Before the government accountants had proceeded far with their work a number of points of controversy arose which resulted finally in the power company appealing to the commission for a hearing, and, although no official expression in regard to the matter has been made, it is believed that the commission will suspend the work until a number of matters of policy have been decided. It also is possible that the resumption of the work may await the action of Congress in providing suitable personnel for this phase of the commission's duties.

The commission has proceeded actively in the discharge of all of the other tasks assigned to it by the water-power act. In the matter of making valuations, however, it has been apparent that work could not be undertaken on an intelligent basis without the employment of specially qualified men.

Alabama Power's Rates Are Voluntarily Lowered

The Alabama Power Company lately asked the Public Service Commission of the state to allow it to reduce the price of electrical energy to residential consumers approximately 8 per cent, to take effect Nov. 1, and President T. W. Martin then asserted that the lower rate would go into effect on that date whether the commission had rendered its decision or not. The new rates affect 20,000 customers in Alabama. They do not affect residential consumers in Birmingham, however, owing to the fact that the company sells its energy at wholesale to the Birmingham Railway, Light, Power & Fuel Company, which retails it to the residential consumers.

The new rates are 10 cents for the first 30 kw.-hr., 8 cents for 170 kw.-hr. additional, 7 cents for 300 kw.-hr., 6 cents for 350 kw.-hr. and 5 cents for all over 350 hours. Mr. Martin said: "We have filed the new rates because of the growing demand throughout the state for electricity in the homes for a variety of uses, especially for cooking purposes."

St. Croix Disputants Before Wisconsin Commission

Agents of the city of St. Paul and representatives of the Marcom Kelsey-Brewer interests of that city combined to fight before the Wisconsin Railroad Commission recently the request of the St. Croix Falls Development Company, a Byllesby utility, for power rights on 40 miles of the St. Croix River above St. Paul, and action was delayed until the Kelsey-Brewer interests shall file a petition for permission to build a single dam across the river, which forms part of the boundary line between Wisconsin and Minnesota. The Kelsey-Brewer interests hold title to sites on both sides of the river.

The hearing was on the application of the Byllesby interests for permission to raise the Nevers dam and to construct two additional dams to utilize the 40-mile stretch of the St. Croix above St. Paul. Both the St. Croix Falls Development Company and the St. Paul organization now have applications before the Federal Power Commission for permission to build dams.

Sioux City Public Utilities Combine

A merger of the Sioux City Service Company with the Sioux City Gas & Electric Company was completed at Chicago on Nov. 2, in accordance with an ordinance passed by the City Council and approved by the people of Sioux City on Aug. 28. E. L. Kirk, general manager of the first-named company, was elected president to replace R. J. Dunham of Chicago, resigned. William J. Bertke, secretary and assistant manager of the Sioux City Gas & Electric Company, has been appointed vice-president and general manager of the new company, which will retain the name of the Sioux City Service Company. He will have direct charge of the operation of the electric service as well as of the street-railway, steam-heating and gas departments.

Following the merger, Mr. Bertke said that a contract had been signed with the Iowa Light & Power Company, with state headquarters at Carroll, to furnish service to about seventy towns north and east of Sioux City and that it would be the aim of the consolidated company to occupy a place in the forefront of Middle Western utilities.

California Defeats Water and Power Act

Majority of Nearly Two to One Rolled Up Against State-Ownership Amendment to Constitution—Amendments Extending Commission Control Over Municipal Plants Fail to Carry

The people of California at the election on Tuesday, Nov. 7, declared themselves in no uncertain terms on the proposed constitutional amendment known as the water and power act, which would have pledged the credit of the state to the extent of half a billion dollars to engage in the business of developing hydro-electric power. Incomplete returns indicate that the measure has lost by nearly two to one. The election was the culmination of a very bitter fight waged by the proponents of the measure for its passage. Their campaign all the way through was characterized by insinuations of graft, exorbitant profits and misrepresentation of the stand of the power companies, and the power interests were accused of trying to build up a political machine and create a monopoly by which they could control the state.

Briefly, the act provided for the control of the water powers of the state by a board of five, to be appointed by the Governor, which would have at its disposal $500,000,000 to be raised by the sale of bonds and backed by the credit of the state. This money could be used at the discretion of the board to develop and distribute water and electrical energy and, if deemed expedient, for the acquisition of the power plants and distribution systems of privately owned utilities.

Two other measures of interest to the electrical industry of the state have apparently lost by majorities too large to be overturned when the complete returns are counted. One was an act to bring municipally owned utilities under the jurisdiction of the California Railroad Commission and to give the commission the power of regulation in all matters except the issuance of securities. The other was an act requiring municipally owned utilities to pay the same tax that is required of privately owned utilities.

Plans of Southern Power

New High-Tension Lines 200 Miles in Length—System Rating to Be Increased to 600,000 Hp.

IN ANTICIPATION of the completion next year of two new hydro-electric plants and two steam-plant additions, which will give an additional total generating capacity of 200,000 hp., the Southern Power Company is pushing to as rapid a completion as possible the construction of new high-tension transmission lines more than 200 miles in length. This extension of lines, exclusive of transformers, switches and incidental equipment, will cost approximately $2,000,000.

The longest and one of the most important of the new transmission lines is being built from Lookout generating station, west of Statesville, to Winston-Salem, High Point and Greensboro, a distance of 75 miles. Another important line is being built from Great Falls, S. C., where the new Dearborn hydro-electric station will soon be completed, to Newberry, S. C., a distance of 50 miles. A new line, 40 miles in length, is being built from the large new Mountain Island plant to Salisbury. A similar line is under construction between Mountain Island and Gastonia. Another line which will serve Gastonia is being built from the Mount Holly steam plant. A line is also being built from the Mount Holly steam plant to the Mountain Island hydro-electric plant. A new line is being built from Shelby to Caroleen, and still another from Hickory to Rhodhiss.

The steam-plant additions will be at Mount Holly, where equipment will be installed to generate 40,000 hp., and at the Eno power house at University Station, N. C., the capacity of which will be increased 20,000 hp. Of the new hydro-electric installations, the Dearborn plant, at Great Falls, S. C., is expected to be ready for operation by next March and the Mountain Island station, near Mount Holly, N. C., will probably be ready for operation in August.

The company began signing contracts for power in anticipation of new developments immediately after contracts were let for the Mountain Island and Dearborn stations. Applications for more than 35,000 hp. were already on file, and since work has started the demands for prospective power have been so active that the company has sold all the power it dares sell against its new developments, so that the power situation today is approximately what it was a year ago; that is to say, there is no power in prospect beyond the amount which is already under contract.

The Southern Power Company has at present generating capacity in its hydro-electric and steam plants very nearly totaling 400,000 hp. The present transmission system of the company embraces approximately 2,200 miles. When the new lines are completed the total mileage will be approximately 2,400.

American Delegates to International Electrotechnical Commission, Meeting at Geneva, Switzerland, November 20

C. O. Mailloux
Consulting Engineer,
New York

Gen. George H. Harries
Vice-president
H. M. Byllesby & Company

Clarence L. Collens, 2d
President
Reliance Elec. & Eng. Co.

Charles E. Skinner
Assist. Director of Engineering
Westinghouse Elec. & Mfg. Co.

Schuyler Skaats Wheeler
President
Crocker-Wheeler Company

Frank V. Magalhaes
Superintendent
Meter and Test Department.
New York Edison Company

Clayton H. Sharp
Technical Director Electrical
Testing Laboratories,
New York

H. M. Hobart
Consulting Engineer,
General Electric Company

Coal Situation Worse

Public Utilities Not Getting Enough Fuel to Permit Proper Reserves—High Prices in Middle West

DESPITE reassuring statements from the Department of Commerce and from the Federal Fuel Distributor, representatives of the public utilities contend that the coal situation, so far as their plants are concerned, is getting worse instead of better. The figures of the American Railroad Association are attacked as being inaccurate, a belief being expressed in public utility circles that there are duplications in the figures as to car loadings. Since the utilities are hampered by fixed incomes in bidding for coal against manufacturers, they believe nothing short of the re-establishment of class No. 2 priority will enable them to build up the reserves necessary to carry them through the winter.

Eastern and Middle Western utilities have been asked to await the closing of the lakes before attempting to build up storage. They contend, however, that the closing of the lakes will mean that freezing weather has arrived and that a tonnage far in excess of that moving up the lakes will have to be delivered to domestic consumers. Moreover, the advent of cold weather means that the railroads will be 20 per cent less efficient. Transportation disability, the public utilities contend, will be even greater this winter because of the shortage of motive power and the run-down condition of locomotives and cars.

The point on which the public utilities are placing most emphasis in their representations to the Fuel Distributor and to the President's coal commission is that deliveries on their contracts frequently are as low as 15 per cent, while in only rare instances are they exceeding 50 per cent. The high prices being paid for coal in the Middle West have unbalanced the transportation movement from Eastern mines, and this situation is further curtailing the chances of the public utilities to accumulate reserves sufficient to insure the proper margin of safety.

State Commissioners to Confer on Rural Extensions

A round-table conference on rural extensions of electric light and power service will be one feature of the thirty-fourth annual convention of the National Association of Railway and Utilities Commissioners, which will be held at Detroit next week at the Hotel Tuller, beginning Tuesday, Nov. 14, and continuing until Friday. Henry G. Wells of the Massachusetts Department of Public Utilities will on Wednesday present the report of the committee on this subject, and it will be discussed by Sherman T. Handy of the Michigan Public Utilities Commission, H. A. Russell of the Kansas Public Utilities Commission and other commissioners.

Other matters to come before the convention will be co-operation with the Interstate Commercial Commission in arriving at an understanding of policy in transportation cases where federal jurisdiction and state jurisdiction meet, the regulation of the telephone business, and state and federal regulation in connection with depreciation. On Thursday M. H. Aylesworth, executive manager of the National Electric Light Association, will make an address on "Public Relations," Martin J. Insull will talk about utility problems, and Frank W. Smith, president of the N. E. L. A., will describe the work of furnishing light and power in the metropolis. O. C. Merrill, executive secretary of the Federal Power Board; Carl D. Jackson, retiring president of the National Association of Railway and Utilities Commissioners, and C. C. McChord, chairman of the Interstate Commerce Commission, will be among others prominently connected with utility regulation, who will be heard from.

Tacoma to Proceed with Lake Cushman Project

Work on the plans and specifications for the Lake Cushman hydro-electric project of the city of Tacoma, Wash., will begin immediately upon completion of the steam plant on the waterfront, according to an announcement by Commissioner Ira S. Davisson. All legal obstacles preventing the city from proceeding with this project have been overcome, and the long litigation in the courts was ended by a recent decision of the Supreme Court of the State of Washington upholding the right of the city to condemn state lands for public use.

Plans for the entire project will be prepared, although it is planned to install only one unit at the present time. This will include a power plant at the dam, with a transmission line into the city, costing approximately $3,000,000 and requiring about eighteen months to complete.

Pittsburgh's Electrical Show

An entire electrical home with all the rooms and appurtenances necessary to the modern household, and electrical fountain containing twenty thousand varicolored jewels which formed a lamp shade about a column of water shot 50 ft. in the air from an illuminated pool, a continuous radiophone broadcasting demonstration and a searchlamp mounted on the roof and capable of throwing a beam of light more than 80 miles were leading features of the electrical exposition held in Motor Square Garden, Pittsburgh, from Nov. 4 to Nov. 11. Manufacturers of apparatus, appliances and industrial applications all over the country and local jobbers and dealers co-operated in planning the exposition, which included all the usual exhibits and educational features of such affairs. It was planned and carried out by the Electric League of Pittsburgh.

Los Angeles Seeks License for Owens Gorge

The city of Los Angeles has altered its application to the Federal Power Commission in connection with its Owens Gorge project so as to ask for a license instead of a preliminary permit. Action on this application is being withheld pending the outcome of litigation between the city and the Southern Sierras Power Company. A verdict in that suit is expected within a few weeks. If the verdict is favorable to the city, it is believed it will begin in the near future the extension of its aqueduct system and the development of the additional power covered by previous applications. The total approximates 150,000 hp. When to that total is added that of the Haiwee project and the two San Francisquito plants a total development of about 300,000 hp. in connection with the water-supply system of the city is indicated.

The application for license covering the Haiwee project was only recently submitted to the commission. It covers the construction of a power plant in Haiwee Narrows, 2 miles below the Haiwee Reservoir on the Los Angeles aqueduct.

State Delay Hampers Water-Power Financing

That part of the water-power act which provides for a sort of dual control by stipulating that the state law must have been complied with before a license is issued presents an avenue through which an obstructionist may work. The possibilities in that connection have just been brought out in connection with the handling of the license for the Clarion River Power Company. A license was authorized on Sept. 11, but its execution was delayed for weeks by the failure of the Pennsylvania State Water Supply Commission to approve the plans of the application. This failure of the commission's officials to approve the plans, although its engineering division had reported that they were in proper form and entirely satisfactory, all but upset the carefully laid plans which had been made for financing the project.

Whatever may have been the reason for the long delay in approving these plans, it tended to accentuate the fact that public officials frequently are indifferent to the effect that delays may have on a business negotiation. There are times when an eleventh-hour obstruction of the machinery which grinds out water-power licenses will cause very serious financial embarrassment to the prospective licensee, since the raising of the large sums required for building dams and power houses constitutes in itself a delicate process.

State officials, however, are usually found eager to facilitate any local development, and thus far the Federal Power Commission has found them ready to co-operate with it.

Power Club Proceedings

"Handbook" to Be in Two Parts—Ship Electricians, Manufacturing Census and Temperature Rating

ONE of the last acts of the Electric Power Club at its recent convention at Asheville, N. C., which was reported in part in last week's *Electrical World*, was to decide to issue the "Handbook" in two parts. One part of the new "Handbook" will be the standardization rules of the Electric Power Club, including adopted standards, recommended practices and recognized departures, this part of the book to be available for general public distribution. The other part of the "Handbook" will include that part of the present book which is composed of the constitution and bylaws, rules of procedure, list of member companies and representatives, and one page to each member for listing of products manufactured, officers, etc. This part of the "Handbook" will be principally for distribution to members of the Electric Power Club.

As a byproduct of the work of one of the committees it was brought out that at the present time there is no arrangement for the examination and licensing of electrical men to take care of electrical equipment on board ships, and that it seems advisable for the electrical industry to take action to help provide a suitable status for such men, on account of the rapidly advancing utilization of electrical equipment on shipboard.

After an extended discussion pro and con there was a consensus of opinion that the census committee should work out a means of supplying statistical reports to the Department of Commerce, on the assumption that a sufficiently representative group of manufacturers would supply this information. The Department of Commerce has offered its services in gathering and distributing such information.

The anticipated discussion on the 40-degree versus 50-degree rating question led to no definite conclusion or agreement as to a single rating. There was, however, a unanimous opinion expressed that the present two standards of rating should not be continued if an agreement can be had upon a single standard. The committee was instructed to continue to try to find a single standard upon which the members of the club could unanimously agree.

Utility Advertising Association Joins World Clubs

The national advertising commission of the Associated Advertising Clubs of the World at a recent meeting in Chicago admitted to membership the Public Utility Advertising Association, organization of which began during the convention of the Associated Advertising Clubs in Milwaukee last June. The action of the commission came soon after the presentation of the association's claims for membership, following a round-table conference of utility advertising and publicity men during the annual convention of the American Electric Railway Association in Chicago early in October. The Public Utility Advertising Association will as the result of this action go to the annual convention of the parent organization at Atlantic City next June with a complete program of its own and will also participate in the general sessions of the convention.

The members of the new association will include advertising men of the electric light and power, manufactured gas, telephone and street-railway industries, representatives of the various state committees on public utility information and representatives of the national associations of the various utilities.

Asks Transfer of Permit

Pacific Coast Company Seeks to Acquire Privilege Granted by Power Board to Another

AN UNUSUAL situation confronts the Federal Power Commission regarding a preliminary permit which, after hearings and negotiations covering two years, it authorized for two projects on the Deschutes River on the application of the Columbia Valley Power Company. The permit has not yet been executed, but two weeks after its authorization the Bend Water, Light & Power Company of Bend, Ore., appealed to the commission to transfer to it the Metolius site, one of those covered by the application of the Columbia Valley Power Company. The Bend company desires to utilize a maximum of 86,000 hp. for irrigation and to feed the remaining primary power, and during the non-irrigation season a part of the power which is not required for pumping, into its existing system in central Oregon. It has plans for developing a large domestic heating load at low rates. In addition there are prospects of increases in the industrial load, particularly in the electrical energy required in the manufacture of wood pulp.

The Bend company contends that since it is in a better position to utilize the power than the rival applicant, the commission should reverse its action and award the preliminary permit to it. The chances, however, are against any reversal.

ANOTHER CALIFORNIA PROJECT

M. C. Seagrave of 593 Market Street, San Francisco, has applied for a preliminary permit covering a combined power and irrigation project, including a dam and reservoir on the headwaters of the North Fork of the Consumne River. The water is to be conducted through a canal 5 miles long to a power house on the same stream. The primary power that can be made available is estimated at 10,000 hp. It is the intention to install machinery sufficient to develop 13,000 hp.

San Francisco Engineers Celebrate in New York

A reunion was held in New York recently to celebrate the tenth anniversary of the Engineers' Club of San Francisco. This organization was founded in 1912 to provide headquarters and a meeting place for engineers in connection with the Panama-Pacific Exposition, held three years later, and now is a flourishing club with headquarters at San Francisco.

W. W. Briggs of the Westinghouse Lamp Company is a past-president of the club and called together about fourteen non-resident members at the office of A. H. Griswold, assistant vice-president of the American Telephone & Telegraph Company. Here congratulations were exchanged by long-distance telephone with the Pacific Coast headquarters, where about 150 club members enjoyed the transcontinental reunion.

Those participating in the New York reunion were Guy C. Bailey, A. M. Hunt, Allen Hazin, A. H. Griswold, S. G. DeRemer, C. C. Broadwater, F. W. Gay and W. W. Briggs. Among those talking at San Francisco were W. G. Vincent, Jr., Charles Merrill, George Dillman, A. H. Babcock, Robert Sibley and A. H. Halloran.

Meter Readers, Truckmen and Linemen Sell Washers

According to telegraphic advices from Portland, Ore., the Pacific Power & Light Company, with operating headquarters in Portland, conducted a most successful washing-machine sales campaign during October. The company serves about 24,000 residential customers in seventeen smaller communities in Oregon and Washington and, although electrical devices are already well distributed in the community, 355 more washers were sold during the month in this campaign. The best previous month's record on the Pacific company's system was in October last year, when 236 washing machines were sold.

The outstanding feature of the campaign is that the men who led in sales were meter readers, truckmen and linemen who were accustomed to entering the homes of the customers and meeting the housewives. It is pointed out that this is proof that the central station with a complete organization, whether in the sales, line or meter department, and with one objective, can accomplish what is wanted. The largest city served by the Pacific company has a population of only 18,000. This is a representative community; and while it has only 654 electric residential customers, fifty washers were sold in this town during the month.

The officials who directed this campaign are Lewis A. McArthur, vice-president and general manager; John B. Strange, assistant general manager, and H. B. Moon, appliance sales superintendent.

Court Halts Work in Disputed Wisconsin Territory

Pending the settlement of a dispute before the Wisconsin Railroad Commission between the Badger Public Service Company of Elkhart Lake and the Eastern Wisconsin Electric Company of Sheboygan over the right to build a line to serve the town of Calumet, the Circuit Court has issued an order halting the activities of both companies in the territory named. The Badger Public Service Company maintained that it had taken over a franchise from the Malone Light & Power Company which gave it the right to operate in this territory. To this the Eastern Wisconsin attorneys replied that no work had been done under the franchise within the year specified by the law for the commencement of activities under public service franchises and that therefore the franchise was void. The Badger company's representatives asserted that the statute cited did not apply since it was passed before the grant of the Malone company's franchise and related specifically to franchises granted prior to the enactment of the statute.

British Engineers Unite in Joint Council

Influenced in some degree, it is thought, by the establishment in America of the Federated American Engineering Societies with their Engineering Council, the engineers of Great Britain have formed an Engineering Joint Council consisting of representatives of the Institutionof Civil Engineers, the Institution of Mechanical Engineers, the Institution of Naval Architects and the Institution of Electrical Engineers. Among other objects, the joint council, as stated in the announcement of its formation, will strive to improve the status of engineers, to insure the better utilization of their services in the interests of the nation and the appointment of properly qualified individuals to responsible engineering positions, and to prevent the unnecessary duplication of activities.

This Engineering Joint Council will co-operate with the Federated American Engineering Societies' committee on affiliation with engineering societies outside of the United States in establishing direct contact between American and British engineers. The F. A. E. S. committee has already established contact with engineering bodies of France, Italy and Czecho-slovakia.

West Virginia Coal Operators Seek Lower Power Rates

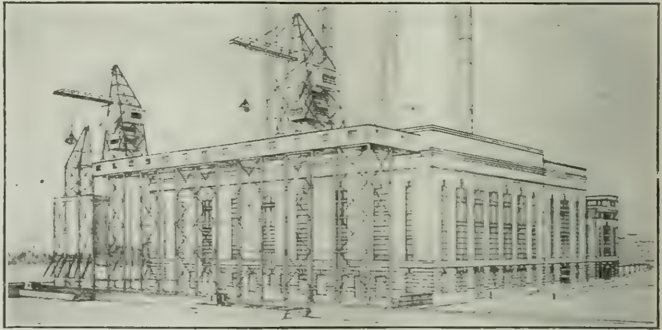
A reduction of 30 per cent in their monthly bills is sought by a large number of coal-operating companies in the Winding Gulf, Pocahontas and Tug River coal fields of West Virginia, and proceedings in a complaint lodged by them with the Public Service Commission of the state against the Appalachian Power Company have been pending since February, the brief of the coal operators' attorneys being finally filed last week. after voluminous evidence had been taken. Much interest is manifested in the case by power companies in West Virginia and adjoining states.

Nearly every principle of utility regulation is involved. The petitioners claim that the value of the company's property for rate-making purposes ascertained from the actual cost record in the power company's books is approximately $12,000,000. The power company claims this value to be between $17,000,000 and $23,000,000 on the "reproduction new" theory. There is also a wide difference of opinion between the petitioners and the respondent as to the propriety of charging numerous items to operating expense.

Innovations in New Brooklyn Power House

Compactness of Record-Rating Turbines, Novel Switch Installation, Method of Heat Balance, Generator-Transformer Units, High-Voltage Transmission to Substations

ADDITIONAL information has just been made available regarding the new 400,000-kw. steam-turbine station under construction by the Brooklyn Edison Company. Aside from the record rating of the turbines to be installed, this plant is notable for the size of its boilers, the relatively small increase in size of turbines for their rating, the method of obtaining heat balance, the connection of generators to transformers without intervening switches, the extent of the use of high voltage for transmission underground to the substations, the method of isolation of phases and the use of an entirely new type of switch installation.



NEW POWER HOUSE OF BROOKLYN EDISON COMPANY, NOW UNDER CONSTRUCTION

Only one-half the ultimate building will be erected for the present, the boiler room next to the river, the turbine room and separated switch and bus house and the coal-storage space farther inland. Coal will be received by water and conveyed to the overhead bunkers by electrically operated coal towers. The overhead bunkers will accommodate four days' fuel supply under ordinary operating conditions. Traveling lorries will distribute the coal to the stokers. Six of the stokers purchased for the first installation will be Westinghouse and two Combustion Engineering. For the time being eight 19,650-sq.ft. B. & W. boilers will be installed. Ashes will be carried from beneath the furnaces to an outside under-water storage pit by hydraulic sluices, from which they will be hoisted to a concrete ash bunker and flow by gravity to ash scows.

Steam will be delivered to the turbine throttles at 265 lb. pressure and 200 deg. superheat. Both of the turbine-alternators are rated at 62,500 kva., 80 per cent power factor, one being a Westinghouse-Parsons tandem compound unit and the other a General Electric-Curtis unit. The Westinghouse turbine is about the same length as the 40,000-kw. turbines previously developed by the Westinghouse company, the increased power being obtained primarily through increasing the diameter of the bucket disks gradually rather than in steps and by the use of a cone-shaped drum barrel instead of cylindrical drums increasing in diameter by steps. The Curtis turbine is about the same length as the 50,000-kva. 90 per cent power-factor machines developed for the Detroit Edison Company, and it embodies all the results of the intensive research and experimental work carried on by the General Electric Company in the last two years. Both turbines will embody the latest refinements in disk and bucket construction, sealing glands, etc.

At full load (50,000 kw.) the Westinghouse Parsons unit has a guaranteed water rate of 10.44 lb. per kilowatt-hour, while the General Electric-Curtis unit has a guaranteed rate of 10.45 lb. per kilowatt-hour. The most economical water rate—namely, 10.04 lb. per kilowatt-hour—is obtained at 40,000 kw. load with the General Electric unit. In the Westinghouse unit the best economy is obtained at 36,000 kw. and is 10.1 lb. per kilowatt-hour.

Exceptionally large condensers are used, having 70,000 sq.ft. of cooling surface, both being supplied by the Westinghouse company. The condenser for the Westinghouse turbine is provided with rubber expansion joints and supported from the girders under the turbine. That for the General Electric turbine has rubber expansion joints but is supported by springs from foundations on the basement floor. Two circulating pumps are provided for each condenser, each rated at 50,000 gal. per minute. All the auxiliaries are electrically driven except one-third of the boiler-feed pumps, which are turbine-driven.

Generator and Transformer Unit

The generators are rated at 13,800 volts, 60 cycles, and, as stated before, are connected directly to auto-transformers stepping up the generator voltage to 27,600 without intervening oil circuit breakers, thus making each turbo-generator and corresponding transformer a unit. This voltage of 27,600 is adopted owing to the congested sub-surface street conditions in the vicinity of the station and the greater economy of transmission at this voltage for the distances encountered in Brooklyn.

Vertical isolated-phase construction was adopted for the electrical gallery; that is, phase switches A, B and C with their corresponding buses are situated on separate floors one above the other. This arrangement not only reduces the building space to the smallest dimensions but assures also reliability of operation and permits the adoption of special facilities for switch handling and easy inspection.

Special-type oil circuit breakers were designed by both the General Electric Company and the Westinghouse company to meet the requirements laid out by the engineers of the Brooklyn Edison Company.

The oil circuit breakers are of the dead-tank type, insulated for 37,000-volt operation, and each breaker is provided with bushing-type current transformers of high accuracy. The elimination of current-transformer compartments will save considerable space in the ultimate installation. The generator bus-tie and group-feeder breakers are to be capable of interrupting 1,500,000 kva., and the feeder breakers, which will be in series with feeder reactors, will have an interrupting capacity of 500,000 kva.

Each circuit breaker with its connections to the bus forms a cubicle and is hung on "I" beams from the ceiling, thus eliminating all barriers, bus, disconnecting-switch and circuit-breaker compartments. The operating mechanism is mounted on the top floor above the phase switches, while below them on the ground level are the potential transformers and grounding and testing switches. The potential transformers and grounding and testing switches are to be of the compound-filled type with no live parts exposed.

Screw rods operated by the mechanism on the top floor and extending down through the phase switch floors make it possible to lower each switch 15 in., thus completely disconnecting it from the bus. By this means all disconnecting switches have been eliminated. In this position the breaker may be removed, making replacement of parts very easy. Further operation of the lowering screws drops the tank so that all of the inside parts can be inspected. All operating parts of the switch are so arranged as to permit operation in the lowered position.

With the exception of the motors requiring variable speed, such as stoker and clinker-grinder drive, forced-draft fans and coal hoists and cranes, the auxiliary drive in the plant will be of the alternating-current type. The forced-draft fan motors and the coal-hoist motors will be operated with the Ward Leonard type of control. Motor-generator sets will be provided for supplying the direct current, the motors being supplied from the 2,300-volt bus.

The heat balance for this station will be obtained automatically by bleeding the turbines at two points into high-pressure and low-pressure closed heaters. The condensate from the main turbine will be used first to condense the exhaust steam from the house turbine, after which it will pass to the suction of the boiler-feed pumps, on which line the surge tanks also float.

The auxiliary power will be derived from three sources—power transformers fed from the high-tension bus, house turbine-generators and a reserve source of energy from a frequency-changer set which will be driven from the 25-cycle Gold Street station.

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Program of Credit Men's St. Louis Meeting

For the twenty-seventh annual meeting of the Electrical Credit Association, Central Division, to be held at the Gatesworth Hotel, St. Louis, Nov. 16 and 17, the tentative program includes the following features:

THURSDAY, NOV. 16

Morning.—Reports of officers and regional directors on trade conditions; election of officers; "Collection Troubles and Cures," August L. Abbott.

Afternoon.—Entertainment

Evening—Annual dinner, speakers, State Attorney-General Jesse W. Barrett, "Ethics in the Conduct of Business"; Rev. H. L. Reader, "Fellowship"; John S. Leahy, "Electricity and Credits."

FRIDAY, NOV. 17

Morning.—"Making Salesmen of Credit Men," F. B. Whitlinger; "A Credit Man's Road Experiences," A. F. Hearl; "C. O. D. Problems," V. G. Fullman; "Service Snags and Solutions," Miss S J. Burchill; "Value of E. C. A. Membership," W. P. Johnson; "When and How to Use the E. C. A. Forms"; Experience meeting and general discussion.

Afternoon.—"Creative Credit Management"; "Credit Work and Credit Letters," M. A. Patterson; "Ways to Make Money for the House," F. E. Watts; "Radio Problems," J. D. Meek; "Credit Insurance Experiences"; general discussion.

Brief News Notes

New Plant for Dallas.—The Dallas (Tex.) Light & Power Company has, it is announced, purchased a tract adjoining its present power plant on which it will construct an addition to house a 15,000-kw. unit, making its total available capacity 37,000 kw. The new plant will cost approximately $2,180,000, which with new substations and lines will bring the cost of improvements to $3,000,000. Work will start about Jan. 1, 1923.

Presumpscot River Power Exhausted. With the building of a new 1,000-kw. generating plant on the Presumpscot River, in Maine, now under way, by the Mallison Falls Power Company, which has leased the water rights of the Windham Manufacturing Company, it is said that virtually all the water power available from the river named will be utilized. The new plant will be of double the capacity of the company's present plant on the other side of the river.

Los Angeles Consumers Get Refund.—The Southern California Edison Company has been directed by the Railroad Commission to return to consumers unrefunded deposits aggregating $77,123 on hand at the time the city of Los Angeles took over the company's distribution system there. These deposits had been made to secure extensions. The city of Los Angeles contended that the money should be turned over to it, while the consumers, who were supported by the Edison company, claimed the refund.

Port of Seattle Year Book.—A handsomely printed and illustrated publication bearing this name has been issued under the authority of the municipality giving full data on Seattle's shipping business, terminal and harbor facilities, imports and exports and many other particulars of the rapidly growing city and port. Among the illustrations are one of the Gorge plant of the municipal Skagit River hydro-electric development and an outline map of the United States showing the water power of each state. This map bears the legend: "Total horsepower represented, 540,000,000, of which the State of Washington has one-sixth."

Interconnection in Southern Appalachian Region.—The general subject of interconnections between main and short lines and the contemplated super-power survey for the southern Appalachian mountain system were discussed at a meeting of the executives of the Southern Appalachian Water Power Conference held at Asheville, N. C., recently. The meeting was the first held since the formation of the conference last July. The entire proceedings of the conference are to be published in book form. If decision is reached to proceed with the survey, it is probable that federal and state aid will be invoked. Prominent engineers of North Carolina, Georgia and Tennessee attended the conference.

Progress in Green Bay Region.—To increase the capacity and improve the light and power service in Marinette, Wis., and Menominee, Mich., a new 2,400-hp. waterwheel generator will be installed by the Wisconsin Public Service Corporation at its White Rapids power plant, 20 miles north of Marinette on the Menominee River. This installation will increase the capacity to 11,000 hp. Land has been purchased by the Menominee & Marinette Light & Traction Company for the purpose of erecting a new substation which will pool the Rapids hydro-electric plant with the High Falls and Johnson's Falls hydro-electric plants and the steam plants at Green Bay and Manitowoc, bringing a 40,000-hp. supply to the two cities.

Tennessee Electric Power Company to Have Headquarters in Chattanooga.—Announcement is made that the Tennessee Electric Power Company, recently formed as the result of the merger of several Tennessee utility companies, will have its headquarters at Chattanooga. The company, it is stated, has completed a survey of the probable power needs of the territory it serves and has found that the present plants are adequate to meet all demands for the next two years, but after that time, if contemplated developments in the industrial life of the section take place, the company will be forced to make additional provisions. The company has power sites on the upper Ocoee and other streams in the state, including the Tennessee River.

Progress on El Dorado Plant.—Rapid progress is being made on the 100,000-hp. hydro-electric development on the American River in California to be known as the El Dorado plant of the Western States Gas & Electric Company. About 1,500 men are engaged on construction work, and it is expected to have the first unit of 20,000 kw. completed by December, 1923. The ultimate development calls for four units totaling 100,000 hp. The operating head will be 1,900 ft., making this one of the high-head developments of the country. Work is now about 40 per cent complete on the first unit. A double-circuit 110,000-volt transmission line will be constructed to connect with the present system of the company, and this will later be extended to Stockton as the demand for energy increases.

Report of Toronto Hydro-Electric System.—The eleventh annual report of the Toronto Hydro-Electric System, for the year ended Dec. 31, 1921, has just been received. It indicates a gross income of $3,622,605, an expenditure for electrical energy, operation and maintenance of $2,212,374, and charges for interest, depreciation, taxes and similar items of $1,195,888, leaving a net surplus amounting to $214,353. Energy sold was 221,384,558 kw.-hr., the connected load was 227,600 hp. and the peak load 76,378 hp. There were 81,923 meters and 46,126 street lights in use. According to the report, "this year's figures show that to date the system's customers have been saved not less than approximately $28,000,000 of the aggregate they would have paid for the same amount of electrical energy had the rates that were in force in this city at the inception of the enterprise [1912] been continued."

Customer Ownership Analyzed.—In the current issue of the *Saturday Evening Post* (Nov. 11) James H. Collins presents an extensive analysis of the benefits of customer ownership of utility securities, basing most of his observations upon the customer-ownership development in the electric light and power industry. While much of the material presented by Mr. Collins will be new to electrical men, his interpretation of the advantages of customer ownership to the community and to the utilities is sure to prove of interest to the electrical fraternity.

Connecticut Light & Power Company's Devon Plant.—The new plant of the Connecticut Light & Power Company to be built at Devon, on the Housatonic River, as recorded by the *Electrical World* for Sept. 2, page 500, will start with the installation of two 25,000-kva. prime movers and is now being laid out to permit the ultimate addition of four 40,000-kw. units, though the size of the prime movers to be installed in the future has not been absolutely determined. The boiler pressure will be 300 lb. and the pressure at the throttle 285 lb. Westinghouse underfeed stokers and 1,680-hp. Springfield boilers are to be employed. The temperature of the steam will be 700 deg. at 300 per cent rating, and the closed system of ventilation will be used for the generators. This station, as already announced, will have a transmission system of 75 miles and will serve Waterbury, New Britain and the Naugatuck Valley directly and the western end of the state indirectly.

Indianapolis Competitive Situation Before Governor.—Whether the Indiana Public Service Commission shall permit the Terre Haute, Indianapolis & Eastern Traction Company to sell electrical energy to Indianapolis patrons is being considered by Governor McCray. The company recently petitioned for authority to provide service. The Merchants' Heat & Light Company and the Indianapolis Light & Heat Company, as possible competitors, are opposing the petition. Those who are trying to keep out the prospective competitor have argued before the Governor that if the traction company be permitted to enter the field it will be able to make a power service rate so low that the two companies now in the field will be unable to compete and will be left with residential lighting service as their principal business. The Indianapolis city administration is favorable to admitting the traction company, which is proposing to spend approximately $7,000,000 to enlarge its West Tenth Street and other city power stations.

Associations and Societies

Philadelphia Section, I. E. S.—Davis H. Tuck, illuminating engineer with the Holophane Company, New York, will address this section of the Illuminating Engineering Society on Tuesday evening, Nov. 14, his subject being "School Lighting."

Utah Contractor-Dealers Reorganize.—The Contractor-Dealers' Association of Utah has been reorganized and is now known as the Utah Association of Electragists. The following officers have been elected for the ensuing year: George R. Randall, president; G. W. Forsberg, vice-president; Blaine Gray, secretary; C. R. Dodge, treasurer. Noon luncheon meetings of the new association will be held on Tuesday of each week.

A. I. E. E. Sections Interested in Street Traction Problems.—The "trackless trolley" is to be discussed by J. A. Queeney and J. F. Collins before the Philadelphia Section of the A.I.E.E. at its meeting on Monday, Nov. 13. The same subject was discussed at a recent meeting of the New York Section before a large gathering, when the relative merits of trolley cars, motor buses and the trackless conveyances were compared by J. C. Thirlwall of the General Electric Company's railway engineering department. The Baltimore Section has also discussed the topic.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Ontario Association of Electrical Contractors and Dealers—Toronto, Nov. 13-14. J. A. McKay, 24 Adelaide St. W., Toronto.

National Association of Railway and Utilities Commissioners—Detroit, Nov. 14-17. J. B. Walker, New York Transit Commission, New York

Electrical Manufacturers' Club—Hot Springs, Va., Nov. 15-19

Electrical Credit Association, Central Division—St. Louis, Nov. 16-17. F. P. Vose, 1347 Marquette Bldg., Chicago.

Electrical Supply Jobbers' Association—Cleveland, Nov. 20-24. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Physical Society—Chicago, Dec. 1 and 2. D. C. Miller, Case School of Applied Science, Cleveland.

American Society of Mechanical Engineers—New York, Dec. 4-8.

Electrical Supply Jobbers' Association, Pacific Coast Division—Coronado, Calif., Dec. 7-9. A. H. Elliot, 502 Flatiron Bldg., San Francisco

New York Electrical Credit Association—New York, Dec. 14. W. J. Kreger, 47 W. 34th St., New York.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Commission Rulings

Telephone Equipment for Radio Beyond Commission's Jurisdiction.—The Wisconsin Railroad Commission has dismissed the complaint of the Madison Kiwanis Club against the Wisconsin Telephone Company for its refusal to carry certain speeches to be broadcasted by wireless telephony, the commission asserting that it has no jurisdiction over telephone company equipment used in sending radio messages. An agreement between the club and the telephone company, however, permits the club to use the wires.

Company Forbidden to Require Customers to Advance Cost of Installing Meters.—Permission has been refused by the Illinois Commerce Commission to the Perry Light & Power Company to require the public to contribute to the capital expenditures of the utility by paying in advance the cost of installing meters, even though the amount so advanced is to be returned to the consumers by deductions from monthly bills. The charge complained against resulted from the discontinuance of the generating plant at Perry and the purchase of power from the Central Illinois Public Service Company, this necessitating the replacement of the former direct-current meters with alternating-current meters.

Pennsylvania Commission Orders 1906 Rates Restored.—The York Haven Water & Power Company has been directed by the Public Service Commission of Pennsylvania to restore its old rates for furnishing electric power to the borough of Middletown. The old rates were suspended by a tariff effective Oct. 1, 1920, which changed the charges to the borough from a flat rate of 1 cent per kilowatt-hour, as provided in a contract made in 1906, to a variable rate depending upon the amount of energy taken and monthly consumption. This change resulted in a virtual increase of about 50 per cent. The power company is now ordered to restore the old rates within ten days from the date of service, and they are to become effective on one day's notice.

Principles Governing Rural Rates.—In granting to the Mount Horeb Heat, Light & Power Company an increase in the rates charged farm customers ranging from $2 a month for a transformer rated at 1 kva. to $6.30 a month for a 7½-kva. transformer and from 14 cents for the first 20 kw.-hr. used per month to 5 cents for all in excess of 60 kw.-hr., the Wisconsin Railroad Commission made these observations: "The intent of a rural schedule is to provide a rural charge which will take care of all the excess fixed charges and operating expenses due to the nature of the rural business and which will, when paid, place the rural consumer on exactly the same basis as an equivalent urban consumer and make the urban rate applicable. In the present case applicant proposes to establish a block type of schedule together with a rural charge, instead of the active-load rate now in effect for urban service. This proposed schedule is designed to cover both lighting and power service. In its computations applicant has used certain figures which are at variance with those commonly used by the commission in computing the special fixed charges allocatable to rural service. It has, for example, used an allowance of 12 per cent to cover depreciation, taxes, maintenance, etc., whereas the commission has customarily used 10 per cent. No evidence has been submitted by applicant sufficient to cause the commission to revise its allowance in this case. In our computations, therefore, we have adhered to our usual allowance of 10 per cent."

Recent Court Decisions

State of Idaho Holds Title to Beds of Navigable Streams Below High-Water Mark.—Declaring, in Miller vs. Lewiston-Clarkston Canning Company, that in the State of Idaho the state holds title to the beds of navigable streams below the ordinary high-water mark for the use and benefit of the whole people, the Supreme Court of Idaho found that the appellants in the case had no right or title to any part of the bed of the Snake River. When land bordering upon navigable water is granted by a patent of the United States government, the court said, title to the adjacent land under the navigable water does not pass by virtue of the patent. It is the settled law of Idaho that title to such land is vested in the state. (209 Pac. 195.)*

Commission Cannot Force Resumption of Service Abandoned Because Federal Court Ordered Right-of-Way Vacated.—Twenty-one towns on the branch lines of the Louisville & Nashville Railroad in Alabama will not have their telegraph service restored and the State will be unable to collect penalties aggregating $914,000 against the Western Union Telegraph Company as a result of a decision of the Supreme Court of Alabama. The decision affirmed the decision of the circuit court of Montgomery County, which held that the telegraph company could not be forced to reinstate the service, which was abandoned when the federal court ordered it to vacate the right-of-way of the Louisville & Nashville Railroad. The Alabama Public Service Commission had ordered the telegraph company to continue the service when notice of abandonment was received. The telegraph company ignored the order, and the Attorney General of the state filed a petition to require the company to establish the service and to pay $1,000 for every day that passed without such re-establishment.

Municipality Has Right to Condemn State Lands for Public Use.—The city of Tacoma won a condemnation suit in connection with the development of the proposed Lake Cushman hydro-electric project when the Supreme Court at Olympia, Wash., reversing the court below, recently upheld the city's authority to condemn state lands for public use and to appropriate the entire flow of the north fork of the Skokomish River for hydro-electric purposes. The city showed that since 1901 the state had maintained a salmon-hatching station at the site, although the station had not been used since four months after it was built. There had been since that year no act or declaration of intention on the part of the state to use the station, and the mere fact that the state owns property and has the right and power to devote it to public use is not sufficient to estop the city, the court held, inasmuch as the city's proposed use is immediate and public. The court also found that the proposed diversion of the entire flow of the north fork of the stream would not be damaging to the state, but possibly be beneficial by preventing floods of the main stream at the Skokomish hatchery site.

Overhead Expense Paid from Revenues Should Not Necessarily Be Excluded in Valuation.—The Public Service Commission of New York erred, according to the finding of the New York Supreme Court, in People ex rel. New York State Railways vs. Commission, in excluding from the valuation of a utility overhead expenses representing necessary engineering, legal and administrative services in connection with the construction of utility property on the ground that they had been furnished by the regular staff of the company, whose salaries were charged to operating expenses. "Undoubtedly this feature should receive due consideration," said the commission, "but some portion of these expenses must necessarily have been incurred by reason of the organization, construction and development of the particular road in question." The commission disallowed nearly all the items, however, because "otherwise it would be necessary to revise the operating expense accounts by excluding a portion of the salaries of the officials concerned, and such revision would produce larger net earnings. . . . It has been held that past losses are not to be considered in determining the rate base and whether the present rate is confiscatory. It would seem to follow as a necessary corollary that if past losses may not be considered in fixing a base rate, neither should past profits be so considered, nor what would have been past profits or 'larger net earnings' by a readjustment of operating expenses." (195 N. Y. S. 174.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Doherty in Business Forty Years

Henry L. Doherty, who founded and built up the Cities Service Company, controlling more than a hundred public utility and petroleum subsidiaries, reaching from the Atlantic to the Pacific Coast and from Canada into Mexico, recently celebrated the fortieth anniversary of his entry into the public utility industry. "Doherty Week," Oct. 15 to Oct 23, was set aside as a mark of honor to their leader by the employees of the Cities Service Oil Company and the Doherty organization. Mr. Doherty was a newsboy in Columbus, Ohio, when at the age of twelve he became an office boy with the Columbus Gas Company. As a result of hard work and close application he rose so rapidly in the engineering department that at twenty-two he was chief engineer and assistant to the manager of the Columbus plant. In that year he went to Madison, Wis., as manager of the Madison Gas & Electric Company, and later he became its president. Since then, in succession or simultaneously, he has filled the positions of engineer of the Columbus Electrical Company, general manager of the St. Paul Gas Light Company and St. Paul Edison Company, constructing engineer for the Jacques Cartier Electric Company of Quebec, chief engineer for Emerson McMillin & Company, New York, chief engineer and manager of the American Light & Traction Company, engineer and manager and afterward president of the Denver Gas & Electric Light Company. With this record to his credit, he developed his large public utility business, to which in more recent years he has added an oil business of great proportions.

H. L. DOHERTY

Mr. Doherty has taken an active and most creditable part in many non-commercial bodies interested in the gas and electric industry. He guided the Society for Electrical Development from its beginning until a year or so ago, and during his term of office as president of the N. E. L. A. the program of the association was broadened to include commercial and accounting activities as well as engineering functions. Mr. Doherty is still working out new problems each day from his office at headquarters in New York, where he is applying the two principles that he adopted early in his career—"pride of workmanship" and "pride of service."

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Philip S. Smith to Direct Geological Survey

The resignation of Dr. George Otis Smith as director of the United States Geological Survey, so that he could qualify legally as a member of the President's coal commission, places the full responsibility for the conduct of the survey during the next eleven months in the hands of Philip S. Smith, who has been serving as the survey's administrative geologist. The new director has spent practically his entire career on the staff of the survey. While his outstanding accomplishments have been based on his geological and economic studies in Alaska, he has had wide experience with many phases of the work done in his bureau. Dr. Smith's resignation is of a temporary character and he will be reappointed as director of the survey when his duties with the coal commission are over.

◆

C. T. Russell General Counsel of New York Telephone Company

Charles T. Russell has been appointed general counsel of the New York Telephone Company, succeeding John L. Swayze, who died in August. Mr. Russell will have charge of all the legal, legislative and tax matters of the company and will also act as general counsel of the Empire City Subway Company, Ltd., the Friendship Telephone Company, the Holmes Electric Protective Company and the New York Telephone Realty Corporation. Mr. Russell became associated with the telephone company in 1906, when he accepted a position in the legal department. In 1911 he was appointed counsel and in 1915 general solicitor, in charge of all legal and tax questions other than legislative and Public Service Commmission matters.

◆

Frank Rand is now chief engineer of the electric light and power plant at Titusville, Pa., replacing John Smith.

San Joaquin Utility Appoints G. S. Jacobs Consulting Engineer

Gaskell S. Jacobs, a prominent San Francisco engineer, has been appointed consulting engineer for the San Joaquin Light & Power Corporation and subsidiary companies, with headquarters in Fresno. Mr. Jacobs enters this work after thirteen years of public utility work with various California companies and a long experience on the staff of the California Railroad Commission and in independent consulting work. After graduation from the University of California in 1909 he was engaged as engineer on the staff of the People's Water Company of Oakland, now known as the East Bay Water Company. In 1911 he was engaged by the J. G. White Engineering Corporation for valuation work, with headquarters in San Francisco. After spending the following year with the Great Western Power Company in its Northwestern division he became associated with C. L. Cory of Berkeley in rate and valuation work. Later he was engaged in special work for the Pacific Gas & Electric Company, and from 1915 to 1921 he was on the staff of the California Railroad Commission in the gas and electric department. For more than a year past Mr. Jacobs has been associated with F. Emerson Hoar in special investigations in rate valuations and project developments in San Francisco. His many years of experience well qualify him for his new work with the San Joaquin Light & Power Corporation in helping to co-ordinate its extensive operations.

G. S. JACOBS

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John H. Anderton, of the firm of Thebo, Starr & Anderton, consulting engineers of San Francisco, has recently returned from Japan, where he spent several years in supervising hydro-electric development on the Kisogawa River in the heart of the Japanese Alps for the Daido Electric Company. Mr. Anderton was formerly chief engineer for the Stone & Webster interests.

O. R. Hogue New Walker Sales Manager

Oliver R. Hogue, chairman of the Commercial Section, N. E. L. A., on Nov. 1 assumed the position of sales manager for the Walker Vehicle Company, Chicago. To this position he brings the training and experience obtained during twenty-five years' active service in the electrical industry. Mr. Hogue was born in Philadelphia in 1874, going to Chicago with his parents the same year. In 1896 he became associated with the Chicago Edison Company, now the Commonwealth Edison Company, and he has served this company ever since as chief clerk in both the inspection and contract departments and later, up to the time of his new connection, as head lighting agent. He has been a consistent worker in the lighting end of the central-station business, having organized an engineering corps for the purpose of furnishing customers with reliable data on layouts for lighting systems. As chairman of the Lighting Sales Bureau in 1921 he was largely instrumental in obtaining information on store lighting. He has taken a prominent part in the activities of the N. E. L. A., the I. E. S. and the Illinois State Electric Association.

O. R. HOGUE

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J. C. Hoyt, administrative official of the division of surface waters of the Geological Survey, Washington, D. C., has just returned after a six weeks' tour of Western districts.

Elwin M. Inghram has been appointed to the position of engineer in charge of stations No. 7 and No. 8 of the Public Service Company of Northern Illinois at Joliet, replacing D. C. Fraser, who was made master mechanic some time ago. Mr. Inghram went into the service of the Economy Light & Power Company in 1907, and when it was absorbed by the Public Service Company became an employee of the latter. Before his present promotion he was assistant to the engineer of stations No. 7 and No. 8.

George P. Rich is now chief engineer of the Walhalla Electric Power Plant, Walhalla, N. D., replacing V. C. Kelsey.

L. D. Cornell is now superintendent of the Ipswich Electric Light & Power Company, Ipswich, S. D., replacing W. H. Morris.

C. P. Frey is now engineer in charge of the power station of the municipal water and electric light plant at Springfield, Tenn., replacing W. L. Felts.

Samuel Ferguson, vice-president of the Hartford (Conn.) Electric Light Company, has been elected second vice-president of the Hartford Chamber of Commerce.

C. Opitz, formerly district agent for the Puget Sound Power & Light Company at Renton, Wash., has resigned to become district agent for the Olympic Power Company at Port Angeles, Wash. L. P. Heath has been appointed to the vacancy at Renton.

L. M. Kean, for six years connected with the sales department of the Edison Electric Appliance Company, has joined the Faden Electric Company, Chicago. This appointment dates from Oct. 1, when the Faden company became a distributor of Hotpoint products.

Frederick Franz, who for the past four years was chief engineer of the Terminal Engineering Company, has established an engineering office in New York City for the purpose of solving special problems of engineering relating to labor-saving machinery for industrial plants.

A. L. Thexton has been made assistant editor of the *Edison Round Table*, the semi-monthly publication issued by the Edison Club for the employees of the Commonwealth Edison Company. He is succeeding M. J. Lucas, who has become associated with the advertising department of the company. Mr. Thexton brings many years of newspaper experience to the service of the organization.

Howard D. Matthews has terminated his connection with the Milwaukee School of Engineering, where he has been head of the department of electrical design for the last four years, and is now in the engineering department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. Before going to Milwaukee Mr. Matthews was for ten years with the General Electric Company at Schenectady, N. Y., as a designing engineer.

Frederick B. Larsen has become associated as field representative for South Carolina, Georgia and Florida with the Bryant Electric Company of Bridgeport, Conn. For three years he has been manager of the Hunter Electric Company of Clearwater, Fla., and prior to 1919 he was for twelve years a sales representative of the Robbins & Myers Company in the South Atlantic States. Mr. Larsen brings to his new duties not only a wide acquaintance with business in the South but experience as a contractor-dealer.

Westinghouse Chief Engineer Honored

In recognition of his notable engineering achievements as chief engineer of the Westinghouse Electric & Manufacturing Company, the Joseph Sullivant medal has been awarded to Benjamin G. Lamme by the Ohio State University. This medal owes its establishment to Dr. Thomas C. Mendenhall, professor emeritus of physics and a member of the board of trustees, who recently presented the university with a fund for that purpose in honor of Joseph Sullivant, a member of the first board of trustees and a man more influential than any other person in determining the character and future of the university at the most critical period in its history. Mr. Lamme, who was graduated from Ohio State in 1888 in mechanical engineering, is the first person to receive the medal. He has been associated with the Westinghouse Electric & Manufacturing Company since 1889 and has been its chief engineer for nineteen years, having become one of the best known electrical engineers not only in the United States but also throughout the world. About four years ago he was elected chairman of the Naval Consulting Board, and in June, 1919, the Edison medal was awarded to him by the American Institute of Electrical Engineers for special merit in engineering and research.

B. G. LAMME

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Charles E. Stahl, vice-president, assistant general manager and sales manager of the Connecticut Telephone & Electric Company, Meriden, Conn., has resigned. Mr. Stahl had been with the company for ten years.

William A. Root, formerly assistant secretary of the Bronx Gas & Electric Company of New York City, is now the treasurer of the company, with which he became associated ten years ago as new-business manager. Previous to his connection with this company Mr. Root was purchasing agent of the Empire Gas & Electric Company with headquarters at Auburn, N. Y.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic **Problems** of the Producer and Distributor, with Market Reports, **Trade** Activities, Foreign and Construction News

Quality in Product and in Salesmanship*

Influence of Creative Standardization on Competition—Education of the Salesman in Essential Policies

By R. J. Russell
President Electric Power Club, Vice-president and Secretary
Century Electric Company, St. Louis

COMPETITION among manufacturers is possible only because all are competing to preserve the quality of their wares of service. Without competition, development and expansion are slow and unusual. Our very existence makes it necessary that we seek ways to preserve our quality. The best survivor is he who is the best co-operator. He who has not developed qualities fit to survive and function with others is weak and cannot successfully co-operate. We can co-operate with and help each other by setting up standards of minimum quality for the guidance of others, and all this without action which essentially obstructs the activities of any one.

Two Ways to Compete

I believe that without exception all electrical manufacturers have competition — both at home and abroad. There are only two ways to meet it:

(a) The negative way, which is to reduce the quality of the article and sell it on price.

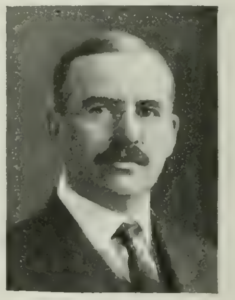
No manufacturer of electrical apparatus can succeed who turns out goods of poor grade, due to design, to material, to workmanship or to all three, because the demand is not great enough to permit him to avoid the selling effort, and the sales effort required by low-quality goods will prove entirely too expensive because of the small number of repeat orders.

(b) The other or positive way, which is to keep up the quality—one of the definite objects of the Electric Power Club.

It is most important to make the price fair, reduce overheads to reduce costs, employ acknowledged good business practices and build up a good sales organization to market the product, and keep everlastingly at the job of manufacturing and selling.

That we certainly cannot expect to compete in the overseas market on any other than a quality basis all who are active in the foreign field must be ready to agree; hence we must as Americans co-operate to keep up the quality and advance the reputation of our products and to maintain clean-cut businesslike policies and practices abroad.

As we decide upon standards which indicate our belief of the minimum of quality the industry should offer, we should further co-operate to obtain the best results for all interested by incorporating these standards in our daily practice—to compete on the basis of superior quality or service within reasonable limits. To do this without the lapse of an appreciable period of time is not always easy for various reasons:



R. J. RUSSELL

(a) We may be delayed because of necessity for working off several months' supply of a given line or size of goods or parts therefor.

(b) We may not feel sufficiently strong commercially to undertake the pioneer work of launching a new line or practice ahead of our larger and better equipped competitors.

(c) We may not find ourselves financially able to make immediately the investment necessary to put the new standards into practice.

But delays in adoption of new standards should be avoided—they suggest to the uninformed public, other associations and engineering bodies many things that are not particularly desirable. When standards are adopted, we should individually let the public know it, and state it in our advertisements, our literature, our price sheets and even on our nameplate. By all means we should refrain from offering freak ratings or adopting peculiar or questionable practices which as a body we may soon find it difficult to correct.

Reduction of Overheads Important

One of the best ways to compete profitably is to decrease the overhead. The question of reducing overhead or burden is one that I hesitate to start to discuss because it is such a broad one. I firmly believe there are but few factories that cannot by careful thought be relieved of some of the burden. In some of them we find too broad or varied a line of goods manufactured or not enough to get good production from a small line. In other words, they are job shops as compared to a shop that has tools at work on one operation for days at a time if not continuously. And then in others there are too many non-producers—for instance, engineers—who cannot let a design rest long enough to get it into real production. In many cases we need to give more attention to the small affairs of our business.

The question of what price to charge for the product of our works is something that should have our most careful consideration before it is established. He who allows his competitors, in lines like ours, to fix his price is in serious danger. His competitor may be guessing or have made a mistake in his calculation. The Electric Power Club has co-operated with the rest of the electrical manufacturing industry in setting up a most creditable accounting system. If we use it or its equivalent and take the results as our guide to what we can do under normal conditions and apply a factor of safety to cover the lean years or periods, our price will not be such as to prevent people buying and filling up our works.

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*Abstract of presidential address before Electric Power Club, Asheville, N. C., Oct. 30-Nov. 2, 1922.

Competition is especially keen in business practices. It is keen particularly because many continually endeavor to go their competitors just one better in terms, conditions of sale and so on. We find that those who compete most successfully, who co-operate best, are they who have established a definite policy governing all phases of their business. Using as their guide a determination to treat all alike and to conduct the business along what are generally conceded to be safe and sane lines, they have put this policy into such definite rules that their individual organization understands it and carries it out. Usually their policy will incorporate a margin of safety into the articles they make, so that their value will not be less than the customer has knowingly purchased and make it necessary to answer complaints and make replacements or repairs.

When manufacturers establish this principle their terms or financial practices are not such as encroach upon the field of the banker through the indorsing of customers' paper. Their stock remains in or under their control where it can be used to satisfy any customer who places an order. Those who believe that placing consigned stock with prospective customers is profitable should examine each case carefully as some surprises may await them.

High-Class Salesmen Necessary

Competition of a high order can be indulged in when we have sales organizations made up of men who are a credit to the industry and reflect the personality of the house they represent and carry out its precepts with authority. We, in the industry represented by the Electric Power Club, do not obtain our best salesmen from among those who are suspected of being "natural-born electricians," neither do we secure them from our competitors. We must make them—and that takes time.

The best are made by selecting them carefully from among technically trained men—men who know how to find out, who have had little, if any, of the varied experience such men frequently desire to acquire. We must look well to their nationality, age, stature, appearance, health, reputation, habits and so forth. We can take into our employ men like these who have not acquired fixed habits and practices in the business world, and in a few months—

(a) Teach them that they must be guided by the highest code of ethics they can conceive.

(b) Teach them that they and the company they are connected with cannot have all of the business to be had unless perchance they have a monopoly on their line.

(c) Teach them the fundamentals of our policy.

(d) Convince them as to which is the best kind of business to seek —for illustration, motors off the shelf, because then the works can be operated more economically through an even rate of production and steady employment of workmen.

(e) Teach them that in handling complaints they must never assume the burden of proof, but rather maintain that the apparatus is right until it is proved otherwise or its condition indicates an inherent defect.

(f) Teach them that every transaction involving a portion of the productive capacity of the factory must be covered by a non-cancellable order or contract—that we cannot otherwise insure the sale of that capacity.

(g) And, finally, put the salesman on a salary with no commission and remove the temptation to work for the customer.

Finally, let us learn to know our competitors better that we may be able to co-operate more efficiently. It will aid our efforts to reach decisions as rapidly as possible on the various questions of standardization that have for their object an improvement in the articles we manufacture. It will improve the standing of our product and the demand for it not only in this country but abroad.

And to this end let us assume a co-operative attitude toward other organizations that are carrying on co-operative work, even though they may be concerned with matters in which we may have only passing interest.

Will the Electrical Jobber Endure?

How This Question Finds a Practical Answer in the Record of the Hardware Industry—What the Jobber's Function Should Be—With a Word on Compensation

By W. E. Robertson
General Manager Robertson Cataract Electric Company, Buffalo, N. Y.

It always amuses me when I hear men hold forth on the future of the jobbing business in the electrical industry and predict that the wholesaler is on his way to oblivion. They strive to prove that the jobber was an economic necessity during a certain period of our development, but that with the increasing activity of the larger manufacturers and their more broadly organized selling distributing machinery in certain lines the jobber is ceasing to serve any useful purpose. And they are apt to cite the dwindling of the dry-goods jobber as ominous evidence.

It so happens that I had occasion not long ago to investigate the record of the jobber in the only line directly comparable with ours—the hardware jobber. The dry-goods jobber is not comparable. He sold the output of mills manufacturing varied and kindred designs and styles in a staple line, changing little fundamentally from year to year, and the evolution of the great department stores bridged over his head. But the hardware line embraces a broad variety of staples and specialties constantly changing and progressing, ever in a state of flux. And as the world moves on the hardware jobber changes with it, steadily gathering this assorted merchandise, combining it and making it available to the retailer to enable him to meet the onward drifting demand of the public. He serves the same economic purpose that the electrical jobber does.

Why Jobbers Live Long

I applied to Babson and to the Harvard Research Bureau for statistics on the stability of the jobbing business. They had no data, but I pursued my own investigation and found out some interesting things. I found, for instance, that in New York there are two such jobbing houses that antedate the Constitution of the United States. In Philadelphia there is a hardware jobber that dates back to four years after the coming of William Penn. And there is one in Buffalo that was established there shortly after the British burned the city. And the reason why the hardware jobber endures so long, I believe, is this:

The manufacturer in any industry produces a limited line. His market and his prosperity are affected by all manner of localized influences. Along comes an industrial crisis and he fails. New inventions come along and take his market away from him. Some unexpected obstacle interferes with his service of supply. Styles or other trends in his field change the whole nature of his opportunity. But the jobber has a broader line. His eggs are not all in one basket. When the times change his line changes in balance with the altered market. He buys in the markets of the world and he sells not a line but a trade, and his problem is not the restricted necessity for selling that which he makes but rather the need for providing whatever his trade wants at the time.

Manufacturers may change, markets may change, the character of the demand may change, good times may come and go, and even governments may change, but the jobber goes ahead meeting the demand that is to be met and continuing to function in tune with the times. I can see no possible reason for any uncertainty as to the permanence of the electrical jobbing business when I contemplate the history of the hardware jobber.

It is well, however, to remember one thing. There never has been and never will be opportunity for spectacular profit in this business. The very elements that make for its durability preclude this possibility. Success through succeeding generations rests fundamentally upon an intelligent understanding of the present and proximate future needs of the territory served, a knowledge of the world centers where these needed things are produced and of the transportation, customs and other charges that must be added in obtaining them. These are the things that will determine the compensation to be derived therefrom:

1. Low cost of warehousing.
2. An appreciation of the significance of turnover.
3. Accurate cost accounting without indulgence in frills.
4. A strong selling force of steady pluggers.
5. The establishment of a reputation for dependability that must be maintained at all costs.
6. Constant and careful training of men in the policies and traditions of the business, so they may take the places of the older men as their work is finished.
7. The accumulation of reserves out of profit to care for periods of depressions, which are inevitable and which no cleverness can prevent or altogether overcome.
8. And, finally, first, last and all the time, the quality and need of the service rendered.

The reason that I have stayed in the electrical jobbing business and the reason that it sustains my interest year after year is because it presents this ever-changing panorama of opportunity. No man who is striving to make his organization function as it should can ever go stale. Within our easy recollection we have passed through the tremendously interesting experiences of radio, of the electric clothes washer, of the electric vacuum cleaner and a dozen more striking examples. We have seen each one of these lines come groping into the light, gain strength and grow into a boom and then settle down into a business. All the more reasons why we, each one of us, should study carefully every new line that comes along before embarking on its exploitation and its distribution.

WHAT THE FUNCTION SHOULD BE

Before the jobber takes on a line he should determine and know fully what he is to do with it. If the manufacturer is to create the demand, then the jobber should be paid for the warehousing function. But if the manufacturer is going to rely on the jobber to do the pioneering and create the market, then the jobber must be adequately compensated for this greater responsibility and the greater effort entailed. There have been many cases where the manufacturer has convinced the jobber that he should do the market building in order to enjoy the benefits of the expected future reorder business and then the manufacturer has changed his policy or his line and no future profit has come. And so the jobber should study always what part it is that he should play in the distribution of any commodity, not just to fit into the plan of the manufacturer but to suit the future demands of the market. His profit on that line should be arranged in accordance therewith. And the jobber should concentrate his attention and his effort on the line that pays.

No man need feel any lack of confidence in the future of the electrical jobber. For the jobber renders an absolutely essential service to the industry as the great balance wheel of distribution. He provides a permanence and stability to the electrical trade that is of a value beyond estimation. And as the hardware jobber has endured through all these generations so will the electrical jobber bend to the times and "carry on" through each succeeding stage of evolution.

Survey of Business Conditions

Appliance Manufacturers Enjoying Better Business

Manufacturers of electrical socket devices for home and other use are as a rule much busier than last year. Production is still going forward on orders placed in anticipation of the 1922 holiday trade and plans are being made for next year's business. An excellent Christmas demand is anticipated this year. At present in some quarters there is much difficulty reported in securing a suitable labor supply.

Sales of appliances to South Africa, Australia and South America are improving. Toasters, flat-irons, waffle irons, radiant heaters and other lighter devices are selling best in this country. Interest in electric ranges is reasonably active, although the present is a quiet period of the year in this line.

October sales for wedding presents showed up well in the hollow-ware lines, and a gain in interest in vacuum cleaners is beginning to be in evidence. Prices hold firm in appliance lines, and the volume of trade is responsive to the efforts of central-station companies and other retailers to develop new business.

◆

Greatest Bituminous Loadings Recorded Last Week

The railroads of the United States loaded more bituminous coal during the first three days of last week than during any corresponding period since the miners' strike began on April 1 last, according to reports received from the carriers by the American Railway Association.

The total for the three days was 105,571 cars. This exceeded by 1,598 cars the total for the same three days of the previous week, which had marked the peak for such a period.

Bituminous coal loading on Wednesday of last week amounted to 28,048 cars, while loading of anthracite coal on the same day totaled 1,931 cars. Both were reductions under the day before and which were due to the observance in the coal fields of All Souls' Day on Nov. 1.

Storage-Battery Business for Renewals Is Most Active

In its November *Monthly Business Review* the Federal Reserve Bank of Cleveland says that a well-known storage-battery company in that district sold more batteries in the month of September for renewal purposes than it ever sold in one month before. Commenting on conditions in the industry, the review says:

"The storage-battery business is reported to be very good with most of the large companies. Orders from car manufacturers for original equipment are holding up well and are in keeping with the time of the year. During the period when prices showed frequent drops dealers were inclined to carry small stocks, but this condition has changed now and the manufacturers believe dealers' stocks are normal.

"The electrical industry is reported to be keeping in step with the general improvement in business. The direction in which this business is showing the greatest improvement is in the additional equipment ordered by public utility corporations to take care of the rapidly growing demand for electricity in all its uses. This demand is not confined to any particular locality, but it is remarkably widespread over the entire length and breadth of our country. A demand for generating and transforming apparatus, together with switching and control apparatus, is reported by a large company to be coming from central stations in all parts of the United States.

September Electrical Exports Totaled Over $5,000,000

Electrical machinery, apparatus and appurtenances to the extent of more than $5,000,000 were exported during September, returns to the Deartment of Commerce show. The detailed figures are as follows:

ELECTRICAL EXPORTS FOR SEPTEMBER, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

	September, 1921	September, 1922
	Value	
Turbines		$68,574
Generators	$855,419	
Direct-current		
Under 500 kw		57,467
500 kw. and over		104,222
Alternating current		
Under 2,000 kw		7,688
2,000 kw. and over		24,870
Accessories and parts for generators		30,680
Self-contained lighting outfits		48,339
Batteries	271,232	
Primary—dry		88,441
Primary—wet		111
Storage		142,387
Transforming and converting apparatus:		
Transformers	353,033	
Power transformers		499,755
Other transformers		80,390
Rectifiers		5,359
Condensers, double-current and motor generators, dynamotors, synchronous and other converters		113,834
Transmission and distributing apparatus:		
Switches and accessories	159,690	...
Switches and panel boards, except telephones		365,348
Switches and circuit breakers		131,359
Fuses and fuse plugs		15,612
Meters and measuring instruments	191,411	
Watt-hour and other measuring instruments		24,270
Volt, watt and ampere meters and other recording, indicating and testing apparatus		66,915
Lightning arresters, choke coil reactors and other protective devices		66,567
Motors, starters and controllers:		
Motors under 1 hp		78,829
Stationary motors—		
1 to 200 hp		188,390
Over 200 hp		25,320
Railway motors	75,307	35,251
Electric locomotives	59,817	
Railway		132,498
Mining and industrial		28,297
Other motors	537,558	12,847
Rheostats, controllers and other starting and controlling equipment	45,304	106,414
Accessories and parts of motors		112,015
Electrical Appliances:		
Electric fans	$21,129	$59,537
Electric lamps—		
Arc	455	2,288
Incandescent—		
Carbon-filament	2,448	7,019
Metal-filament	76,187	99 893
Other electric lamps		17,505
Flashlights		29,630
Searchlights and projectors		22,247
Motor-driven household devices		49,920
Domestic heating and cooking apparatus	95,699	56,748
Industrial electric furnaces and ovens		24,988
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries		46 716
Signal and communication devices:		
Radio and wireless apparatus	65,563	207,535
Telegraph apparatus		34,261
Telephone apparatus, including switchboards	262,062	296,025
Police, fire and burglar alarm apparatus		4,577
Railway signals, switches and appurtenances		25,469
Bells, buzzers and annunciators		7,162
Other electrical apparatus:		
Spark plugs, magnetos and other ignition apparatus	66,509	96,984
Insulating material		90,048
Metal conduit, outlet and switchboxes		23 434
Sockets, outlets and receptacles		65,735
Other wiring devices	55,761	158 818
Other electrical apparatus, not elsewhere specified	1,544,876	417 394
Globes and shades for lighting fixtures		37,495
Electric glassware—except for lighting		18,278
Electric porcelain		129 241
Carbons for electric lighting, electrodes and batteries	42,402	109,724
Insulated wire and cables (iron and steel)		25,403
Maufactures of aluminum, including wire	193,648	63,411
Copper:		
Bare wire	65,787	161,493
Insulated wire and cable	270,145	187,544
Total electrical machinery apparatus and appurtenances	$5,311,442	$5,238,753

Electrical Heating Appliance Sales Increasing in England

Considerable publicity is being given by British electricity supply interests to the use of appliances for heating and cooking, with some noteworthy results. A striking example is at the plant at Croydon, where the heating and cooking load has been increased from 68,727 to 768,240 units in the past year

Says Average American Home Offers Big Lighting Market

That the average American home offers one of the largest lighting markets, and that the average total wattage per home is less than half what it should be to provide adequate and proper lighting, is the opinion of M. Luckiesh, director of applied science, National Lamp Works of the General Electric Company. Mr. Luckiesh has presented the situation in the following manner:

"Investigation of nearly 2,000 homes in more than twenty representative cities throughout the country shows that the watts per socket is fairly close to the recommended average. The deficiency lies in the number of sockets per home. Particularly is the scarcity felt in the case of convenience outlets, portable lamps and wall brackets.

"Some idea of the wonderful opportunity that awaits the progressive dealer for the sale of electrical conveniences can be seen from the following table, in which is shown what a small portion of the potential market for your goods has been reached. A few introductory words are first necessary to show how the figures were derived.

"We have 'built' or set up in our mind's eye an average home, conservatively lighted, of middle-class family, which we say consists of six rooms besides bathroom, basement, hallways, porches, etc. In this home we assumed there are nine convenience outlets eight portable lamps, nine wall brackets, six ceiling fixtures and lamp aggregating 1,770 watts. When compared with the standard of lighting and electrical convenience that guides the building of present-day 'electrical homes,' you will readily agree that we have been conservative in our 'conservative ideal home.'

PRESENT BUSINESS IN TERMS OF WHAT IT SHOULD BE

	Percentage	
	Saturation of Present Market (8,000,000 Wired Homes)	Saturation of Potential Market (All Wired and Unwired Homes)
Wattage of lamps	46	15
Energy consumption (estimated)	50	17
Convenience outlets	28	9
Portable lamps	20	7
Wall brackets	29	10
Ceiling fixtures	100	33
Modern ceiling luminaires (estimated)	50	17

"The second point to bear in mind is that only about 8,000,000 homes, or about one-third of the total homes in this country, are wired for electric service."

The Metal Market

Difference of Opinion as to Price of Copper at 13⅞ Cents—Steel Is Slow

There is more difference of opinion as to the price of copper this week than of any of the other metals. Several producers are holding to the 13⅞ cents delivered level and have sold several thousand tons at that price, even where the freight rate is slightly less than normal in some instances. The 13⅞-cent business has been greater than last week, and one producer reports that the 13.75-cent copper seems to have been pretty well cleaned up. The larger consumers around New York also report no difficulty in getting copper at the lower price.

Most of the metal sold has been for November-December-January delivery, though there is no 'quotable difference in the price of copper for November shipment from that for shipment in the first quarter of the new year.

Consumption continues excellent, but there are indications that consumers are fairly well supplied with copper for the remainder of the year and that the demand from now on will be largely confined to first-quarter shipment or delivery.

Export business has been about on the scale of last week at prices at or slightly below 14 cents, c.i.f. A feature of the export market has been the ratification of agreements between the Nichols Copper Company and certain foreign interests whereby the Nichols company will actively compete for business in the foreign market. This competition with the Copper Export Association and other selling interests has already been evident.

The irregularities recently developed in iron and steel, in respect of both demand and prices, continue in evidence. Apart from railroad requirements, which remain a prominent feature, buying of iron and steel has abated, and premiums on deliveries are disappearing.

NEW YORK METAL MARKET PRICES

	Nov. 2, 1922 Cents per Pound	Nov. 9, 1922 Cents per Pound
Copper		
Prime Lake	13.87½	13.87½
Electrolytic	14.00	14.00
Casting..........	13.45	13.45
Lead, Am. S. & R. price..............	5.75	5.75
Antimony..........	5.25	5.25
Nickel, ingot .	36.00	36.00
Zinc, spot	6.50	6.50
Tin, Straits. .	32.20	32.20
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00–11.25	11.00–11.25
Brass, heavy	5.75– 6.25	5.75– 6.25
Brass, light.. .	5.25– 5.50	5.25– 5.50
Lead, heavy. .	4.62½–4.75	4.62½–4.75
Zinc, old scrap. . .	3.00– 3.37½	3.00– 3.37½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday
of This Week for Points West of the Mississippi River and on
Tuesday for All Eastern Points

CONDITIONS in the electrical industry continue to improve. Jobbers and manufacturers announce better business than for some weeks past and are satisfied with the outlook for future orders. Central-station business shows improvement. Fixtures for commercial use are selling better, and there is less effort shown in placing outside business. Conduit stocks are spotty, but jobbers are finding it less difficult to fill reasonably large orders. Heater sales are better along the Pacific Coast owing to colder weather.

New York

Spotty Conduit Stocks in Evidence—Heating Devices in Demand—Fixtures Selling Well

Business continues to improve in all lines and there is much optimism expressed concerning its prospects. Deliveries are better. Prices generally are firm.

Conduit.—Spotty stocks are in evidence, but now and then jobbers are filling reasonably large orders. Prices are firm.

Appliances.—Heating devices for lamp-socket service are in much better demand, toasters and percolators being especially sought. Some increase in heater selling is noted. Washers and vacuum cleaners are moving fairly well and are being sold under intense competition.

Fixtures.—An increase in buying is apparent. Many jobs long postponed are now coming into the market. Commercial installations are absorbing much material, and less outside campaigning is needed.

Chicago

Wire Demand Steady—Conduit Still Scarce—Motor Sales Active—Radio Call Slow

Business in the electrical trade for the past week has been steady but uneventful. Prices on wire and conduit are firm, and the demand for conduit still remains above the supply. Manufacturers of high-tension equipment still report active business. Motor sales for the month have been brisk.

Conduit.—Shipments from manufacturers arrive just often enough to tease jobbers into believing that the conduit situation may soon be improved.

Wire.—The market continues steady and prices are firm. Rubber-covered No. 14 is available for $6.40 per 1,000 ft. in lots of 5,000 ft. Stocks are normal. Call for weatherproof or bare wire has been featureless although prices are steady.

Flexible Armored Conductor.—No change in price. The No. 14 two-wire single-strip still remains at $45 per 1,000 ft. in 5,000-ft. lots.

High-Tension Equipment.—Sales remain active. Orders for the following were received by one company: Six 33,000-volt steel-tower outdoor substations ranging in capacity from 300 kw. to 900 kw.; four 66,000-volt substations with capacities from 1,200 kw. to 3,000 kw.; thirteen 13,200-volt substations ranging from 200 kw. to 600 kw. Another firm shipped some 70,000-volt switching gear equipment to a utility in Pennsylvania.

Motors.—Movement on the smaller sizes is brisk, but while prices have not been advanced the tendency is upward. Most of this equipment is installed for new power requirements. Stocks of dealers and manufacturers are good. Most manufacturers report their sales curve has advanced for the past month.

Radio.—Several indications toward the start of the fall radio boom have not developed. The buying public has shown only slight interest in this equipment. Dealers' shelves are well provided with complete sets, head telephones, vacuum tubes and spare parts.

Boston

Loom Prices Showing Tendency to Stiffen—Flexible Armored Conductor Deliveries Well Maintained

Trade continues in well-sustained volume, with a more favorable delivery situation for the time being. Prices are firm, with upward tendencies in loom. Jobbers are doing a much better business than for many months. General business is improving in New England. The woolen industry is very active, and building contracts for the week ended Oct. 31 totaled $8,361,400 against $3,779,100 for the same week last year. Conditions in the leather manufacturing field are improved, paper mills are busy and electrical machinery is in broader demand. Retail trade is much better this fall than last year. Metal-manufacturing plants are showing decided improvement and some labor scarcity is noted.

Wire.—Rubber-covered No. 14 sells at $6.25 per 1,000 ft. in 1,000-ft. lots, with an active market and ample supply. Weatherproof, on a 17.5-cent base, is moving fairly well according to central-station expansion needs. The bare-wire market is dull, the tendency toward the use of loops and vacuum-tube radio sets cutting down the sale of copper conductors for outside aerial construction.

Loom.—Prices are showing a tendency to stiffen slightly on account of the upward movement of cotton costs. Only moderate sales of loom are reported.

Motors.—Previous gains in motor sales are being held, and a gradual month-to-month improvement in business is noted on sales sheets. Lately some large motors, of 100 hp. rating and over, have been purchased for paper-mill work. A wholesome demand exists for small motors of integral horsepower ratings, and just at present interest is quickening in fractional-horsepower motors. Sales of these last are relatively higher than of other ranges. Prices are firm and steady, deliveries being easy and generally from factory or distributors' stocks.

Flexible Armored Conductor.—Orders are in good volume, and deliveries are well maintained. No. 14 single-strip is steady at $44.20 per 1,000 ft. in 1,000-ft. lots.

Atlanta

Conduit Shortage Reported — Industrial Motors Slow — Good Stocks of Porcelain on Hand

"Business conditions are unmistakably better than they have been for any time in more than two years," according to the business summary of the Sixth Federal Reserve Bank. Retail trade was larger in the aggregate for September than for the same month last year, this being the first increase shown over a corresponding period of a year ago. Business is booming throughout the district with an enormous amount of construction under way, and the prospects are for this rate being maintained until well in the spring. Electrical business is brisk. A shortage in conduit is reported, with an advance of two points effective this week.

Industrial Motors.—Demand continues rather slow, though prospects for improvement are to be noted. Stocks are in good shape, with shipments and deliveries satisfactory.

Armored Conductor.—Extensive building construction is stimulating sales in this line and the volume of orders is good. Jobbers' stocks have been brought up to standard with deliveries satisfactory. Prices remain steady.

Porcelain.—Good stocks are on hand throughout the territory with sales quite active in all varieties. Shipments are satisfactory, with no recent price changes reported.

Schedule Material. — Keeping pace with building materials in general. Ample stocks are the rule throughout the territory, with prices remaining steady.

High-Tension Transformers.—High-tension transformers have slowed down with no immediate prospects for a pick-up until spring. There are practically no stocks on hand, and shipments are varying from a matter of six to twenty-four weeks.

St. Louis

Power-Equipment Business More Active—Shortage of Higher-Voltage-Type Lightning Arresters

Building permits in St. Louis jumped from $1,715,117 in September to $2,957,283 in October. The principal items of increase were hospitals and schools, the October permits containing an item of $150,000 for a hospital and another of $1,148,000 for a school building. Residential and industrial construction continues on about the same level as for several months past. The industrial permits for October amounted to $95,700, but this does not include cost of equipment.

Power-equipment business is becoming quite active as evidenced by heavier motor sales. Central stations are closing large blocks of power contracts. two in excess of 1,500 kw. each being reported as closed last week. These two represent replacement of isolated plants and will result in large orders for motors, transformers, converters and similar equipment. Construction work has just started on a new factory for the Atlas Tack Company which will require about 500 hp. in motors and about 100 kw. in industrial heating equipment.

Lightning Arresters.—Sales are very good in all types from 13,200 volts down. Local stocks are short on the higher voltage, but ample for 2,300 volts and lower. Several good orders for 2,300-volt arresters were placed last week. Prices are unchanged but keenly competitive.

Meters.—Central stations are reasonably well stocked and there are no striking developments in sales. Local stocks are in excellent condition. Prices show no indication of immediate change. Portable meter business is quite dull.

Motors.—Fractional-horsepower business is exceedingly competitive, with demand fair and slowly improving. Industrial sizes, especially from 3 hp. to 25 hp., are active. Stocks are good but reasonably conservative. Recent price adjustments have been made which slightly increase the level.

Cleveland

Jobbers and Dealers Taking Advantage of Milder Weather to Replenish Heater Stocks

Appliances dominated the week. Lighting fixtures have had fair demand and washers and ironers have been active. Jobbers report good collections.

Radio.—Dealers are moving out parts rapidly. The renewal of activity has brought a number of small orders to jobbers for holiday delivery.

Heaters.—Jobbers and dealers have taken advantage of the milder weather to replenish their stocks. The small portable type continues to have fair demand.

Washers and Ironers.—All standard makes are in good demand with sales of ironers better. Jobbers have sufficient orders on hand to insure activity until after the holidays, while manufacturers report production easily absorbed.

Ranges.—It is thought that the recent exhibitions of electrical homes are responsible for the increased demand for ranges. Stocks of ranges on hand are ample.

Denver

Radiant Heaters in Good Demand—Vacuum Cleaners Active—Schedule Material Prices Increase

Interest in the fall election has commanded considerable attention from the electrical industry during the past week for the reason that one of the constitutional amendments referred to the people is designed to reclothe the Public Utilities Commission with the power it was originally intended that it should possess and give it jurisdiction over the home rule cities of the state. Its passage will mean the immediate authorization of at least five or six million dollars in improvements and extensions of an electrical nature.

Street-Lighting Equipment.—Several municipal jobs in the southern part of the state and a suburban project here indicate returning interest and possibilities of a number of big municipal prospects.

Radiant Heaters.—There is a good demand for the standard line, and one jobber reports inability to make further deliveries before Dec. 15. A five-dollar heater recently introduced is proving popular.

Vacuum Cleaners.—A central-station campaign is stimulating interest. Sales in outside territory are picking up.

Schedule Material.—Slight increase in price is reported. Ample stocks on hand with firm demand.

Salt Lake City

Sudden Advent of Wintry Weather Has Had Stimulating Effect on Business—Heaters Active

The sudden advent of wintry weather has had the effect of stimulating business in most lines. Electrical merchants are sharing in the increased demand for household appliances. Heating devices are moving well, including electric pads and air heaters. Building activity has slowed down considerably on account of the inclement weather. Buying is reported to be on a better scale in the farming communities. Collections are much improved.

Air Heaters.—Excessive stocks are indicated in the eagerness of some dealers to unload. A standard seller at $12.50 is offered at $7.45. A slow-up in buying is looked for with the advent of furnace weather.

Toasters.—A popular type is offered on the retail market at $5.95, this price representing a reduction from the regular quotation.

Portland-Seattle

Jobbers Report Improved Business—Appliance Stocks Are Low—Conduit Demand Is Excellent

General business is moving along in a normal manner. Portland's exports for October were less than for a year ago owing to a slump in the Japanese lumber market and to the waterfront strike, which hampers grain movement. Apple and prune shipments from the Northwest are active at this time. Fruit growers from interior towns are having much difficulty in getting their products to market on account of the shortage of cars. This shortage is also affecting lumber shipments materially, while lumber production for the past week was in excess of normal. Shipments were virtually 40 per cent below production. Building permits for the Portland district showed somewhat of a decrease over a year ago owing primarily to a very extreme shortage of cement. Seattle's permits, on the other hand, showed a very appreciable increase. In general, building seems to be progressing very satisfactorily, and electrical permits for portland were the greatest in the history of the department. Electrical jobbers report business improving. Stocks are short in many lines. Conduit shipments are arriving, but back orders take up all surplus as soon as it arrives. Electrical appliance stocks are low, particularly in the less expensive lines. Prospects for supplying the holiday trade do not look favorable. Some lines of air heaters are low, and demand is active.

Outlet Boxes.—The demand is heavy, but as with conduit the stocks are very short with no immediate prospect of an improved condition.

San Francisco

Excellent Christmas Season Expected—Collections Slightly Better—Business Good in Used Motors

An excellent Christmas season is expected. Collections are slightly better. Considerable power construction and distribution work is pending as a result of the forthcoming elections and the state vote on the power and water act. All branches of the electrical industry rallied to defeat this dangerous measure.

Motors.—Stocks are large and sales are in good volume. Used-motor shops report excellent business.

Lamps.—The expected seasonal increase is accentuated a bit by new types, such as the 75-watt white style. Miniature sales are much improved by new discount schedule.

Ranges.—Constantly increasing sales testify to efficiency of conservatively planned campaigns. One power company sold more than 100 ranges on its lines during October. This is very encouraging, considering that much of effort so far has been missionary and that effective selling organizations have had to be built up.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Habirshaw Electric Forms a Reorganization Committee

As the result of a meeting at which forty creditors of the Habirshaw Electric Companies representing claims of more than $1,500,000 were present, a committee for the merchandise and sundry creditors of the companies was formed to confer with the existing debenture holders committee in working out plans for reorganization. Claims against the Habirshaw company total about $6,000,000, divided as follows: United States government claim, $1,000,000; debenture holder claims, $2,000,000; banks' claim, $1,500,000; merchandising claim, $1,500,000.

The committee for the merchandise and sundry creditors is composed of Malcolm D. Whitman, chairman; Wylie Brown, J. B. Beaty, G. W. Ekstrand and H. B. Hubbard, with Selden Hanley, secretary, 25 Madison Avenue, and Rabenold & Scribner, counsel.

Frank H. Stewart to Have Another Building

The Frank H. Stewart Electric Company, Philadelphia, under the title of "Business Isn't So Bad," has recently issued a formal announcement that it is now adding another building, four stories and basement, to its six-story fireproof structure, known as the "Old Mint Building," which is at 37 North Seventh Street.

Arthur H. Abbott Takes Auth Agency

Arthur H. Abbott, manufacturers' representative, 88 Broad Street, Boston, has been appointed New England agent for the Auth Electric Specialty Company, New York City, manufacturer of annunciators, push-buttons, telephones, bank apparatus, battery-charging panels, cabinets and other equipment.

Johns-Manville Company to Retire Preferred Stock

The preferred stock of the Johns-Manville Company, Inc., will be retired at $120 a share and accrued dividends during the last half of December, according to announcement made by the company. Reports were circulated in financial circles during last week that, in addition, the company contemplates the declaration of a stock dividend amounting to 400 per cent and that a special stockholders' meeting will be called to approve such action. Last week it was reported that in place of a stock dividend the company will adjust its common capitalization so that 250,000 shares of no-par-value common stock will be outstanding in place of the present 25,000 shares of $100 par value. After this is approved, stockholders will receive eight shares of new stock for each share now held, while 50,000 shares will be reserved for sale to employees on favorable terms.

Wagner Electric Company Calls Stockholders' Meeting

A letter to stockholders of the Wagner Electric Manufacturing Company from President W. A. Layman explains that the stockholders' meeting called for Dec. 29 is one of the steps incident to carrying out the plan of financial reorganization along lines agreed to.

All assets have been transferred to the new company, the Wagner Electric Corporation, and other adjustments have been made. It is desired for taxation purposes not to continue the present high capitalization of $7,500,000. Several propositions have been made upon which the stockholders will vote.

"Apex-o-meter" Says Laundry Owners Are Worried

Under the title "Laundry Owners Worried," the *Apex-o-meter*, the official organ of the Apex Electrical Distributing Company, Cleveland, comments on an article which appeared in the August issue of the *Laundry Journal*. "The popularity of electric washers is giving the owners of laundries considerable concern," says the magazine of the electrical cleaner firm.

The owner of a laundry is quoted in the article by the laundry organ, and he says: "The manufacturers of electric washers, electric driers, electric flatwork ironers and washing supplies are causing many housewives to believe that they should use these products. In their advertising the family washing is shown as being done by the housewife as she reads a book or while the children play about in the scene, with everybody all smiles. With a clever combination of sunshine and chirping birds, the otherwise burdensome household duty is shown to be quite an enjoyable affair.

"Look through any of the women's magazines. You will find them containing many advertisements and special articles depicting in words and pictures the excellent properties of domestic laundry equipment. You cannot refrain from looking at the advertisements, for they are usually representative of the highest type of the advertising art.

"When you consider the millions of women's magazines being scattered broadcast throughout the country carrying similar messages into practically every home, then you can see something of the magnitude of the campaign."

Cash Prizes for Window Decorators of Eureka Organization

One hundred and ninety dollars in cash awaits the star window decorators of the Eureka Vacuum Cleaner Company (Detroit) sales organization. This sum is the aggregate value of the fifteen prizes offered for photographs of the best window displays run during the fall housecleaning campaign. Eligible to win prizes are all distributors, dealers, branch-store managers and resale department managers.

The committee which picks the winning pictures will base its decisions on originality of arrangement, attention-attracting qualities, advertising value and sharpness of the photograph.

Changes in District Offices of Westinghouse Electric

A number of changes in the personnel of the district offices of the Westinghouse Electric & Manufacturing Company have been announced by W. S. Rugg, general sales manager of the company.

In the Pittsburgh office the power division has been changed to the central-station division with Barton Stevenson as manager. Mr. Stevenson will also be in charge of the sale of supply apparatus throughout the entire Pittsburgh district. The railway division has been changed to the transportation division, with F. G. Hickling as manager. A merchandising division has also been organized, of which F. C. Albrecht has been appointed manager.

A transportation division has been organized in the Philadelphia office, and Thomas Cooper has been appointed manager. A central-station division has been organized with H. L. Moody as manager. Mr. Moody will also be in charge of the sale of supply apparatus in the Philadelphia district, assisted by H. F. Brinckerhoff, who has been appointed assistant manager of the central-station division. W. P. Cochran will temporarily have charge of the merchandising division, which has been newly formed.

Similar changes have been made in the Detroit office. A central-station division has been established with L. Whiting as manager. Mr. Whiting will also have charge of the sale of supply apparatus. F. D. Koelbel has been made acting manager of a newly created merchandising division. A transportation division has been established with R. L. Hermann manager.

Changes in address have been made by the St. Louis and Los Angeles offices. The former office is now at 717 South Twelfth Street, St. Louis, and the latter at 420 South San Pedro Street, Los Angeles.

G. E. Company to Erect $50,000 Building at Pittsfield, Mass.

The General Electric Company is to erect a new brick and steel one-story building 400 ft. x 100 ft., at Pittsfield, Mass., to cost about $50,000. It will be used for the impregnation and treatment of wood used in the manufacture of transformers, providing a much-needed increase of facilities to meet the demands upon the transformer department. The Austin Company, New York, has the contract, which calls for the completion of the building within seventy-five days.

Sager Electric Supply Opens Branch in Brockton, Mass.

The Sager Electric Supply Company, Boston, has opened a branch wholesale house at 26 High Street, Brockton, Mass., in charge of W. M. Fyffe, formerly purchasing agent of the organization.

The Brockton branch is serving southeastern Massachusetts and the Cape Cod territory through direct contact with the trade and industry in that section.

To a representative of *Electrical World* President J. E. Sager stated that not only has the business of the Brockton branch surpassed expectations, but that the month of October, 1922, showed the best total home office business in the history of the Boston headquarters since the establishment of the parent concern in 1887.

Present upward tendencies in prices appear to be causing somewhat of a slowdown in building in eastern New England, but it is hoped that this situation will improve before long.

The Weston Electrical Instrument Company of Newark, N. J., announces that G. P. Atkinson for several years connected with its home office sales organization, has opened an office in Atlanta, Ga., for the territories of Georgia, South Carolina and northern Alabama.

The Standard Electric Works, 17 Bibb Street, Montgomery, Ala., has plans for a new factory for the construction, rebuilding, repair, etc., of electric motors.

The C. M. Sorensen Company, 177 East Eighty-seventh Street, New York City, manufacturer of electric air compressors, parts, etc., has plans nearing completion for the construction of a three-story factory, 40 ft. x 75 ft., at Radde Street and Hunter Avenue, Long Island City, to cost $60,000.

The Multi Electrical Manufacturing Company, 1848 West Fourteenth Street, Chicago, has appointed the Clark & Gansman Electric Company, 718 Cherry Street, Philadelphia, as sales agent for its "Powerlet" conduit fittings, "Multi" porcelain bushings and "Multi NEC" cut-outs. The appointed company will cover the eastern part of Pennsylvania as well as the cities of Baltimore and Washington.

The Philadelphia Fire Underwriters' Association, 131 South Fourth Street, Philadelphia, announces that charges for electrical inspections are reduced 10 per cent. This reduction took effect Nov. 4. Charles A. Hexamer is secretary of the association.

The United States Navy Central Sales Office, Washington, D. C., announces the sale of navy surplus electric elevators for handling coal, sand, gravel and ore. Bids will be opened Nov. 14.

The Beaver Machine & Tool Company, Inc., manufacturer of electrical specialties, Newark, N. J., announces that it has just appointed the Panama Lamp & Commercial Company, 595 Mission Street, San Francisco, its sales representative for the Pacific Coast.

The Ideal & Electric Manufacturing Company, Mansfield, Ohio, has announced the placing with the Austin Company, Cleveland, of its contract for an additional factory building, which is 100 ft. x 325 ft., with one 50-ft. wide, 20-ton crane aisle and two machine-shop aisles, 25 ft. wide.

The Holt Power & Light Company, Detroit, manufacturer of farm-lighting and power plants, is conducting a sales campaign direct by mail. One of its bulletins says: "From early morn till setting sun woman's work is never done —unless electrically done."

The Simplex Wire & Cable Company, Boston, announces that B. Earl Achenbach has joined its sales force and will do intensive sales work in the Philadelphia territory. For eleven years, except for two years in the Ordnance Department during the war, he has been a salesman for electrical jobbers in Philadelphia. For the past two years he has been conducting a jobbing business of his own in Virginia.

The General Refractories Company, Oliver Building, Pittsburgh, has acquired the plants and businesses of the Hayes Run Fire Brick Company, Orviston, Pa., and the Pennsylvania Fire Brick Company, Beech Creek, Pa. These properties will be consolidated with others lately purchased in the same section and continued in operation. The purchasing company has arranged to operate with a capital of $18,000,000.

The Maniscalco New Power System Company, M. & M. Bank Building, Sharon, Pa., it is announced, is arranging for the installation of machinery in a local building to manufacture a special type of electric motor and parts.

The Raymith Manufacturing Company, manufacturer of electrical switch boxes, 3707 Ogden Avenue, Chicago, announces that it has leased the first floor, 50 ft. x 125 ft., of the building at 1943 Carroll Avenue, for a term of five years.

The Ohio Electric Controller Company, 5900 Maurice Avenue, Cleveland, announces the opening of a district sales office at 53 West Jackson Boulevard, Chicago.

Foreign Trade Notes

AN ELECTRIC PLANT AUTHORIZED IN HONDURAS.—The Honduran Congress has issued, *Commerce Reports* states, a decree granting the Esfuerzo Electrico Comercial of Colinas, Santa Barbara, Honduras, rights to establish an electric plant at any point in the district of Santa Barbara. Free entry of material and supplies is provided for a period of five years. The plant must be installed by April, 1924.

PROPOSED NEW AUTOMATIC TELEPHONE EXCHANGE AT SYDNEY AUSTRALIA.—The erection of a new telephone exchange, with a capacity of 16,000 lines, at Sydney, Australia, has been recommended by the Australian Federal Public Works. The cost is estimated at £404,000.

ELECTRIC STREET LAMPS TO REPLACE GAS LAMPS IN AUCKLAND, NEW ZEALAND. — Plans are being prepared by W. E. Bush, city engineer, to replace the gas street lamps now in use with electric lamps in the city of Auckland, New Zealand.

ELECTRIC DISTRIBUTION SYSTEM PROPOSED FOR STANLEY POOL, BELGIAN CONGO.—Tenders will be received by the Belgian Ministère des Colonies, 20 Rue de Namur, Brussels, until Jan. 5 for the installation of an electric distribution for the town of Stanley Pool in the Belgian Congo, and to operate the system under a thirty-year concession, beginning Jan. 1, 1923.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase and agency is desired in New Zealand (No. 4,189) for wireless apparatus and accessories.

Purchase is desired in Norway (No. 4,217) of electric installation and telephone materials, insulated cables, 1.5 sq.mm. to 100 sq.mm., electrolytic copper, high-tension magnetos, high-tension spark plugs and automobile supplies.

Purchase is desired in Mexico (No. 4,232) of a radio-telephone receiving set, capable of receiving over a distance of 1,500 to 2,000 miles, with amplifying transmitter for an audience of 200 persons.

An agency is desired in Canary Islands (No. 4,239) for electrical appliances for lighting, telephone and telegraph services.

An agency is desired in Australia (No. 4,241) for electrical accessories, switchgear, fittings, electrical glassware, insulating materials, wires and cables, heating appliances, etc.

An agency is desired in Norway (No. 4,245) for all kinds of electrical goods and wireless broadcasting systems.

CONCESSIONS GRANTED FOR AN ELECTRIC PLANT IN SANT' ANNA, BRAZIL.—By a decree published Aug. 18, according to *Commerce Reports*, exclusive rights have been granted for furnishing electricity for lighting and power purposes to the municipality of Sant' Anna do Ipanema, Alagoas, Brazil. The concessionaires are required to furnish thirty-five street lamps of 50 cp. each. The plant must be established within twelve months after the approval of the contract. The municipality had a population of 40,234 in 1920. There are no railroad connections.

New Incorporations

THE POWER CORPORATION OF NEW YORK, Watertown, N. Y., has filed articles of incorporation with the Secretary of State. The company proposes to issue 100,000 shares of preferred stock having a par value of $100 and 300,000 shares of common stock having no par value. The directors are John N. Carlisle, D. C. Middleton C. B. Martin, Watertown.

THE WILLIAMSPORT (MD.) POWER COMPANY has been chartered with a capital stock of $250,000 by Joseph C. Byron, Clarence M. Stickell and John R. Keiffer. The company will build the power plant at Williamsport which is to supply electricity for the Hagerstown & Frederick Railway Company and its allied interests.

THE LINCOLN COUNTY LIGHT & POWER COMPANY, Portland, Ore., has been incorporated by H. A. Holland, Maurice W. Seitz and M. E. McDermott. The company is capitalized at $40,000.

New Apparatus and Publications

FEED-WATER HEATERS AND PURIFIERS.—Catalog No. 80 issued by the Hoppes Manufacturing Company, Springfield, Ohio, describes and illustrates the "Hoppes" feed-water heaters, purifiers, steam separators, oil eliminators, exhaust heads and V-notch water meters and other products of the company.

AUTOMATIC DRILL PRESS. — Joseph W. Jones, 29 West Thirty-fifth Street, New York City, is distributing a leaflet covering the "Jones" automatic drill press recently placed on the market.

BATTERY CHARGER. — A new-type radio and automobile battery charger, known as the "Valley" type "A and B" charger, has been placed on the market by the Valley Electric Company, 3157 South Kingshighway Boulevard, St. Louis.

ELECTRIC MOTOR.—A new revulsion type of electric motor for temperature regulator use has been placed on the market by the Honeywell Heating Specialties Company, Wabash, Ind. This device was developed by the engineers of the company in co-operation with the General Electric Company.

ULTRA-VIOLET LIGHT. — The Cooper Hewitt Electric Company, 95 River Street, Hoboken, N. J., is distributing bulletins Nos. 400, 401, 402 and 403, describing the use of ultra-light for phototherapy, sterilization and photochemistry; "Uviarc" lamps in the laboratory, the "Lab-Arc," and quartz-glass apparatus for photophysics and photochemistry respectively. Bulletin No. 99 explains the "Uviarc" test method for dyes, textiles, paints, inks, etc.

HEATER PLUG.—A new heater plug, known as the "Beaver Gripall," has recently been developed by the Beaver Machine & Tool Company, Inc., 625 North Third Street, Newark, N. J. This heater plug has been approved by the National Board of Underwriters.

AUTOMOBILE DEFECTOMETER.—Paul G. Niehoff & Company, 232 East Ohio Street, Chicago, has placed on the market a new model of its automobile defectometer.

ELECTRIC GRINDER. — An electric grinder with a type "NU" motor has been placed on the market by the Marathon Electric Manufacturing Company, Wausau, Wis.

PANELBOARD. — A unit-construction panelboard, "T-P," with two branch circuit connections and carrying switches, etc., has been placed on the market by the Frank Adam Electric Company, St. Louis.

DISK FAN.—The Kimble Electric Company, 634 Northwestern Avenue, Chicago, has placed on the market a variable-speed reversible disk fan.

ELECTRIC HEATER.—The A. C. Gilbert Company, New Haven, Conn., has recently placed on the market a new electric heater, known as the "Polar Cub."

INDUCTION MOTOR. — A repulsion-start induction motor has recently been developed by the Dayton Fan & Motor Company. It is made in four sizes ranging from ⅛ hp. to ½ hp.

ARMORED CONDUCTOR.—An armored conductor, "Uniduct," made with two or three conductors, No. 12 or No. 14 wire, has been developed by the Appleton Electric Company, 1701 Wellington Avenue, Chicago.

CIRCUIT BREAKERS.—"Protection Up to Date" is the title of a 98-page booklet published by the Cutter Company, Philadelphia, covering its "U-re-lite" circuit breakers.

ELECTRIC DRYING MACHINE.—An electrically-heated clothes drying machine has recently been developed by the Canton Clothes Dryer Company, Canton, Ohio.

AUTOMATIC LAUNDRY EXTRACTOR. —The American Laundry Machinery Company, Cincinnati, has recently brought out the "Humatic" clothes extractor for commercial laundries.

ELECTRIC ANNOUNCING DEVICE.—The Bulletin Machine Company, 10-16 Lock Street, Buffalo, is manufacturing the "Davis" Annunciator," an electric announcing device for vaudeville theaters.

ELECTRIC GLUE POT.—The J. D. Wallace & Company, 1401 West Jackson Boulevard, Chicago, has placed on the market a new bench glue pot with automatic heat control.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

AUGUSTA, ME.—The Central Maine Power Company has started work on extensions to three of its power plants, which will include the installation of an additional 1,000-hp. generating unit at the Waterville station, a 1,300-hp. additional unit, making the fourth, at the Skowhegan plant, and a 1,500-hp. unit at the Deer Rips station, for which an order has been placed. In addition to this a 4,000-kw. synchronous condenser will be installed at the Deer Rips station and a new transmission line erected from the station to Lewiston.

BAR HARBOR, ME. — The Penobscot County Water Company has been granted permission to issue $403,000 in capital stock for the purchase of the properties of the Bar Harbor & Union River Power Company, the Orono Water Company and the Bangor Railway & Electric Company. The properties will be consolidated and extended and improved.

VAN BUREN, ME.—The Van Buren Light and Power District has granted the Cyr Electric Company, recently organized, permission to supply electrical service in certain districts.

BRATTLEBORO, VT.—The Presbrey-Leland Quarries, Inc., contemplates equipping its new granite sheds, in course of construction, with electrically driven machinery. From 600 hp. to 800 hp. will be required.

BOSTON, MASS.—The Eastern Massachusetts Electric Company has applied for permission to issue $110,000 in capital stock and $75,000 in bonds, part of the proceeds to be used for extensions and improvements.

HOLYOKE, MASS.—The proposed plant of the Holyoke Gummed Products Company to be erected at South Hadley Falls will be operated by electricity. The contract for electrical equipment will soon be awarded. Energy to operate the plant will be supplied by the Electric Light Department of South Hadley.

LOWELL, MASS.—Plans for extensions to the ornamental system have been submitted to the Lowell Electric Light Company for an estimate of cost by the Public Service Board. The lamps, it is understood, will not be installed until next spring.

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Middle Atlantic States

DEPEW, N. Y.—The Depew & Lancaster Light, Power & Conduit Company is preparing plans for additions to its power plants, including the installation of equipment.

LE ROY, N. Y.—The Genesee Light & Power Company has applied to the Public Service Commission for authority to issue $85,000 in capital stock, the proceeds to be used to acquire the property of the Le Roy Hydraulic Electric & Gas Company.

MONTICELLO, N. Y.—Application has been made to the Public Service Commission by the Murray Electric Light & Power Company for permission to issue capital stock to finance proposed extensions and improvements to its system.

NEW YORK, N. Y.—The George H. Stern Lumber Company, 545 East Seventy-first Street, will build a power house at its new yard on Sixty-ninth Street and Avenue A. William H. Gompert, 117 Madison Avenue, architect.

NEW YORK, N. Y.—Bids will be received by the New York Central Railroad Company, 466 Lexington Avenue, until Nov. 16, for electric motors and controlling apparatus. (Serial Contract 32-1922.) C. S. White, Room 344, 466 Lexington Avenue, is purchasing agent.

NEW YORK, N. Y.—A power house and refrigerating plant will be installed in the proposed municipal market to be constructed by the Department of Plant and Structures, Municipal Building, in the vicinity of the 149th Street bridge, Harlem River, to cost about $5,000,000.

NEW YORK, N. Y.—A power department, including electric, ice and refrigerating plants, will be installed in the fourteen-story hospital to be erected on Livingston Place, near Sixteenth Street, by the Beth

Israel Hospital, 70 Jefferson Street to cost about $3,000,000. Louis A. Abramson, 46 West Forty-sixth Street, is architect.

NORWICH, N. Y.—The New York State Gas & Electric Company contemplates the erection of a 44,000-volt transmission line, to cost about $25,000.

WHITE PLAINS, N. Y.—A power house will be built in connection with its proposed new hospital to be erected on Mamaroneck Avenue, at a cost of about $500,000 for the New York Orthopedic Hospital, Third Avenue and Twenty-third Street, New York City.

BELLEVILLE, N. J.—The Town Commission is considering improvements to the street lighting system.

HACKETTSTOWN, N. J.—The New Jersey Power & Light Company has acquired the Hackettstown Electric Light Company and will consolidate the property with its system in this district. A transmission line will be erected from Dover to Hackettstown.

NEWARK, N. J.—A power house and electrical equipment will be installed in the new baking plant, to be erected on Abington Avenue, Third to Fourth Street, by Dugan Brothers, 287 Broadway, Brooklyn, N. Y., to cost about $200,000.

PATERSON, N. J.—Considerable electric power equipment will be installed in the printing plant to be erected at Twenty-fourth and Eighteenth Streets, by the Paterson Industrial Development Company, to cost about $400,000. Walter Kidde & Company, 140 Cedar Street, New York, are engineers.

TRENTON, N. J.—The Eberhard Watch Corporation of America, recently organized, will build a power house in connection with its proposed plant in the Woodside Park section to cost about $150,000. The company is represented by Marvin L. Spaulding, 147 East State Street.

ALLENTOWN, PA.—The Pennsylvania Power & Light Company has purchased the Heidelberg Power & Light Company, recently organized to operate in Lehigh County.

BETULA, PA.—The Saeger Glass Jar Corporation will build a power plant in connection with its proposed local factory.

BLOSSBURG, PA.—Plans are under consideration by W. T. Merrick, Wellsboro, and associates for the installation of an electric light and power system, to cost about $30,000.

EASTON, PA.—The Lower Milford-Lehigh Power Company, Dunham-Busks Power Company, Washington-Berks Power Company and Hereford-Berks Power Company, recently organized, plan to install electric systems in their respective territories.

PHILADELPHIA, PA.—The Ketterlinus Lithographic Manufacturing Company, Fourth and Arch Streets, will install an electrical department in its proposed eight-story plant addition.

PHILADELPHIA, PA. — The Wilmot Fleming Iron & Steel Company, 956 Foulkrod Street, will install a power house at its new iron and steel plant on Cottman Street, now in course of erection.

PHILADELPHIA, PA.—The Breyer Ice Cream Company, Ninth and Cumberland Streets, will build a power house, an ice-making and refrigerating plant in connection with its proposed works to be erected on Forty-third Street, near Woodland Avenue, to cost about $500,000.

POTTSVILLE, PA. — Considerable electric power equipment will be installed at the proposed printing plant to be erected by the Pottsville *Daily Republican*, estimated to cost $500,000.

BALTIMORE, MD. — The Baltimore & Ohio Railroad Company plans to rebuild the grain elevator at Locust Point, which was destroyed by fire last July. The cost is estimated at about $3,000,000. John S. Metcalf & Company, 108 South La Salle Street, Chicago, are engineers.

HAGERSTOWN, MD. — The Potomac Public Service Company will extend its transmission lines in Garrett County to serve new coal properties throughout that section.

WILLIAMSPORT, MD.—The Potomac Public Service Company has been organized by the officials of the Williamsport Power Company, with capital of $250,000, to construct and operate its proposed generating plant at a cost of about $5,000,000.

SHINNSTON, W. VA.—The Alley Glass Company will build a power house in connection with its proposed new plant, to cost about $300,000, with equipment.

DANVILLE, VA.—The Municipal Electric Light Department is planning to extend its transmission line to Stokesland and install a distributing system there.

NORFOLK, VA.—Bids will be received by the United States Engineer Office until Dec. 2 for the construction of two power plants at Fort Story, Cape Henry.

NORFOLK, VA.—George W. Taylor & Company, Haddington Building, will remodel and improve their ice-manufacturing plant and will install new electrical equipment, to cost about $100,000. Ophuls & Hill, 112 West Forty-second Street, New York, are engineers.

PETERSBURG, VA.—The Virginia Railway & Power Company is considering doubling the output of its Locks power plant. The erection of a 110,000-volt transmission line from Richmond to Portsmouth, with two substations is also contemplated. The cost is estimated at about $250,000.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Nov. 20 for switchboard supplies, as per Circular 12873—1 C.P.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Nov. 18 for electrical supplies, as per Circular 11229—A—4 C.P.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Nov. 17 for two storage batteries (Circular 12945—A—1 C.P.).

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Nov. 22 for equipment for the Canal Zone, including high-tension insulators, electric motors, transformers and copper wire (Circular 1500).

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, until Nov. 15 for 125 junction fuse boxes (Circular 23-41); also, until Nov. 14 for 300 Liberty switch 2-ohm resistance units (Circular 476).

North Central States

HOLT, MICH. — The Consumers' Power Company will extend its transmission line from Lansing to Holt, with branch lines to Pine Lake, Okemos and Haslett, for light and power service.

JACKSON, MICH.—Bids will be received by the Treasury Department, Supervising Architect's Office, Washington, D. C., until Nov. 22 for the installation of an electric freight elevator at the local post office.

MONTAGUE, MICH.—The property of the White Lake Power Company has been purchased by the Commonwealth Light & Power Company, 141 Broadway, New York City. Extensions, it is understood, will be made to the property.

PORTLAND, MICH.—A bond issue of $12,000 is being arranged for the installation of additional equipment in the municipal power plant.

AKRON, OHIO.—The installation of an ornamental lighting system extending from Cuyahoga Falls over the new viaduct into Akron and to South Kenmore, a distance of about 5 miles, is under consideration by the City Council and local business men.

BOWLING GREEN, OHIO.—The Council is considering the installation of ornamental lighting system to replace the arc lamps now in use. The cost is estimated at about $40,000.

CINCINNATI, OHIO.—The Union Gas & Electric Company plans to rebuild its electric substation, recently damaged by fire, causing a loss of about $45,000.

CLEVELAND, OHIO.—The City Council is considering the installation of an ornamental lighting system on Lorain, Clark and Prospect Avenues and Broadway, to cost about $115,000.

CLEVELAND, OHIO.—The City Council is considering extensions to the municipal electric system, including the construction of a new plant, extensions to distribution lines, etc., to supply 15,000 additional consumers. The cost is estimated at $10,400,000. A. B. Roberts is director of public utilities.

DELAWARE, OHIO. — The Department of Public Welfare, Columbus, contemplates the construction of a power house and laundry and two reservoirs, small pumping station, etc., at the Girls' Industrial Home here, to cost about $25,000.

SYCAMORE, OHIO.—Bonds to the amount of $23,000 have been issued for extensions to the municipal electric light system.

NOBLESVILLE, IND.—The Noblesville Heat, Light & Power Company will install additional machinery at its hydro-electric power plant on the White River, to cost about $150,000.

HARVEY, ILL.—A one-story power house will be erected at the Memorial Hospital. Chatten & Hammond, 64 East Van Buren Street, Chicago, are architects.

BEAVER, WIS.—The Wisconsin Power, Light & Heat Company has applied to the Wisconsin Railroad Commission for authority to issue $120,000 in capital stock for the purpose of acquiring the property of the Beaver Dam Light & Fuel Company.

MANITOWOC, WIS.—A second transmission line will be erected from the local power plant of the Wisconsin Public Service Corporation to the city of Two Rivers. The cost is estimated at about $16,500.

STRATFORD, WIS.—The Stratford Light & Power Company has petitioned the Railroad Commission for authority to issue $12,000 in bonds for the purpose of erecting a transmission line and substation to supply electricity in Stratford. Energy will be obtained from the Wisconsin Valley Electric Company at Wausau.

THREE LAKES, WIS. — The Electric Light and Power Commission of Eagle River has submitted a proposal to the Village Board offering to furnish electrical service in Three Lakes.

EXCELSIOR SPRINGS, MO.—The Excelsior Springs Water, Gas & Electric Company plans to install a local substation and electric system.

MAYSVILLE, MO.—The Maysville Electric Company, contemplates additions in its plant, including the installation of equipment.

ST. LOUIS, MO.—The Board of Public Improvements contemplates the construction of a municipal power plant at Clark and Twelfth Streets, to cost about $1,000,000.

ST. LOUIS, MO.—The United States Public Service Company has issued $1,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

OMAHA, NEB.—The Continental Gas & Electric Corporation has acquired the properties of the Union Power & Light Company, operating in Nebraska, Iowa and South Dakota. The system will be merged and extensions and improvements made.

LEAVENWORTH, KAN. — The Kansas Electric Power Company has issued $1,000,000 in capital stock, part of the proceeds to be used for extensions and improvements.

Southern States

ATHENS, GA.—The Atlantic Ice & Coal Corporation will install electric power equipment at its proposed refrigerating and cold-storage plant, to cost about $70,000.

BRADENTOWN, FLA.—The Board of Trade is developing plans for the installation of an ornamental lighting system in the city park on the waterfront.

CLERMONT, FLA.—The Clermont Ice Company plans to install a substation and electric equipment at its proposed ice-manufacturing plant.

GROVELAND, FLA.—Preliminary plans are being considered for the installation of a street-lighting system. A municipal ice-manufacturing plant is also planned.

MACCLENNY, FLA. — The Macclenny Electric Company is considering extensions to its power plant and system.

KNOXVILLE, TENN. — The Knoxville Power & Light Company has authorized a fund of $430,000 for plant and system extensions and improvements.

MEMPHIS, TENN.—Bids will be received at the office of the Mississippi River Commission, First and Second Districts, Custom House, Memphis, until Dec. 2 for furnishing turbines, pumps, feed-water heater, boiler-feed pumps and an electric light plant.

SHUBUTA, MISS.—The Spinks Ice & Manufacturing Company plans to erect an auxiliary electric plant, to be operated in conjunction with its present hydro-electric station.

PLAQUEMINE, LA.—Bonds to the amount of $150,000 have been issued for remodeling the municipal electric power plant.

CEMENT, OKLA. — Plans are being drawn for extensions and improvements to the municipal power plant and distributing system. The proposal to issue $33,000 in bonds for the work will be submitted to the voters on Nov. 21. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

COLLINSVILLE, OKLA.—The City Council is considering closing down the municipal electric generating plant and purchasing electricity to operate the local system.

WANETTE, OKLA.—Plans are being prepared for extensions to the street-lighting system. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

CELINA, TEX.—The proposal to issue $50,000 in bonds for the installation of an electric light plant and waterworks system will be submitted to the voters on Nov. 28.

HOUSTON, TEX.—The Houston Lighting & Power Company has filed notice of increase in capital from $3,000,000 to $4,500,000, part of the proceeds to be used for the construction of a new generating plant.

STAMFORD, TEX.—Extensions to the plant of the Stamford Gas & Electric Company are reported to be under consideration.

TULIA, TEX.—Bonds to the amount of $100,000 have been voted for extensions to the electric light, water and sewer systems. A new electric plant will be built.

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Pacific and Mountain States

COLVILLE, WASH. — A franchise has been granted to the Stevens County Power & Light Company for the erection of a transmission line along the Inland Empire Highway between Moyers Falls and Chewelah.

DEER PARK, WASH. — The Mount Spokane Power Company has disposed of $100,000 in bonds, the proceeds to be used for extensions to its hydro-electric plant and system, including raising dam, new flume, canals, generators and other equipment, transmission lines, etc. The Nixon-Kimmel Company, S 169 Wall Street, Spokane, is engineer.

GRANITE FALLS, WASH.—The property of the Granite Falls Electric Company has been purchased by the Puget Sound International Railway & Power Company, Everett. The local system, it is understood, will be connected with the high-tension transmission lines of the Puget Sound company.

NORTHPORT, WASH. — The Northport Power & Light Company will erect a transmission line to the Deep Creek district.

SPOKANE, WASH.—Surveys are being made by the Washington Water Power Company for the erection of a 69,000-volt transmission line to Pateros on the Columbia River to connect with the lines of the Okanogan Valley Power Company, which it will take over Jan. 1. The proposed line will extend from Coulee City to Pateros, a distance of 54 miles.

CROWS LANDING, CAL.—Plans for the new irrigation project of the West Stanislaus Irrigation District provide for four electric booster plants and a main electrically driven pumping station. The cost is estimated at $600,000. E. N. Bryan, Forum Building, Sacramento, is engineer.

HANFORD, CAL. — Negotiations are under way for the purchase of the distributing system of the Southern California Edison Company, to be operated by the municipality. Extensions are contemplated.

SACRAMENTO, CAL.—Property owners on Fifth Street between J and I Streets and on I Street between Fifth and Ninth Streets will install an ornamental lighting system. The city has granted approval.

SAN BERNARDINO, CAL. — Contract will soon be let for the installation of an ornamental lighting system on F, E and South Third Streets.

SANTA CRUZ, CAL.—Contract will soon be let for the installation of a lighting system in the Boulder Creek district.

STOCKTON, CAL.—The Western States Gas & Electric Company has issued notes for $5,000,000, part of the proceeds to be used for extensions and improvements.

LOGAN, UTAH.—The City Council has applied for permission to construct a municipal hydro-electric plant on the Logan River, near the State Dam. The initial installation will provide for 1,000 hp.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has surveys in progress for its proposed hydro-electric power plant at Soda, on the Bear River, with initial capacity of about 11,000 hp.

FORT MORGAN, COL.—Bonds to the amount of $125,000 have been voted for the construction of a new municipal electric light plant.

◆

Canada

WEST VANCOUVER, B. C. — Arrangements have been made whereby the British Columbia Electric Railway Company, Ltd., will supply electricity in West Vancouver. A bylaw will soon be submitted to the ratepayers to provide funds to establish the service.

LONDON, ONT.—Arrangements are being made by the Public Utilities Commission for the erection of a new hydro-electric substation in the vicinity of the Grand Trunk Railway carshops.

MAGOG, QUE.—The Council is considering submitting a bylaw to the ratepayers providing $50,000 for improvements to the municipal electric light plant.

Electrical Patents

Announced by U. S. Patent Office

(Issued **Oct. 17, 1922**)

1,432,442. Electric Furnace; E. F. Collins, Schenectady, N. Y. App. filed March 1, 1921. Resistance element in form of arc over material.

1,432,455. Method and Apparatus for Receiving Sustained Wave Signals; A. N. Goldsmith, New York, N. Y. App. filed July 28, 1919 Incoming energy modulated at audible frequency.

1,432,456. Method and Apparatus for Transmitting Sustained Wave Signals; A. N. Goldsmith, New York, N. Y. App. filed July 29, 1919. Radio-tone transmission from sustained wave generator.

1,432,491. Electric Heater; S. I. Phelps, Rockford, Ill. App. filed March 24, 1919. Grill plate.

1,432,508. Paste for Storage-Battery Plates; T. A. Willard, East Cleveland, Ohio. App. filed June 2, 1917. Paste for negative plates containing oxide of lead and wood dust.

1,432,543. Art of Making Electrolytic Iron; F. A. Eustis, Milton, C. R. Hayward, Quincy, H. M. Schleicher and D. Belcher, Boston, Mass. App. filed July 7, 1921. Reducing ferric solution to ferrous state with hydrogen sulphide, precipitating sulphur, then depositing iron.

1,432,544. Art of Making Electrolytic Iron; F. A. Eustis, Milton; C. R. Hayward, Quincy; H. M. Schleicher and D. Belcher, Boston, Mass. App. filed Jan. 17, 1922. Electrolytic solution of iron oxide dissolved in dilute acid and ferrous salt.

1,432,556. Means for Indicating and Disconnecting Defective Branches from Electric Current Networks; M. Hochstadter, Gravenhage, Netherlands. App. filed July 27, 1920. Apparatus for disconnecting short-circuited line from distribution system.

1,432,584. Electric Motor; R. H. Williams, Richmond, Ind. App. filed Aug 23, 1918. Oppositely rotating armatures placed side by side to reduce vibration.

1,432,600. Automatic Signaling System for Industrial Establishments; W. L. Jacoby, Larchmont, N. Y., and R. M. Hopkins, Rutherford, N. J. App. filed May 7, 1918. Makes it possible to locate any one passing through plant.

1,432,618. Automatic Telephone Selecting System; W. T. Powell, Rochester, N. Y. App. filed Jan. 24, 1919. Means of controlling the movements and release of switches employed in interconnecting lines.

1,432,623. Telephone; G. B. Riley, London, England. App. filed April 26, 1921. Type used on vehicles, trains, ships, aircraft, etc.

1,432,627. Employee's Time-Registering Apparatus; F. B. Shenstone, Sydney, New South Wales, Australia. App. filed Jan. 5, 1922. Electrically operated and clock-controlled mechanism.

1,432,637. Supported Laminations for Electrical Apparatus and Method of Making the Same; H. F. Stratton, Cleveland, Ohio. App. filed Sept. 21, 1921. Metal frame cast around annual laminations.

1,432,650. Light-Control Switch; C. J. White, Long Beach, Cal. App. filed March 15, 1921. Switch contains resistances for dimming lights.

1,432,711. Clamp; R. H. Manson, Rochester, N. Y. App. filed Feb. 13, 1920. Clamp for fastening impulse-transmitting devices to telephone instruments.

1,432,712. Electric Fuel Vaporizer; F. H. Mark and H. J. McConochy, Portland, Ind. App. filed Jan. 6, 1922. Electric heating element across inlet manifold.

(Issued Oct. 24, 1922)

15,477 (reissue). Electric Heating Element; F. W. Moffat, Weston, Ontario, Can. App. filed Jan. 5, 1922. Plate type.

15,478 (reissue). Rheostat; F. A. Rojas, New York, N. Y. App. filed Jan. 30, 1922. Rheostat of compressible resistance material with means for drawing material apart to lessen its conductivity.

1,432,781. Means for and Method of Avoiding Interference; H. S. Osborne, New York, N. Y. App. filed July 31, 1918. Avoidance of disturbances from outside sources in ocean cables.

1,432,800. Insulated Support for Electrical Conductors; L. Steinberger and G. Hill, Brooklyn, N. Y. App. filed May 18, 1918. Applied to radio apparatus dealing with currents of high frequency and high potential.

1,432,806. Sealing Device for Battery Terminals, E. G. Templeton, Akron, Ohio. App. filed April 17, 1922. Grooved rubber washer and metallic retaining member.

1,432,823. Electrode Holder for Electric Furnaces; J. Young, Welland, Ontario, App. filed April 12, 1920. Water-cooled holder in which water acts as conductor to electrode.

1,432,826. Automobile Signal; M. J. Barnett, San Francisco, Calif. App. filed Jan. 26, 1920. Direction signal on rear of automobile.

1,432,829. Electrical Testing System; F. H. Best, Westfield, N. J. App. filed Dec. 30, 1921. For measuring impedance unbalance between loaded signaling circuits.

1,432,831. Planer and System of Motor Control Therefor; H. L. Blood, Plainfield, N. J. App. filed Aug. 1, 1921. Reciprocating table positively connected with electric motor which is periodically reversed.

1,432,844. Contact Carrier; H. A. Douglas, Bronson, Mich. App. filed Feb. 4, 1918. Miniature light socket.

1,432,845. Battery Grid and Process of Making Same; H. I. Edney, Wirt, Okla. App. filed Feb. 26, 1920. Filling paste of an active material, collodion, sulphuric acid and a carbonate.

1,432,852. Telephone Switching Key; A. D. Hargan, Bayonne, N. J. App. filed Aug. 26, 1921. Interlocking device for ringing keys.

1,432,856. Maximum-Demand Wattmeter; J. Harris, Lafayette, Ind. App. filed Feb. 2, 1920. Adapted either to alternating-current or direct-current circuit.

1,432,863. Transmission System; K. S. Johnson, Jersey City, N. J. App. filed July 1, 1918. Improving quality of transmission from incoming line to vacuum-tube repeater.

1,432,867. Electron Discharge Device and Method of Making the Same; M. J. Kelly, New York, N. Y. App. filed Nov. 15, 1919. Amplifier comprising a cathode and anode with coating having good heat-radiating qualities on anode.

1,432,868. Sectional Switchboard Frame, H. Koch, Jamaica, N. Y. App. filed June 17, 1921. Switchboard construction for telephonic apparatus.

1,432,871. Switchboard Mechanism; H. F. Krantz, Brooklyn, N. Y. App. filed Aug. 5, 1918. Heavy current switch.

1,432,876. Portable Electric Lamp; P. J. L'Evesque, Paris, France. App. filed March 17, 1920. Two lamps and projectors, one with parallel beam and the other for diffused lighting.

1,432,883. Electrical Switching Device; N. H. Lysons, Montreal, Can. App. filed Sept. 14, 1920. Telephone hook switches.

1,432,885. Telephone Transmitter; J. P. Minton, East Orange, N. J., and C. A. Finley, Brooklyn, N. Y. App. filed March 27, 1918. Suitable for places subjected to severe extraneous noises.

1,432,894. Shuttle for Wrapping Machines; W. B. Pierce, Chicago, Ill. App. filed April 29, 1920. Adapted to apply spiral wrapping around object with one or more reinforcing wrappings.

1,432,903. Engine-Driven Electric Generator Unit; C. E. Reddig, Richmond Hill, N. Y. App. filed Sept. 17, 1920. Fans force air through ventilating passages of engine and generator.

1,432,907. Portable Electric Lantern; C. S. Rhoads, Jr., Yonkers, N. Y. App. filed May 27, 1920. Combined automobile headlight and trouble light.

1,432,915. Spark-Adjusting Apparatus; W. E. Schwarzmann, Longmeadow, Mass. App. filed Dec. 23, 1920. Short-circuit device for timing mechanism of magneto ignition systems.

1,432,925. Impulse Sender; G. Thompson, Mount Vernon, N. Y. App. filed Nov. 3, 1919. Adapted for use in telephone exchange to differentiate between parties making call.

1,432,931. Electric Discharge Device; H. W. Weinhart, Elizabeth, N. J. App. filed Nov. 1, 1916. Electron tube with hollow electrode adapted to have cooling fluid pass through it.

1,432,937. Storage Battery; W. H. Wood, Cleveland, Ohio. App. filed Jan. 22, 1920. Porous active material allows electrolyte access to internal parts.

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Where the Central Station Stands

WE TALK of the central station—we of the electrical industry—and what it should and should not do. We discuss its functions, its obligations, its opportunities, its methods, its achievements, its mistakes. But seldom do we stop to think of what it has become today, its place in this great working world.

Yet it is well sometimes to stand away off and scrutinize such a familiar thing. For out of it will often come new understanding of relations and responsibilities that have been indistinct amid the clutter of our busy-ness.

What *is* the central station, then? Where does it stand today in this electrical industry of ours and in the nation?

THE central station is the great heart that pumps life blood continuously to every electrical man in all communities. It is a vital factor in the work of every dealer, contractor, jobber and manufacturer. Stop the central station and you stop all—the manufacturer would find his market gone, the jobber's trade would become paralyzed, the contractor would wire no buildings, the dealer would sell no appliances. For each one is dependent upon the central station to provide the energy to vitalize and sustain his business life. Without central-station service the lamp, the motor, the heating appliance is valueless to the general public, and there would be no electrical industry.

To the public the central station has become indispensable. In the modern community we rely upon electric light, not alone for comfort and for health in streets, homes, stores, offices and factories, but to reduce the risks of fire, accidents and crime. We rely upon electric power to provide street transportation and elevator service, to save labor and to supply the facilities for production that make the modern industrial concentration possible. In our homes we depend upon electricity to lighten housework and contribute all kinds of comforts that have come to mean much in human happiness.

Electric service has woven its pleasing pattern into the very fabric of our lives It has brought us more health, more peace, more ease, more play. And so the central station has become essential to the maintenance and improvement of our very standards of living and to the growth and prosperity of every modern community. For deny electric service to any city and how many of its people would remain?

THE central station has inspired the building of an industry and with the opportunity has assumed the obligation. It has guaranteed a fundamental service to its industry as well as to its public. Its policies cannot just serve itself. They must be fair and helpful to all other electrical men of every class, both locally and nationally. And the growth and greatness of the electrical world today are a measure of how well this service has been rendered.

Henry Morrell Atkinson

A public utility executive and banker who helped build the electrical industry in the South.

BACK of every electrical development there are men with legal and financial training who have the courage to place money at the disposal of engineers and the vision to build with the future properly weighed and judged. H. M. Atkinson has had financial affiliations and experiences as a utility executive which have placed him among the leaders of the South and have enabled him, as chairman of the board of directors of the Georgia Railway & Power Company, to develop successfully large utility systems for supplying light, power and transportation to Atlanta and vicinity.

Born at Brookline, Mass., on Nov. 13, 1862, he was educated at private schools in Boston and was graduated from Harvard in 1884 with the degree of A.B. In September, 1886, he went to Atlanta, where, after a short experience with the cotton industry, he entered the banking business. He rapidly forged to the front as a banker and was active in the reorganization and consolidation of several Atlanta banking institutions. He served as president and vice-president of banks until 1910, when he resigned as vice-president of the Third National Bank to devote his entire attention to his other duties.

Mr. Atkinson has been identified with nearly all the important electrical projects that have been put through in Atlanta for twenty-five years and has contributed much to the city's growth and prosperity. He organized and built the first electric lighting system in Atlanta and was the first president of the Georgia Electric Light Company. With others, he consolidated the City Railways & Lighting Companies of Atlanta into the Georgia Railway & Electric Company. He also organized the Georgia Railway & Power Company. This company, which subsequently leased the Georgia Railway & Electric Company, has made, and is continuing to make, extensive water-power developments in Georgia and is now doing the entire street-railway, electric lighting and gas business in Atlanta, as well as a large hydro-electric power business throughout the northern part of the state forming an important link in the Southern system.

Mr. Atkinson organized, built and was the first president of the Atlanta, Birmingham & Atlantic Railroad, which has contributed immensely to the development and commercial prosperity of those sections of Georgia and Alabama served by it. In his social and commercial affiliations and in his ideals of service he is well established as a leader, one in whom the Atlanta district and the electrical industry take great pride.

Editorial Comment

Electrical World, November 18, 1922
Volume 80 Number 21

California Defeats Water-Power Act

CALIFORNIA is still listed among the forty-eight states of the Union. Election day is over; the sober judgment of its voters has been passed on the water and power act, and it is overwhelmingly defeated. Whatever apprehension might have been felt about the sanity and steadfastness of California in such a crisis, the result shows it to have been unwarranted. California chose to remain solvent. All the appeals to prejudice, passion and self-interest have affected her not at all. They have not been able to warp her judgment or lure her from the paths of righteousness. The issue was not one primarily between power companies and the state. It was more vital than that. It involved the sanctity of covenants and the honor of the commonwealth. That her voters chose to recognize such obligations speaks volumes for California.

At the same time, we hope that the electric public utilities of California will emerge from this attack with a humble and grateful spirit of dedication to the principles of service and to the furtherance of harmony and friendliness. Not that these have been ignored—quite the contrary. The vote, however, shows that there are still tens of thousands in California who need conviction on the issues involved. To win over this opposition is the task that now confronts the utilities. California's public utilities can have but few interests not shared by the state and its people. Therefore, if the utilities seek to gain good will they must convey it. If they are to harmonize conflicting opinions, they must breathe the spirit of harmony and exhibit a willingness to let bygones be bygones.

The support given the utilities was magnanimous. It was a wonderful tribute to their efficiency and standing in the state. It shows that the public is not ungrateful. On their part the utilities should not be unmindful of this tribute, and by their future actions they should convince the public that it was not undeserved.

Italy Discards Government Ownership

THE fallacies and weaknesses inherent in popular forms of social philosophy are not always immediately discernible or provable. Time is necessary to reveal their shortcomings and defects, and the largest service of history is that it teaches by experience. We have always held that our system of private ownership and operation under public regulation is the logical way of conducting the business of public utilities and the best that can be devised. When, therefore, we encounter confirmations of this fact in unexpected ways and places they seem to us "proofs strong as Holy Writ."

One would hardly expect even a regenerated socialist to be impenetrably prejudiced in favor of private and against public ownership, yet we find the recognized head of the Fascisti of Italy, Premier Mussolini, pronouncing most emphatically against the latter. Delving into the economic situation in that country, he encountered vast deficits and immediately set about to stop the leaks. One-third of these losses were attributable to the state-owned public utilities, and almost overnight Mussolini determined to rid the government of those utilities whose earnings and services were such as to make them obnoxious both to the owner and the user. As a result the state-owned telephone system and a large part of the government railroads of Italy will soon be operated by private enterprise, thus eliminating from the budget many of the items which went to make up the deficit. The details available are much too meager to justify more extended comment, but they are sufficient to indicate that the mills of the gods are grinding.

Public Purchases Bonds in Small Denominations

THE bond of small denomination has become a popular issue. This may have been brought about by the Liberty loan campaigns, but a very decided influence has been the customer ownership campaigns of electric utilities. A compilation made by Dow, Jones & Company of issues for more than a million dollars in bonds of one-hundred-dollar value shows that of the 160 companies listed the electric and telephone companies number 123. A cause for congratulation lies in the compilation of the *Wall Street Journal* showing comparative average prices for several classes of bonds. The average price of the public utility bond is next highest to that of the industrial bond and has made the greatest increase in the past year.

Electrical utilities as a rule prefer to issue secondary securities, but frequently there is a necessity to issue bonds to obtain adequate capital at favorable rates.

Most utility executives are favorably disposed toward the issue of bonds of small denominations to secure needed money, and the banks and bond houses also find the small bond profitable. Utility financing is now at its height, and in this connection recent remarks of Samuel Insull are significant of the trend of thought. He favors making mortgages cover the widest possible ground and making provisions for issuing bonds under them at varying rates of interest and in various denominations so as to assure maximum flexibility in marketing. In his opinion the best form of public utility bond is similar to the "debenture" type which has been widely used in England.

These changes in financial methods and thought are encouraging signs of health, and in their development the electric utilities are in the forefront in the magnitude and diversity of their operations.

Electric Furnace Comes Into Its Own

A SLOW recognition of the merits of the electric furnace in the steel industry was to have been expected, because changes of magnitude in methods or equipment in such a large industry occur slowly. But that this recognition now exists is made clear in this issue by the president of a steel company, who lauds the furnace as the agency that has enabled that industry to meet new demands for better quality in its products.

The great advantage of the electric furnace is not necessarily in low cost of production, but in its flexibility for many uses and its ability to make high-grade steel of uniform quality. For melting, refining and casting iron or steel the furnace has a field, and it speaks well for the initiative of American engineers to find that the United States leads the world in the number of installations.

This splendid condition already exists, but there are many possibilities for a greater use of the furnace. It is particularly well suited for foundry purposes because it produces an equally good product in the large and the small sizes. Central-station companies may well help introduce the furnace to the foundrymen, because it results in a splendid load on the system and may be adapted to valley conditions. The automatic regulating equipment has eliminated the features of older installations which were bad from the load standpoint.

Increasing Service Reliability

HEAVIER loads upon central stations and increasing investment in plants and lines give new force today to the definition of "service" accepted by the progressive public utility managers concerned with the production and distribution of electrical energy. The public relations aspect of poor service is of tremendous importance. Hence it is not surprising that the study of system layouts, station development and the retirement of less modern equipment, the organization of more "shipshape" means of handling service and the analysis of load curves, log sheets and operating reports should be uppermost in the minds of central-station managers as a more or less continuous problem.

A broad view of the question of obtaining more reliable service is given on another page by Fred D. Gordon. From this article one becomes increasingly aware of the number of factors which enter into the operation of a central station's usefulness to its community. The economic problem of getting the most out of the equipment at the lowest cost consistent with good service is always present. Where the system combines the outputs of hydro-electric and steam plants, the stage is always set for first-class engineering in the operation of such a property. The author's diversified experience adds not a little to the weight of his views, for the Maine companies with which he has been associated have illustrated in a very striking way a successful solution of the problem of providing good service under varied conditions of water supply, varied proportion of steam auxiliaries justified, transitions in station and equipment design, and a market with extremely divergent uses of service.

Two points in Mr. Gordon's opinions may well be elaborated by the operating reader for himself—the need of getting rid of obsolescent machinery and apparatus and the importance of giving regular executive attention to daily log sheets and reports of operation. We need not stress these points in detail, but among the sins of commission and omission which darken the shield of the well-intentioned but preoccupied manager these two stand out in small or medium-sized companies in altogether too prominent emphasis. It is human nature to get along with a machine or a device as long as it will function and to pigeonhole routine reports from stations, but alert and progressive operating executives do not build or maintain their reputations in this way. Courage and industry applied with insight and vigor to these two matters will reap their reward in the service record.

Oregon Commission Establishes a Bad Precedent

IN WRITING a ratio of investment cost to annual revenue into a set of rural service rules as a basis on which utilities must make investments in service-line equipment the Public Service Commission of Oregon has set a bad precedent. To begin with, the rules are confusing. One rule dealing with increases in line capacity due to increases of load is so framed that it at first appears as if the utility were required to finance the entire cost, and the requirement is then modified in such a way that it appears as if the utility could collect a sufficient sum from existing consumers on the lines to bring its investment in the district affected to a basis of two dollars of investment to one of revenue. The exact interpretation of the rule is a matter of doubt in several ways. The effect of consumer investments is also doubtful. Later, in dealing with the actual extensions, the utility is required to invest four dollars for every dollar of minimum or guaranteed revenue. It is thus difficult to determine just what is meant, but regardless of the ratio figure used, it does not appear that any figure can be adjusted so that conditions on all the utility's properties even in one state can be met and the resulting practices be non-discriminatory.

Costs of rural service from the power house to the consumer are difficult to obtain because little attempt has been made anywhere to get complete and accurate figures. Taking the study based on the conditions of an Iowa company which appeared in the September 23 issue of the *Electrical World* and reducing the figures in Tables I and XI (pages 656 and 658) to the cost and revenue per mile shows that for one to three customers (a fair average per mile for American rural systems) the cost of lines ranges from $1,064 to $1,392 per mile. The utility must receive from the consumers $250 to $393 per mile to cover all service costs from the power house to the consumer—or, roughly, 23 to 28 per cent of the investment in line equipment for the consumer's use—before any charges for energy are made. In other words, the indications are that for a varying number of consumers per mile the ratio must be higher for the larger number because there are certain expenses, such as consumer, transformer and meter costs, that vary directly with the number of consumers. The actual line investment costs for the comparatively small number of customers available remain stationary, and the actual costs of service for the group become a bigger percentage of the investment cost.

This use of the Iowa figures probably does not express Oregon conditions in an extremely accurate manner, but it does indicate a condition which should give pause to other commissions that may be inclined to copy the Oregon method. Short-cut methods that look inviting and are apparently easy to administer are usually dangerous, and in this case the Oregon commission may find that it has put itself in the position of forcing the utilities of the state to do what it recently decided the Mollala Electric Company must pay a penalty for doing—overbuild in sparsely settled territory.

Use of CO_2 as Fire Extinguisher Offers Advantages

THE adoption by many central-station companies of the inclosed system of ventilation for large generators offered opportunity for the use of new methods for extinguishing generator fires. The system at Hartford described in this issue by T. H. Soren affords additional evidence that the use of CO_2 is efficacious and comparatively cheap. The great advantage of the system is that service can be maintained for some minutes in the event of generator trouble without having it spread to all parts of the winding. This gives the operators time to make an investigation or to shift the load gradually. Another advantage is the elimination of steam or water fire-prevention systems which in themselves introduce insulation hazards by their proximity to the winding.

The cost of the gas is not great and the system marks a distinct advance in practice. Actual experiences with fires under operating conditions are yet needed to tell the whole story. It is to be hoped that this method will solve the problem that has led to its trial, for the speed with which destructive fires accomplish their work once they get a start in turbo-units operating at the usual peripheral velocities leaves little or no time to organize men and apparatus to fight them.

Insure Against Lost Opportunity

THERE are two reasons why so many central-station companies neglect to establish competent sales departments. First, they look upon this department as an expense and only as an expense. They hesitate to hire a good sales manager and, in the larger companies, to give him a good staff, because much money would have to be paid out in salaries. Second, the executives themselves not being salesmen fail to visualize the opportunity and the way to grasp it. They fail to see that a *good* sales department pays all its own expenses plus a profit and that a *good* sales manager himself knows how to get business and generate his own ideas. He is not a burden on anybody.

It took a long while to teach the public the value of insurance, but today the principle of insurance is pretty well established as regards life, fire, accident and casualty policies of various kinds. Every central-station executive thoroughly believes in it and protects himself in this effective way. But, after all, a sales department is only a further application of the same sort of sound common sense. It insures a volume business. It insures growth. It insures an additional source of income from merchandise sales and an opportunity to select the class of business which is most profitable to develop. Without an effective sales department a central station is commercially drifting. With a competent sales force it shapes its own future.

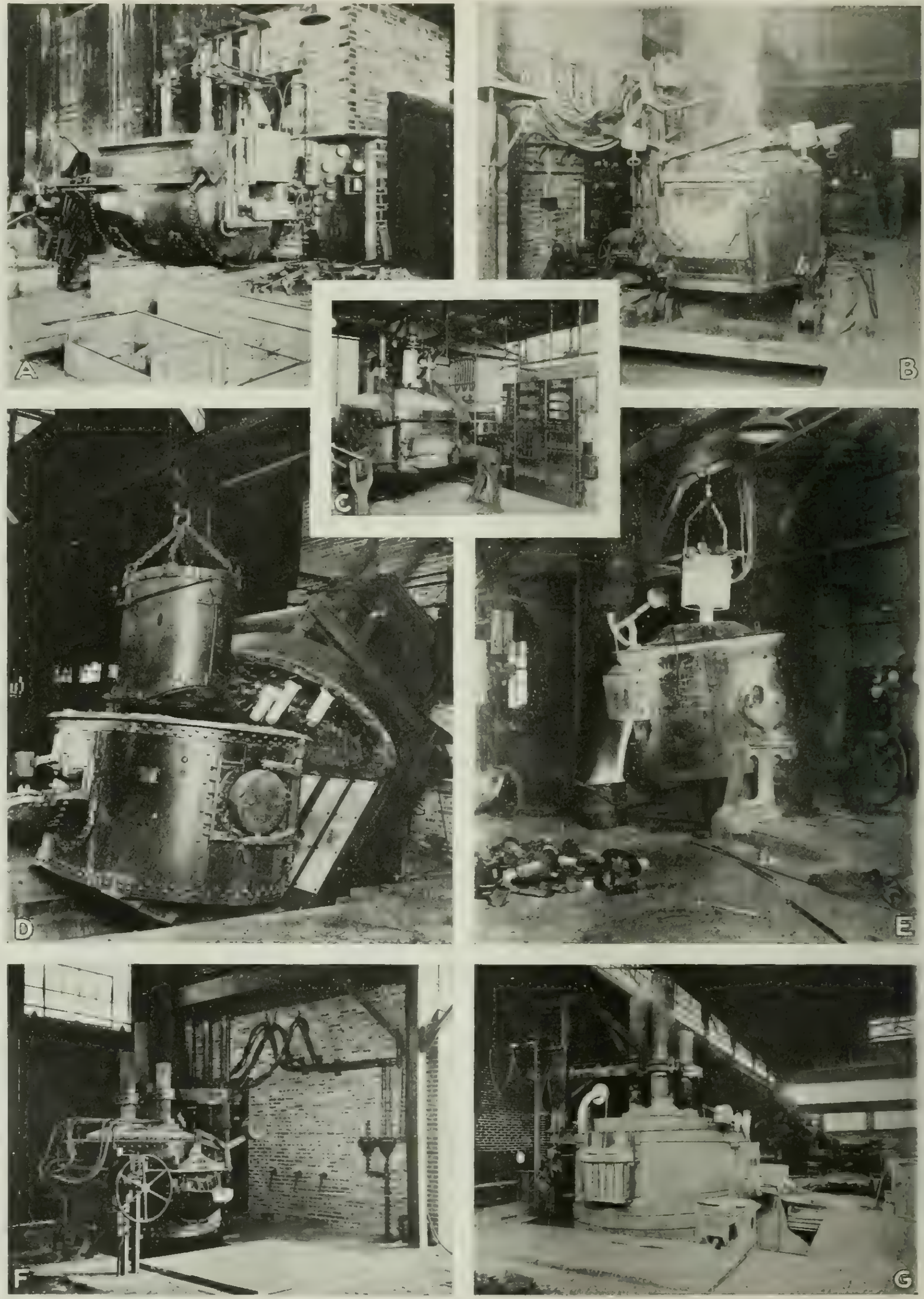
Some of the Problems of Flicker Photometry

WE HAVE learned to look to Ferree and Rand for highly ingenious experimenting and interesting results. The paper prepared by them for the convention of the Illuminating Engineering Society deals with the often-discussed matter of flicker photometry. Of course, it is well known that in the comparison of lights of different colors the flicker instrument gives results materially different from the equality-of-brightness photometer. It is generally regarded, too, as more reliable, but where a discrepancy exists and there is no available method to ascertain with absolute precision the cause of the variation, it is always worth investigating. In the case of flicker photometry the research is fraught with almost every conceivable kind of difficulty, because little is definitely known about the relation of the sensation of flicker to the color stimuli that reach the retina and the speed at which they are developed. It is this last-named factor with which the paper before us deals; that is, the growth of color sensation as a function of time in the transient sensation obtained in the use of a flicker photometer. The study made in the paper under notice bears definitely on the rate of growth with time of the sensations of color. This rate of growth proves to vary greatly, like all similar functions, in different persons and different states of adaptation in the same individual.

So far as Ferree and Rand's investigation goes, it does not deal yet with a sufficient group of observers to allow a safe average to be taken, nor does it make altogether clear the particular state of adaptation reached during the experiments. It does, however, bring out very clearly that there is a somewhat large factor of uncertainty in flicker due to the variations in the relatively slow rise of sensation for the several colors. What is perhaps the most striking result of this very interesting investigation is that it was found that, using the flicker photometer on the one hand and the equality-of-brightness photometer as the "blink" instrument on the other, the results dropped into coincidences. In other words, taking the variations of sensation in the flicker method as they were found, glimpsing the equality-of-brightness field for the same observing time led to the same result as in the case of the flicker. A large element of uncertainty appears, then, to be introduced by the use of the brief exposures of the flicker disk as against the steady stimulus of the ordinary equality-of-brightness method.

It should here be noted that a flicker photometer of the Simmance-Abady type gives a very different character of exposure as regards its time relations from the instrument used in the experiments here described. This may indicate the reason why the photometer performs a good deal more steadily than these very experiments appear to show. The improved relation between the two general methods obtained with very short exposures in the equality-of-brightness comparison suggests an interesting side line of research on the effect of such brief exposures on simultaneous contrast of colors, which is known to be one of the troublesome factors in photometry of colored lights. We trust that by next season's convention the authors of this painstaking study will have had opportunity to try out this and many other collateral experiments which naturally suggest themselves. It is good team work to co-operate in this kind of research.

Electric Furnaces Produce Quality Steel



The drastic specifications for steel materials have offered opportunity for the electric furnace in the industry. Various types of furnaces are available and a great development has occurred in the control and regulating equipment so that these furnaces now afford a splendid load for central stations which is growing rapidly.

Extinguishing Generator Fires with CO$_2$

Marked Success Obtained in Hartford Tests—Ten per Cent Concentration Found Not to Support Combustion—Can Be Established Four Seconds After Detection of Fire and Maintained Sufficiently Long

By **T. H. SOREN**
Vice-President Hartford Electric Light Company

CARBON dioxide promises marked success as a means of stifling turbo-generator fires, according to recent tests made at the South Meadow station of the Hartford (Conn.) Electric Light Company. Measurements of the percentage of CO$_2$ retained in the casing at various periods after admission under pressure show that the conflagration hazard may be regarded as nil if prompt action is taken by the operating force, and that several minutes may be utilized in investigating the causes of apparent difficulties or threatened troubles before it becomes necessary to close the turbine throttle and shut off the water of the air-cooling system. These results are achieved by relatively simple means—means arrived at, however, after experiments lasting through many months.

The South Meadow station has one 20,000-kw. General Electric generator installed at present, the foundations being prepared for a second unit of the same size. When the plant was designed the General Electric Company recommended the installation of the inclosed system of air cooling, and as experience elsewhere and local conditions were favorable, this was done. Fig. 1 is a diagram of the ventilation system, showing the arrangement of apparatus for admitting CO$_2$ to the generator casing in emergencies, a general view of the equipment being shown in Fig. 3.

The air is taken in at each end of the generator and discharged through the center. The air, therefore, comes down between two partitions and up through the air washer and eliminators. Doors are provided which are geared together so that, if necessary, the system can be operated as an ordinary open system by opening vertical doors on each side of the intake and one side of the discharge and, at the same time, closing a door horizontally to prevent recirculation. The air is then drawn in at the lower part of the chamber through the air washer and discharged toward the boiler room at the upper side of the foundation. The discharge is through a duct equipped with doors, so that the warm air can be diverted for use either in the turbine room or under the draft fans in the ash room.

For generator fire protection the manufacturers recommended and furnished with the generator a sprinkler system around the end connections for the use of either steam or water. This seemed undesirable, and, owing to the fact that the inclosed system proved satisfactory and reliable, it seemed best to control generator fires by an inert gas in place of steam or water. The latter system was therefore installed.

The apparatus centers in a tank at the condenser floor level, about 3½ ft. in diameter by 16 ft. long, filled with gas at 200 lb. pressure. This gives approximately 2,000 cu.ft. of gas at atmospheric pressure. The whole inclosed system has a content of about 3,300 cu.ft. of free air, and the air is recirculated at the rate of 55,000 cu.ft. per minute. Therefore the maximum possible proportion of gas is about 40 per cent. From this tank is taken a vertical riser, at the top of which is a tee, with a device, shown in Fig. 2 and described below, for releasing the gas. The pipe then runs along the generator foundations, where the gas is discharged through a 3-in. pipe and a 1-in. nozzle directly under the air intake at each end of the generator. In order to detect fire in the generator, a 3-in. pipe has been inserted through the casing of the air chamber at each end of the armature winding. Weighted dampers have been placed under these pipes, which are held open by a cable running back to the device for releasing the gas. When the gas is released, these dampers close automatically. The water from the spray nozzles is drawn off at the bottom through a trap. This was found necessary because considerable gas was entrained with the water running to waste.

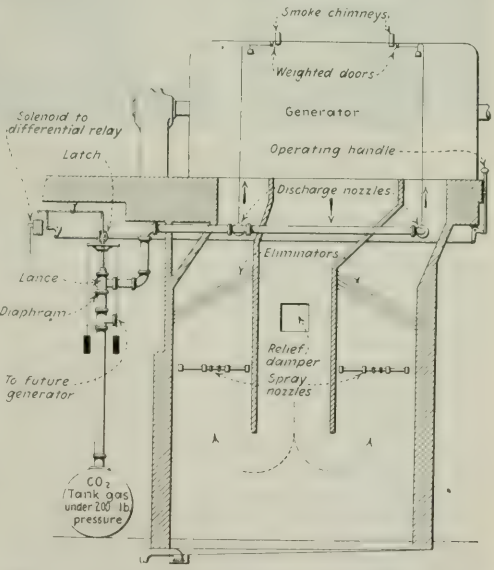
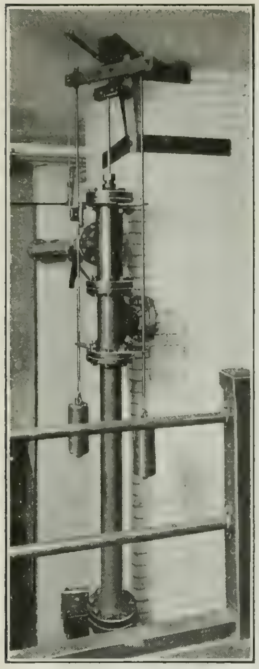


FIG. 1—CO$_2$ IS INSTANTLY ADMITTED TO GENERATOR CASING WHEN DIAPHRAGM VALVE IS PUNCTURED

As the generator lagging is reasonably tight, no change was made from the manufacturer's standard design. The openings in the foundation walls originally intended for the change from open to closed system were closed up with steel doors clamped tightly in place. In one of these doors there is a weighted damper for relieving the pressure when the gas is released from the tank.



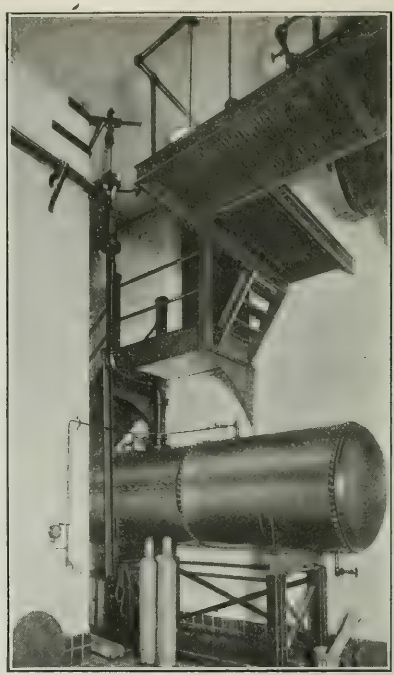


FIG. 2 (AT LEFT)—COPPER DIAPHRAGM IN UPPER SECTION OF PIPING PIERCED BY WEIGHTED LANCE TO RELEASE CO_2

FIG. 3 (AT RIGHT)—CO_2 TANK AND PIPING OCCUPY LITTLE USEFUL SPACE

The first essential is prompt release of the gas in case of suspected fire, but it is not expected that the gas will have to be released frequently. As a valve is liable to leak and require considerable time for opening and closing, the following arrangement has been substituted:

Under the tee in the riser from the tank there is a thin copper diaphragm and above it a spearhead (Figs. 2 and 4). This spearhead is weighted and when released passes completely through the copper diaphragm. In case of suspected fire the spearhead is released from an operating handle on the turbine floor immediately adjacent to the turbine.

The generator is protected by differential relays between the neutral and the generator switch. In case of internal short circuit these relays trip the generator switch automatically. At the same time that the relays operate on the generator switch they also release the spearhead, so that the air chamber is immediately flooded with CO_2.

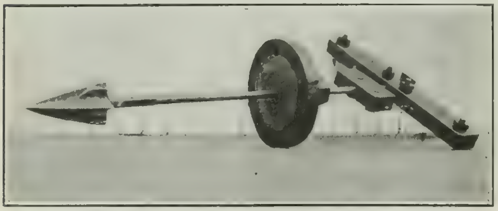


FIG. 4—SPEARHEAD FOR PUNCTURING COPPER DIAPHRAGM TO RELEASE CO_2

The object of the scheme is to release the gas immediately on suspicion of fire, giving the operator time to investigate the condition of the machine without interrupting service. With water or steam it would be necessary to take the load off the generator and open the field. With the scheme described it is only necessary to release the gas. Curve *D* in Fig. 5 shows the rate of discharge of the gas in the first two minutes.

Through the courtesy of the General Electric Company, tests were made in its research laboratory which indicate that air diluted with 10 per cent inert gas will not support combustion. Therefore the first rush of gas into the system should snuff out any flame and prevent its breaking out again while there is not less than 10 per cent gas.

Tests were made under different conditions, but none were made with the fire inside the air chamber. This naturally would decrease the amount of free oxygen. Several tests were made without turning off the water in the air chamber. All tests for percentage of gas were made by taking samples from the discharge side of the generator, as shown in Fig. 6. The gas is taken off in gas bags and tested in an Orsat apparatus, a check being made by testing for oxygen. CO_2 gas was used in all tests but one, as it was the cheapest and most available. The cost per charge was $25. One test was made with nitrogen, as shown in curve *C* (Fig. 5). The cost of a charge of nitrogen is

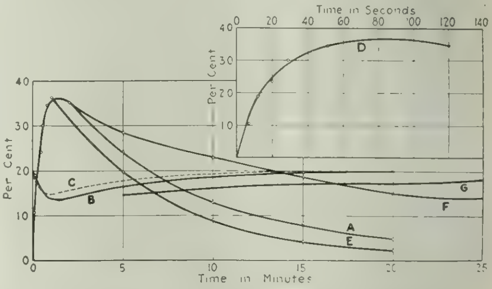


FIG. 5—CONCENTRATION AND DURATION OF CO_2 OBTAINED IN GENERATOR VENTILATING SYSTEM

The results of the CO_2 tests at Hartford are shown in the above diagram. Research laboratory tests show that air diluted with 10 per cent inert gas will not support combustion. In the diagram curve *A* shows the percentage of CO_2 with the generator operating at full speed with cooling water shut off. The non-combustion percentage was not diminished for about twelve and a half minutes after gas admission. Curve *B* shows the percentage of oxygen corresponding to curve *A*. Curve *C* shows the percentage of oxygen at various periods when using nitrogen instead of CO_2, the generator being run at full speed and the cooling water supplied at full head. In curve *D* the percentage of CO_2 measured during the first two minutes is shown, the maximum being about 37 per cent, attained in about eighty seconds. It will be noted that the non-combustion percentage of 10 per cent was attained in about four seconds after the puncturing of the diaphragm valve. Curve *E* shows the percentage of CO_2 measured with the generator at full speed and with cooling water running at full load. Curve *F* shows the percentage of CO_2 with the generator and cooling water shut off about the same time the CO_2 was released. Curve *G* shows the oxygen corresponding to curve *F*.

about $50. Nitrogen is not so easily obtained, requires more tanks to charge the main tank and is not quite as efficient as CO_2.

The test condition shown in either curve *A* or curve *E* (Fig. 5) will allow the operator several minutes to investigate conditions before shutting off the water and closing the throttle on the turbine, and still retain a sufficient percentage of CO_2 to prevent general conflagration. In case of a serious short circuit the generator field is opened and the gas released automatically. The operator then trips the throttle valve and shuts off the water. Curves *F* and *G* show CO_2 and oxygen curves under this condition from tests.

After the machine came to rest, in about twenty minutes, the proportion of CO_2 remained for some time practically constant at above 13 per cent. It would therefore appear that the system as installed can be counted on to prevent the spread of fire from one set of coils to the next set under the worst possible conditions.

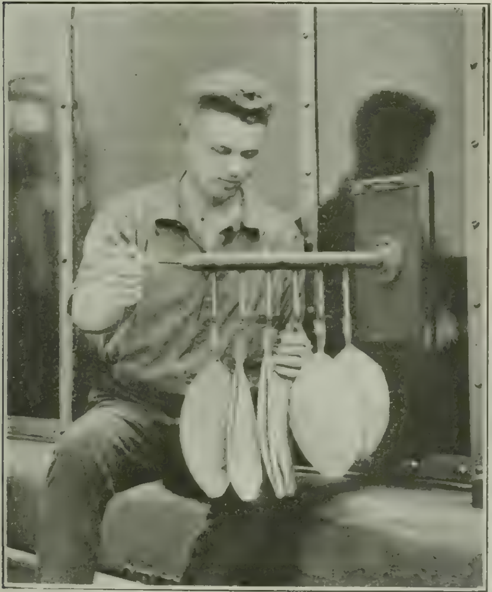


FIG. 6—TAKING GAS SAMPLES FROM GENERATOR HOUSING TO ASCERTAIN CONCENTRATION OF CO_2 AND DURATION

The system as laid out is intended to take care of more than one generator. With additional generators it might be advisable to install a second smaller tank with gas between 300 lb. and 400 lb. pressure that could be released into the larger tank and so continue to feed CO_2 to the system or, in case of a second fire, into the second generator.

The process of charging the large tank from the high-pressure tanks as purchased is a long one, requiring two or three hours. The tanks purchased contain liquid CO_2, and to release this into the main tank requires a water jacket heated by a steam jet.

The writer is indebted to A. R. Smith of the General Electric Company, Schenectady, N. Y., for his assistance in working out many of the problems of this system.

Electric Furnaces Lauded

Said by Steel Company Executive to Have Fulfilled Almost Every Expectation—Extremely Practicable and Adaptable for Quality Products

POINTING out that "the electric furnace was opportunely invented to meet a new demand rather than to replace an old process," John A. Mathews, president of the Crucible Steel Company of America, went on to say, in an address delivered at the meeting of the American Iron and Steel Institute at New York on Oct. 27, that "its astonishing flexibility has attracted the attention of the metallurgical world in almost every branch of smelting, refining, heating and even baking metals. It seemed very slow in achieving the recognition that we felt must inevitably come to it, but at last its products have fulfilled almost every expectation in every field wherein it has been thoroughly tried. The present success is due not only to the original inventors, but also to the active co-operation of the great manufacturers of electrical equipment, furnace designers and builders, makers of refractories and electrodes and a group of earnest metallurgists. When users acquire a full appreciation of what clean, sound steel means in terms of national efficiency, safety and economy, we shall see more rapid growth than has as yet been seen. Its usefulness to engineering and industries has just begun.

"There are now nearly a thousand electric furnaces in America and Europe, not quite half of them in the United States and Canada. [There are 388 in the United States with a productive capacity of 1,500,000 tons.] Italy has about 180 electric furnaces for steel melting, twenty-seven of which have from 15 tons to 25 tons capacity. In 1921 her tonnage of electric steel was second only to that of the United States and reached a new high mark for that country. The annual productive capacity there is about 1,000,000 tons. Some of these furnaces were operating at unusually high speed and with great economy of electrode consumption, as low as 6½ lb. per ton for cold melting. For installed capacity Italy ranks ahead of Germany, England and France and second only to the United States.

"There are sixty-five furnaces in Germany engaged in the manufacture of ingots," Mr. Mathews said, "with a yearly productive capacity of 430,000 tons and an unknown number of furnaces making steel castings with a capacity estimated at 300,000 tons per annum. We may estimate the total number of electric furnaces in Germany as about 100 to 110.

"In Sweden, Norway and Italy, where metallurgical fuel is very dear and electricity is cheap, electric smelting of ores is an established industry. The world's production for 1921 is placed at 377,900 tons, although the year 1921 was not a year of high records."

The reasons for the world-wide expansion of electric steel making are three in number, according to Mr. Mathews. These reasons he gave thus:

1. *Cheapening of wholesale power rates.* This is due to hydro-electric and improved steam-plant developments.

2. *Extreme flexibility and adaptability.* Electric furnaces have a wide range of uses. They may be successfully used for melting cold charges or refining liquid charges, for making ingots or castings and for melting ferro-alloys. They may be used alone or in conjunction with the Bessemer or the open-hearth process, or with both. They may be operated acid or basic. They may be used in conjunction

with the blast furnace or cupola for making gray iron, malleable and semi-steel castings. For foundry use particularly the small units are advantageous for making frequent small heats of steel or iron castings. All of the manifold methods of operation are possible with arc furnaces, which are by far the most frequently used here and abroad. (Of the different types of arc furnaces in the United States nearly one-half are of the Heroult type, and considerably more than one-half the productive capacity is represented by them.)

3. *Quality of products.* The cost of electric steel is rarely lower than open-hearth and never lower than Bessemer, and therefore its success is presumably due to its producing a generally superior product. Of course, there are especially favored localities or peculiar market conditions which warrant the installation of small electric furnaces where open-hearth and Bessemer installations would be out of the question. Where electric furnaces operate successfully alongside of large-tonnage fuel-fired furnaces, quality must be the principal reason for success rather than low cost.

"Quality depends upon the selection of raw materials, the process of melting and subsequent care in forging and heat treating," Mr. Mathews went on to say. "The electric furnace provides a reducing atmosphere in which sulphur is readily removed, and with it goes one of the generally recognized inclusions, manganese sulphide. The same condition serves to eliminate oxides. By way of illustrating the freedom from inclusions in electric steel, I might mention," said Mr. Mathews, "the result of the actual count of hairlines, due to inclusions, in the ground surface of chrome nickel steel made with the same chemical specifications by the basic and acid open-hearth and basic electric processes. The average count ran in the ratio of eight to four to one, and the hairlines in the electric steel were much shorter than in the steel of the open-hearth manufacture.

"The recent paper by W. J. Priestley* outlines the splendid results of electric furnace ordnance steels made at Charleston, W. Va., in the largest furnaces in the United States. He shows that the results are due to clean steel and freedom from oxides, sulphur and phosphorus. These results show that large units with proper handling can produce very high-quality steel, and we can see no reason, now that larger electrodes can be made of dependable quality, why 60-ton or 80-ton furnaces cannot be expected to give relatively satisfactory results."

Commenting on electric furnace developments, Mr. Mathews declared that no new principles of heating have been employed since the first few years of development, with the possible exception of the high-frequency induction furnace. Of mechanical and electrical refinements there have been many, all in the nature of improvements in regulation and economy. Among these may be mentioned two of American origin, the automatic electrode regulator and the peak-load regulator. "The desirability of relatively high voltage for melting and low voltage for refining is now generally recognized," he continued. "Many improvements have been made as the shortcomings of the earlier furnaces appeared, such as well-fitting doors, water-cooled arches, better electrodes and holders, and economizers to cut down oxidation and waste of the electrode. In my own experience," said Mr. Mathews, "I have seen electrode costs per ton of product as high as $8 gradually decline to 35 cents. This was in a furnace refining molten charges."

During the years 1917 and 1918, when electric steel furnaces were installed in great numbers, the fear was expressed that furnaces would be built faster than skilled operators could be trained. At that time "fears were justified, for much electric furnace product was not what it should have been," declared Mr. Mathews, who pointed out that he has "always discouraged the idea that the electric furnace was a foolproof and automatic process for making superior steel by those unskilled in steel making.

"The most popular size of electric furnace in this country is of a gross capacity of 6 tons," he said, "but furnaces of from 0.5 ton to 40 tons capacity have proved equally successful. In furnaces of 6 tons or a little larger hand charging is general, but in the larger size either mechanical charging of cold materials or the use of hot metal charges is usual."

Again asserting that the usefulness of the electric furnace to engineering and industry has just begun to be appreciated, Mr. Mathews said that, besides being used extensively in the steel industry, "the electric furnace is also a recognized factor in melting nonferrous alloys, such as brass and monel metal, as well as especial alloys, such as nichrome, rezistal, stellite, stainless steel, manganese steel and high-speed steel, besides an endless variety of the simpler alloys and carbon steels from the mildest to the hardest tempers." Right now "the electric product is opportune to meet the new and exacting requirements for ordnance, automobiles and aëroplanes and other devices in which alternating stresses are very severe. The electric furnace also has some possibilities in this country for the manufacture of pig iron from the ore."

Lighting in Relation to Safety

THIS is the subject of a pamphlet issued by the Edison Lamp Works of the General Electric Company and is one of a series of bulletins on the general subject of lighting. Because of the greatly increasing interest in the safety movement from both the welfare and the financial points of view a study of the relation of adequate illumination to safety is of interest. A discussion of the magnitude of the safety question is followed by examples of improper lighting—glaring lights, insufficient lighting, improperly placed lights, etc.—and of correct and adequate lighting to show how safety is retarded or promoted thereby. The pamphlet says:

> In a well lighted shop, obstructions being more readily visible, are much more likely to be removed, or even if not removed, are likely to be seen by the workmen, and thus accidents are avoided.
>
> Similarly, over a wide range of conditions, good illumination is the best possible warning of danger, facilitating the removal of the cause and further helping the employee to see any dangerous conditions and thus avoid danger. An employee is certainly entitled to this protection. Few employers would think of letting a blind man go in among powerful machines in a workshop, yet it often happens that they render an employee partially blind by glaring or inadequate illumination.
>
> It is impossible so to guard a sharp-cutting tool that it is not possible for an operator to reach its danger point. If it is not clearly visible, injury is liable to occur, even though the best obtainable device is used.
>
> A peculiarity of good lighting is that it differs from many other safeguards in that it assists rather than impedes the workman, thus contributing toward raising the quality and quantity of the product. In other words, it pays from every point of view.

The writer also points out the value of proper lighting for automobiles, public and private buildings and streets, asserting:

> In all walks of life, and in all occupations or recreation, artificial illumination is a necessity, not alone from the standpoint of making movements possible through the ability to see, but also from the humanitarian standpoint of assisting in making all of these safe.

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*Proceedings, American Institute of Mining and Metallurgical Engineers, Vol. LXVII, page 317.

Unit Labor Costs on Electric Construction

Figures for Installation Involving More than 50 Miles of Conduit, 8,500 Lighting Fixtures and 1,000 Switches, Based on Standard Cost-Keeping Records — Excellent Mechanical Equipment an Important Factor in Lowering Costs

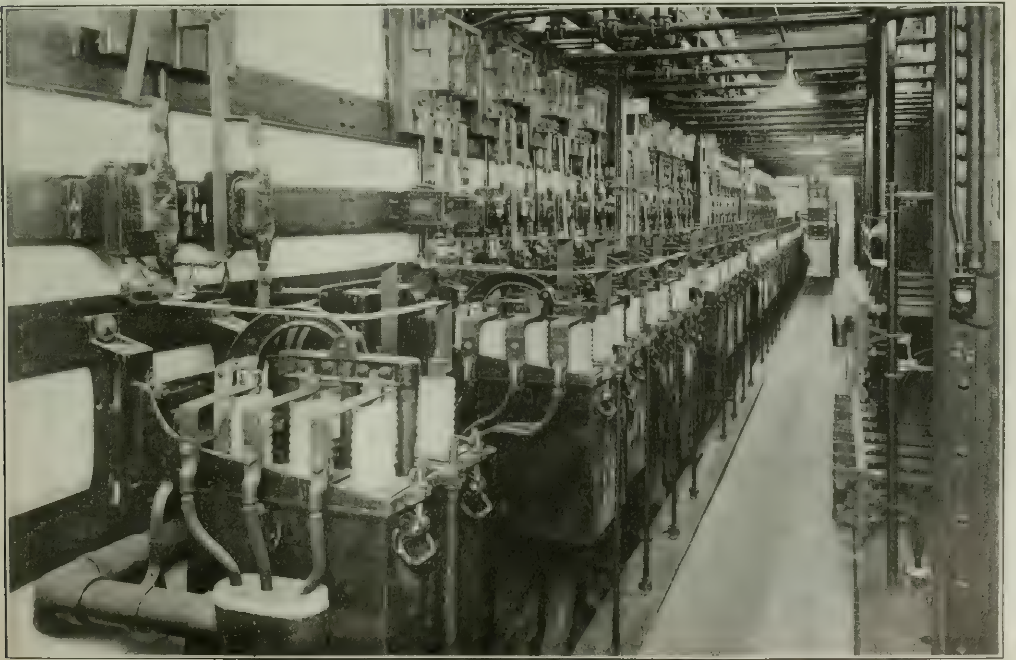
By CAMPBELL HIGGINS
With Hatzel & Buehler, Inc., Electrical Engineers and Contractors

ACCURATE records of the labor cost of installing electrical equipment kept during the construction of the Elizabeth (N. J.) plant of the Willys Corporation are presented here in detail on a unit basis. The work involved the installation of circuits, switches, outlets and fixtures for an industrial plant having more than 1,800,000 sq.ft. of floor area, and it consumed eighteen months' labor immediately subsequent to April, 1920. As brought out in Table I, more than 50 miles of conduit, 8,500 lighting fixtures and 1,000 switches were installed. The relative amounts of productive and non-productive labor required for roughing, wiring, installing apparatus and finishing are indicated in Table II. Table III, which gives the unit cost of construction, exclusive of material, is classified so as to permit ready reference.

When the work was undertaken speed was considered the essence of the contract, which was to be completed in five or six months, and observations showed that this result would probably be attained. However, a change of program went into effect a few months after the start, with the result that our work required eighteen months to complete. Although the concrete buildings were erected and the electrical work nearly completed in six months, using a gang of about sixty men, the steel structure or main shop was not erected until work in the concrete buildings was nearly completed. When it was erected the electrical work was slowed down at the owner's request on account of change in policy, so that for many months the actual construction was carried on with a force of ten men and one superintendent.

As a result of this change alone two noticeable effects were observed, (a) the productive labor was accomplished for considerably less than the amount estimated, while (b) the non-productive labor was found to be greatly in excess of the amount estimated. The total labor expended was close to and less than the amount estimated. Despite the fact that the wage scale for wiremen and helpers increased a dollar a day after the third month of the work, the construction was completed with a net expenditure for labor 3 per cent ($2,700) below that estimated.

The general conditions affecting labor during the life of the contract, and which will have to be considered in future work, are given below. The physical conditions



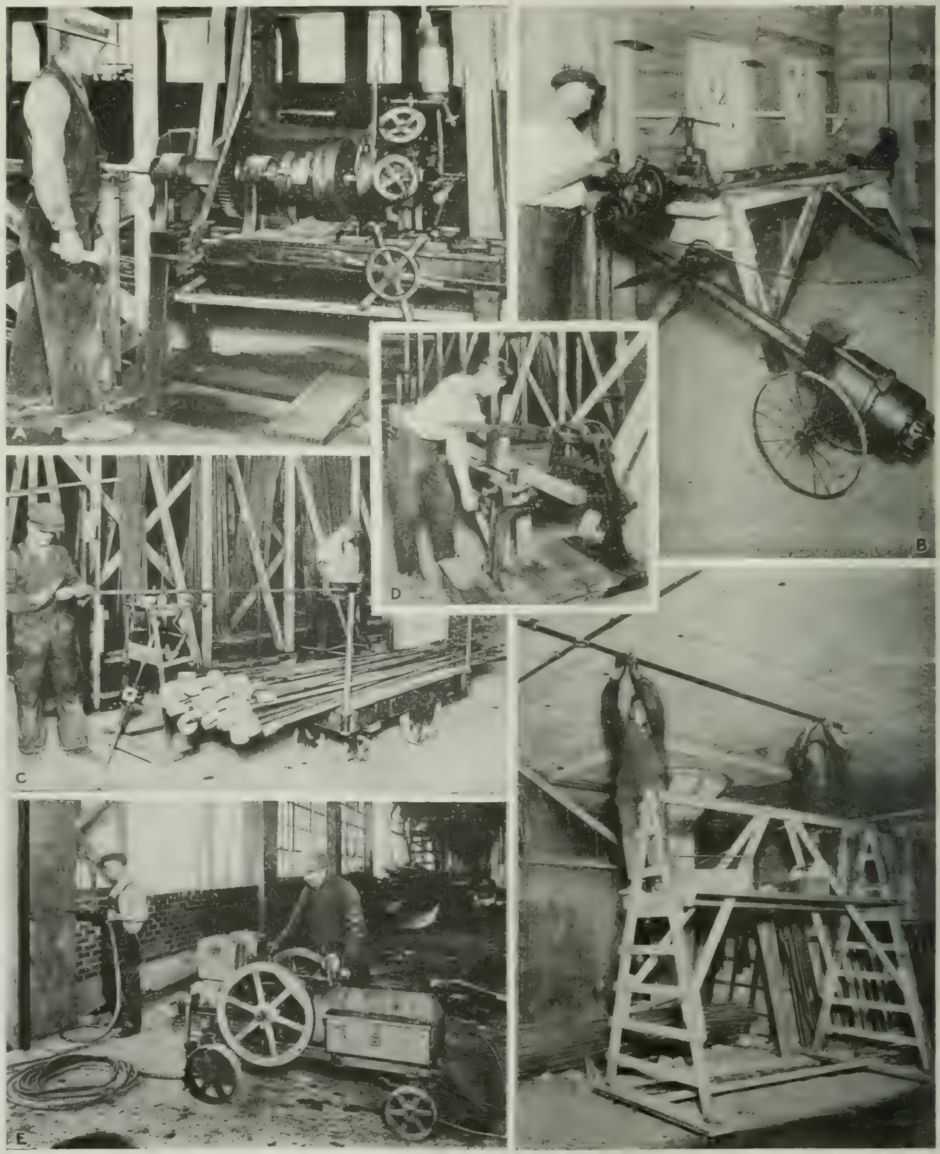
NATURE OF ELECTRICAL WORK BACK OF SWITCHBOARD

Note method of mounting oil switches, current transformers, disconnecting switches and overhead bus. The 4-in. x ¼-in. bus is under floor and runs to the main disconnecting switch.

affecting the work are briefly described under each item in the cost data.

Owing to war conditions a lowered efficiency was noticeable during the first three or four months and resulted in a slightly increased expense for the small conduit installation in the concrete buildings. Consequently those particular data are subject to discount on future work.

Because of the location of this unusually large job in a small city and the existence of a local union sufficiently well established to prevent the use of outside labor but not capable of furnishing a large number of



MECHANICAL EQUIPMENT USED IN ELECTRICAL CONSTRUCTION

A—Machine-driven pipe cutter and threader used mostly for ½-in. and ¾-in. conduits. B—Portable power-driven threader for large conduits. C—Attaching outlet boxes for conduits prior to installation; box complete on one end and lock nut on other. Note rack for storing conduits. D—Power-driven hacksaw used on job for cutting small conduits to length. E—Portable air compressor and drill used in mounting electrical equipment. F—Rolling scaffold used to install branch conduits in all concrete buildings. Note the threaded inserts in ceiling to which pipe hangers are secured.

TABLE I—SCOPE OF WORK TO WHICH COST DATA REFER

Floor area* of assembly, storage, manufacturing and shipping Buildings (sq.ft.)	1,820,300
Amount of equipment installed:	
Lighting outlets:	
R.L.M.	8,100
Cooper Hewitt	560
Switches:	
Toggle (30-amp.)	775
Push	340
Receptacles and plates	150
Extent of conduit (miles):	
Branch circuits	41
Main feeder	15
Period of work (months)	April, 1920, to December, 1921
Labor wage† (per day):	
Journeymen	$8 to $9
Helpers	$4 to $5

* The assembly buildings are of reinforced concrete without beams, whereas the shop bays are structural steel.

A power house measuring 140 ft. x 80 ft. and containing two 2,000-kva. turbo-generators, one 3,000-kva. unit and a 75-ft. switchboard was also constructed.

† Lower rates are for period up to August, 1920.

skilled men, a lowered output was experienced. This condition of affairs resulted in a serious restriction during the time the force on the work was being increased and it was noticeably less from the time of the first layoff on Aug. 1. The cost of installing small conduits in the concrete buildings was somewhat increased. The effect of these conditions on work in similar surroundings cannot be discounted unless the wage scale is correspondingly lower than has ordinarily been the case.

Another important cause of increased cost for the small conduit installed on the ceilings of the concrete buildings was the lack of any suitable and adequate mechanical means of drilling for the lead anchors used to support the ceiling outlets. (The pipe straps were secured by means of screws in wood inserts.) About half the outlets were secured to bolts set in the forms, but in the other half (in the area where the forms had been poured) the holes were drilled almost entirely by hand. This was necessary because the portable air compressor which it was intended to use for this purpose arrived at the job too late, and its use was found to be impracticable owing to the wide field of operations, its weight, the condition of the floors and the fact that no elevators were in operation at the time.

While it is safe to say that the costs were considerably increased on this account on this particular job, it is highly probable that the same cause would have been much more serious had it not been for the wooden inserts. However, since the inserts were clearly shown on the estimating plans and dependence had been placed on their use, the lack of speed in the remaining drilling was a net loss so far as the units were concerned.

The foregoing experience would seem to come under that class of contingency which makes its appearance on every job and causes contractors to be very slow to figure new work on the basis of the lowest figures obtained in the past on the same class of construction. Despite the above difficulties, the productive labor for the job was more than $10,000 (7 per cent) less than estimated. This was due to a number of well-defined causes, but principally to the fact that all during the last year of the work the conditions of the labor market were exactly the reverse of conditions experienced during the first few months.

Another very important factor in the lowering of labor costs was the splendid mechanical equipment provided for the work. Among the more important items were thirty rolling scaffolds for work on the ceilings, power-driven hack saws, power-driven pipe threaders of all sizes, air-compressor and drilling outfits which proved of the greatest value on the larger holes, a well-equipped blacksmith shop where much standardized work

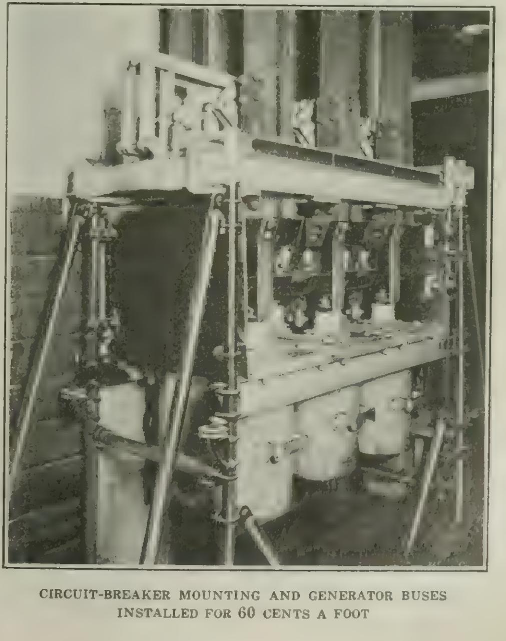
TABLE II—GENERAL CLASSIFICATION OF LABOR EXPENSE TAKEN FROM COST RECORDS

	Percentage of Productive Labor	Percentage of Total Labor
Roughing—Conduits; outlets, boxes	64.2	47.8
Wiring—Pulling all wires and cables	13.4	10.0
Apparatus—Installing and connecting switchboard, panels, cut-outs, buses, etc.	12.7	9.4
Finishing—Installing and connecting switches, receptacles, fixtures, watchman's clock	9.0	6.7
Unassigned	0.7	0.5
Total productive labor	100.00	74.4
Total non-productive labor*	31.86	23.7
Temporary light and power and replacements	2.4	1.9
Total labor	134.26	100.0

* Includes erecting office, stockroom, thirty rolling platforms, clerical work (two men, two boys), laying out work (subforeman), general supervision (superintendent and field engineer) and handling material.

SAMPLE OF FINISHED CONDUIT WORK AND PANEL-BOX INSTALLATION

Observe that the pipe-strap inserts on each side of outlet box are of wood, while the remainder are of metal threaded for ⅜-in. bolts.



CIRCUIT-BREAKER MOUNTING AND GENERATOR BUSES INSTALLED FOR 60 CENTS A FOOT

Table III—Itemized Construction Expenses Expressed in Terms of Unit Cost

The costs given below are as nearly correct as they can be made considering the prolonged life and size of the job.
The sum of the items checks with the actual payroll.

CONDUIT

Installing.—In the assembly, stock and test buildings, which were built of reinforced concrete without beams, the conduit hangers and outlets were run exposed and fastened to ¾-in. threaded metal inserts spaced 3 ft. 4 in. throughout. Wooden blocks were provided at the center of each bay for attachment purposes. In general all ceilings are 11 ft. high. In the structural steel buildings the conduits are hung from the trusses.

½-in. and ¾-in.	Unit Cost
73,000 ft. ½-in. galvanized	
35,550 ft. ¾-in. galvanized	
67,850 ft. ½-in. loricated	
14,500 ft. ¾-in. loricated	
190,900 ft. all systems (per foot)	$0.1262
Concrete buildings, including changes	
73,000 ft. ½-in. galvanized	
35,550 ft. ¾-in. galvanized (per foot)	0.1428
Concrete buildings straight new work with changes deducted.	
72,000 ft. ½-in. galvanized	
35,000 ft. ¾-in. galvanized	
107,000 ft. (per foot)	0.1275
7,070 lighting outlets; average run 15 ft.; approximate 10 ft. counting junctions; 70 per cent at lower wage scale.	
First 25,500 ft. standard layout on ceiling cost (per foot)	0.119
Shop transfer bay, receiving bay, etc., about one-quarter concealed, rest exposed.	
67,850 ft. ½-in. loricated condulets	
14,500 ft. ¾-in. loricated condulets	
82,350 ft., 75 per cent high up on steel (per foot)	0.1044
1-in. and 1¼-in.	
Concrete buildings, including a number of changes.	
25,400 ft. 1 in.	
1,600 ft. 1½-in.	
27,000 ft. (per foot)	0.155
The above figure includes costs which do not properly belong in the cost of running the conduit, and therefore the unit is too high. The following figures which were determined on the job before changes were made are accurate.	
Home runs:	
23,450 ft. 1-in.	
660 ft. 1½-in.	
24,110 ft. (per foot)	0.1302
In shop on hangers suspended from concrete floor of balcony.	
5,000 ft. 1-in.	
3,000 ft. 1½-in.	
8,000 ft. (per foot)	0.106
Long straight runs with boxes approximately 20 ft. apart.	
1½-in. and 2-in.	
Concrete buildings:	
10,350 ft. 1½-in. (long power lines)	
2,360 ft. 2-in. (lighting feeders)	
12,710 ft. (per foot)	0.19
From job records:	
7,950 ft. 1½-in. long horizontal runs in single lines hung from ¾-in. inserts (per foot)	0.12
Shop, etc.:	
Mostly two conduits on same hangers hung from concrete floor of balcony.	
3,000 ft. 1½-in. boxes, 20 ft. on centers.	
8,960 ft. 2-in.	
11,960 ft. (per foot)	0.104
2,360 ft. 2-in.; each run 100 ft. horizontal and up to fourth floor through sleeves and feeding three or four lighting panels (per foot)	0.40
2½-in. and 3-in.	
All buildings:	
5,950 ft. 2½-in.	
11.750 3-in.	
Runs up to 1,300 ft. all horizontal. Mostly on channel irons in truss and tunnel; also power house.	
17,700 ft. total (per foot)	0.322
3-in. conduit on channel iron hangers in tunnel; three runs 1,300 ft. plus each; conduit within reach from floor, pull boxes 400 ft. apart, two offsets; all horizontal, hangers not included.	
3,945 ft. 3-in. conduit (per foot)	0.22
3-in. conduit from main switchboard through power house and tunnel to stock bldg., with reduced but efficient gang. Conduit runs with many angles and sets, so that work was of most difficult nature.	
770 ft. 3-in. conduit (per foot)	0.29

3½-in.	Unit Cost
In one straight horizontal run on pipe hangers in threaded inserts.	
1,100 ft. 3½-in. conduit (per foot)	$0.16
Cutting and Threading	
Forty nipples from 3-in. conduit, each 15-in. long using power hack saw and hand Toledo (per nipple)	2.29
Hangers	
Drilling concrete ceilings for:	
All holes within space of eight bays using air compressor and one team; seventy-two ¾-in. holes each approximately 1½ in. diameter (per hole)	0.36
Making	
Forge work, making all kinds of hangers, etc. at forge and drill.	
Making 100 hangers of 4-in. channel iron, 4 holes (each)	0.35
Installing	
The cost of this work was generally included in the cost of the conduit except as noted below:	
In tunnels 4-in. channel, each 3 ft. long using threaded inserts, 100 hangers (each)	0.81

BOXES

Setting	
Lighting-panel boxes in all concrete buildings:	
All boxes exposed on pilasters, with four expansions, holes drilled with air hammer. Compressor in same position for four or five boxes.	
106 boxes at	2.83
1,456 circuits, at	0.21
Power-panel boxes in all-concrete buildings:	
Boxes about 2 ft. square, 4 in. deep set on T. C. partition, 100 amp., three-pole, thirty-one two-circuit, six three-circuit (per box)	3.73
Secondary-lighting boxes:	
Each box 44 in. x 44 in. x 24 in.	
Six built in T. C. wall (per box)	12.00
One free standing on pipe supports (per box)	27.00
Pull boxes:	
1 box 28 ft. x 18 in. x 18 in. (four-side)	
1 box 15 ft. x 20 in. x 10 in. (four-side)	
1 box 20 ft. x 18 in. x 16 in. (two-side)	
1 box 32 ft. x 34 in. x 20 in. (four-side)	
4 boxes installed (per box)	40.25
Seven boxes each 14 in. x 11 in. x 3¾ in.; also setting and connecting seven automatic starters for blower motors on roof, under bad conditions. (per outfit)	20.00
Section-switch and power-junction boxes:	
On ceiling of concrete buildings at long intervals.	
Each box mounted with a single ¾-in. tap bolt to threaded insert, principal cost involved being the location of the box and handling ladders.	
74 switch-boxes 18 in. x 12 in. x 6 in.	
143 junction boxes 24 in. x 8 in. x 6 in.	
217 total (per box)	1.20

PANELS

Setting and connecting	
Lighting panelboards and trims (tumbler-switch type)	
106 panelboards (per panel)	7.14
1,456 circuits (total) (per circuit)	0.52
Secondary panels for lighting. Each consisting of single slate slab with three 200-amp. or 400-amp. three-phase double-throw-back connected switches.	
Seven panels and trims (per panel)	17.14
126 connections No. 4/0 and 500,000 circ. mil (per connection)	1.00
Power panels and trims (wall cabinets), 3 to 3 wire fuse panels, no switches.	
Thirty-seven panels, two circuits (per panel)	7.41
370 lug connections, Nos. 4, 2, 1 and 4/0 (per connection)	0.74
Primary power-panels, one three-pole, 400-amp., nine lugs each.	
Eight panels (per panel)	16.50
Seventy-two lug connections, No. 4/0 and 400,000 circ. mil (per connection)	1.83
Heavy slate panels (two) in boxes on ceiling, each panel having one 600-amp. and one 400-amp., two pole switch with fuses (setting only) (per panel)	8.75
Polarity power panels and compensators, in shop (total)	190.00

SWITCHES AND CUTOUTS

Setting and Connecting	Unit Cost
Main line cutouts in all buildings. Mostly 400-amp., three-pole, with three 500,000-circ mil main and six No. 4/0 branches (total)	$210.00
Safety switches, eleven 100-amp., three-pole 8 ft. up on T. C. wall (cranes) (per switch)	3.82
Section switches, three-pole, single-throw, unfused, 100 amp., 440-volts, in boxes widely distributed on ceiling	1.40
Safety switches, D. C. (total)	248.00
Cut-outs Plug and N. E. C., 245 in main shop, for light and power, in very small boxes on ceiling, under very bad conditions. Cut-outs mostly 30-amp., plug type, three-pole, none larger than 100-amp. (per cutout)	3.67
Wall switches and plug receptacles, including plates.	
334 double-pole switches in cast-iron boxes,	
150 standard receptacles and plates.	
484 Total (per unit)	0.48
Shop toggle switches (846 30-amp. G. E. tumbler type); generally mounted two to a box and each switch secured with two screws in tapped holes. (per switch)	0.343

FIXTURES

Hanging and connecting	
5,000 Benj. RLM. 100 to 200-watt, with S neck and box fitting.	
703 Benj. RLM. 200-watt, on stems with Benco socket.	
226 Duplexalites, 100 to 200-watt,	
237 Miscellaneous lamp receptacles, and angle reflectors, assembling.	
6,166 (total) (per unit)	0.457
Fixtures of various types and methods of mounting, generally suspended at 25 ft. height from condulet attached to stem. In many cases the cost includes pulling 20 ft. to 40 ft. of duplex (used traveling crane)	
282—500-watt Benj. RLM.	
119—500-watt Benj. Elept.	
579—500-watt Ivanhoe RLM.	
36—100-watt Benj. RLM.	
1,016—total including making up 385 small strap iron hangers (per unit)	1.00
Stem hangers (326) for Cooper Hewitts in assembling buildings, using stems of ½-in. pipe, couplings, 1 in. x ½ in. strap iron and two-hole pipe strap and two ½-in. round iron hangers (per hanger)	1.30
Cooper Hewitts (326) to the above stems. Mounting height about 11 ft. (per unit)	0.92
Total cost per lamp	2.22
(268) in shop, lamps hung close to steel at mounting height of about 13 ft. Including making small strap hangers, and connections with 2-ft. lengths of "canvasite." (per unit)	1.30

WIRE AND CABLE

Pulling.—In all cases on pulling the costs recorded cover the cost of setting up reels and all preparations. No splicing nor connecting is included.

Practically all 400,000; 500,000; 600,000; 700,000; and part of the No. 4/0 cable was pulled with the aid of a powerful electrical truck and largely without the use of tackle except a snatch block used as a fair leader.

Nos. 14 and 12 duplex; all buildings	
292,000 ft. No. 14 duplex	
28,000 ft. No. 12 duplex	
320,000 ft. (total) (per 1,000)	13.10
In the concrete buildings more than 230,000 ft. of duplex evenly divided between ½ in., ¾ in. and 1 in., where the 1 in. runs were very long, cost (per 1,000)	13.50
In the shop and high bays more than 65,000 ft. of duplex, about half of which was pulled by climbing on the steel, cost (per 1,000)	12.00
In concrete buildings, the cost of pulling duplex above includes the cost of a large part of the splicing and all tagging of ends.	
Nos. 10, 8, 6 single rubber-covered, all buildings, all kinds of runs.	
11,000 ft. No. 10 single	
6,000 ft. No. 8 single	
7,000 ft. No. 6 single	
24,000 ft. total (per 1,000)	7.90
Nos. 5, 4, 3, 2, 1 single rubber-covered.	
31,000 ft. No. 4 single, long power runs.	
13,400 ft. No. 2 single, long power runs.	
7,600 ft. No. 1 single, long power runs.	
52,000 ft. total (per 1,000 ft.)	12.23

(Table III continued on page 1097)

Table III—Continued from page 1096

		Unit Cost
Three-wire runs in 1½ in. conduit on ceiling, long single lines		
No. 1 0, 2 0, 3 0, 4 0, rubber-covered:		
2,000 ft. No. 1 0 long power runs		
15,300 ft. No. 2 0 part used as neutral		
26,700 ft. No. 4 0 long power runs and light.		
44,000 ft. (total) (per 1,000)		$22 34
Mostly in horizontal runs, typical of a large plant. A considerable part of the No. 2 0 was used as the neutral leg of two 500,000 circ mil wires, and as that part was prorated the cost may be a little high.		
400,000 *circ.mil varnished cambric*		
28,040 ft. 400,000 circ.mil varnished cambric (per 1,000)		37.25
Mostly in horizontal runs with a maximum length of 1,300 ft. plus one way. Evenly divided between runs on low tunnel ceiling and runs in truss about 25 ft up, no splices included.		
Average price in tunnel, no splices		22 00
500,000 *and* 600,000 *circ mil.* rubber-*covered.*		
15,000 ft. 500,000-circ mil.		
600 ft. 600,000-circ mil.		
15,600 ft. (total) (per 1,000)		34.90
Two or three long runs and the rest comparatively short; horizontal.		
700,000 *and* 1,000,000 *circ mil rubber-covered.*		
1,760 ft. 700,000 circ.mil. pulled in one two-wire run with one bend and two offsets, horizontal line with two pull boxes.		
1,760 ft. (total) (per 1,000)		23 00
180 ft. 1,000,000 circ.mil in two two-wire runs (per 1,000)		128 00
Splicing		
700,000 circ.mil in boxes installed on ceiling:		
Four splices made with sleeves Six connections to lugs 400,000 and 500,000-circ.mil.	Each..	2 80
Accurate costs kept on a number of splices at three locations show the following results for splices made with sleeves:		
a. Difficult overhead conditions, each....		3.00
b. Fair to good conditions, each		2 00
1,000,000 circ.mil. sweating four lugs.		3 50
CAPPING OUTLETS USED AS JUNCTIONS, LOCATING TROUBLE, TESTING, ETC. (TOTAL)		**200 00**
MAIN GENERATORS		
Bus work, installing under engine-room floor between three machines and switchboard, including making-up from bar copper and installing complete with pipe supports and insulators; also including connections to three oil switches and up to "disconnects" at board.		
Two 2,000-kva., three bars per leg		
One 3,000-kva., four bars per leg mounted direct to beams with pipe supports alternating. Ninety-six bus supports.		
2,300 ft., 4 in. x ½ in. bus (per ft.)		0 602
Oil switches, installing, located on side of concrete generator foundation with pipe supports to floor.		
Three oil switcnes (per switch)		32.83
Field wires, connecting (per machine)		8.00
Direct-current exciters, connecting		
One 25 kw.		
One 75 kw. (per machine)....		$20 50
MAIN SWITCHBOARD		
Erecting and connecting thirty-seven panels main switchboard, complete (per panel)		55 00
Does not include generator bus, pull box or conduit work on feeders.		
Drilling holes in 4-in. channel mounted on wall using electric drill, for oil switches, current transformers and disconnecting switches.		
400 holes (per hole)		0 272
Mounting twenty-five 400-*amp oil switches* (per switch)		8 24
Making and placing operating gear of ¾-in. pipe for above, at various angles (per switch)		8 00
Setting twenty-five disconnecting switches (per switch)		4.68
Current transformers (six) (*per transformer*)		6.81
Erecting thirty-seven panel switchboard including pipe supports (switchboard proper):		
Mounting panels and frames..	$300	
Mounting panels and small bus	212	
Miscellaneous work behind board	280	
Small wiring at rear.	188	
Generator panels	28	
Thirty-seven panels erected	$1,008	27 47
Erecting G. E. bus and supports, all cut to fit assembled and erected on pipe supports, 260 ft. single, bus, 97 supports (per ft.)		0 634
Connecting twenty-five oil switches (per switch)		5 62
150 lugs, all 400,000 and 500,000 circ mil (per lug)		0 937
Changing twenty-five meters (per meter).		1 12
Testing and filling twenty-five oil switches (per switch)		0 88
TRANSFORMER BANKS		
Connecting		
440-volt, three-phase, to 110-220-volt, each transformer having five connections, including filling with oil		
Transformers were placed on rails by others and all but two banks were placed at floor level. Two banks were mounted on exterior wall at second floor level.		
15 50-kw transformers		
12 100-kw transformers		
3 200-kw transformers		
30 (total) transformers (per transformer)		12 57
150 (total) connections (per connection)		2 51
DYNAMOMETER CONTROL BOARD		
Installing and Connecting		
Forty-four panels for testing finished automobile engines, each board consisting of slate panel about 2 ft. square, mounted on 1¼-in. pipe frame, free standing from floor		
a Setting two vertical pipe supports and two braces by means of four floor flanges having two holes each, eight holes per frame: 352 holes total. Drilling done with heavy air hammer		
b Securing braces and mounting panel with standard U-bolts		
c Twenty-five small connections to resistance		
Two line connections (no motor connections). No. 4 wire		
d Mounting resistance grid at rear, with four U-bolts.		
(Per panel).		$9.66
The above panels were set in lots of twelve at one time, and the costs given would be exceeded without the aid of a good air hammer.		
Instead of expansion bolts, we used standard bolts leaded into holes.		
WATCHMAN'S SYSTEM		
Installing		
Iron-back boxes (87) for watchman's magneto stations. Boxes 6 in. x 6 in. x 1 in., each fastened to concrete with two ¼-in. expansions. (Boxes so widely distributed that to ring in rotation an 8-mile walk is necessary) (per box)		0.85
Cast-iron W. P. boxes (per box)		5.10
Annunciator of 100 *drops*, also 100 point interconnection strips in box (includes connecting)		180.00
Time clock and racks **(non-electrical)**		**34.00**
Nos. 16 *and* 14 *single wire, all but lugs.*		
72,000 ft. No. 16 single		
8,000 ft. No. 14 single		
10,000 ft. No. 16 duplex		
90,000 ft. (total) (per 1,000)		3.55
The above cost includes the connections to eighty-seven magneto stations. This wire was pulled into all sizes of conduit from ¾-in. to 1¼ in.		
Unassigned costs **(total)**		**464.00**
CONVERTER AND BATTERY OUTFITS		
Installing		
Rotary converter **board of four panels of** 1½-in. slate on free standing frame, including some corrections of bus work; includes most connections (total)..		164.50
Seven battery-charging boards, including making and setting angle-iron frames secured to floor and wall with four bolts per frame. Similar to small motor starters (per board)		11.00
House battery, 110-volt set with charging panel and connections to motor-generator set, including the initial charge (total)		133.00
Truck-charging board, secured to wall; no connections (total)		44.76
CRANE SYSTEM		
Installing		
Coal Crane wiring, complete		235.00
The above figure covers the cost of practically rebuilding the crane from an electrical standpoint. Milwaukee crane man states that his firm considers the cost of assembling and connecting the electrical work on a properly shipped crane should be.		75.00
Trolley wire, **approximately 900 ft., No. 1/0 bare, bad conditions (per 1,000)**		**96.00**
Trolley insulators and blocks on I-beams already drilled.		
700 pine blocks, 13 in. x 5 in. x 3 in., purchased with drilling for bolts and screws. (each)		0.40
Two 6-in. x ⅜-in. bolts and nuts (each)		0.04
Three 7-in. x ⅜-in. lag screws (each)...		0.04
Three 4-in. porcelain spools (each)		0.35
700 blocks assembled and installed (per block)		0.27
Material cost of each complete outfit		1.65
BLOWER MOTORS		
Connecting		
Seven alternating-current, installed in power house using No. 4 wire (each)..		11.60

was done, excellent storage and handling facilities, including hand trucks, and, lastly, in the case of the heavy pulling on extremely long cables, the use of powerful electric trucks.

One point to be considered in using the accompanying unit costs on future work is the proper allowance for non-productive labor. The allowance shown was entirely correct for this particular job. Owing to the fact that those performing work of this class were at no time engaged in work with tools, it was possible to be very accurate in the cost keeping. As Table II indicates, the non-productive labor was 31.86 per cent of the productive labor. From studies made in the field it seems safe to say that had the work been carried out as planned in the five months' time, the percentage estimated (15.8 per cent of the productive labor) would have been approximately correct, because the field office force would not have been increased and was in fact organized with this particular task in view. The field force was retained during the entire five months which should have seen the job nearing completion.

In considering new work it would seem proper to take 15 per cent as a minimum for the ratio of non-productive labor to productive labor where the conditions are sure to be good with respect to speed of operations—and proportion of space sure to be available at one time. The upper limit for non-productive labor should not be over 32 per cent for a large operation. Furthermore, where there is any likelihood of the work being dragged out at the end of the job, or of serious delays being experienced during the life of the job, the percentage allowed should be nearer 30 per cent than 15 per cent.

Increasing the Reliability of Service

Opportunities Offered Through Regular Inspection, Constant Interpretation of Plant Records, Ring Feeders and Ample Reserve

By Fred D. Gordon

General Manager Cumberland County Power & Light Company, Portland, Me.

No MATTER how fast the expansion of central-station service takes place, no matter how rapidly gains in operating efficiency may be realized, reliability remains in the very front rank of importance. It is of little avail to install larger and larger units if the continuity of service is not adequately safeguarded. Higher economies in plant performance are also of little significance if these are accompanied by frequent or protracted interruptions. The bad effect of poor and unreliable service upon public relations ought to be self-evident and is apparent apart from its damaging influence upon operating revenues.

The active interest of utility executives in the quality of service rendered by their companies ought to be spontaneously accorded. The story the log sheet tells is quite as important as the morning mail. A searching study of the causes of every interruption is worth real money to a progressive operating company. Systematic handling of plants and lines under a centralized control is demanded today in place of the older and more haphazard methods.

Too Little Attention Paid Service Records

As a public utility executive I believe that too often only a perfunctory interest in the service record from hour to hour is displayed by central-station managers and superintendent. It is not at all difficult to change all this, if the manager cares to do it. On our property a complete log sheet covering the major events of importance for the twenty-four hours ending at 7 a.m. is placed upon the executive desk every morning before 8 o'clock. We can see at a glance how every unit in each of our hydro-electric and steam generating stations was handled during the preceding twenty-four hours, note the variations in the height of water in the forebays, follow the load curve of the system from half-hour to half-hour, see what transmission lines were in service from hour to hour, study station outputs, fuel consumption and numerous other points. Log sheets of excellent design are common enough in the central-station industry, but unless such records receive close scrutiny from executives while they are fresh, opportunities may be lost to initiate investigation of great value. Incidentally, the esprit de corps of an organization is maintained at a higher level when the staff knows that the management has a real interest in its work and stands ready to give co-operating direction in the handling of the system to obtain the best possible efficiency.

Right after an interruption is over is the time to "get down to brass tacks" and study its causes and future prevention. The failure to do this is a weakness by no means rare among operating companies. Superficial notes to the effect that "Line No. 4 'shorted' at 8:20 a.m.; 'juice' on at 8:28," are not of much value to any one. Operating failures should be reported as completely as possible, including the exact location of the trouble if it can be found, with results of inspections, observations at the time of interruption, tests of insulators removed, etc. It is better to have such reports a little too full of detail than "shy" of data, because the value of plant and line records lies chiefly in the possibility of interpreting them as guides for future work.

The ideal report of an interruption is one that will satisfy the engineering mind by its completeness of details. The failure of the operating organization to put down on paper all possible *essential* data hampers the management in its efforts to arrange for better service in the future. In making clear to system operators, station men, line foremen and other employees what sort of information is really important when studying service interruptions, a field of activity exists which at present is far from thoroughly covered.

Engineering studies of transmission-line development, of the cost and value of ring feeders, of the relation between reserve plant capacity and load requirements and of equipment obsolescence contribute so much to securing greater service reliability that they should not be neglected. On the Cumberland County system a program has lately been carried forward with the idea of establishing a complete double-loop transmission system connecting the major plants and more important substations, and with the building of a new steam plant in South Portland for auxiliary service a double-ring system will ultimately be provided in the city itself. There is no question, in my opinion, that stand-by steam generating capacity is essential even where excellent storage facilities are available for the hydro-electric plants. At such plants fuel oil means the possibility of securing economical operation even when running at load factors of 10 or 15 per cent, and of course the speed of getting into action in such plants is of immense value from the standpoint of service reliability. The choice of units in such plants is closely related to service reliability, and where two machines of equal size go in rather than one unit of double the rating the possibilities of all-day economy as well as the reliability factor are naturally better.

Old Equipment Should Be Discarded

On many systems there is a strong temptation to retain old-time and obsolete apparatus for possible emergency service requirements. On the score of overhead cost this practice is very undesirable. It admittedly swells the assets of a company to retain a lot of hoary-headed old units of small size scattered about the property, but the labor cost of keeping these ready for service is by no means negligible. Rates should be sufficient to permit writing off obsolete equipment as junk and providing in its place modern apparatus of decent efficiency and adequate capacity. I cannot see where the cause of reliability gains by hoarding these old units.

As interconnection between adjacent systems proceeds the amount of reserve equipment necessary to handle a particular load cycle falls off relatively to the installed capacity, but it is unwise to attempt to get along with little or no stand-by plant. The hazards of transmission are real and cannot be reduced to zero with present available equipment. However, by systematizing inspection and maintenance methods and by arranging for rapid transfers of load to other lines or plant in case of trouble, service reliability can be greatly increased. Altogether, constant vigilance and continuous looking forward are essential to the making and holding of A-1 service records.

Intimate Notes from Italy

A News Letter That Visualizes the Italian Hydro-Electric Developments, the Scenery and the Courteous Hospitality of the Italian Engineers—The Electrified St. Gotthard Tunnel—Diesel Engines Rated at 3,000 Hp.

By MORGAN BROOKS
Professor of Electrical Engineering University of Illinois

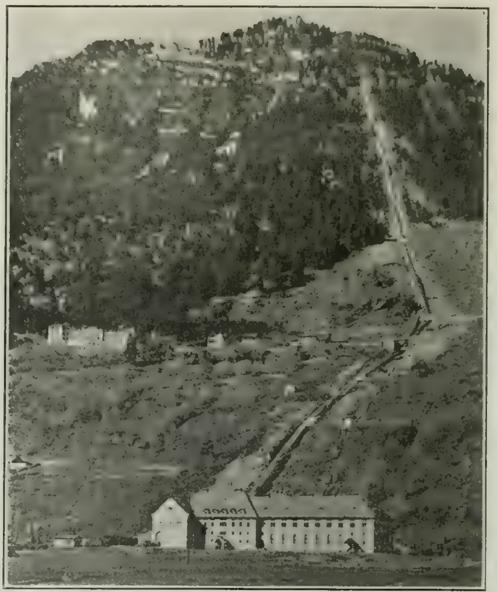
AN EXAMPLE OF THE SPLENDID ARCHITECTURE AND DECORATIONS OF ITALIAN POWER STATIONS IS THIS INTERIOR OF THE CREGO POWER HOUSE OF THE CONTI UNDERTAKINGS COMPANY

THE Associazione Elettrotecnica Italiana has just celebrated at Milan its twenty-fifth anniversary by holding a notable week-long convention with important papers and social functions. Through the courtesy of President del Buono and Past-president Guido Semenza—many of your readers met the latter at the Salt Lake convention of the American Institute of Electrical Engineers last year—it was my privilege to join the exceptionally interesting inspection trips which concluded the convention program. As the only American present I am sending you an account of these trips.

The party of more than five hundred engineers left Milan on the morning of Oct. 7 at 6 o'clock in a special train of new corridor coaches over the partly electrified Italian State Railway. At Domodossola transfer was made to twenty-seven automobiles, mostly of the "rubberneck" type. There were seats for all, since the arrangements, as might be expected from engineers, were perfect throughout.

Then began a most interesting climb of 1,000 m. (3,280 ft.) up the splendid Alpine roads with their zigzag engineering construction, more difficult than the Simplon Pass, giving superb views of rapidly changing scenery; for every turn, and the road was never straight, brought new points of attraction. Cascades were frequent, one suggesting the Staubbach by its extraordinary single leap. The day was cloudy, and occasionally a cascade would appear to drop down the mountain side out of the low clouds, leaving to the imagination the estimation of its full height. One of the scenic features was a ruined castle built upon an immense boulder carried into the valley ages ago by some prehistoric glacier.

In two hours, after passing three plants of the Società Imprese Elettriche Conti, we soon reached our destination, the plant at Valdo under construction, the highest of the chain of plants. The Valdo plant is far up the river Toce, near the Swiss frontier. High up the mountain slope toward the west the eye follows the



A HIGH HEAD PLANT OF THE SWISS FEDERAL RAILWAYS AT RITOM DEVELOPING 48,000 HP.

double penstock line until lost in the clouds 775 m. (2,443 ft.) above the Valdo station. A small lake, Vannino, augmented by a dam, together with two other lakes at even higher level, gives a storage capacity of 15,000,000 metric tons of water, insuring continuous power from the two turbines of 15,000 hp., each of Pelton type and Riva (Milan) make. The generators are three-phase, operating at 15,000 volts and 42 cycles and built by the Tecnomasio Italiano Brown-Boveri at Milan. The voltage is stepped up to 60,000 volts for transmission. Although the generators were of the modern inclosed construction, we were able to see them well as the winding of the armatures was in progress. The wonder is that the installation of such a plant should have been undertaken at all, requiring, as it did, the building of many miles of new road to make auto-trucks available.

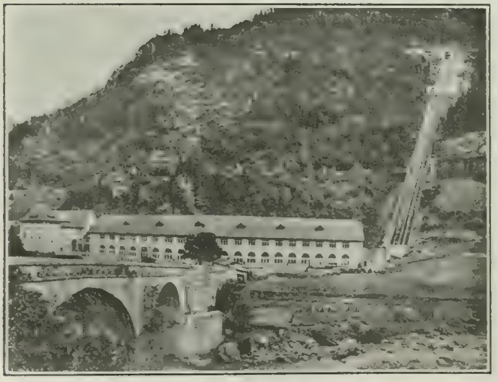
The call to "eats" was now made, and what was my surprise to find that the Società Conti had prepared a sumptuous lunch in the loft of its station, soon to contain the outgoing transmission wires. This made a big dining hall, but who would have expected special frescoes—no less a word applies—with winter sports scenes by an Italian artist of no mean ability and with words of welcome neatly lettered? It was the marvel of all that the company could serve a metropolitan lunch of five courses at so inaccessible a point. I learned that it had even installed a temporary bakery so that the rolls should be fresh.

As there were two sittings for the lunch, the second group, taking the trip in inverse order, were arriving just as the first were rising from the tables, so a combined group photograph of the party was taken in front of the power house.

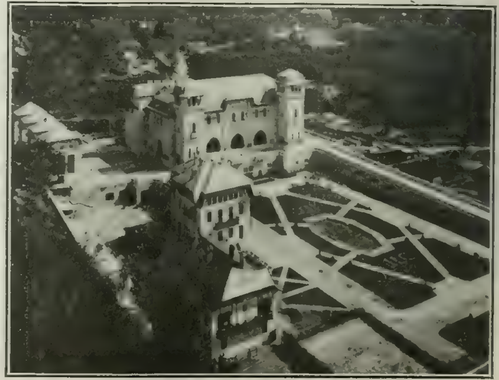
The return trip was at a slightly faster pace, but the steepness and sharp turns of the road prevented speeding. Rain came on, and we were glad to reach one of the lower power plants in operation at Verampio. As indicated in the picture herewith, this plant is a wonder of landscape gardening and architecture. Indeed, it is evident that in Italy power plants are treated as important public enterprises worthy of artistic architectural treatment. Within the main building were found four smaller hydro-electric units, similar to those at the Valdo plant, but totaling only 20,000 kva. owing to the smaller available head—570 m. (1,870 ft.)—and the slightly less flow. The water storage is also less than at the higher plant. The four transformers at the Verampio plant are installed each in a separate house. The plant was put in operation in 1915, and as the units were completely inclosed interest centered in the switching and protective apparatus.

Walking a short distance, the party visited the Crego plant, which utilizes the entire flow of the Toce, here a much larger stream than is available at Valdo. This plant, in operation three years, furnishes another 20,000 kva., although the head here is but 198 m. (650 ft.). The Crego plant is across the valley from its neighboring plant.

In the entire chain of Conti plants are a number more in operation, and the future development in this d'Ossola Valley will more than double present output. The total probable output of the completed system is estimated at 600,000,000 kw.-hr. per year.



THE AMSTEG PLANT OF THE SWISS FEDERAL RAILWAYS DEVELOPS 55,000 HP.



THE VERAMPIO POWER HOUSE OF THE CONTI ELECTRIC UNDERTAKINGS COMPANY

By 5 o'clock the two sections of the party had returned to Domodossola and boarded their special train for Stressa, on Lake Maggiore, where at 8 p.m. three of the distributing companies using the Conti company's output joined in giving a complimentary banquet at the two largest lakeside hotels.

Early next morning the party boarded a special steamer on Lake Maggiore connecting with a Swiss special train for an inspection of the St. Gotthard electrification. This, the most extensive electrification undertaken in Europe since 1914, was begun in 1916; the first train was operated through the St. Gotthard tunnel in September, 1920, and since June of this year the entire line from the Swiss boundary at Chiasso, near Como, to Lucerne, a distance of 225 km. (140 miles), has been in operation by electricity. The quantity of coal used in 1915 was 100,000 metric tons. None is used today. Within a year the extension to Zurich will be in operation, and by the close of 1924 the line will be electrified to Basle on the French frontier. The St. Gotthard tunnel is only one-third the total length of 45 km. (28 miles) of tunnels on the line, and several other tunnels, each a nearly complete mile-long turn of a huge helix, are much more interesting examples of engineering skill in overcoming the quick ascents without too steep a grade. The tunnels and most of the line are double track. The sharpest curve has a radius of 280 m. (920 ft.) and the steepest grade is 2.7 per cent. When electric locomotives replaced steam not only were heavier trains operated but 15 per cent better speed was obtained, greatly increasing the passenger and freight capacity of this international route through the Alps.

GUESTS OF SWISS FEDERAL RAILWAYS

These facts were put before the members of the party in pamphlets distributed by the Swiss Federal Railways system, our hosts for the day. A ride of nearly three hours through Alpine scenery like that enjoyed the day before from the touring automobiles brought the train to Amsteg, not far from Lake Lucerne, where the Amsteg hydro-electric station, now almost ready for operation, was inspected. This plant, near the railway line, contains four 10,000-kw. units with turbines from the Ateliers de Constructions Mécaniques of Vevey, operating under 258-m. (840-ft.) head at 333 r.p.m. Three of these drive Oerlikon single-phase alternators for railway service at 16.6 cycles; the fourth drives a three-phase Brown-Boveri generator of 8,600 volts at 50 cycles for commercial service.

At noon a lunch provided by the Swiss Federal Railways was served at Amsteg, after which the party entrained for Piotta, near the south or Italian end of the Gotthard tunnel, where the Ritom power house was visited. Like that at Amsteg, this plant has four turbines of Pelton type, but the head is 800 m. (2,625 ft.), or three times that at Amsteg. All the generators are single-phase Brown-Boveri, 15,000 volts, 16.6 cycles, for railway service, and have been in operation since 1916. This plant has the advantage of a large storage lake of 26,000,000 metric tons of water, one hundred times the insignificant storage available at the Amsteg station. It is therefore expected that during the summer, when the water supply at Amsteg is ample, that plant will take all the load, allowing the lake to accumulate water for the use of the Ritom plant in winter.

The single-phase current at 15,000 volts as generated is fed directly into the trolley wires for sections adjacent to the power houses, but is stepped up to 60,000 volts for distant sections. The transformer substations are five in number and are housed in buildings, but it is proposed to add three more of the "open-air American type" in the near future. Transmission circuits are one-third underground and two-thirds overhead construction. No. 4/0 trolley wire is used, and the trolley wires are in duplicate within the tunnels. All are in catenary suspension at 18 ft. to 20 ft. above the rails in the open and 15.8 ft. above in the tunnels.

At Piotta the railway had placed on exhibition two of its heavy electric locomotives, weighing more than 100 tons each and averaging 2,000 hp. from its series-wound alternating-current motors. One, of Brown-Boveri design for passenger service, had the single-reduction gear connected through a most ingenious flexible joint directly to the drivers, allowing ample play. The other, of Oerlikon design for freight service, had its two pairs of eight drivers connected with the motors through a system of connecting and side rods, also providing flexibility. The day's trip concluded with the return direct to Milan by the special train, on which the railway company served an excellent box lunch to each guest.

UP-TO-DATE EQUIPMENT IN ITALIAN FACTORIES

An extra inspection visit was scheduled for Oct. 9 by the Società Franco Tosi to its extensive and varied factories at Legnano, near Milan. The smaller group of members and guests that gathered there received every courtesy. They saw the manufacture of steam turbines up to 10,000 kw., of Diesel oil engines up to 3,000 hp. (for submarine service 600 hp. was maximum), of steam locomotives and of waterwheels of various types, as well as the pattern shops, the foundry, the boiler shops and the forge shop, where large steam hammers of Tosi make were active. It should be noted that these shops were equipped with up-to-date tools for heavy manufacturing and that the shops did not differ noticeably from those of large American concerns. However, the absence of signs in several languages was noticeable, and I saw only Italians in the shops. The rapidity of handling traveling cranes and the skill with which steam hammers and other tools were operated attracted my attention. A beautiful new bicycle shop, operated also by the Tosi company, was visited, giving evidence of the continued demand for bicycles in Italy. Here were a number of American shop tools, such as turret lathes and automatic screw-making machines. The employment of electric furnaces was extensive. One large three-phase furnace was producing cast iron in order to maintain strict uniformity in the product.

After these visits automobiles were taken to go to a large steam generating station of the Società Lombardia per Distribuzione di Energia Elettrica, where several large Tosi turbines were in operation. Here was being installed one of the 3,000-hp. Diesel engines we had seen building at the Tosi shops. A row of four synchronous condensers with "G. E., Schenectady, U. S. A." nameplates looked like old friends in this foreign land!

In the not distant future northern Italy seems likely to become completely electrified from the Alpine "white coal." The nation has gained marked engineering ascendency, and any American engineer visiting Europe will make a serious mistake if he overlooks the accomplishments and activities of the Italians.

Electrical Research Viewed as a Career

Vast Field for Activity Open—Qualifications and Compensation—Need of Men Who Take Broad Viewpoint

By William Spraragen

Secretary Division of Engineering, National Research Council

THROUGHOUT the ages men have devoted themselves to research work. As early as the seventeenth century there were investigators in the electrical field. Gilbert, Guericke, Gray, Priestley, Franklin, Galvani, Volta, Davy, Ampère, Sturgeon, Faraday were among the pioneers. In our own times the names of Acheson, C. A. Adams, Baekeland, Behrend, Bell, Blakeslee, Carty, E. A. Colby, Crocker, Clark, Cummings, Cowles, Cutler, Campbell, Coolidge, de Forest, Dunn, Edison, Emmet, Fink, Grissinger, Hall, Hammer, Hunter, Hutchinson, Jewett, Kennelly, Lamme, Langmuir, Leonard, Lincoln, Lemp, Mitchell, Pupin, Reist, Ryan, Sheldon, Steinmetz, Weston, Westinghouse, Whitehead and Whitney are familiar to all of us.

In past times research was carried on by few, but today, as a result of education and the financial rewards of research, one can scarcely pick up an electrical periodical without finding some article relating to the subject. In the last few years particularly the appreciation of the commercial value of research has become so evident that three of the largest electrical concerns are spending annually sums that range from half a million to ten millions of dollars for this purpose.

This tremendous increase in the appreciation of research has led to a demand for research men and men trained in research ways. This demand has in turn opened up great possibilities to young men who are properly qualified to enter this field. It is unfortunate that the college man is inclined to be deterred from embarking upon such a career by the feeling that research means "finding something new" and that there is not any likelihood of *his* finding something new when so many have sought before. The correct view is to consider that research in many instances means making a thing better, replacing an ineffective process or apparatus by something more efficient, replacing rule-of-thumb methods by scientific analysis, deducing laws from experimental results, and in general finding the "why" of things.

Electrical engineering particularly furnishes a vast field for research. Each year adds to the store of vital truths and knowledge in electrical science. New and old industries find that their manufacturing apparatus and methods can be improved by electrical equipment. As it is aptly described in "The Story of Electricity," by T. C. Martin and S. L. Coles, electricity is the world's energy of all work, the ubiquitous Mercury transporting speech or written word instantaneously in all directions, the distributor of light with profuse bounty in darkened areas. It picks up the power of the cataract and delivers it, in quantities as ordered, to turn the wheels of transportation and of industry; it runs, lights and warms trains and ships; it welds metals together with a strength and firmness unapproached by many of the older methods; it aids the metallurgist and chemist, exerts innumerable good offices in behalf of hygiene and sanitation, enlarges equipment and increases the horrors of wars by its terrible military efficiency, acts as a more efficient substitute for sunlight in photography, works in horticulture, does the farmer's work, furnishes light, heat and power for homes and offices, and operates machines in every industry.

Not one of the numerous branches of electrical practice has reached the stage of completion. There is no electrical engineer in any branch of the profession, however great and effective its present condition, who would claim for it the prestige of a perfected art. Rather is it an art in which new discoveries and wider applications may be and are expected. In manufacturing organizations difficulties regarding materials and methods inevitably arise, tending to prevent smooth working. To overcome these difficulties investigation is necessary, and often when the reason why is known a complete transformation in methods of manufacture or production results. In the largest manufacturing companies there is usually a complete scientific staff and laboratory facilities to deal with such troubles. Frequently there is appreciation of the need in industry for some new tool, method or material which necessitates a deliberate search for means to satisfy that demand. Researches in pure science often result in the most important industrial gains. Moreover, research in many fields will result in the extension of the use of a particular product. Examples of present-day research problems in electrical engineering can be found on every hand.

The present-day method of attack on research problems does not imply that the young engineer shall achieve impossibilities. We have passed from the stage of the world's development in which we could depend solely upon individual geniuses for advancing the wheels of progress. The modern method is to bring together groups of well-trained, thoroughly competent men and to set before them the problems needing solution. In such an attack the scientist and the engineer work side by side.

Must Be Grounded in Science

The qualifications of the research man in the electrical field are a thorough grounding in the principles of mathematics, physics and chemistry, devotion to work, resourcefulness, absolute honesty, and the ability to reason the "why" of things. In addition to this it is necessary that the research man in any field shall have a keen power of observation and record methodically all the phenomena observed in connection with any investigation, even though at the time they have apparently no direct bearing on the subject in hand or the solution sought. Often we are unable to know beforehand all the variables involved, and although supposedly we are keeping all conditions constant except the one variable under observation, in reality there may be several other variables of which we are unable to take cognizance. The phenomena just referred to are in many cases very helpful in indicating some of these unknown variables.

In selecting any career one of the first questions we ask ourselves is: "What rewards, financial and other, are we likely to attain?" No definite figure can be set on the value of the services of the research man in the electrical field. According to his own native ability and opportunities, his annual remuneration may vary from $3,500 to several hundred thousand dollars. An average figure for the research engineer who has attained some prominence in his chosen field of endeavor is approximately $10,000, but as a beginner he may have to content himself for a number of years with a salary ranging from $2,000 to $3,000—plus experience and training.

In a recent address before the division of engineering of the National Research Council, Professor Karapetoff of Cornell University likened the findings of researchers to dots on a chart which record experimental observations. What we lack in this country is research men of the caliber to place dots out in spaces where little is known. Organization, for which we seem particularly fitted, can fill the gaps, but it cannot place the pioneer dots. Lack of thorough understanding of scientific phenomena leads to a predominance of experimental research; consequently we have an abundant supply of men who are willing to conduct experiments, but there are few who generalize or deduce fundamental laws from experiments.

Such an understanding of scientific phenomena comes only with a fundamental knowledge of the laws of physics and chemistry. To prepare one's self for a research career it is suggested that, in addition to a course in a recognized technical school, several years be spent in the testing department of one of the large electrical companies. Whether the student acquires a sound grasp of fundamentals depends upon the man himself.

Rural Extensions on Revenue Basis

Rules Newly Promulgated by Public Service Commission Require Utility to Invest $4 for $1 of Annual Revenue—Define New Terms

EXTENSIONS on a basis of utility investment in lines and equipment of $4 for every $1 of revenue per annum are the basis on which the Public Service Commission of Oregon placed its rural service rules issued under date of Oct. 14, 1922, with the order that all present practices in the financing and constructing of electrical lines in rural territory shall in so far as they differ from the new order be superseded. The rules, which will probably receive considerable discussion in all parts of the country from those concerned in the rural-lines situation are as follows:

RULE 1. DEFINITION OF TERMS USED HEREIN.

(a) The term "consumer" shall be any person or persons, firm or corporation, who shall contract to use electricity at tariff rates for a period of at least five years and be financially responsible therefor.

(b) The term "rural district" shall include all of the distribution system built primarily to serve "consumers" located outside the corporate limits of cities and towns or other territory which has a character or density of population generally similar to urban conditions.

(c) The term "rural division" shall apply to any subdivision of a rural district receiving electrical energy through a particular primary circuit.

(d) The term "rural extension" shall mean any continuous addition to a particular rural division constructed at any one time and such subsequent additions thereto as comply with Rule 2-d.

(e) The term "utility extension unit" shall refer to that part of a rural extension constructed over utility rights-of-way.

(f) The term consumer extension unit shall refer to that part of a rural extension constructed over consumer rights-of-way.

RULE 2. COST OF CONSTRUCTION DEFINED.

(a) *Rural Extensions.*—This cost shall include all labor, material and other expense for the distribution and installation of poles, wire, cross-arms, insulators, line hardware, protective equipment and transformers (meters excluded) used in the construction of rural extensions.

Metering equipment shall be supplied by the utility and the cost of same shall not be included in the cost of the extension as used herein.

(b) *Utility Extension Unit.*—This cost shall include all labor, material and other expense for the distribution and installation of poles, wire, cross-arms, insulators, line hardware, transformers and protective equipment used in the construction of rural lines over utility rights-of-way.

(c) *Consumer Extension Unit.*—This cost shall include all labor, material and other expense for the distribution and installation of poles, wire, cross-arms, insulators and line hardware (meters excluded) used in the construction of rural lines over consumer rights-of-way.

(d) All subsequent additions to a utility extension unit costing per individual consumer the same or less than the then outstanding average cost of the original unit to which physical connection is made shall be considered as a part of such utility extension unit.

(e) Any continuous addition constructed at any one time costing more per individual consumer than the then outstanding average cost of the utility extension unit to which physical connection is made shall be considered as a separate and distinct extension unit.

(f) The net cost of increasing the capacity of existing circuits and apparatus and the cost of overbuilding of existing secondary circuits with primary circuits shall be considered a part of the cost of rural extensions in accordance with Rules 2-b and 2-c.

(g) Whenever load conditions on an existing rural division, due to increased service demands, necessitate additional line capacity on a utility extension unit in order to maintain adequate service, the additional investment shall be made as follows:

The utility shall finance the entire cost of such increase in line capacity, and for that part of the total net investment of the utility in the various utility extension units of that rural division in excess of two times the annual revenue to be obtained from such division may require all of the consumer of such rural divisions to advance such excess cost on a pro rata basis.

(h) The adoption of standards of construction which will reflect an ultimate minimum cost to the consumer shall prevail under these rules in so far as they will not conflict with the commission's rules and regulations governing the safe construction and operation of electric overhead systems. In case part of the actual construction work, hereby limited to ground work, is performed by the consumer, such construction work must be done under the supervision of the utility furnishing the service.

RULE 3. ANALYSIS OF EXTENSION.

Each utility shall, upon written request for electric service by a prospective consumer or group of consumers located in the same neighborhood, make an investigation and ascertain the number who will contract for service under the terms hereinafter prescribed, and shall estimate the construction cost as outlined in Rule 2, and shall also estimate the annual revenue to be derived from the extension.

Copy of each work-order estimate sheet showing in detail the estimated and actual construction costs to be filed with the commission upon completion of the work.

RULE 4. FREE UTILITY EXTENSION UNIT DEFINED

The utility shall finance and construct at its own expense any utility extension unit where the cost of same does not exceed four dollars for each dollar of minimum annual revenue to be obtained from such rural extension, and in cases where the guaranteed annual revenue per consumer shall exceed the minimum annual revenue the utility will be required to invest in such extention four dollars for each dollar of guaranteed annual revenue.

RULE 5. UTILITY EXTENSION UNIT ABOVE FREE LIMIT DEFINED.

If the cost of the utility extension unit required in order to furnish service is greater than the free extension cost limit specified in Rule 4, such an extension unit shall be made under the following conditions:

The utility will be required to finance and construct the entire utility extension unit, and for that portion of the cost of the extension above the free limit may require the consumer or group of consumers to deposit in advance an amount equal to such excess investment on a pro rata basis.

RULE 6. CONSUMER EXTENSION UNIT DEFINED.

The consumer or group of consumers will be required to finance the entire consumer extension unit, while the actual construction work shall be performed by the utility at the expense of the consumer. (See Rule 2-h.)

RULE 7. OWNERSHIP AND MAINTENANCE OF LINES.

The arrangement as to ownership and maintenance must be such that the title to lines and equipment in rural districts, when completed and placed in service, will rest in the utility, and the utility shall be responsible for their maintenance, operation and replacement.

RULE 8. ADDITIONAL CONSUMERS ON EXISTING UTILITY EXTENSION UNIT.

In case a prospective consumer or group of consumers along an existing extension shall apply to the utility for service, such service shall be furnished, provided such consumers shall each deposit with the utility an amount equal to the average investment per consumer then on deposit on the previously constructed utility extension unit, in addition to financing their own consumer extension unit, as per Rule 6.

RULE 9. REFUNDS TO CONSUMERS.

Within two months after the completion of each addition to a utility extension unit the utility shall refund on a pro rata basis to all consumers of such unit that part of the sum of the amount deposited by the additional consumers (see Rule 8) and the utility (see Rule 4) which is in excess of the actual cost of the additional construction.

RULE 10. CHARGES FOR RURAL SERVICE.

Regular Rates.—The regular tariff rates for rural service on file with the commission and in force at the time for any service performed by the utility shall apply under these rules.

RULE 11. ACCOUNTING REQUIREMENTS AFFECTING UTILITY EXTENSION UNIT.

(a) The unrefunded amounts of consumer deposits outstanding on rural extensions shall be shown on the utility's balance sheet, in the annual report to the commission, as a deferred credit item. This balance-sheet account or appropriate sub-accounts shall be so kept as to show separately the investments in utility extension units and consumer extension units.

(b) No consumer or his successor in the ownership of the property served shall be refunded more than the excess payments advanced under Rule 5. When all advance payments on any utility extension unit have been refunded, such extension unit will be considered as finished and no further accounting will be necessary.

RULE 12. CONSTRUCTION OF RULES.

(a) If the actual construction cost exceeds the estimated construction cost, each prospective consumer or group of consumers shall upon demand make up that difference. If the actual construction cost is less than the amount collected on the basis of the estimated construction cost, the utility shall refund the difference to the consumer or group of consumers in proportion to the amount paid by said consumers.

(b) The aforesaid rules shall not be construed or interpreted as prohibiting any utility from making free extensions requiring greater proportionate investment than above specified so long as no discrimination is practiced between consumers whose service requirements are the same or similar.

(c) If the conditions surrounding a proposed extension are such as to make it doubtful whether the business derived therefrom will ever pay a return on the investment, then and in that event, should the utility and the prospective consumer or consumers be unable to adjust the basis upon which the extension will be constructed, the matter may be submitted to the commission for investigation and determination as to the reasonableness of such extension.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Electrostatic Disturbances During Thunderstorm

To the Editors of the Electrical World:

Some time ago I made some interesting observations of electrostatic disturbances from the top of the Union Central Building during an electric storm. The facts pertaining to the observations were essentially as follows:

The Union Central Life Insurance Building is situated in the downtown portion of Cincinnati and has a height of about 492 ft. above the street. The street elevation above sea level is approximately 550 ft., so that the top of the pyramid tower of the building has an elevation of 1,042 ft. This pyramid is about 30 ft. square at the base and 30 ft. high with a walkway around the base of the pyramid.

A visiting engineer desired a bird's-eye view of the Cincinnati district, so I took him to the top of the tower during an approaching electric storm. The storm was sweeping across the ring of hills 4 miles distant, which have an elevation of between 800 ft. and 900 ft. The maximum land elevation within a radius of 15 miles from the Union Central Building is 972 ft. While at the top of the tower it was observed that there was considerable lightning accompanying the storm and that there was a pronounced sound similar to static or corona discharge which seemed to emanate from the iron-pipe lighting standards at the four corners of the tower. This sound was of varying intensity. It was weakest immediately after a lightning discharge and gradually increased in intensity until the lightning discharge occurred at the center of the storm area, 4 or 5 miles away. The time interval between the lightning discharges varied from three to six seconds.

It would appear that the potential stresses in the air are distributed over a considerably larger area than the actual storm area and that useful information might be obtained regarding the character of electrostatic charges in the air by making further observations from the tower or some similar place favorably situated.

F. D. WYATT,
Electrical Engineer.

Union Gas & Electric Company,
Cincinnati, Ohio.

Open-Car Situation in the Northwest

To the Editors of the Electrical World:

The benefit of a proper distribution of flat and gondola cars in the Northwest is not, we fear, properly appreciated by operating managers, the Interstate Commerce Commission and the American Railway Association. The few open cars now in the Northwest are being improperly distributed and given to lumber and other operating concerns which ordinarily use box cars for the movement of their commodities. The result is that the producer of Western red-cedar poles for power purposes is not able to make the deliveries which he should under existing conditions. The situation has reached a crisis.

One carload of 40-ft. poles will build 2 miles of power lines which can distribute from 10,000 kw. to 50,000 kw. of power for the benefit of every consumer along that line. Ten carloads of poles would build a line more than 20 miles long and in certain sections distribute more energy for light, heat and power purposes than possibly ten or twenty train loads of coal would produce over a given area.

Recent articles written by Dr. Steinmetz of the General Electric Company serve to show the great saving in the distribution of power from hydraulic development and also from the development of power at the mouth of mines. The saving in transportation of coal and the conservation of our coal supply is something that every operating railroad man, the Interstate Commerce Commission and the American Railway Association should consider.

The Western red-cedar pole producer takes the position that in times like these, when cars are so scarce, a closer study of the distribution of cars to accomplish the proper distribution of fuel and of poles for power purposes is absolutely necessary. Recently a resolution on this subject was forwarded to the Interstate Commerce Commission and the American Railway Association. But very little satisfaction was had from either of these associations, simply for the reason that they do not realize that the only equipment which a pole man can use is open equipment, and, further, do not realize that a few carloads of poles is worth more to the consumer from a power distribution standpoint than many trainloads of coal which will be used inefficiently.

It is to be hoped that publicity will bring to the attention of the proper authorities the necessity of a correct distribution of open equipment in the interest of shippers and power consumers.

E. L. CLARK,
President.
Valentine-Clark Company,
Spokane, Wash.

"The Fused Neutral"

To the Editors of the Electrical World:

Recent correspondence on this subject in your paper tends to promote a "safety first" movement in the business of housewiring. Codes, where the final supply voltage is 220 and more, are rather emphatic about the neutral not being fused from the power house up to and including the house-service cut-out on the consumer's premises. Further, so far as the power house and substations are concerned, the neutral may not be disconnected even for a test except at a certain prescribed hour after midnight.

Danger to life where there is a standard supply voltage of 110 is limited to very extreme cases such as a person being wet or otherwise lacking the insulating properties of a healthy skin. It is the consumer's apparatus and contiguous property that are exposed to injury, as may be seen from the example of a ten-apartment house. In this case the supply is taken as being three-wire, direct-current, and it is assumed that the ground-floor apartments, fitted with advertising signs, etc., are shops, one of which has closed for the night, causing a temporary "out-of-balance," as shown in Fig. 1.

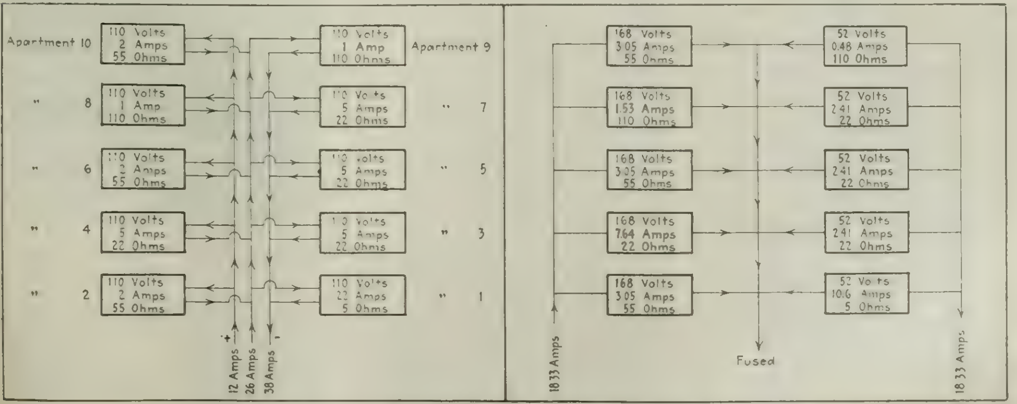
The neutral fuse blowing at this moment produces the effect illustrated in Fig. 2, which is merely Fig. 1 simplified, with the new conditions of current and voltage inserted as obtained from the series-parallel resistances and a simple application of Ohm's law. The comparatively small resistance of the wiring has not been considered.

The strain on both apparatus and insulation on the lightly loaded side is apparent without further elucidation. What aggravates the situation more than ever during an occurrence of this kind is the ignorance of the consumers on the other side, who, finding their lights very dim, promptly proceed to switch on others that may be available.

Code or no code, there is probably not one utility undertaking that does not "link" all neutral cut-outs, or otherwise bridge them with wire, out of all proportion to relative fuses in the "live" wires. The question is how we may apply the practice to consumers' circuits to the best advantage.

All codes and insurance regulations seem to choose the lesser of two evils in their insistence upon fusing equally both conductors of each circuit. A correctly selected fuse in one conductor of each circuit gives that circuit ample protection against short circuits. It will also act if the "live" wire gets grounded, but the neutral may develop a solid ground connection without having the least effect on the fuse; and as the consumer's bills too will not be affected, this grounded neutral with its attendant electrolytic action will go on unperceived until some worse damage than a local burn-out has been done to the property so far as its metallic structure and piping are concerned.

L. H. B. SANDWELL.
International General Electric Company, Inc.,
Schenectady, N. Y.



WHAT HAPPENS IN AN UNBALANCED THREE-WIRE SYSTEM WHEN THE NEUTRAL FUSE BLOWS

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of
Economically Utilizing Electrical Energy

High-Tension Line in Mine Shaft Reduces Loss

SUPPLYING motor-driven pumps for "dewatering" a mine from an 11,000-volt substation at the 1,700-ft. level of a 2,000-ft. shaft satisfactorily solved the problem of increased power demands and overcame the high distribution losses of the former low-voltage system. The old system utilized 440-volt feeders to the pump motors from a substation at the collar of the shaft.

STRIPPED CONDUCTORS AND METHOD OF INSULATION OF MINE SHAFT CABLE

The installation now in service for dewatering consists of one steam plunger pump delivering 1,500 gal. per minute and nine motor-driven centrifugal pumps varying in capacity from 125 gal. to 2,200 gal. per minute. These all pump into a drain tunnel at the 1,500-ft. level. The steam pump is on the 1,700-ft. level and is used only in emergencies. The larger electric pumps are set in pairs on the 1,700-ft. and 2,000-ft. levels and are operated as required by the flow of water. Electric power obtained from the Utah Power & Light Company at a potential of 11,000 volts was originally transformed at the collar of the shaft and taken underground at 440 volts. The increasing power demand and the high loss in transmission through the wet shaft suggested the installation of a high-tension transmission line, with the transforming and distributing done on the 1,700-ft. level.

The cable used was a three-conductor No. 4 AWG strand, each conductor insulated with $\frac{8}{32}$-in. varnished cloth, with the three conductors bound together with $\frac{6}{32}$-in. varnished cloth and $\frac{1}{8}$-in. plain lead sheath over all. The stripped conductors and the method of insulation are shown in the accompanying illustration. Before delivery the cable was tested for five minutes at 40,000 volts both between conductors and from the conductors to the lead sheath. To facilitate shipment and handling at the mine it was delivered in three sections.

In installing the cable a $\frac{3}{4}$-in. plow-steel, blue-center messenger rope, wound on the drum of the hoisting engine, was fed over a sheave wheel into the shaft. A ball weighing about 150 lb. was attached to the free end of the rope. At the collar of the shaft the cable itself was clamped to the messenger rope at 5-ft. intervals and lowered. When the first section of the cable was in place it extended from the 1,200-ft. to the 1,700-ft. level. At the 1,200-ft. level the messenger rope was anchored, and the remainder was cut and hoisted to the surface. The second section of the cable was now clamped to the messenger rope, lowered and anchored at the 600-ft. level. In a similar fashion the third section was placed and anchored at the collar of the shaft. As a result the entire cable is carried by three independent lengths of messenger rope, supported at three places. Pothead connections were employed in joining the ends of the cable sections together.

The cable was carefully inspected throughout the entire length of the shaft, and extra lead sheathing was wrapped around it at all points where it touched the timbers and other transmission lines.

On the 1,700-ft. level a concrete fireproof chamber was constructed to accommodate three 150-kva. transformers, reducing the 11,000 volts down to 480 volts for distribution. Cooling of the chamber is accomplished by a sucker fan electrically driven.

Lightning arresters were erected at the collar of the shaft, where a control switch was placed. This switch can be opened by means of a push-button near the transformers.

The crew installing the cable averaged nine men per shift and consisted of one electrician, one man drawing the cable and the messenger rope, one man unwinding the cable reel and marking the clamp positions, four men clamping the cable to the messenger rope, and two men following the cable down the shaft, keeping it clear from obstructions. Mining operations were suspended for three days during the installation of the cable. Considerable difficulty was met with in avoiding obstructions in the shaft.

C. M. BURTON,
Mining Engineer.
Ontario Silver Mining Company,
Park City, Utah.

◆

Pipe-Line Cradles Replaced During Service

THE decayed condition of the wooden cradles and sills on the wooden stave pipe line of the Northwestern Electric Company has made it necessary to replace approximately 1,200 cradles at its hydro-electric plant on the White Salmon River in Washington. This pipe line is 13 ft. 6 in. in diameter, 4,987 ft. in length, and is supported on wooden cradles set on wooden sills. The wooden sills and lower cradle ties have decayed and are being replaced with wooden cradles on reinforced-concrete sills. As some of the cradles were in worse condition than others, it was necessary to replace them in the order of their respective deterioration.

FLEXIBLE METAL PIPE USED TO POUR CONCRETE SILLS FROM NARROW-GAGE TRACK

In order that this might be accomplished economically, it was necessary to provide equipment which could be readily moved from point to point. A concrete mixing plant was located at a central point directly on the pipe line where all material could be supplied by gravity chute from a nearby road. A 24-in. gage track with 4-in. x 4-in. fir rails protected with strap iron was laid on top of the pipe line for its full length. A 3-hp. motorboat engine provides the motive power for the concrete dump car shown in the accompanying illustration. This motor is capable of pulling the two dump cars used on the job at a speed of from 3 miles to 4 miles per hour and in addition handles all cradle material. Two hoppers with "elephant trunks" were constructed for handling the concrete.

The "elephant trunks" were made of sectional iron pipe to conform to the curvature of the pipe line so that the concrete could be placed in the forms without the necessity of hoeing or shoveling. This equipment is provided with removable dolly wheels which can be easily attached and the whole apparatus towed with the gasoline motor from one location to another. Portable forms are used for the concrete sills, which are 18 ft. x 12 in. x 18 in. and are reinforced with steel bars.

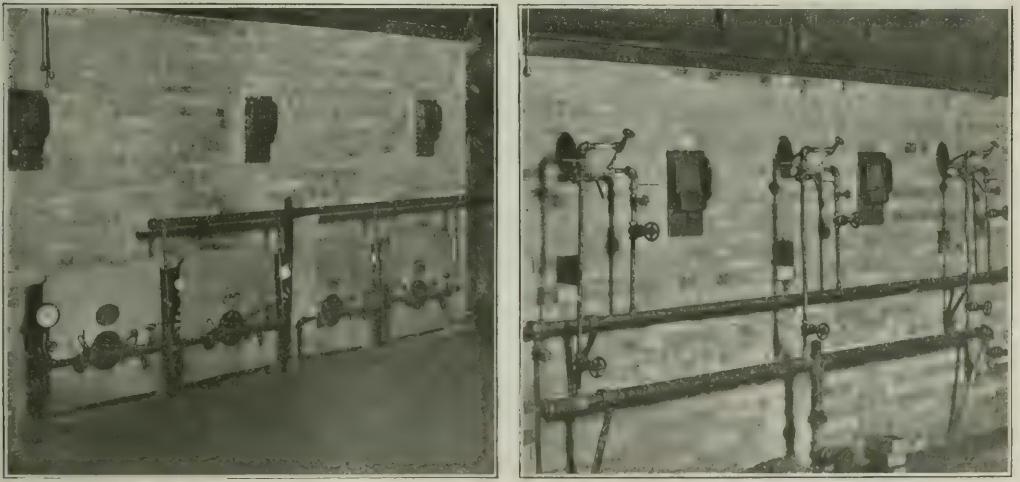
An average of eighteen sills per week is poured, which indicates rapid progress considering the occasional long moves.

E. F. Pearson,
Electrical Engineer.
Northwestern Electric Company,
Portland, Ore.

Changing from Coal to Oil in Record Time

On Sept. 1 It Was Decided to Make the Alteration in Equipment, and Twenty-six Days Later the First Boiler Was on the Line —Barge Used as Floating Storage Tank

To avoid any possibility of a coal shortage tying up its electrified lines in and near New York City, the New York Central Railroad recently decided to change several of its boilers in its Yonkers power house so that they would burn fuel oil. Twenty-six days after this decision the first oil-fired boiler went on the line, although no tanks, heaters or pumps had been installed.



OIL BURNERS AT YONKERS POWER STATION OF NEW YORK CENTRAL RAILROAD FED FROM BARGE ALONGSIDE PLANT

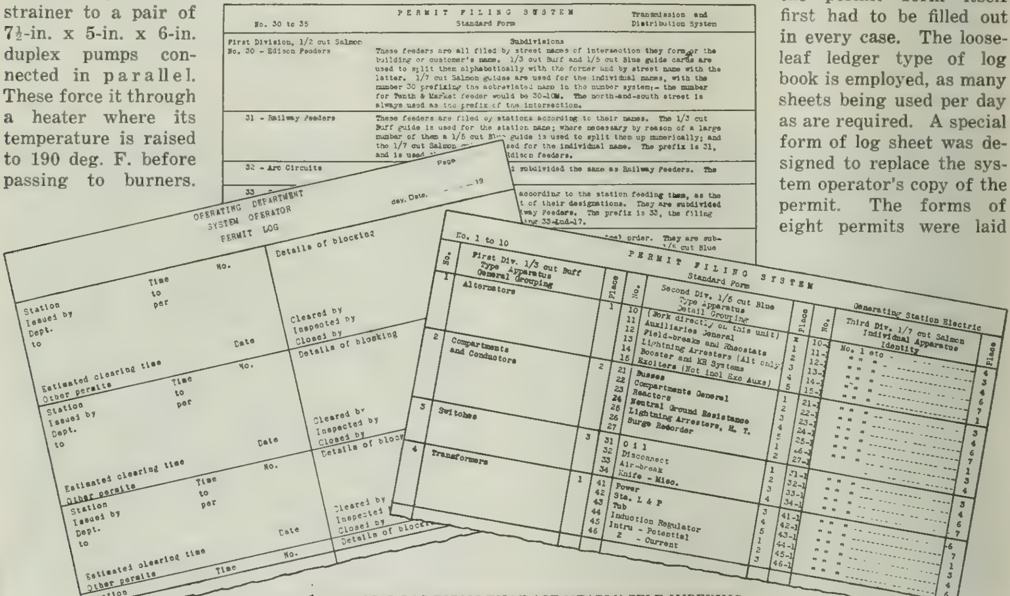
Four of the six boilers now equipped for oil burning use the type of burner shown at the left. The other two use the oil burners shown at the right

The installation was made not only to conserve coal but also to gain the practical information needed for use should a more serious emergency arise. The experiment has shown that under the conditions prevailing in water-front locations in the New York district it is possible to overhaul stoker-fired boilers and put them back on the line ready to burn fuel oil in less than four weeks after the change has been decided upon. In view of the fact that the average power plant normally keeps coal on hand for three or four weeks' operation, this demonstration should be reassuring to engineers confronted with the possibility of a coal shortage.

The work involved rebuilding the settings of six Babcock & Wilcox boilers equipped with Roney stokers, including the installation of steam jet burners. Of the six boilers now operating on fuel oil, four are equipped with Enco burners, there being four burners to a boiler, and two have Hammel burners, three to a boiler.

An 8,000-bbl. oil barge fully loaded with 14-16 Baumé light Mexican topped crude oil was obtained for an indefinite period as a floating storage house and was tied up to the dock alongside the plant. Steam was carried from the plant through a 2-in. flexible connection to the barge, where it passed to the oil-heating coils and to a small simplex oil pump, both the coils and the pump being part of the permanent equipment of the barge. Another flexible connection ran from the pump discharge to the oil main, which projected through the wall of the boiler-room basement. After being heated to 160 deg. F. in the tanks of the barge, the oil was forced into the main by the simplex pump. The pressure of 80 lb. per square inch at the pump allowed the burners to operate at 75 lb. per square inch. A steady flow of oil was maintained considerably in excess of that required by the burners, the portion not used coming back to the dock through the return side of the main and passing to the barge tanks through a flexible connection. This excess flow was necessary to prevent the oil from cooling below a workable temperature. The procedure described was followed before the inside tanks were installed.

As the inside equipment is now in operation, the oil is pumped directly from the barge to three tanks, each of 2,500 gal. capacity. These are in the basement of the station and will soon be surrounded with a concrete wall 12 in. thick. The space between the tanks and the wall will be filled with sand to reduce the fire hazard. After being heated from 160 deg. F. to 180 deg. F. by thermostatically controlled coils submerged in the tanks, the oil gravitates through a twin strainer to a pair of 7½-in. x 5-in. x 6-in. duplex pumps connected in parallel. These force it through a heater where its temperature is raised to 190 deg. F. before passing to burners.



No. 30 to 35	PERMIT FILING SYSTEM Standard Form Transmission and Distribution System
First Division, 1/2 cut Salmon No. 30 - Edison Feeders	Subdivisions These feeders are all filed by street names of intersection they form or the building or customer's name. 1/3 cut Buff and 1/5 cut Blue guide cards are used to split them alphabetically with the former and by street name with the latter. 1/7 cut Salmon guides are used for the individual names, with the number 30 prefixing the abbreviated name in the number system;- the number for Tenth & Market feeder would be 30-10M. The north-and-south street is always used as the prefix of the intersection.
31 - Railway Feeders	These feeders are filed by stations according to their names. The 1/3 cut Buff guide is used for the station name; where necessary by reason of a large number of them a 1/5 cut Blue guide is used to split them up numerically; and the 1/7 cut Salmon sed for the individual name. The prefix is 31, and is used Edison feeders.
32 - Arc Circuits	subdivided the same as Railway Feeders. The
33	according to the station feeding them, as the t of their designations. They are subdivided way Feeders. The prefix is 33, the filing ing 33-Ind-17.
	order. They are sub- 1/5 cut Blue

OPERATING DEPARTMENT
SYSTEM OPERATOR
PERMIT LOG
Page
day, Date. ________ 19

No.
Station
Issued by
Dept.
to
Time
to
per
Date
Estimated clearing time
Other permits
Details of blocking
Cleared by
Inspected by
Closed by

No.
Station
Issued by
Dept.
to
Time
to
per
Date
Estimated clearing time
Other permits
Details of blocking
Cleared by
Inspected by
Closed by

No.
Station
Issued by
Dept.
to
Time
to
per
Date
Estimated clearing time
Other permits
Details of blocking
Cleared by
Inspected by
Closed by
Details of blocking

No.
Time
Other permits
Station

No. 1 to 10

PERMIT FILING SYSTEM
Standard Form
Generating Station Electric

No.	First Div. 1/3 cut Buff Type Apparatus General Grouping	Place	No.	Second Div. 1/5 cut Blue Type Apparatus Detail Grouping	Place	No.
1	Alternators	1	10	(Work directly on this unit)	x	10-
			11	Auxiliaries General	1	11-
			12	Field-breaks and Rheostats	2	12-
			13	Lightning Arresters (Alt only)	3	13-
			14	Booster and KR Systems	4	14-
			15	Exciters (Not incl Exc Auxs)	5	15-
2	Compartments and Conductors	2	21	Busses	1	21-
			22	Compartments General	2	22-
			23	Reactors	3	23-
			24	Neutral Ground Resistance	4	24-
			25	Lightning Arresters, H. T.	5	25-
			26	Surge Recorder	1	26-
			27		2	27-
3	Switches	3	31	O i l	1	31-
			32	Disconnect	2	32-
			33	Air-break	3	33-
			34	Knife - Misc.	4	34-
4	Transformers	1	41	Power	3	41-
			42	Sta. L & P	4	42-
			43	Tub	5	43-
			44	Induction Regulator	1	44-
			45	Intru - Potential	2	45-
			46	2 - Current	3	46-

Third Div. 1/7 cut Salmon Individual Apparatus Identity	Place
No. 1 etc	4
" " "	3
" " "	4
" " "	6
" " "	7
" " "	1
" " "	3
" " "	4
" " "	6
" " "	7
" " "	1
" " "	3
" " "	4
" " "	3
" " "	4
" " "	6
" " "	7
" " "	6
" " "	7
" " "	1
" " "	3
" " "	4
" " "	6

FIG. 1—TYPICAL LOG FORMS THAT ARE NEARLY SELF-INDEXING

As no outside storage space, aside from the barge, has been provided, it will be necessary for the present to keep the barge tied up to the dock whenever fuel oil is burned, replenishing the supply from time to time from other barges. If operation with fuel oil is continued, two 30,000-bbl. tanks may be installed outside the power station, probably on a foundation made by driving piles and building up land in the docking space that is located on the river side of the station.

These changes were supervised by the electrical department of the New York Central Railroad under the direction of E. B. Katte, the chief engineer of electric traction.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Improving the Operating Log of a System

TO MAINTAIN some degree of accessibility in the matter of approximately 20,000 items comprising the operating log developed a problem that caused one central-station company to abandon the system of log records which had been in effect for seven years—during which time the business handled, as evidenced by the log entries, had increased 200 per cent—and adopt a scheme that was more nearly self-indexing and not as complicated as the former method.

In this company the official operating log is kept in the office of the system operator, from where the operation of the whole generating, transmission and distribution process is directed. All work on operating equipment is handled through a system of permits issued by the system operator. Such work and the proper blocking of the apparatus to permit it are carefully followed up. A separate permit is made out in duplicate on each job and for each separate crew working on the apparatus. One copy is filled out by the system operator who issues it and is entered in the log together with a brief history of the work. The other copy is made out at the place where the work is done and, when signed by the workman and by the operator in charge there, is forwarded to the system operator. Prior to the rearrangement in the record system the two copies of the permit were filed in numerical order in the office for a short time and then destroyed, the item in the log being the official record.

Of the estimated 21,000 items in the log for the year 1921, 12,000 were permit items. It was here that the efforts at reform were directed, for these 12,000 log entries represented only half the clerical labor entailed on the part of the system operator in giving out the permits, since the permit form itself first had to be filled out in every case. The loose-leaf ledger type of log book is employed, as many sheets being used per day as are required. A special form of log sheet was designed to replace the system operator's copy of the permit. The forms of eight permits were laid out on a log sheet, front and back together, four to the page, as shown in left form of Fig. 1. With this scheme the system operator had only one form to fill out. The permit sheet was filed in the ledger following the regular log sheets at the end of the day, after a memorandum had been taken concerning each permit still outstanding by reason of the work on it being uncompleted. This scheme still meant numerical and chronological filing of the permits, and because of the great number of them some form of index was necessary to keep them available.

The system finally adopted was that of making the permit itself the official record, dispensing entirely with the permit entry in the log, permanently filing the permit slip according to station and apparatus regardless of chronology and serial.

The permit file consists of two sections—the station section and the transmission and distribution section. In the former all stations are arranged by name in alphabetical order irrespective of class of service. Transmission lines are filed by number and distribution lines by name. A standard form of divisions and subdivisions, shown in the two other forms in Fig. 1, was worked up and so designed that the same kind of apparatus would always have the same relative position, with the same kind of index guide card, in every part of the file. The file is laid out according to type of apparatus, as much of the layout as needed being repeated in each station. Each station, therefore, can form in itself a complete file of standard layout. Each division and subdivision has been given a number as well as a name, and the file is so indexed, both number and name appearing on the guide cards in the manner shown in Fig. 2. At the top of each permit as issued is noted its filing destination. Sometimes this may embrace several words. Referring to Fig. 1, it will be seen that 13-6 would be equivalent to "Alternators—lightning arresters—No. 6 unit."

The schematic layout is the secret of the success of the file. The number of filing places is limited because extensions can be made only as prescribed, hence there can be no private pigeonholes to suit the notions of the individual operators. It is automatic, the outline stating definitely where each type of work must go. Growth according to plan is possible at every part of the file without affecting any other part.

Indexing the various entries in the log is a difficult but essential task. Some classification and reference to the 9,000 assorted items added yearly to the record is necessary. When a report on the action over a period of time of some certain unit in the equipment, or on the quality of service supplied to or from some branch of the system, is wanted, if the whereabouts of the desired information is not indicated in the index, it will be found only through a careful search of every page of the log book over that period.

The index that was in use consisted of a set of sheets in the log book for each month on which all major operating events were classified and made the headings of columns wherein were noted the dates on which each such event had an entry in the log. The permit file now in use offers a much more flexible means of indexing. A card containing the index notes placed immediately in front of the permits for any line, station or unit of apparatus is instantly available and in addition contains all the data for that particular line, station or unit. To obtain the same information from the older index would entail consulting the separate sheets for each month over the period wanted and searching the entire column of any classification to get the items relating to the particular unit concerned. Furthermore, the sheets are always limited to the number of subjects listed in the column headings.

The change in method of filing the permits overcame the necessity for indexing any longer those items on which permits were taken out. This effected quite a saving in clerical work, as the only items that did not always have permits were interruptions, switching errors, storms and unusual operating conditions. The interruptions are noted on the cards for the individual lines and circuits or the customers' substations. Switching errors and serious station interruptions are entered on the cards of the stations. Storms and unusual trouble are grouped for the system. In the absence of a permit stating so, a card is made out on new apparatus showing the date it is put in service.

Since the system operator's office must function impersonally and the man on the job at any time must be fully conversant with everything going on, there is occasion for the writing of innumerable memoranda concerning happenings not in the scope of the log, arrangements for work more or less distant, changes in plans and what not. Most of these are soon destroyed, but many have a permanent value. The permit file offers a receptacle to keep them out of the way and at the same time instantly at hand.

One of the greatest values of the file is the facility it affords for consistency in operating practice. Different men will have different methods for accomplishing the same results; but while all may be equally effective, the impression left with those dealing with the system operator will be more favorable the more consistently his office functions. Standardized operating methods are best. With his ready access to all the permits issued by his office he can immediately determine the method employed in handling any job on previous occasions and so be guided in his procedure.

Camden, N. J. FRANK GILLOOLY.

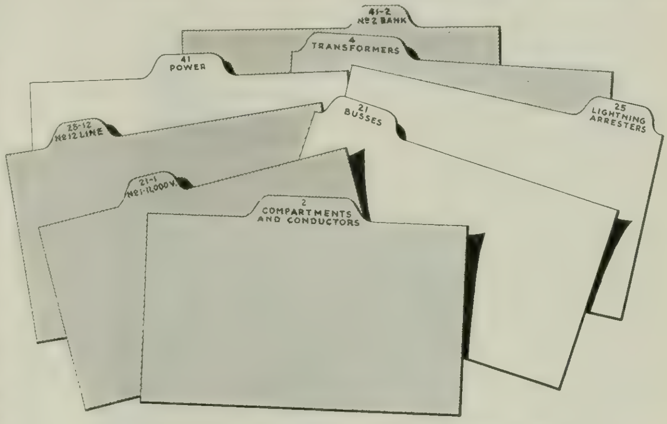


FIG. 2—GUIDE CARDS USED IN FILING FORMS SHOWN IN FIG. 1

* * *

Value of Local Repair Shop for Generating Plant

LOCAL repair shops in large generating stations afford means of securing economical repairs which should not be overlooked, according to Frank M. Lucas, assistant chief operating engineer Narragansett Electric Lighting Company, Providence, R. I. Failure of parts not in stock necessitates the making of such parts at once, and this time element makes a local shop imperative.

When emergency repairs are sent outside to local shops it has been found very difficult to impress those in charge with the gravity of the repair situation from the central-station standpoint. The work must be speedily and yet accurately machined. Transportation must be provided and someone detailed to remain with the job until it is completed. Instructions relative to the amount of turning to be done in certain classes of repair work are essential and delays sometimes have arisen through the failure of outside shopmen to remember these. Sometimes the cost of outside work is greatly increased by the fact that the shop may be steam-driven, necessitating keeping on the job at overtime rates firemen, engineers, shop superintendent, general foreman, gang foreman, machinist and helper, with truck driver and other transportation charges and delays. To overhaul a 24-in. throttle valve required thirty hours in an outside shop compared with eight hours in the South Street station shop after the latter had become established. In another case a new thrust-collar lock nut was made at the plant shop in one and one-half hours. Had this been sent outside it would probably have taken many hours and resulted in the shutting down of a turbine needed on the following Monday, the nut failure occurring on a Saturday.

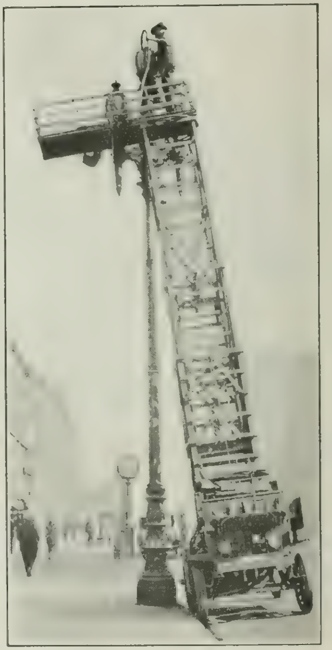
SHOP OF GREAT ADVANTAGE DURING CONSTRUCTION PERIODS

During the installation of fuel-oil burning equipment and of a recent new turbine unit the proximity of the machine shop to the new work was of inestimable value in connection with the fitting and adjustment of new parts. Numerous regulators, rams, furnace parts and valves have been produced in connection with devices to improve plant efficiency. Three machinists are constantly employed reseating valves, making new stems, glands and nuts, repairing oil-burner parts, making special pins and bolts and reversing boiler, pump, fan and other parts. In a word, the shop is "open house" to all repairs from mop wringers to turbo-generators. The present machine tool equipment consists of three lathes (30, 16 and 14-in.), one 24-in. shaper, three drill presses, one power saw and emery wheels. This particular shop is at the South Street generating plant of the Narragansett company, which has a rating of about 120,000 kw., including two 45,000-kw. turbo-generating sets and several smaller units. The total number of machines in the plant, including auxiliaries, is about 100, each having an average of about 700 parts.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Tower Truck Cleans Street Lamps with Vacuum

A COLLAPSIBLE tower mounted on an electric truck is used by the Pacific Gas & Electric Company for trimming the luminous arcs in the "Path of Gold" on Market Street, San Francisco. The uppermost lamp is about 35 ft. above the sidewalk, and it was necessary to have a type of trimming device which would enable a man to work on the lamps safely and quickly. The idea of the tower truck shown in the accompanying photograph was suggested by the shorter tower used by street-railway companies for working on overhead construction. It was only necessary to add one more collapsible section to make a three-section tower that would have a maximum lift of 30 ft. The tower is mounted on a 1½-ton electric truck and is provided with a platform mounted on a turntable so that it may be turned in either direction. The 110-volt battery which drives the truck is also used to operate a motor for raising and lowering the tower. This motor is started by pulling a rope which may be reached from the working platform to raise or lower the tower, automatically stopping when the limits have been reached.


VACUUM CLEANER ON 30-FT. TOWER TRUCK CLEANS ARC LIGHTS

For cleaning the lamps an ordinary household vacuum cleaner, driven from the battery on the truck, is mounted on the under side of the working platform. By means of a rubber hose attached to the cleaner the magnetite dust and particles are drawn from the lamps. A circuit from the battery is used to test the lamps after they have been trimmed. The truck travels about 4 miles a day and uses from 80 amp.-hr. to 120 amp.-hr. Each day thirty-six lamps are trimmed and eighteen cleaned in addition to repairing any lamps that may have been reported "out." The use of this truck has been so successful that a second one has been built.

A. J. THEIS,
Superintendent Overhead Department.
Pacific Gas & Electric Company,
San Francisco, Cal.

Defects Which Engineering Inspection Disclosed

EXAMPLES of "how not to do it" occasionally have value to the operating man, and a list of sins of omission and commission revealed by an engineering study of a small central-station system of overhead lines may at least serve as a guidepost to that small percentage of companies which fail to heed the signs of the times and put their electrical households in order. Some of the things disclosed are:

Primaries run on bottom instead of top cross-arms.

Overhead lines run in unsatisfactory and indefinite arrangement.

Distance between primary wires on poles 12 in. instead of 28 in.

Primaries and secondaries frequently attached to same arms.

Plant shut down when making line repairs.

Primaries attached to houses by strain insulators.

Rotten cross-arms which would not hold bolts were tied with ropes.

Rope suspension of 2,300-volt wires from pole.

Insulators nailed to cross-arm on pole.

Lack of strain insulators in guy wires.

A run of 1,000 ft. mill service, primaries, used No. 10 copper.

Power wires laid upon pine arms without insulators.

Primaries run on small porcelain knobs nailed to a chimney.

No. 10, No. 12 and even No. 14 wire used to carry primary service to house transformers instead of No. 6.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Promotion of Rural Business*

Can It Be Developed Without the Imposition of an Additional Burden on City Business?—Need for Discretion in Taking on the Many Grades of Farm Customers

By R. B. King
General Superintendent Idaho Power Company, Boise

THE cost of serving rural business is obviously greater on the average than that of city business. The question, then, resolves itself into that of the prospective rural customer paying the excess cost or the city rates being higher than they otherwise would be.

There are all grades of rural business, varying from the outskirts of cities, nearly as dense as the city itself, to the more remote districts with from no houses to six houses to the mile; also, from the rapidly growing district that is sure to increase steadily in density to the district doomed to all appearances to remain forever in its present condition—or worse. There is no doubt some rural business within the reach of every utility company that can be developed profitably, where the prospective consumers are not only willing but able to pay the excess cost during the period of development, but there is need for the use of discretion in handling applications or soliciting business requiring extensions into rural territory.

Two Plans Have Prevailed

Two general plans of meeting this situation have been more or less tried out in practice:

First, to let the prospective customers build, own, operate and maintain the necessary distribution lines, and sell power to them at wholesale from some suitable point of delivery on the utility company's system. This plan has been worked out with apparent success in some localities, and conditions do exist where it seems much the better plan. It seems to have the advantage of eliminating service complaints and of getting the individual consumer to do willingly for his local organization many things he would not do at the request of a public utility company.

Second, to adopt an extension policy where the prospective rural customer may obtain service by paying the cost of that service. Such an extension policy has been one of the big problems before utility companies during the last few years, and the matter became particularly acute when construction and maintenance costs went skyward during and after the war period.

Many different forms of extension rules have been devised which attempted to express this policy in workable form. Whether or not a quality of workableness is attained, they are all based upon the fact that excess cost in connecting and serving new customers does impose an additional burden on somebody, and the rules attempt to specify the necessary adjustments to relieve the present customers and place the excess burden upon those directly benefited. The adoption of such an extension policy seems to be the solution of the problem in all districts that have prospects of immediate growth, where it is reasonable to expect that within from five to ten years the business will have developed to approximately the average density of the system as a whole.

Correct Extension Rule Needed

Under these conditions a reasonably accurate estimate of the excess carrying charges for the average development period can be made and service furnished with equity to both old and new customers. It is, then, a question of the correct extension rule, which is as yet an unsettled question.

In general, the more detailed and exact the adjustment attempted, the more complicated and unworkable the rule becomes, and to be practicable a rule must be based on general averages. It must, also, be based on an assumed development period and an adjustment to cover the entire period be made at the start and in advance of construction.

There is throughout the Northwest, however, a great deal of territory with a different future ahead of it, territory with no prospect of developing to the average density of the system and no prospect of being supplied with electric service except at considerably higher cost than the general average. This is what may be called permanent rural territory. It seldom is cut by public highways into less than half-mile squares, with a maximum of from eight to ten customers per mile of line, and service is supplied by means of primary distribution lines and separate transformers for each customer.

Cost per Mile

Lines suitable for this class of service can be built for about $1,500 per mile, and the transformer, meter and service installation will average $95 per customer. With ten customers per mile the investment per customer will be $245, or an annual investment cost of $29.40. The annual operating, maintenance and customer costs will be appreciably higher than for urban business and will average at least $20 per customer. With power costing $50 per kilowatt-year at the substation, the total cost in this case will be $49.40 per customer plus $50 per kilowatt of the average simultaneous demand at the station.

The demand in this kind of territory, particularly in dairying districts, is liable to be more per customer than in urban business. Assuming 1.5 kw. as the average demand per customer at the substation, the annual cost will be $125 for this rural territory. If the rural customers can be induced to do enough of their work electrically to give them a load factor of around 20 per cent, or an average consumption of about 250 kw.-hr. per month, they will then be profitable and self-supporting customers at an average rate of 4½ cents per kilowatt-hour.

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*Abstract of a paper presented before the Northwest Electric Light and Power Association, Boise, Idaho, June 7-10, 1922.

This means a fairly free use of ranges, small motors and other appliances and an average monthly bill of $10.40 per customer for all service, and it is an unusually thriving community that can maintain that average. It is, therefore, quite evident that rural business will impose some additional burden on other customers, unless a higher rate is charged, and the adoption of a higher rural rate for the purpose of adjusting the burden in accordance with the cost often falls farther short of accomplishing that purpose than uniform rates would do.

How much higher the rural rate should be depends upon where its application begins, and drawing the rural rate line appears to be a process more arbitrary than equitable. Some of the costs are more easily segregated than others. The customers' costs furnish the clearest case, while the segregation of distribution, investment and operating costs is arbitrary in nearly all cases.

DRAWING THE LINE

The nearest to a workable plan seems to be the assembling of excess customer costs into a so-called rural charge to be added to the regular city rate. This, however, lends no aid in the drawing of the line. In some localities the line may be plainly marked by conditions, but in many others it must be purely arbitrary, so gradually do the urban and rural territories merge one into the other.

The benefit from this kind of relief to cities at the expense of the rural communities is also very questionable. The amount of relief to the average city customer is obviously small in proportion to the burden placed upon the average rural customer, and it is probable that a thriving condition of the rural territories is of greater value to the city customer than would be his assessment through the operation of uniform rates.

Special cases will always be found, of course, requiring special treatment, but in general, it being admitted that the development of rural business will always impose an additional burden on somebody, a reasonable limit should be fixed up to which the company will assume the cost of furnishing service and spread such cost over all business. Beyond that reasonable limit, where future growth is sufficiently assured to warrant the fixing of a development period, an advance adjustment should be made whereby the carrying charges on the excess cost will be paid by the prospective customers.

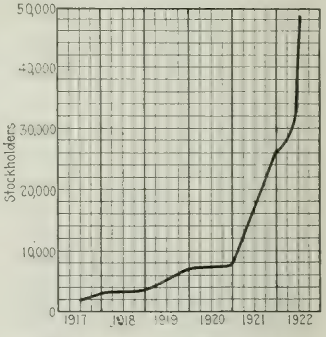
Territory where the cost of service is beyond the reasonable limit, and where the conditions indicate no prospect of immediate growth, should be furnished with wholesale power wherever the residents are able to perfect an organization to supply their own distribution system.

A Public Utility with 48,000 Partners

Remarkable Progress in Southern California Edison Company's Aim to Make Every Customer a Stockholder—How the Sales Plan Operates

BY A. N. KEMP
Vice-president Southern California Edison Company, Los Angeles

THROUGH the operation of customer ownership the Southern California Edison Company, in a period of five years, has increased its stockholders from approximately 1,800 in 1917 to more than 48,000 in 1922. Probably the greatest single factor in the success of this campaign has been the policy of the company first to make every possible person in the territory served a partner in the business. The idea of raising new capital, while highly important, was of secondary consideration. The results accomplished have been obtained almost solely through the intense co-operation of the 4,000 or more employees of this great central-station organization.



INCREASE IN STOCKHOLDERS FROM YEAR 1917 TO 1922

The plan had its inception in 1917 when the properties of the Southern California Edison Company and the Pacific Light & Power Corporation were merged. The officials of the company foresaw the benefits of having the ownership of the company remain in local hands and decided almost immediately to put the customer-ownership plan into effect.

The campaign was launched in August of that year, the first step being to hold a number of meetings at the company's various branch offices, at which time a plan whereby the employees might purchase stock on easy installment payments was explained in detail. The terms offered to employees were such that within a very short time more than 75 per cent of them had become partners in their company's business to the extent of several million dollars. Now more than 4,300 employees, or 98 per cent of the permanent force of the company, are shareholders and are purchasing better than $5,000,000 (par value) of Edison common stock. The plan permits them to purchase stock through payroll deductions of 75 cents per share per month. They are credited with the full dividends on the stock, which at the present time yields 8 per cent on the par value, and they are charged 6 per cent interest on the deferred payments. In actual practice it figures out that for every dollar an employee pays on his stock contract the company adds approximately 20 cents.

Before the company started the sale of stock to the general public a further series of employee meetings were held at which the whole plan of campaign was outlined and literature, descriptive booklets and order blanks were explained in detail. Thus when the first campaign was opened by a series of newspaper advertisements throughout southern and central California the company had several thousand men and women thoroughly familiar with the value of the security and who could answer any ordinary question that a prospective customer might put to them.

As will be noted from the accompanying chart, the selling period covers five years, but in the latter part of 1917 and the year 1918 the company retired from the field so as not to interfere with the various

Liberty loan campaigns which were running at that time. In this period there was sold to the public $28,442,800 par value of stock and to officials and employees $6,993,600 par value. In all, a total of $35,436,499 par value of stock has been sold at average sales cost of $1.05 per share. As the result of loyalty of the employees to their company and intensive sales effort, in June, 1922, in one week's time, virtually $2,500,000 worth of common stock was sold to more than 11,000 new subscribers. This particular drive for stockholders was put over by the Edison organization as a compliment to their president, John B. Miller, and was named the "John B. Miller Week."

SALES METHODS

A number of sales methods have been tried and all have produced results. It is difficult to say which particular method was the most successful, but a general outline of the sales policy may be of interest. Where the sale of stock is conducted through the agency of the employee the first consideration is to have as large a number of employees as possible as stockholders in the company. Secondly, they must be thoroughly "sold" themselves on the merits of the securities they are offering to the public.

This was accomplished through a series of meetings at which all employees and department managers attended, where they were thoroughly grounded in the main talking points of the security. Next, quotas were set for each district served by the company and each department of the organization for the number of new stockholders to be secured for the year. It was thus put squarely to each employee that he would be held responsible for obtaining his share of the quota for his particular department. A series of charts are kept in all of the departments with the names of the employees, showing the results of their efforts day by day, and a monthly report is sent to every employee on the system showing the results obtained by districts and departments. A sales force of approximately thirty men was used, one to each geographical district, whose duties were not only to obtain new stockholders themselves but to assist the other employees.

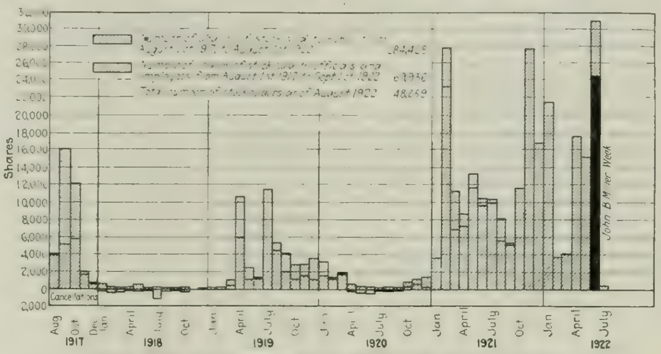
While the several campaigns were on the employees were helped by advertising in all of the newspapers in the larger cities and in the country districts. These advertisements brought out strongly the points of safety, rate of return and marketability of the stock and the fact that the company was a hydro-electric power company serving one of the fastest-growing sections of the United States. Circulars and subscription forms were mailed to every consumer on the system, and in addition a small sticker was attached to the electric light and power bills mailed out each month calling attention to the security. Permission was obtained from the managers of large and small factories to address their employees at the noon hour, and this was followed up by personal interviews with the men while they were at work at the factory or by calling on them at their homes in the evening. Simultaneously with the newspaper advertising illustrated articles appeared in the papers dealing with the enormous construction work which was being carried out at Big Creek and other parts of the system. Notices were sent to old stockholders asking them to explain to their friends and relatives what the Edison company was doing toward building up their community and telling them of the value of Edison stock as an investment.

Another great help was the action of the Edison employees' clubs in the various districts in putting on an entertainment and a dance and asking the general public to attend. On these occasions motion pictures were shown of the construction work in progress on the company's property.

No one was asked to purchase stock at these meetings, but the fact remains that when the employees subsequently called on customers they received a much better reception than if the person had not known of the constructive work of the company in the districts it serves.

A bonus of 50 cents a share was paid to all employees and a flat amount of $1 for every new stockholder they obtained, but no bonus was paid for sales made to stockholders already on the books. Additional prizes were offered to districts and departments for the ones who first made their quota of new shareholders.

It was found that the best salesmen were usually those who after having made a sale won the confidence of the purchaser and were able to get a list of the new stockholder's friends and relatives to work on. Some of our salesmen have been able to make as many as fifty additional sales through the good services of one stockholder.



STOCK SOLD TO CUSTOMERS AND EMPLOYEES IN FIVE YEARS

In every sales program unforeseen obstacles will crop out and they must be handled as they develop. However, our experience in customer ownership has shown some characteristic pitfalls which can be avoided, and a few words of caution may prove of value to other companies interested in selling stock locally.

PITFALLS TO AVOID

Do not expect the employees, in addition to their regular work, to go out and sell stock without an incentive. Give them a fair commission and extra prizes. In case of dispute as to the payment of a bonus on any particular sale by an employee, always give the employee the benefit of the doubt where possible, as nothing will take the "pep" out of an employee salesman more than to think he has lost a sale. Do not let employees try to sell to a selected list of people over the telephone. This is being done by every wildcat oil and mining company. A most important point in selling to the public is to remember that the woman of the house usually has something to say about making investments, and the most successful salesmen are those who first sell the idea to her. It is then an easy matter to obtain the consent of the husband.

Never make special prices to any one. If you are selling stock at $100 a share, be sure that every one pays the same price and that no rebates are given. With a large employee sales force it is only natural that statements are sometimes made that are not in accordance with the facts. When a stockholder says that certain statements were made to him investigate the matter thoroughly and always give the stockholder the benefit of the doubt, for, if he is treated with absolute fairness, he will be a booster for your company and its stock among all his friends and relatives.

Be sure to have your securities organization in such shape that the public will receive its certificates within a reasonable time after subscribing, and in any event see that a receipt is given for the money taken as soon as it is received by the company. In acknowledging receipt of money a letter should be sent to the subscriber explaining that a certificate will reach him within two or three weeks. Explain the routine that such a certificate must go through and the reason it takes so long to get it to him.

The measure of success in placing your securities with the general public depends on two things—first, the company's past treatment of its customers and the general public; second, the company's past record with its employees. If the company has been fair and aboveboard with reasonable rates, it will have the support of its consumers. If because of fair treatment the company has the whole-hearted support of its employees, it can ask them to do anything reasonable and they will go out and "put it over" with gusto. In other words, the success of building up a large customer ownership resolves itself into the old rule of co-operation.

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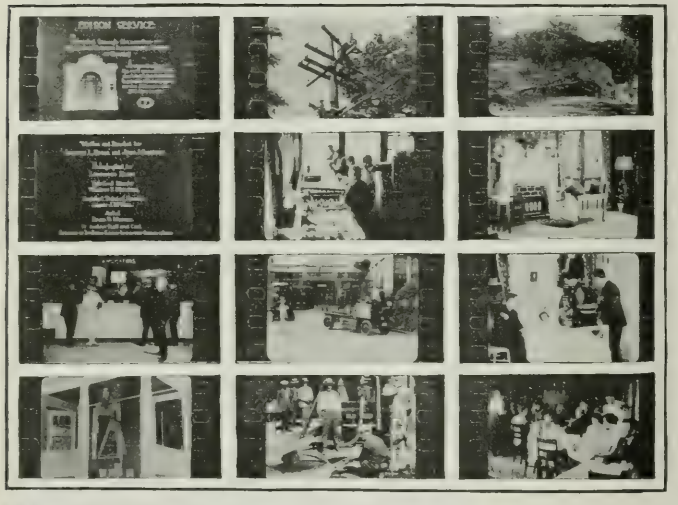
"Edison Service" Film Features Varied Activities of Boston's System



TO ACQUAINT the public in its 640 square miles of territory with the extraordinary diversified task of supplying electric service under conditions ranging from the subsurface of a metropolitan street to the remote pole lines of distant suburbs, and to emphasize the varied uses of electricity in home office and factory, the Edison Electric Illuminating Company of Boston prepared an elaborate "movie" of its activities which will be shown to the public during the coming winter as a part of the lecture service maintained by this company. A few views from the film are reproduced here. The "actors" in the story were all company employees, and the entire film was prepared by company talent, with perhaps a single exception. As a means of better visualizing what "Edison service" means behind the scenes as well as beyond the meter the picture has already attracted much interest.

What Other Companies Are Doing

Stamford, Conn.—All previous records for electrical output on its system were broken by the Stamford (Conn.) Gas & Electric Company for the June-September period this year. The maximum daily output in kilowatt-hours recently ran 15 per cent above the largest single day's output during the war, including both day and night demands. Plans are being pushed for practically doubling the capacity of the company's generating plant in order to meet the additional load requirements. A general expansion of load along different lines rather than a spectacular growth in any one field of service is the characteristic of the situation.

Dallas, Tex.—The Dallas Power & Light Company reports 677 new customers added during September, which broke all past records for increase in residential business, according to C. E. McBride, assistant secretary and treasurer of the company. The majority of the new customers represented new homes. During the last nine months 3,025 new customers have been connected, bringing the total number of customers on the company's books up to 37,902.

Ohio.—Industrial power consumers, as reported by central stations of Ohio, now number 27,350, according to figures obtained from the Ohio Committee on Public Utility Information. The surveys show this to be an increase of 2,300, or 9.2 per cent over 1921, when there were 25,050 industrial concerns in Ohio using power furnished by central-station companies. In 1916 the total number of power users was 16,560. Since then power users have increased 153 per cent. In addition to the industrial users, there are more than 700,000 wired homes in Ohio.

Chicago, Ill.—An increase of 16.83 per cent in the electrical energy output of the various public utility properties of the Standard Gas & Electric Company for the week ended Oct. 20, 1922, was obtained over the corresponding week of 1921. Applications were received for 2,579 new electric services, which cover 1,293 kw. for lighting and 1,575 hp. in motors. The electrical connected load shows a net gain of 1,011 customers with 1,002 kw. of lighting load and 980 hp. of motors.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Utilization of Surplus Flood Water to Suppress Backwater in Water-Power Developments.—FLOYD A. NAGLER.—The effect of stream flow upon load capacity of an ordinary low-head hydro-electric plant indicates that the available output should increase with the volume of flow up to the maximum rating of the equipment and remain there uninfluenced by any further increase in the volume of flow because the surplus water goes to waste. Unfortunately, it would be an exceptional low-head plant that could maintain its maximum output as the stream flow approaches that of a flood. To sustain plant capacity under such conditions is a problem which may find its practical solution in the backwater suppressor scheme described in the article.—*General Electric Review*, October, 1922.

Proposed 450,000-*Hp. Development at Niagara Falls.*—Another plant has been proposed to develop this amount of water power by taking the water through a canal from about 4 miles above the Falls and discharging it into the lower gorge near Lewiston under an effective head of 301 ft. The plan includes a four-circuit, 220,000-volt transmission line to New York City, a distance of 315 miles. Nine turbine units of the vertical-shaft type would be connected to 45,000-kva., 12,000-volt generators, with transformers directly connected to the generators without any intervening switches. The cost of this generating station with the canal would be approximately $35,000,000. For the four-circuit transmission line with step-up transformer station at the generating end and step-down transformer station at the terminal, including everything complete, the cost would be about $27,500,000. Taking the amount to be earned on the investment as 15 per cent and the total earnings per year as $9,000,000, power at the terminal station in New York would be $35.30 per kilowatt-year, or 0.47 cent per kilowatt-hour, based on allowing this system to carry the base load for the metropolitan district and allowing the peak load to be carried on the steam plants.—*Power*, Oct. 24, 1922.

Generation, Control and Switching

Application of Relays.—L. A. TERVEN.—The fourth of a series of articles dealing with substation relay equipment for guarding against line faults. —*Electric Journal*, September, 1922.

The Overloaded Generator.— H. M. PHILLIPS.—The major considerations to avoid troubles due to overheated generators are considered. The main points discussed are the greater overload capacity when the machine is first started, how and where to place thermometers to obtain the best temperature readings, and the consideration that during cool weather greater overload capacity may be secured.—*Power*, Oct. 24, 1922.

Latest Transformer Standardization. —The latest edition of the "Transformer Standards Handbook" just issued by the Transformer Section of the Electric Power Club contains information on all transformer standardization effected by that organization to date. Copies may be obtained from any American manufacturer of distribution or power transformers. The information includes standard types, frequencies, sizes, voltage ratings, taps, lead markings, polarity, nameplate marking, accessories, basis of guarantees for distribution and power transformers and general engineering recommendations. Distribution transformers for lighting and power service and power transformers for lighting and power, constant-potential transformers and connections of single-phase transformers in multiple and in three-phase banks are covered.—*Transformer Standards of the Electric Power Club, Second edition*, September, 1922.

Transmission, Substations and Distribution

Capacity of Cables for Intermittent Loads.—LOCHHEAD.—The choice of the proper cable size for intermittent service should not be determined from the mean effective current, but from the time constant. This constant must be determined by calculation, and from a curve diagram the higher load for intermittent service as against constant load may be found. The drop of voltage limits the permissible length of the cable. Another set of curves gives a convenient and quick determination of this voltage drop for different sizes of cables and loads. The V. D. E. issued recently new rules for the intermittent current-carrying capacities of cables, and it recommends that the size of fuses for intermittently operating motors be selected not according to the cable size, but according to the highest permissible motor load.—*Brown-Boveri Mitteilungen*, October, 1922.

Water-Flow Indicator for Transformers.—A. M. ROSSMAN.—The water-flow indicator described consists of a heavy cone-shaped metal plunger floating in a circular orifice. The change in the amount of water flow demands a corresponding change in the free area of the orifice, and this is obtained by a vertical movement of the plunger in the orifice. This movement is transmitted through a bell crank and shaft to an external pointer which moves over a scale calibrated in gallons of flow per minute. A number of these indicators have been in successful operation since 1920.—*Journal of the A. I. E. E.*, October, 1922.

Units, Measurements and Instruments

A Simple Harmonic Analyzer.—V. BUSH.—This article describes a mechanical integrator. Its principal use is for the determining of harmonics of an irregular function such as the problem of splitting an oscillograph curve of current or voltage into its components.—*Publication No.* 28 *of the Massachusetts Institute of Technology.*

Stroboscopic Method of Speed Measurement.—V. A. FYNN.—The apparatus consists of a stroboscopic primary standard used for calibrating purposes, a stroboscopic slip meter for asynchronous motors permitting instantaneous readings, a stroboscopic device for instantly ascertaining the speed of any kind of a motor, and a number of tachometers of the magneto type. The calibrating device is based on accuracy of a tuning fork, as the rate of vibration of such a fork is of extraordinary accuracy well beyond the requirements of any ordinary laboratory. The stroboscopic slip meter comprises a synchronous self-starting motor controlled by a switch and mounted on a base provided with handles. The instantaneous stroboscopic speed-measuring device permits the rate of revolution of any motor to be determined on the instant without putting any load on the machine whatsoever.—*Journal of the A. I. E. E.*, October, 1922.

Tentative Standards for the American Society for Testing Materials.—The 1922 edition of the "Tentative Standards," just issued, comprises 774 pages and contains 163 tentative standards. Of these eighteen relate to steel, wrought and cast iron, thirteen to non-ferrous metals, twenty-seven to cement, lime, gypsum and clayer products, fifteen to preservative coatings, thirteen to petroleum products and lubricants, thirty-five to road materials, four to coal and coke, nine to waterproofing, five to insulating materials, four to shipping containers, twelve to rubber products, four to textile materials and four are miscellaneous.—*American Society for Testing Materials.*

Illumination

The Use of Light in Hospitals.—The Illuminating Engineering Society (London) arranged a joint discussion with the Royal Society of Medicine to discuss the chief problems in the use of light for hospitals, particular attention being devoted to lighting of wards and operating tables. The introductory paper by Mr. Darch was supplemented by a series of questions with the object of inviting additional information. The introductory paper tells the requirements for lighting operating tables. These requirements are very exacting. The discussion brought out valuable information on lighting of hospitals in general, wards, operating tables, special inspection lamps, microscope illumination, illumination of colored objects, the lighting of pathological museums and the lighting of dispensaries.—*Illuminating Engineer* (*London*), Vol. XV, No. 6.

Electrical Response of the Retina to Stimulus by Light.—E. L. CHAFFEE and W. T. BOVIE.—It has been found that changes in electrical resistance or other characteristics are brought about in the eye and nerves when light impinges on the sensitive portion of the eye. These observations have been based on experiments with the eyes of frogs, the minute changes in current being amplified by vacuum tubes and indicated by sensitive galvanometers. Very interesting effects due to the action of light are described.—*I. E. S. paper, Swampscott, Mass.*, Sept. 25-28, 1922.

Motors and Control

Starting Direct-Current Motors.—C. A. ARMSTRONG.—An explanation is given of what happens when a motor comes up to speed and the starting resistance is cut out, and how the increasing counter-electromotive force in the armature may be used as a means of starting the motor automatically.—*Power*, Oct. 10, 1922.

Electric Drive in Tanneries.—J. A. LORNE.—A detailed description is given of the electric drive in two tanneries, one operating by the vegetable process and the other by the chrome process. The data presented amply demonstrate that the electric motor is readily adaptable to drive the variety of machines that are used in tanneries, is a desirable substitute for manual labor and a more productive, more reliable and yet cheaper motive power than has hitherto been used in this industry.—*General Electric Review*, October, 1922.

Winding Small Motors.—A. C. ROE.—The details of shop methods for winding small two-phase and three-phase stators are given. These include directions for checking the coil pitch, insulating the core and slots, taping the coil ends, etc. The types of winding covered are the basket winding, two-layer windings with one diamond-coil side per slot, the flat diamond mush coil, two-layer diamond mush pulled coils, and the winding with strap-copper conductors.—*Industrial Engineer*, October, 1922.

Heat Applications and Material Handling

Small Electric Furnace.—J. RITZ and G. KELLER.—A combination arc and resistance furnace is described in this long paper which possesses a number of desirable features, is simple and apparently inexpensive. It is a three-phase type with two graphite electrodes and the third phase connected to a bath electrode. The capacity of these furnaces is from 200 kg. to 300 kg. at an energy consumption between 80 kva. and 140 kva. The furnace itself has the shape of a horizontal cylinder, with two electrodes entering from the top, one behind the other, in a plane parallel to the main axis of the cylinder. The oven is stationary during the melting period and may be tilted by hand or hydraulically for pouring. The electrode regulation is governed by hand for each phase independently. An interesting feature is the possibility of lifting the melting drum out of the furnace frame, so that two or more drums may be kept by the foundry for two or more metals or alloys with only one frame or support. As a rule a three-phase furnace transformer with one reduced voltage tap in each phase is sufficient for the start and the running of the oven. To further minimize any possible voltage fluctuations on the line, a three-phase iron-core choke coil may be connected between the power line and the transformer primary. To improve the operating power factor this choke coil can be bridged by a short-circuiting switch. Complete tabulations of all operating data for melting twelve different metals and alloys are given, and also comparative operating costs between this furnace and oil-fired and coke-fired furnaces, showing very decided economies of the electric type.—*Brown-Boweri Mitteilungen*, October, 1922.

Electrophysics, Electrochemistry and Batteries

Applications of Electrical Equipment in the Metallurgy of Nickel.—J. L. McK. YARDLEY.—Most of the metal at the present time is being recovered by pyrometallurgical methods, but the electric furnace is being used to some extent and its use is constantly increasing. This article gives a synopsis of the field for electric furnaces in the reduction of nickel ores and gives a description of some of the electrical apparatus at the new British America Nickel Corporation's refinery. It is apparent from the accompanying table that the nickel-electrolytic plant must be more than three times the size of the copper-electrolytic plant; also, that either electrical equipment of a different voltage range or a different number of tanks in series must be employed.—*Engineering and Mining Journal-Press*, Nov. 4, 1922.

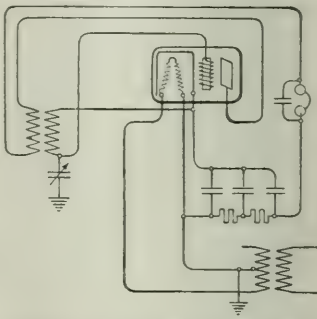
COMPARISON BETWEEN NICKEL-ELECTROLYTIC AND COPPER-ELECTROLYTIC PLANTS

	Copper	Nickel
Atomic weight	63.57	58.58
Chemical equivalent	31.785	29.34
Electrochemical equivalent, metal deposited per 1,000 amp.-hr., lb.	2.61	2.41
Heat of formation of sulphate, calories	197,500	228,700
Theoretical deposition, voltage	1.22	1.90
Theoretical metal deposited per kw.-hr., lb.	2.135	1.27
Practical ampere efficiency, per cent	80	80
Practical depositing voltage...	2.0	3.0
Practical energy efficiency, per cent	50	50
Actual metal deposited per kw.-hr., lb...	1.07	0.635
Annual output assumed, lb....	9,500,000	18,000,000
Power required per annum, kw.-hr	8,800,000	28,300,000
Electrolytic capacity required, kw	1,020	3,280
Daily output of electric furnace, 310 days per year, tons	..	60
Daily tonnage of ore, approximate	1,500	

White Metals.—A. H. MUNDEY, C. C. BISSETT and J. CARTLAND.—The authors review the principal classes of white metal, their composition and physical properties, chiefly in relation to their uses and manufacture, and consider their constitution only as far as the user is directly interested. The metals considered include anti-friction alloys, bearing metals, printers' alloys, fusible alloys and die-casting alloys.—*Engineering*, Oct. 6, 1922.

Telegraphy, Telephony, Radio and Signals

Combined Kenotron Rectifier and Pliotron Receiver.—A. W. HULL.—A four-element tube is described which combines the functions of kenotron rectifier and pliotron and can be operated from an alternating-current source of power without either an "A" or a "B" battery. The cathode is an equipotential surface so that alternating-current hum is inappreciable even with three stages in series. The combination of equipotential cathode and large cathode area results in unusually high amplification and detection constants, making the tube a practical radio-frequency amplifier.—*Paper presented before the Institute of Radio Engineers, New York*, Nov. 1, 1922.



RECEIVING CIRCUIT FOR 110-VOLT TUBE USING POWER LINE AS ANTENNA

Miscellaneous

Torsional Strength of Reinforced-Concrete Beams.—C. R. YOUNG, W. L. SAGAR and C. A. HUGHES.—A series of torsional tests on rectangular reinforced-concrete beams have been made by the authors with the following results: Rectangular specimens of plain concrete develop substantially the same computed maximum torsional shearing stress at the center of the long sides. For 1:2:4 concrete this is about 540 lb. per square inch. Longitudinal reinforcement was found to be valueless. Spiral reinforcement increases the torsional strength of beams. Spiraling to the amount of from 0.4 per cent to 1 per cent increases the strength from 20 per cent to 25 per cent.—*Canadian Engineer*, Oct. 10, 1922.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed,
Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Batteries, Storage, for Mine Locomotives.

Endurance tests indicate that the battery cells at present supplied for mine locomotives have sufficient mechanical endurance to withstand the ordinary jolts they are likely to receive in service. Details of these tests are given in Serial 2,358.—*U. S. Bureau of Mines, Pittsburgh, Pa.*

Brush, Carbon, with Laminated Texture.

A brush of high specific gravity has been developed having a laminated texture. The resistivity of the brush in the direction of its thickness is between five and six times that along its length. This tends to cut down the cross-bar or short-circuit currents; the permissible current density is thereby increased and the commutation improved.—*Pure Carbon Company, Wellsville, N. Y.*

Coal, Spontaneous Combustion of.

The relative tendency of the Pennsylvania coals to ignite spontaneously has been investigated. The research consisted largely in the development of methods for the determination of the comparative sensitivity of coals to oxygen. The coal constituents were separated by the aid of a microscope. —*U. S. Bureau of Mines, Pittsburgh, Pa.*

Instruments, Alternating Current, Thermocouple Type.

Recognizing the difficulties involved in measuring very low alternating potentials by means of the ordinary portable instruments, we have recently produced low-reading alternating-current voltmeters on the thermocouple principle, similar to the thermocouple ammeters used for radio-frequency work. The thermocouple is inclosed in a glass bulb partially filled with hydrogen gas, the object of which is to give the filament a quick thermal action. In other words, its temperature is quickly established. Bulbs which are electrically interchangeable are produced by varying the amount of hydrogen contained until with a given current a certain thermal emf. is produced. By means of these bulbs low-reading thermal ammeters and milliammeters are also produced.—*Paul MacGahan, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

Magnetic Tests with Superimposed Alternating Current and Direct Current.

A study was made on iron-core toroids with alternating current to see to what extent the constant field changes the permeability to a rapidly alternating field and whether the previous history influences this permeability and the resulting energy losses in iron. Aside from its bearing upon theories of magnetism, this problem is of interest in the double-frequency transformer, the telephone receiver and in numerous other applications of the polarized electromagnet, where the direct-current field is superposed upon an alternating field. The performance of these devices is conditioned by the change in effective permeability to an alternating field when the core is under the magnetizing action of this constant longitudinal field.—*Alva W. Smith, Ohio State University, Columbus, Ohio.*

Ohm's Law, Deviation from, at High Current Densities

On the basis of the free electron theory, currents at very high densities would be expected to increase as the square root of the applied emf. Measurements were made on very thin strips and films of gold and silver, using a Wheatstone bridge. The specimen was traversed simultaneously by a heavy current and a small alternating current of acoustical frequency. Some traces of the theoretical effect were found.—*P. W. Bridgman, Harvard University, Cambridge, Mass.*

Plating, with Silver.

A large brass parabolic mirror was heavily silver-plated by the bureau recently. In doing so some valuable information regarding the practical operations of plating was obtained.—*Bureau of Standards, Washington, D. C.*

Relays, an Apparatus for Studying the Motion of.

It is of considerable importance to know how the contact points move relatively to each other. The electrical methods commonly employed for determining relay characteristics are quite inadequate; oscillographic records of current merely tell whether contact is single or multiple; methods depending on charging of condensers are only applicable to clean breaks and so are impracticable for the study of the very important case of "chattering." An apparatus was designed for the purpose of obtaining photographic silhouettes, or "shadowgrams," of the moving contact points. In the optical arrangement a "pointolite" lamp is used. An image of the contacts and the pointolite is formed by a lens upon a narrow slit, parallel to the direction of motion of the contacts, and lying closely in front of a rapidly moving photographic film. The shadow traced on the film will be a record of the relay's motion. For details see the *Journal of the Optical Society*, Vol. 6, 1922, page 391.—*H. E. Ives and T. L. Dowey, Western Electric Company, New York City.*

Thermophone, Theory of.

Formulas have been derived for the maximum value of the alternating pressure produced within the inclosure of any thermophone when a given alternating current, superposed on a direct current, is passed through the central foil or wire. These formulas have been verified experimentally by calibrating an electrostatic transmitter with four different thermophones and with a pistonphone. For details see *Physical Review*, Vol. 19, 1922, page 333.—*E. C. Wente, New York City.*

Research in Progress

Lubricating Oil, Reclaiming of.

Experiments with a commercial type of oil reclaimer, which involved increasing the temperature at which the oil was allowed to stand from 180 to 200 deg. F., increased the amount of oil recovered from 80 to 89 per cent. The reclaimed oil seems to be similar to new oil, except with regard to sediment. Satisfactory means for the removal of this sediment, which is probably carbon, requires further investigation.—*Bureau of Standards, Washington, D. C.*

Mines, Electric Shot-Firing Equipment for.

Two series of studies have been undertaken in connection with electrical shot-firing methods in mines—(1) the relative danger of firing shots with iron and copper "leg" electric detonators, which has a possible bearing on the mine fires reported in the Utah field; (2) the cause of "misfires" in the firing of a large number of series shots by push-down-type blasting machines in places where the leakage current through the earth is excessive.—*U. S. Bureau of Mines, Pittsburgh, Pa.*

Plating, with Platinum.

A few experiments upon platinum plating from the phosphate solution indicate that there is no great difficulty in securing bright deposits but the deposits so far produced have been found to furnish very little protection against attack upon the underlying metal by such reagents as nitric acid. If platinum plating is to find extensive use on analytical weights or for the protection of chemical apparatus, a means must be found for producing dense impervious deposits of the metal. Further experiments are in progress.—*Bureau of Standards, Washington, D. C.*

Suggestions for Research

Cables, Intermittent Load on.

In order to compute the temperature rise of a cable with an intermittent load, it seems convenient to introduce the "time constant" of the cable. This constant is defined as the interval of time necessary for raising the temperature of the cable to its safe upper limit, with a continuous load current, when the heat is not conducted or radiated away, but is stored in the cable. For a beginning of such a theory of cable heating see *Brown-Boveri Mitteilungen*, Vol. 9, page 213, October, 1922.

Dielectric Strength, Influence of Thickness

It is well known that the puncturing voltage for solid insulation in plate form is a function of the thickness of the samples. The ultimate strength increases more slowly than the thickness; in other words, thin layers stand in proportion a higher voltage. Assuming the breakdown to take place along a patch of small imperfections in the material, it is desired to apply the mathematical theory of probabilities to the distribution of weak points and to deduce a relationship between the thickness of a plate and the ultimate voltage at which it breaks down.

Fuses for 2,300 Volts and Above.

At the recent convention of the Empire State Gas and Electric Association E. P. Peck of Utica, N. Y., called attention to the lack of satisfactory fuses for voltages of 2,300 and above.

Maximum-Demand Meters.

At the recent annual convention of the Empire State Gas and Electric Association at Lake Placid a need for further study of maximum-demand meters was emphasized and the following problems were brought out: (a) What are the relative registrations of different types of demand meters with different time intervals on one and the same load, uniform or fluctuating? (b) How does a consumer's kva. demand (or poor power factor) affect each part of the electric system, back to the prime-mover shaft? (c) Advantages and disadvantages of different thermal-type load indicators. For an experimental study of maximum-demand meters see Borden, *A. I. E. E. Transactions*, Vol. 39, 1920, page 1847.

Measuring Instruments, Scale of.

In some instruments, such as hot-wire ammeters and electrodynamometer-type voltmeters, the lower part of the scale is suppressed, making the instrument comparatively inaccurate in the lower range. Among different suggestions for improvement, one that recently came from abroad consists in measuring not a constant fraction of the quantity concerned, but a fraction which itself varies according to a predetermined law.

Thermocouples for Measuring High-Frequency Currents.

It is of importance to develop thermocouples which can be worked up in wire form, suitable for temperatures not over 400 deg. C., and which would have a thermo emf in excess of the value given by the materials now in use. The materials in most common use now are "advance" or constantan, with copper or with iron, and constantan with manganin. These materials give a thermo-emf of approximately 40 to 50 microvolts per degree Centigrade. The results would be of importance in application to instruments of the thermocouple, D'Arsonval type, used for measuring high-frequency currents. The design of such instruments is now very much limited by the weak forces in the instrument produced by existing thermocouples. — *Paul MacGahan East Pittsburgh, Pa.*

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

Los Angeles Loses Fight

Court of Appeals Refuses to Let It Condemn Owens River Plant of Southern Sierras Company

THE city of Los Angeles has lost its fight to condemn for its own use a power site on the Owens River belonging to the Southern Sierras Power Company. A decision of the United States Circuit Court of Appeals, just handed down, reverses the victory won by the municipality in the District Court in July, 1921, dismissing the complaint and assessing costs against the city. The decision, which restores the property to the Southern Sierras Power Company, is of importance throughout California as well as the rest of the nation, as it holds that a municipal corporation has not the right to condemn property which a private corporation is devoting to the public uses of other municipalities.

The contention of the Southern Sierras Power Company and its predecessor in ownership, the Mono Power Company, that the needs of the six counties and numerous southern California cities and towns which it serves were equal to the rights of the city of Los Angeles was completely upheld by the Circuit Court. In the lower court a jury had fixed the condemnation price at $525,000, and Judge Van Fleet held that Los Angeles had a superior interest in the power site, which comprises 320 acres, extending a mile along the river at the steepest point in the Owens River gorge.

The Southern Sierras Power Company does not render any public service to the city of Los Angeles or its inhabitants and does not propose to do so, but it sells energy in bulk to Riverside and Redlands and serves directly San Bernardino, Corona and other places. There was no evidence in the case to the effect that the use of the property sought to be condemned for the purpose of providing electrical energy for the present and future needs of Los Angeles was in fact a more necessary use than the public use of the property by the defendant for the present and future needs of the counties, municipalities and towns it serves.

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Italy Likely to Give Up State Ownership of Utilities

According to press dispatches, Premier Mussolini, the Fascisti leader who has become head of the Italian government, means to bring about the transfer of public utilities, including railroad, telephone and telegraph services, to private ownership. All these utilities have, according to the dispatch, been operated at a loss.

It is asserted that the government has already begun negotiations for the turning over of the government telephone system to a private company with headquarters at Milan. The condition of the government system has been serious for some time, and more than 100,000 applications for telephones have been refused because of lack of funds. For more than ten years the Ministers of Telegraphs have been asking for 1,500,000 lire for the improvement of the telegraph and telephone lines, but the government has been unable to supply any such sum.

The proposed remedy, it is said, meets with a large degree of public approval. A similar movement in France, so far at least as telephone service is concerned, was noted in the issue of the *Electrical World* for Oct. 28, page 952.

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Commissioners Discuss Their Problems

Detroit Meeting Full of Interest—Rural Service, Public Ownership, Safety of Operation, Rates and Depreciation Rules Are Debated—Lewis of Iowa Elected President

THE augmented problems of utility and railroad regulation with which public service commissions now believe themselves confronted were responsible this week for the very large attendance at the thirty-fourth annual convention of the National Association of Railway and Utilities Commissioners at Detroit. Prominent among questions considered up to the time this issue of the *Electrical World* went to press were rural extensions of electric service, the report of the committee on public ownership and operation, and the question of regulated monopoly or regulated competition as it is involved in the telephone industry.

DETROIT'S MAYOR SEES MUNICIPAL OWNERSHIP GROWING

Mayor Couzens in his welcoming address told the commissioners that municipal ownership is on trial and that it will continue to grow. He thought the commissioners had not yet entirely eliminated graft, interlocking relationships, unreasonable salaries and other excessive expenses from public utilities. He did not object to a fair return on capital invested, but to the tricks of the bankers and lawyers in boosting the costs upon which people are asked to pay a return.

PRESIDENT JACKSON'S SOUND ADDRESS

President C. D. Jackson in opening his address cited the tendency of the federal government to take charge of almost all forms of human activity, to usurp all the ordinary police power of the states and to substitute centralized paternalism for red-blooded initiative and local solution. In his estimation no organization more completely represents the sentiments of the several states and the local needs and problems of the country than the National Association of Railway and Utilities Commissioners, and none can be more effective in combating federal paternalism.

As touching the movement toward centralization, Chairman Jackson cited the tendency of the telephone companies to shift from the jurisdiction of the state commissions to that of the Interstate Commerce Commission. He did not go into the various ramifications other than to touch on the possibilities of telephony in interstate commerce and the divergence of opinion which exists between the Interstate Commerce Commission and the state commissions on the proper treatment of depreciation and retirement reserves. He deprecated this tendency on the part of the telephone and telegraph companies and stated that any temporary advantage to these utilities from the undue extension of federal interference with local control and regulation would in the end be far more than offset by disadvantages of a very concrete and perhaps disastrous nature. Good public relations, he maintained, are not helped by centralized and distant administrative regulation.

He referred to the present form of socialistic or communistic agitation for state and federal ownership of vast utility properties and was glad to know that California had emphatically repudiated this socialistic propaganda and that virtually the same verdict had been given in Wisconsin.

Dwelling on the monopolistic nature of the public utility business and on the question of franchises, Mr. Jackson cited the chaotic condition which exists in the laws of the several states by reason of which just, stable and effective public service regulation is hampered. Local public relations are susceptible of considerable improvement in the estimation of the commissioner through such channels as customer ownership of securities. The other advantages which accrue to the utility owing to local ownership were also emphasized. Chairman Jackson drew attention to the necessity for opening all legitimate fields for securing capital to public service corporations and the part which public service commissions should play in fostering the credit of utilities under their jurisdiction. No-par-value stock and the evils of tax exemption also came in for comment. Summing up, Chairman Jackson voiced the duty of commissioners to bring the great public service of the country to all the people on the most reasonable and fair basis to all concerned.

The address of C. C. McChord, chairman of the Interstate Commerce Commission, on the relation of state to federal regulation was a feature of the afternoon session on Tuesday.

PUBLIC OWNERSHIP AND OPERATION

The report of the public ownership and operation committee was presented by A. G. Patterson of Alabama. Last year's committee was unanimously opposed to such methods and in favor of the private ownership and operation of public utilities. This year's committee, which was quite optimistic on the future of electric utilities, also announced its belief that the public utility business is essentially a private business. It complained, however, about the prevalence of litigation to prevent public utility commissioners from justly reducing prevailing high rates. The committee expressed itself as strongly of the opinion that the proper solution of the railroad situation would have a tremendous effect in retarding sentiment favoring government ownership and operation of railroads and other public utilities, and to that end it recommended that the Railway Labor Board be abolished and its functions transferred to the Interstate Commerce Commission.

SAFETY OF OPERATION

The committee on safety of operation of public utility companies suggested that the National Electrical Safety Code be accepted as the best guide for use in the formulation of electrical safety rules. It appeared from the report that twenty-nine of the railway and utility commissions have adopted safety rules relating to the construction and operation of electrical supply and signal lines, and of these about eight follow the National Electrical Safety Code.

The committee recommended that special effort be made to impress upon the management of utilities, first, the economic value of safety work; second, that conditions which were prominent a few years ago have quite disappeared; third, that sound, reasonable plans should be followed consistently and if possible should be carried so far as to outline a tentative program which would become a permanent part of utility operation.

RATES FOR HYDRO-ELECTRIC SERVICE

The greater part of the report on public utility rates was devoted to the electrical business, particularly to the hydro-electric development and transmission of energy. The committee contended that the development of the water powers of the country under proper safeguard is in the public interest, but that this development is only practicable where it is possible to obtain a market by transmitting the energy over considerable distances.

Referring to the recent Wisconsin Supreme Court case, in which the court held that communities adjacent to the source of power are entitled to more favorable rates, the committee, notwithstanding this decision, held that the proximity of a city or village to water-power development should not give a priority of interest in that development. In its estimation there are considerations of public policy which not only justify the grouping of communities into a single unit for rate-making purposes but make such grouping of foremost importance.

The committee did not take the position that rates in all cities and villages served should be the same. It believed that the development of water powers is intended to be for the general good of the people who can reasonably be served from those powers, and that the market for the energy should be such that no one community will have great competitive advantage over others in attracting industries because of its proximity to the power. The interest of the state or of the entire geographical section which can be served from a hydro-electric plant ought to be paramount to the interests of any particular community in that section.

NATIONAL CHARACTER OF TELEPHONE

Almost one whole session was devoted to the telephone question. H. B. Thayer, president American Telephone & Telegraph Company, explained the methods and objects of the Bell Telephone System, dwelling on the three classes of service it furnishes—community, state and interstate—which subject the system to three kinds of control, municipal, state and national. With the exception of interstate toll rates, regulation is, however, generally by state commissions, and thus these commissions are confronted with the problem of considering the value to their constituents of telephone development outside the state and the cost of service part of which is rendered beyond the jurisdiction of the state commission.

"Aside from all questions of economy and efficiency," said Mr. Thayer, "a national universal service could not be provided at all by a large number of unco-ordinated local units. As a part of its plan, the contract between the American Telephone & Telegraph Company and the associated companies provides in general terms for such services to the associated companies as can be most economically and efficiently rendered by one central agency. A division between national and sectional toll lines cannot follow state lines. The long lines form one part of the national machine, designed to handle such long-distance service as may be most efficiently and economically provided through this means and so designed to make the national machine as a whole operate most efficiently and economically."

Frank B. McKinnon, president United States Independent Telephone Association, spoke for that body, pointing out the advantages to the public of maintaining competition, though not by any means duplication of service in the same area. Mr. McKinnon argued that all true measure of the value of telephone service and much incentive to progress would be lost if the independent group were to be eliminated entirely, with its operating companies, its factories and its personnel. The success of the independent companies, said Mr. McKinnon, lies in their local character and personality, that is, the personal nature of their service. He raised the question whether the time is not now here when rates should be based on service rendered, and not alone on valuation, thus allowing some regard to be given to economical and efficient management.

Chairman Clyde M. Reed of the Kansas Public Utilities Commission strongly supported the maintenance of an independent telephone group as tending to bring about a healthy condition for telephone service generally.

DISCUSSION OF DEPRECIATION

An extended discussion of depreciation resulted from raising the question of telephone depreciation as apparently delegated to the Interstate Commerce Commission for determination by the transportation act. In so far as the discussion affected other utilities, it was brought out that most commissions favor a depreciation reserve, such reserve to be so set up as to provide for a sum equal to the cost, less scrap value, of a given piece of property at the time of its retirement, provided, however, that excessive depreciation reserves be not allowed to accumulate owing to error in figuring the life of property.

RURAL-LINE EXTENSION

The round-table discussion of rural-line extension showed the nation-wide interest in and the importance of this subject. In introducing it Henry G. Wells of Massachusetts presented the report of the committee on service of public utility companies and showed how the attitude of the public service company had changed from the negative one of two or three decades ago to one of desire and serious effort to make the first aim of such companies service to the public. The solution of the perplexing problem of how to extend that service to rural communities on a basis equitable to both consumer and utility has been often attempted, but these attempts are frequently mere compromises and a real basis is needed.

Sherman T. Handy of Michigan spoke of the Michigan committee of seventeen now seeking a solution and pointed out that extensions of electrical service to rural communities will do more than anything else to keep people on the farm. A particularly urgent demand comes from the farmhouse; for, while farming methods in the field have been improved since 1900, farmhouse life remains much the same. It is true that the average farm consumption per customer is low now, but at present it is pioneer work. Mr. Handy believed that the farmer once on the line will ultimately become a large consumer.

Mr. Flagg of the Washington State Department of Public Works read from the proposed rules of the department which attempt to get away from approaching the problem as one of extension financing and to approach it as one of extension revenue alone. The idea is without setting up special rates to make an extra service charge so that ratio of return to investment on rural lines may be about the same as the ratio of return to investment on the rest of the system.

The New Officers

The following were elected for the ensuing year: President, Dwight N. Lewis of Iowa; first vice-president, Alexander Forward of Virginia; second vice-president, H. G. Taylor of Nebraska; secretary, J. B. Walker, secretary New York Transit Commission, and assistant secretary, J. H. Corbitt, secretary Tennessee Railroad and Public Utilities Commission.

The next convention will probably be held at Miami, Fla., in December, 1923.

President of Alabama Commission Favors Ford Offer

A. G. Patterson, president of the Alabama Public Service Commission, was quoted at length in the Detroit papers of Wednesday this week as saying that Alabama and the other Southern States interested favored giving Muscle Shoals to Henry Ford and that under no circumstances would they consent to its going to the Alabama Power Company, controlled, as in their opinion it is, from Wall Street. In an extended discussion on this matter with a representative of this paper Mr. Patterson said that primarily Alabama was interested in the proper development of the region and that so far, according to the Congressional supporters of Ford, he had made the most attractive proposition. Therefore Alabama favored Ford having Muscle Shoals, provided that he and Congress could eventually agree, as Mr. Patterson thought they could.

The South does not believe Ford to be a philanthropist, Mr. Patterson continued, but thinks that he is looking, quite naturally, for profit from the venture. Nor does the South believe Ford's offer should be accepted as last drawn; but if Ford so modifies his offer that Congress can accept it, Mr. Patterson believes that, on account of the magnitude of the proposition and the benefits to be derived from it, the period of lease should be extended from fifty to a hundred years, an exception to the usual practice being justified. The same exception might well apply to other projects as well, Mr. Patterson admitted, if necessary to promote needed development. Moreover, if any one else should make a more attractive offer than Ford for Muscle Shoals, he should have it. Whoever gets it will be subject to regulation as to rates, whether for industries owned by Ford or for industries owned by others. But, to summarize Mr. Patterson's view, so far as opportunities now exist to develop the Shoals, Ford has made the best offer and he and Congress will, Mr. Patterson thinks, finally be able to get together on businesslike terms.

Samuel Insull on Financing

Tells How $60,000,000 Has Been Raised by Commonwealth Edison With No Recourse to Bankers

MORE than 600,000 shares have been placed with customers of the Commonwealth Edison Company since this plan of financing was adopted by it early in the war period, and $60,000,000 has been raised without recourse to the ordinary means of raising capital through banking houses. This was the statement made by the company's president, Samuel Insull, in an address which he delivered in New York before the Bond Club last week on the subject of local public utility financing.

Mr. Insull's companies were among the pioneers in that field of financing, and he set forth many reasons why he has found the plan exceedingly desirable. In the first place, Mr. Insull said, it serves to promote that thing which is most desirable in the operation of electric light and other utility properties—the interest of the customers in the success of the venture—or, as he put it, "it gets everybody yelling for us." He mentioned several instances in which public utility companies have been materially aided through the efforts of their customer stockholders.

His company was led into the customer-ownership proposition by the necessities of war, he said. When war began in 1914 it was found that large amounts of the stock of the company held abroad were being sent here for liquidation and it was then that the system of distributing that stock among customers was first tried out. Its success is measured by the figures which he presented, showing that, although in the first two or three years only about $1,000,000 a year was raised in this fashion, in 1920 customers purchased 14,358 shares at a cost of $14,684,210 and in 1921 they bought 149,890 shares, paying the company $14,840,932. This year, up to Nov. 4, total sales under this plan have amounted to 287,186 shares, with a value of $28,119,203. Mr. Insull said that most of the utilities had pulled through post-war difficulties in excellent fashion.

Hydro Takes Over Toronto Power Company

On Nov. 1 the Hydro-Electric Power Commission of Ontario took over all the property of the Toronto Power Company for a consideration of $32,734,000. Negotiations have been under way for a considerable time, but the so-called "clean-up deal" was not consummated until last week.

The properties involved embrace the Electrical Development Company of Ontario, with power house at Niagara Falls, Ont.; the Toronto Power Company, the Toronto & Niagara Power Company, the Toronto Electric Light Company, the Toronto & York Radial Company and the Aurora & Schomberg Railway Company.

The Toronto Power Company will continue as a separate corporation with the following officers: Sir Adam Beck, president; Col. D. Carmichael, vice-president; W. W. Pope, secretary; F. A. Gaby, director, and J. W. Gilmour, treasurer.

Memphis Electric Sold

The Memphis Gas & Electric Company was sold at receiver's sale on Wednesday for $10,000,000. F. B. Odlam of New York, representing creditors holding claims amounting to $12,500,000, was the only bidder. The property was sold first in five parcels, on which bids aggregated $9,990,000, and then offered as a whole. The sale must be confirmed by the Federal District Court. The corporation will operate the gas and electric plants under the name of the Memphis Power & Light Company, and the new company, of which H. C. Abell of New York will be the head, will be functioning by Jan. 1, 1923, according to its attorney.

The new owners are pledged to expend $2,000,000 in improvements within eighteen months from the day they begin operations.

Hope for Early Development on the St. Lawrence

There are hints in official circles of an important development in the St. Lawrence River situation. It is believed that private interests are preparing to make a start on one part of the project. Studies now are being made of the power market in and around New York and Boston with the idea of estimating the extent of that market at the time when the proposed development shall have been completed. The construction of dams at Long Sault and at Cat Island is being considered, as is also a plan of constructing only one dam at Long Sault. Such a plan, which would make available 1,200,000 hp. of primary power, has the advantage, it is claimed, that no treaty or understanding with Canada would be necessary. It would only be necessary to utilize the existing machinery of the Federal Power Commission and the International Joint Commission.

Arkansas Executives Meet

Utilities Association, Meeting at Hot Springs, Talks of Service, Rates and Engineering

MEETING at Hot Springs, Ark., last week for its fifteenth annual convention, the Arkansas Utilities Association listened to a plea for fair treatment of the utility companies made by E. F. Wickwire, secretary Ohio Brass Company, Mansfield, Ohio, who declared that manufacturers and workingmen alike are becoming aware to what a large degree their own prosperity is contingent on that of the utilities. "If the income of utilities is limited by legislative enactment while the outgo runs riot," said Mr. Wickwire, "public service development must cease and even begin to go back. The real point for the individual to consider is whether it is to his interest to pay a rate which will enable the utilities to render good service or whether he would be better off if he had to furnish his own electricity, gas and transportation."

Percy Redmund of St. Louis, general manager of the Southwestern Bell Telephone Company, talked on "Service," and urged the liberal use of publicity upon utility men. An address by W. N. Gladson, dean of the College of Engineering of the University of Arkansas, led to the appointment of a committee to co-operate with the dean in trying to enhance the value of the engineering experimental station at the university.

Other addresses were made by former Gov. Charles H. Brough, who said that Arkansas ranked twelfth among the states in the efficiency of her utilities; by Robert Neill, a Hot Springs banker, who dwelt on the relation of the bankers to the utilities, and by H. A. Lane of the Joint Committee for Electrical Development. At the dinner-dance short talks were given by H. C. Couch of Pine Bluff, Earle Hodges, director of the Arkansas Public Service Information Bureau, and Messrs. Wickwire, Redmund and H. A. Lane.

These officers were elected for the coming year: President, S. A. Lane, Little Rock; first vice-president, J. L. Longino, Pine Bluff; second vice-president, Arthur E. Main, Mammoth Springs; secretary-treasurer (re-elected), R. I. Brown, Little Rock. The 1923 convention will be held at Pine Bluff.

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Election Results of Interest to Public Utilities

The "convenience and necessity act," No. 12 on the ballot in the State of Washington, failed at the elections on Nov. 7 by a vote of a little less than two to one. The 1921 Legislature passed the act and the Governor approved it with the veto of certain of its minor provisions. A few days before the act would have become a law the referendum was invoked and the proposed measure was put to a vote of the people. The act required a public utility before entering a field already served by another utility to obtain first from the state authorities a certificate of convenience and necessity.

South Dakota electors voted down the proposal to build a state-owned hydro-electric power plant.

The defeat of the water and power act in California by a great majority, as reported in the *Electrical World* last week, has had a stimulating effect in investment circles in the Far West, and several utility issues which were withheld pending the election will, it is reported, soon be placed on the market.

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Dispute on Musquash Power Leads to Mayor's Defeat

A dispute over the disposition of electrical energy from the Musquash hydro-electric development in the Province of New Brunswick, Canada, has, press dispatches say, led to the recall of the Mayor of St. John, whose opponent polled 4,304 votes to the Mayor's 3,289. It was alleged that the Mayor had, in the negotiations for power between the city and the provincial government, unduly favored the New Brunswick Power Company, which controls the electric light and power, street railway and gas systems of St. John. United States investors own large blocks of the company's securities. The fight, it is said, is likely to reach the courts.

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I. E. S. Demonstrates Proper Home Lighting

At the November meeting of the New York Section of the Illuminating Engineering Society on Nov. 9 W. H. Rademacher of the Edison Lamp Works of the General Electric Company presented a comprehensive lecture on "Common-Sense Electric Lighting in the Home." The lecture was simplified by the use of a revolving stage which clearly demonstrated the contrast of good and poor lighting. With the aid of this exhibit Mr. Rademacher pointed out the many common errors which are found in existing installations and demonstrated how, at a comparatively moderate cost for the proper type of luminaires, the lighting of the living room, dining room, bedroom and kitchen can be improved.

Water Power in Arkansas

Progress of Little Red River Hydro-Electric Project—Annual Output of 175,000,000 Kw.-hr. Predicted

THE first unit of Arkansas' first large hydro-electric project will be completed on Little Red River, near Judsonia, by the Arkansas Power Corporation in March, 1923, if construction work moves along at its present rate. In a recent interview Virgil Pettie of Little Rock, president of the corporation, said: "The entire project is financed, a market for two-thirds of the power already arranged for, and we anticipate no interruption in our work. There is little doubt that the sections reached by our transmission lines will undergo a tremendous industrial growth. The territory produces 100,000 bales of cotton annually and has immense undeveloped resources in timber, stone and minerals. Railroad facilities are excellent.

"The drainage area tributary to the two dams the company will build is 1,400 square miles, with an average rainfall of 48 in. The average run-off is 2,200 cu.ft. per second. The annual power output from both units is figured at 175,000,000 kw.-hr. Dam No. 1 will be 85 ft. high and 800 ft. long. Dam No. 2 will be 150 ft. high and 1,050 ft. long. The first dam will create a lake in the Little Red River 18 miles long. Dam No. 2 will create a lake 42 miles long. These lakes will contain approximately 11,300 acres and 24,000 acres respectively. Besides the industrial value of the power, these two lakes in the very heart of the beautiful Ozark Mountains, will create one of the largest and most popular vacation grounds in the South.

"There will be a total of 256 miles of transmission lines. Ninety miles of this will be strung on steel towers, 166 miles on heavy wooden poles. A tremendous saving of coal will be effected by the construction of this plant. Figuring 3 lb. of coal per kilowatt-hour, the estimated saving on an annual output of 175,000,000 kw.-hr. will be 262,500 tons. At five dollars a ton this amounts to $3,600 a day."

COFFERDAM NO. 1 IN LITTLE RED RIVER, ARKANSAS

The largest single market for power the corporation has is North Little Rock, where it has already a franchise.

The Brazilian Congress

International Engineering Meetings at Rio de Janeiro Cover Wide Radius of Interest

AT THE international engineering congress held at Rio de Janeiro, Brazil, from Sept. 17 to Sept. 30, in connection with the Brazilian Centennial Exposition, North America was represented by delegates from the four big engineering societies as well as from six or eight other bodies of the United States and Canada. A. W. K. Billings, F. J. W. Luck, C. M. Mauseau, J. H. Payne, C. W. Rice, F. H. Shepard, Edwin A. Sturgis and William V. B. Van Dyck were the delegates from the American Institute of Electrical Engineers. Mr. Rice, who also headed the delegation of the American Society of Mechanical Engineers, was made the personal representative of the engineers in this country to continue from Rio de Janeiro with messages to the engineering societies in other cities of South America.

The work of the congress was divided into these eight sections, which show definitely just what problems were considered:

1. Overland, maritime, fluvial and aërial transportation; the Pan-American railway, practical means for its construction.
2. Iron metallurgy.
3. Fuels.
4. Hydraulic power; its utilization as motive power.
5. Sanitation, dams and irrigation.
6. Maritime and fluvial ports, their régime and relations with international navigation.
7. Machinery for agricultural and industrial purposes.
8. Standardization of statistical methods in ports and railroads.

Papers from United States

Twenty-three papers were presented by the four national engineering societies of the United States. Those of especial electrical interest were: "Utilization of Low-Grade Fuels with Seymour Pulverizers," Erie City Iron Works, Erie, Pa.; "Electrical Apparatus for High-Tension Power Transmission," Stephen Q. Hayes; "Technique of Radio Broadcasting," S. M. Kintner; "High-Head Hydro-Electric Development in the Mountains of California," A. A. Northrop; "Long-Distance Telephony in the United States," Bancroft Gherardi and H. S. Osborne; "Development of Electric Drives for Cotton Mills," C. N. Johnson; "Some Service Records of Electric Locomotives and Motor Cars in American Heavy-Traction Service," Homer K. Smith; "Static Transformers for Pressures of 150,000 Volts or Higher," Walter S. Moody; "A New Electric Furnace for Brass, Bronze and Copper," J. Murray Weed; "Factors Limiting the Voltage of Long-Distance Transmission Lines," F. W. Peek, Jr.; "Development in Hydro-Electric Practice," T. A. E. Belt; "Large High-Voltage Oil Circuit Breakers," E. M. Hewlett; "High-Voltage, Long-Distance Transmission of Power," B. Nikiforoff, and "Present Status of the Electric Furnace for the Iron and Steel Industry," John A. Seede.

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Personnel Association Discusses Engineering

Co-operation with the engineering colleges was urged by a committee of the National Personnel Association at the first annual convention of the association, held in Pittsburgh last week. "The present state of engineering education is one of active flux," said the report of the committee, of which W. E. Wickenden, American Telephone & Telegraph Company, was chairman. "Educators and officers of industry are agreed that the demands of civilization on the engineer are becoming broader and call for a more fundamental and less specialized form of education. Engineers have achieved brilliant success in creating the machines and structures which make modern industry possible. They are now being called upon to give equal concern to the agencies of society which utilize this material equipment."

"Human Factor" in Engineering

The committee dwelt upon the importance of the "human factor" in engineering, saying: "As engineers constitute an increasingly influential group in modern industry and government, all member companies are concerned that the schools shall ground them in sound principles and equip them with sound methods in their relations to social and economic questions. There is a need that engineers shall attack these questions with the same unprejudiced fact-finding, analytical methods they have used with such marked success on material problems. As a balance to these dispassionate, scientific methods there is an equal need among engineers for sympathetic insight into human motives and aspirations and an understanding of the principles which underlie governmental, business and industrial organization."

The report commended the United States Bureau of Education for promoting closer relations between education in business and in engineering and asserted that corporations should aid the country's engineering colleges by contributions to funds for plant and equipment, to general endowments and to current expenses; by endowment of chairs and lectureships and for research; by specific grants for research, establishment of scholarships, employment of teachers for expert services by financial arrangement with the college, and by the use of influence in campaigns for endowment or increased public support.

"The engineering colleges have a strong claim on the assistance of the industries in return for services rendered," continued the report. "The schools have made inestimable contributions to scientific knowledge from which the industries have profited without cost. Education has increased earning power and so has made possible the markets on which many industries depend for existence. The colleges have expended on each engineering graduate from $800 to $2,000 above all fees received. The industries profit by this training and would be compelled to provide costly substitutes for it if it were not available."

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Safety Switches Discussed

The desired qualifications for safety switches were brought out in the safety switch conference held on Nov. 3 by the Philadelphia Section of the Association of Iron and Steel Electrical Engineers. All agreed that the safety switch had advanced greatly in design but that there were some features which needed improvement. An exhibition of safety switches by twenty manufacturers was examined with much interest by the engineers present.

A talk on the advantages of safety switches and points to consider in their selection was given by P. T. Vanderwaart, electrical engineer for the New Jersey Zinc Company. Among the points to consider in looking into switches Mr. Vanderwaart named the following: (1) Are all live parts inclosed? (2) Is it externally operated? (3) Is it possible so to connect it that the safety features are inoperative? (4) Is its construction suitable for the location? Dust-proof? Weatherproof? Vapor-proof or acid-proof? (5) Are all parts strong? (6) Is it tamper-proof? (7) Can the unit or parts be quickly removed, replaced and repaired? (8) Is there ample wiring space? (9) Facility for conduit or open wiring connections? (10) Is provision made for easily connecting test instruments into circuit? (11) Can switch be locked in "off" position? (12) Is it possible to open door with switch closed? (13) Is it possible to close switch with door open, even if interlock is manipulated by hand? (14) Is it possible to touch "'live" terminals when door is open? (15) Is it possible for authorized inspector, and he only, to inspect all parts without interrupting service? (16) Is accidental closing of switch probable or possible? (17) Can "disconnect" be opened under short circuit? (18) Positive make on closing? (19) Quick make? (20) Contact resistance liable to become excessive? (21) Is rupturing capacity sufficient for short circuit? (22) Characteristics of overload device? Effect of zero weather? Adjustable settings for time limit and minimum current to trip? Current time-limit characteristic curve? What deviation is tolerated? Is nonautomatic reset furnished for under-voltage-release service? Volt-amperes? Watts? Temperature rise? (23) Is operation of double-throw motor-starting switch positive? (24) Is switch furnished for under-voltage protection? For under-voltage release? (25) Characteristics of operating coil: Volt-amperes? Watts? Temperature rise? One defect in safety switches mentioned by George W. Richardson, Pencoyd Iron Works, was that blades sometimes pull loose from the handle and keep the circuit closed while externally the switch appears to be open. H. W. Moser, Ballinger Company, and J. R. Bower, American Car & Foundry Company, said that the small sizes of safety switches give general satisfaction. It was the consensus of thought, however, that the large sizes are still imperfect. That the development for severe service should be along the lines of the circuit breaker or the magnetic contactor was the opinion of both J. R. Bower, American Car & Foundry Company, and A. H. Allen, consulting engineer, Philadelphia.

A. S. M. E. Meeting to Include Four Joint Sessions

A feature of the annual meeting of the American Society of Mechanical Engineers, to be held in the Engineering Societies Building, New York, Dec. 4-8, will be joint sessions with the American Economic Association, the American Society of Safety Engineers, the American Society of Refrigerating Engineers and the American Engineering Standards Committee. These sessions are expected to attract engineers, manufacturers, economists, educators and industrial managers from all parts of the country.

L. F. Loree, president of the Delaware & Hudson Company, and E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, will be among the speakers at the economic forum, at which addresses will also be delivered by Dr. W. C. Mitchell of the National Bureau of Economic Research and professor of economics at Columbia University; Prof. H. R. Seager of Columbia, president of the American Economic Association, and Dean Dexter S. Kimball of Cornell.

It is officially announced that John L. Harrington of Kansas City will at this meeting succeed Dean Kimball as president of the A. S. M. E.

Educational Aspects of Power Exposition

The national exposition of power and mechanical engineering, which will open at the Grand Central Palace, New York, on Thursday, Dec. 7, following the annual meeting of the American Society of Mechanical Engineers, will be the first large-scale attempt to display mechanical and power-plant apparatus so that the present state of development will be apparent not only to the technical man but to the layman as well. The development of the electric power station will be illustrated by models of central stations in New York City, the original station erected by Edison in Pearl Street appearing beside the Waterside stations and the recent Hell Gate station, which will be a faithful reproduction built to a scale of one-quarter inch to the foot and showing the steam and electric apparatus and the various boiler-room and turbine-room auxiliaries as well as the machinery for handling coal and ashes. It is planned also to show a model of a large industrial power plant.

Fuel Economy in Europe

Smokestacks in Germany contribute a striking feature to the skyline of each industrial community because of their unusual height. This fact impressed O. P. Hood, the chief mechanical engineer of the Bureau of Mines, who recently returned to the United States after an economic survey of the power and fuel situations in several of the European countries. Mr. Hood was particularly impressed, however, by the fact that no smoke issues from these tall chimneys. He knew there was feverish activity in these plants and that the fireboxes which the smokestacks served were being called upon to furnish their maximum of heat. The fact that smoke rarely is seen above a German industrial plant is the best indication, Mr. Hood points out, that the Germans have learned how to prevent waste of fuel and affords a striking contrast to the smoking plants of America.

Mr. Hood believes American industry could profit enormously by a study of German firing practice. The average German plant burns a fuel having but one-third of the heat value of the commercial coal used in America. Briquetting is resorted to at almost every European coal mine, and after studying foreign processes and methods of distribution, Mr. Hood is more convinced than ever that our large annual waste of fine coal could be greatly reduced by a more general resort to briquetting here.

Mr. Hood is also much impressed with the large expenditure made by the British government at a great laboratory at Greenwich which is devoted exclusively to problems of coal carbonization. As a result the English are well advanced on a work in which this government has not even made a start.

Texas Power & Light Plans a Big Plant on Colorado

The Texas Power & Light Company is investigating conditions with a view to building a mammoth power plant on the Colorado River in the lignite field of Bastrop County, Tex., according to W. B. Head, chairman of the board of directors. Government surveys show that Texas has more than one-half the lignite supply of the United States and that the strata near Bastrop are of good quality and of almost unlimited extent. It is believed that lignite can be successfully used for fuel in a great plant on the Colorado River which can supply power for all the central Texas cities and towns supplied by the Texas Power & Light Company.

The company has recently completed negotiations for taking over the municipal light and power system at Austin, Tex., one of the conditions being that the Austin distribution system be connected with the transmission system of the company. This company's high-tension lines, which now extend south to Taylor, 30 miles from Austin, will be prolonged to Austin.

Street Lighting Corps of New York District, G. E. Company

BELOW is shown a group of street-lighting specialists of the New York district of the General Electric Company who met recently at Swampscott, Mass., to discuss their business problems. The study that is being given to the subject of street lighting is evidenced by the size of this group. The New York district of the General Electric Company includes only the State of New York with small sections of New Jersey, Pennsylvania and Connecticut and comprises only 2 per cent of the area served by the company. Meetings of this kind are held from time to time by the specialists of each district.

Front row: J. A. O'Neill, P. S. Bailey, W. D. Jennings, C. B. Grundy, A. W. Lunn, L. Wintner, A. D. Babson, C. J. Dempsey, G. N. Chamberlain. Back row: T. W. [illegible], F. W. Ralston, I. S. Crocker, R. R. Birge, W. L. Harraden, C. A. B. Halvorsen and A. D. Cameron.

Brief News Notes

Poteau Plant Purchased by Oklahoma Gas & Electric.—The Le Flore County Gas & Electric Company has been purchased by the Oklahoma Gas & Electric Company. R. E. Baird will remain as manager at Poteau. This plant will eventually become a part of the big system which will be served by the three-million-dollar plant now being built by the Oklahoma Gas & Electric Company near Muskogee.

Muscle Shoals Records to Have Wide Distribution.—The printed record of the Muscle Shoals hearing conducted by the Senate committee on agriculture and forestry during the last session of Congress is to be widely distributed. Accompanying the record will be a letter signed by Senator George W. Norris of Nebraska, the chairman of the committee. which summarizes his arguments against the adoption of the development plans advocated by Henry Ford and his congressional supporters.

Work Started on High-Tension Line in Oklahoma.—Construction work has been begun on the 66,000-volt transmission line of the Oklahoma General Power Company, a subsidiary of the Oklahoma Gas & Electric Company, which will connect Fort Smith, Ark., with Muskogee and other Oklahoma cities. This line will be completed by Dec. 1. It will pass through Muldrow, Sallisaw, Vian, Gore and Webbers Falls and will distribute power into Oklahoma from the new three-million-dollar power house near Muskogee on the Arkansas River.

One Word Can Go to Europe by Radio for Six Cents.—For the first time in the history of international communication, the Radio Corporation of America announces the public can send a short message to London or to Germany at a rate comparable with postage charges. The rate announced is 6 cents a word with no minimum requirement. Thus it is now possible for individuals or business houses to send, say, a two-word message, as, for instance, "All well," for only 12 cents plus charges for address and for signature, if any.

Electric Annealing Furnace.—A demonstration was recently given before a large party of engineers at the Canadian National Railway shops in Transcona, Manitoba, of a newly installed electric furnace for annealing parts of locomotives. Expert opinion, according to J. I. Brittain, United States Consul General at Winnipeg, was to the effect that the demonstration was satisfactory in every way and that the furnace proved its economy, as by the annealing process many parts of the locomotive which might otherwise be scrapped can be reclaimed. The furnace is the first of its type to be installed in Canada.

Northern New York Companies Merge.—A certificate filed with the State Department of New York announces the merger of the Ballston Spa Light & Power Company, the Glens Falls Gas & Electric Light Company and the Consolidated Light & Power Company of Whitehall with the Adirondack Power & Light Corporation of Amsterdam.

Genesee Light & Power Absorbs Le Roy Company.—Announcement is made that negotiations have been concluded for the sale of the business and equipment of the Le Roy (N. Y.) Hydraulic Electric-Gas Company to the Genesee Light & Power Company of Batavia. The transfer will be made as soon as the Public Service Commission formally approves the sale. The acquisition of the plant by the Genesee company means the entrance of Niagara power into Le Roy and the surrounding country.

Tidewater Power Company Buys Three Utilities.—Purchase by the Tidewater Power Company of Wilmington, N. C., of the St. Petersburg Lighting Company of St. Petersburg, Fla., the Clearwater Lighting Company of Clearwater, Fla., and the Commonwealth Light & Power Company of Missouri has recently been announced by A. E. Fitkin, president of the Tidewater company. A bond issue of $4,000,000 will be floated by the Tidewater company to take care of its purchase and other improvements, which add eighty-five communities to the list of those now served by this corporation.

X-Ray at 200,000 Volts.—A demonstration of a new X-ray apparatus built by the General Electric Company on plans worked out by Professors Hull, Collidge and Davis was made at the Croker cancer research laboratory at Columbia University, New York, last Sunday. It is intended to use this X-ray apparatus, described as the most powerful ever built, in the treatment of cancer. It is so powerful that no one is admitted to the room where it is producing rays. The machine will, it is asserted, drive rays through a quarter of an inch of lead, a foot of aluminum and two feet of brick. It will photograph the bones of the hand at a distance of many feet.

Good Record of Electrically Driven Ship.—An extremely low maintenance cost of propelling machinery in spite of severe service, which included the towing of a vessel nearly 1,000 miles, is the performance of the ship *City of Weatherford*. The records of this 9,000-ton vessel show that she traveled 73,956 miles in the past two years and that the total cost of repairs to her Westinghouse geared-turbine propelling machinery in that period amounted to less than $1,000. On her latest trip, which was from Hull, England, to New Orleans, she towed the *Federal*, also a 9,000-ton ship, to Mobile Bar. In spite of this severe strain on her driving equipment, an inspection made after the trip showed that the machinery was in first-class condition.

Associations and Societies

Electrical Supply Jobbers' Association, Pacific Division.—The regular quarterly meeting of this division will be held at the Hotel Coronado, Coronado, Cal., on Dec. 7, 8 and 9.

Taylor Society.—The Taylor Society will meet at the Engineering Societies Building, New York City, from Wednesday to Friday of next week, Nov. 22 to 24. Organization and management of a medium-size plant, statistical compilation, master budgets of sales and production, reduction of waste and supervision of personnel are among the topics announced.

Coming Institute Meetings.—Some of the meetings of A. I. E. E. sections still to be held this year are: Akron, Nov. 28, "The Story of an Electric Meter," by R. J. Andrews, Sangamo Electric Company; Boston, Nov. 23, "Commercial Aërial Development," and Dec. 12, "Standards — Accomplishment, Trend and Goal," by P. G. Agnew, with discussion by Comfort A. Adams, D. C. Jackson and others; New York, Nov. 24, "The Electrical Engineer on Shipboard," by G. A. Pierce of William Cramp & Sons; Philadelphia, Dec. 11, "Machine Switching," by F. J. Chesterman; Pittsfield, Nov. 23, "Grinding and Abrasives," and Dec. 5, "In Unknown Baffin Land"; Schenectady, Dec. 1, L. T. Robinson, director General Electric engineering laboratory; Toronto, Nov. 24, "Grounded Versus Ungrounded Neutral"; Worcester, Dec. 21, "Vacuum Tubes," by H. H. Newell, Worcester Polytechnic Institute.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Electrical Supply Jobbers' Association — Cleveland, Nov. 20-24. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Physical Society—Chicago, Dec. 1 and 2. D. C. Miller, Case School of Applied Science, Cleveland.

American Society of Mechanical Engineers —New York, Dec. 4-8.

Electrical Supply Jobbers' Association, Pacific Coast Division—Coronado, Cal., Dec. 7-9. A. H. Elliot, 502 Flatiron Bldg., San Francisco.

New York Electrical Credit Association—New York, Dec. 14. W. J. Kreger, 47 W. 34th St., New York.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Western Association of Electrical Inspectors —Chicago, Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Assciation Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

American Institute of Electrical Engineers —New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Recent Court Decisions

"Proximate Cause" Defined.—"Proximate cause," said the Supreme Court of Appeals of Virginia in a recent damage suit, "is a superior or controlling agency as distinguished from those causes which are merely incidental or subsidiary to such controlling or practical cause, and it does not necessarily imply closeness or nearness in point of time or physical sequence of events, but rather closeness or nearness in causal connection." (113 S. E. 711.)*

Appeal from Former Rate Order Does Not Prevent Commission from Passing on New Application Based on Different Facts.—In City of Bluefield vs. West Virginia Public Service Commission the city sought to prevent the commission from hearing an application for a temporary increase in the rates of a water company because a previous hearing had resulted in an increase with which the company was not satisfied and there had been an appeal to the courts which finally awaited adjudication in the United States Supreme Court. The West Virginia Supreme Court of Appeals has overruled the city's contention and declared that the commission has jurisdiction to fix a temporary rate based on different facts from those previously alleged. (113 S. E. 745.)

Minimum Wage Law Declared Invalid.—The Court of Appeals of the District of Columbia has declared unconstitutional an act passed by Congress fixing a minimum wage for woman workers in the District. Holding that if Congress may establish a minimum wage for women, it may also establish a maximum wage for men, the court denies that the act is a proper exercise of police power. "No greater calamity could befall the wage earners of this country," it says, "than to have the legislative power to fix wages upheld. It would deprive them of the most sacred safeguard which the Constitution affords. Take from him the right to freely contract and sell his labor for the highest wage which his individual skill and efficiency will command, and the laborer would be reduced to an automaton—a mere creature of the state. It is paternalism in the highest degree, and the struggle of the centuries to establish the principle that the state exists for the citizen, and not the citizen for the state, would be lost. . . . The modern tendency toward indiscriminate legislative and judicial jugglery with great fundamental principles of free government, whereby property rights are being curtailed and destroyed, logically will, if persisted in, end in social disorder and revolution. Let no one imagine for a moment that our civilization is such that property rights can thus be socialized without the grossest abuse of the privileges granted, or that the restraint of the abuses can be left with safety to legislative or judicial discretion."

Deliberate Negligence of Lineman Bars Recovery of Damages.—Asserting that where an experienced lineman undertook to transfer wires to a new pole in the midst of a network of wires, some carrying a deadly current, without grounding them, as required by a rule of his employer, and in the absence of any showing of an extraordinary situation requiring the sudden exercise of judgment or discretion, he was guilty of negligence, the Supreme Court of Arizona reversed a verdict for damages obtained in Hayes vs. Arizona Power Company. Testimony that the lineman was doing the work in the usual manner and that it was the practice of linemen to take the risk he incurred did not, the court held, excuse the violation of the rule or prove acquiescence therein by the employer. (209 Pac. 280.)

When Must Question of Contributory Negligence Go to Jury?—In Winters vs. Calumet & Arizona Mining Company damages were sought for the death of an electrical worker who in some way came into contact with electric current while employed in wiring a switchboard. The defendant company introduced evidence to show that the only possible way in which the contact could have been made was by the deliberate act of the victim in reaching behind a board erected for protection and touching a fuse terminal. On the other hand, a fellow workman testified that he and the man killed were standing close together when the accident occurred, both engaged in bending a wire, and that he did not see the decedent touch the fuse terminal or put his hand back of the board. The Supreme Court of Arizona refused to reverse a verdict for the plaintiff, declaring that the question of contributory negligence was, on the testimony, rightly submitted to the jury. (209 Pac. 298.)

Federal Permits for Electric Lines Across Indian Reservation Not Terminated by Issue of Patents to Land Crossed.—In Swendig et al. vs. Washington Water Power Company the United States Circuit Court has affirmed the judgment of the District Court in favor of the appellee and forbidding interference by the appellants with its high-tension transmission lines or its telephone lines crossing a former Indian reservation on the route of the company's Spokane-Boise system. Right to carry these lines across the reservation was granted, under the federal law, by the Secretary of the Interior in 1902. In 1906 the reservation was opened to settlement, and the contention of the appellants was that by the issuance of patents to them the United States government automatically canceled its authorization of the company's right-of-way. The courts have found that in the absence of any revocation of the permits originally granted the rights granted by the Secretary of the Interior were not terminated and that the patents to land subsequently issued were subject to them. (281 Fed. 900.)

Commission Rulings

"Deficit Method" of Determining Development Cost Condemned.—In adjusting gas rates for the Pacific Power & Light Company the Oregon Public Service Commission said that the "deficit method" of determining development cost, which includes operating losses even back into the pre-regulatory period or which permits past poor management to be an increment of value, does not justify serious consideration, but a practical allowance for this cost may be made by estimating the deficit in return experienced in the period next following construction during which the reasonably expected business is being acquired.

Is a Connection Charge of $500 to Rural Customers Too Great?—The Wisconsin Railroad Commission in adjusting rates for the Fall River Light & Power Company characterized the company's contract connection rate of $500 as "rather high," but pointed out that if twelve additional customers along the present line were secured, the charge would be reduced to $293. "The company has stated," the commission observed, "that it does not expect the rural consumers on the present lines to contribute further toward the cost of the main lines and that future connection charges will be divided among the consumers then on the line. This appears to us to be an equitable arrangement."

Normal Construction Period.—In evaluating an acquisition to a municipal utility at Oroville, Cal., the California Railroad Commission pointed out that estimates must be predicated upon a normal and reasonable construction period under normal and reasonable construction conditions and that this rule must have its influence on labor and material cost and on the so-called overhead allowances applied to an inventory. "No public utility plant of any size can be built in one day," said the commission. "It is true a contractor may submit a bid for a piece of construction as of a particular day and may be held to the contract price. But this test does not meet the issue. The contractor, before he makes the bid, will of necessity have to estimate upon an expected construction period and will have to take into consideration expected costs of labor and material and overhead during such construction period."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Dr. Wheeler Sails to Investigate Conditions Abroad

Dr. Schuyler Skaats Wheeler has sailed on the *Homeric* for Europe. He will be one of the American representatives at the annual congress of the International Electrotechnical Commission, which opens at Geneva, Switzerland, next week. He will be accompanied by his wife and will spend several months abroad investigating conditions in electrical centers. Dr. Wheeler is a former president of the American Institute of Electrical Engineers. In addition to his mission at the electrotechnical congress, he will attend a number of meetings of scientific societies interested in electrical manufacturing and its problems and will be the guest of the leading societies in the countries to which he has been invited.

S. S. WHEELER

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Charles A. Dean has been appointed manager of the appliance department of the Connecticut Light & Power Company, Waterbury, Conn. Mr. Dean is well known in New England central-station circles, having been merchandising manager of the Cambridge (Mass.) Electric Light Company for a number of years and more recently manager of the Middlesex County Electric Company, East Pepperell, Mass.

E. C. Deal, general manager of the Springfield (Mo.) Gas & Electric Company, which is controlled by the Federal Light & Traction Company of New York City, has recently returned to Springfield after a business trip to New York. According to the plans which the Federal Light & Traction Company has under consideration, Mr. Deal will be required to spend much of his time looking after properties in other cities. Heretofore he has confined his activities to the Springfield office, with which he has been associated for five years.

Dr. Albert Einstein of Germany, identified with the theory of relativity, has been awarded the Nobel prize for physics for 1921 by the Stockholm committee which has charge of distributing the prizes under the Nobel foundation.

Gelasio Caetani, the recently appointed Italian Ambassador to the United States, is well known among American engineers. Immediately after his graduation from the University of Rome, where he completed the course in civil engineering, he came to the United States and entered Columbia University. There he took the complete mining engineering course and then went to California, where he joined the staff of F. W. Bradley. Later Mr. Caetani formed a partnership with Albert Burch and Oscar Hershey. This firm did a flourishing consulting business, with headquarters in San Francisco. When war was declared Mr. Caetani retired from the partnership and returned to Europe.

William Baum, president of William Baum & Company, consulting industrial engineers of Milwaukee, has been appointed vice-president of the National Society of Industrial Engineers in charge of research. Mr. Baum has been a resident of Milwaukee for a number of years. Just prior to his founding the company which bears his name he was for several years research engineer of the Milwaukee Electric Railway & Light Company. From 1915 to 1917 he was dean of the School of Engineering of Milwaukee. From 1903 to 1915 he was with the General Electric Company, where he was closely associated with Dr. Steinmetz. He has a number of inventions in electricity to his credit which are now used in the home and the industrial world.

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Dinner to English Engineer

A group of about thirty-six engineers gathered at dinner at the Engineers' Club in New York on Friday, Nov. 10, as guests of the New York Edison Company, in honor of W. H. Patchell, vice-president of the Institution of Mechanical Engineers (of Great Britain). Mr. Patchell will sail for England on Nov. 25 after a two months' stay in this country, where he has been investigating American central-station practice and acting as an adviser to some American central-station companies, particularly the Detroit Edison Company. Mr. Patchell is well known for his pioneer work in the steam end of central-station work.

F. F. Rohrer Made Westinghouse General Contract Manager

F. F. Rohrer, assistant to manager of both the power and railway departments of the Westinghouse Electric & Manufacturing Company, has been appointed general contract manager of the company. Mr. Rohrer, who was born in Harrisburg, Pa., in 1876 and attended school there until 1895, entered the employ of the Westinghouse company as a student in 1896. After serving in the shops for four years, where he obtained extensive training in the manufacturing and testing departments, he was transferred to the sales department, where his services have included a number of positions of responsibility. During the world war Mr. Rohrer was a member of the committee of the War Industries Board appointed to conserve the production of turbo-generating equipment for government needs. After the armistice he became the representative of the Westinghouse company in the settlement of contracts which were terminated as a result of the ending of the war. In his new position Mr. Rohrer assumes responsibility for service to customers under contracts and will have general supervision of all contract and order work of the company. In addition, he will continue to have direct charge of the contract work of the power and railway departments, duties which he performed in his previous position.

F. F. ROHRER

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H. M. Camp was recently appointed lighting sales manager for the Chattanooga division of the Tennessee Electric Power Company, succeeding L. J. Wilhoite, who has resigned after thirteen years' service with the company to assume the position of advertising manager of the Chattanooga *Times*. Mr. Camp has been associated with the company since 1917, when it was known as the Chattanooga Railway & Light Company. He was exceptionally successful as salesman and was promoted to assistant lighting sales manager in February, 1921. He has held that position until the present time.

A. E. Baron, formerly assistant to the comptroller of the San Joaquin Light & Power Corporation, is now connected with the Southern California Edison Company's stock sales department.

J. S. Pevear, manager of the Birmingham Railway, Light & Power Company, was recently appointed co-receiver of this company with Lee C. Bradley, who will take a long trip on account of ill health.

F. D. Van Winkle is now president of the Mount Hope Electric Power & Water Company, Mount Hope, W. Va., replacing George A. Waldo, who was president and manager. A. M. Rosenblatt has become the general manager.

Allan A. Searle, formerly assistant treasurer and auditor of the Bronx Gas & Electric Company, has been advanced to the position of secretary. Mr. Searle resigned as statistician of the Westchester Lighting Company, Mount Vernon, N. Y., in March, 1918, after having been with the organization nine years, to become associated with the Bronx Gas & Electric Company.

John P. McGreevey, superintendent of the Utica Gas & Electric Company in Little Falls and Herkimer County, N. Y., has been promoted to the position of general superintendent of the entire district surrounding Utica. Mr. McGreevey has been superintendent of the Herkimer County district for several years and was formerly in Ilion. Mr. McGreevey's headquarters are in Utica.

Harry D. Stokes has resigned as power engineer of the Worcester (Mass.) Electric Light Company and will soon enter the electrical supply and contracting field at Rochester, N. Y. Mr. Stokes is widely known in New England central-station circles and also in the other branches of the industry, having served as chairman of the Worcester branch of the National Association of Electragists.

J. W. Carpenter, vice-president and general manager of the Texas Power & Light Company, with offices in Dallas, addressed the Rotary Club of Brownwood, Tex., on community building recently, pointing out that the greater the number of users of electricity in a community the greater the convenience and the lower the cost. The speaker urged community co-operation in electrification.

Edward D. Learned has been appointed head of the power sales engineering department of the Worcester Electric Light Company, succeeding H. D. Stokes. Mr. Learned was educated at the Worcester Polytechnic Institute and after about six months' experience with the Dublin (N. H.) Electric Company joined the power sales staff of the Worcester company, where he has been for the past ten years. Of late he has given special attention to industrial electric heating problems in addition to the sale of commercial power in the Worcester company's territory.

W. W. Sayers of the Link-Belt Company has recently been promoted to the position of chief engineer of the company's Philadelphia works and Eastern operations. For many years Mr. Sayers has been the representative of the company in the Chicago territory in the lines related to power-house machinery, coal storage, Peck carriers, crushers, etc., and later in charge of the locomotive-crane department. His headquarters will be in Philadelphia.

Officers of the Denver Electrical Co-operative League

The Denver Electrical Co-operative League has selected as chairman of the advisory board John J. Cooper, head of the Mountain Electric Company and long recognized as one of the leaders of the industry. Mr. Cooper succeeds E. C. Headrick. The new chairman is a director of the Rocky Mountain Utilities Committee and is the head of several public service organizations in the state. He was one of the organizers of the league in Denver.

J. J. COOPER

Charles N. Shannon of the Shannon electrical firm was chosen vice-chairman; R. W. Elliott, sales manager of the Albert Sechrist Manufacturing Company, secretary, and O. L. Mackell, chief clerk of the Denver Gas & Electric Light Company, treasurer.

The advisory board will include, in addition to the officers, N. E. Lawrence, B. C. Watts, J. C. Davidson and J. W. Ryall for the jobbers; J. Fischer, E. A. Scott and E. C. Headrick for the contractor-dealers; H. Alex Hibbard, G. O. Hodgson and J. P. Sprunt, Jr., for the manufacturers, and R. G. Gentry, Clarence Keeler and F. F. McCammon for the central station.

C. E. Skinner, assistant director of engineering of the Westinghouse Electric & Manufacturing Company, has been reappointed a representative of the American Institute of Electrical Engineers upon the American Engineering Standards Committee for a term of three years commencing Jan. 1, 1923.

W. M. Green, engineer for the United States Reclamation Service, in charge of investigations of various possible reclamation projects in Utah, is at present engaged in compiling and writing his report on the Weber and Ogden River end of the so-called Provo-Weber project. He will submit this as a separate unit of his complete report to F. E. Weymouth, chief engineer for the service. Another report will be made later on the Provo River, and also one on the Tooele County end of the project. In addition, a report will be made on the Dead Man's Bench project, on the lower White River, in Uintah County, where the field work is now being completed in charge of R. R. Robertson.

Obituary

William A. La Due, division superintendent of the Public Service Electric Company, Jersey City, N. J., died recently. He had been in electrical work in Jersey City for many years.

Thomas S. Haddaway, engineer for the steam engineering department Union Electric Light & Power Company, St. Louis, died after a brief illness recently at his home in Webster Groves, Mo.

C. F. Larzelere, vice-president of the American District Telegraph Company in Brooklyn, N. Y., from 1902 until 1910, died there recently in the Methodist Episcopal Hospital. Mr. Larzelere was connected in many enterprises with the late Dr. Louis Kloepseh.

J. Buntzen, who was the first general manager of the British Columbia Electric Railway Company, died recently at Copenhagen, Denmark, the place of his birth. In 1890 Mr. Buntzen left Denmark and settled in Vancouver, B. C. He became associated with the Vancouver Electric Railway & Lighting Company, which later went into bankruptcy and was acquired by English capitalists, together with other bankrupt electric railways of New Westminster and Victoria. The new concern was known as the Consolidated Railway & Light Company, and Mr. Buntzen became its business manager. The company was then sold, and after it was forced into liquidation the British Columbia Electric Railway Company, Ltd., was organized to take over the business. In 1898 Mr. Buntzen became general manager. During eight years of strenuous labor, when the franchises of the company were in a chaotic condition, he accomplished remarkable results. When a partial failure in health compelled him to give up office in 1905, the board of directors made him managing director with headquarters in London, a position which he held for some years, and he was still retained in an advisory capacity when he died. Mr. Buntzen was sixty-three years of age.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic
Problems of the Producer and Distributor, with Market Reports, Trade
Activities, Foreign and Construction News

Cost in Selling Washing Machines

By E. B. SEITZ

Secretary American Washing Machine Manufacturers' Association

JOHN F. GILCHRIST, vice-president Commonwealth Edison Company, Chicago, recently presented two papers before electrical conventions discussing central-station merchandising costs and policies. In these papers, which have both been published in the *Electrical World*, he submitted figures on the cost of selling appliances by nine large central stations, showing that they are all suffering large losses on their merchandising activities. Mr. Gilchrist cited as a detailed example the cost of selling electric clothes-washing machines in the Commonwealth Edison Company's electric shop. He urged better cost accounting by central stations and recommended that prices should be raised to produce a profit. The manufacturers of washing machines have taken exception to the washing-machine figures given by Mr. Gilchrist, holding that they are not representative of proper selling costs according to the best practice, and while heartily indorsing his plea for a better knowledge of merchandising expense, submit this brief in rebuttal. It is published as a further valuable contribution to this important discussion.

Mr. Gilchrist's paper was in no sense a reflection upon the washing-machine industry. It was a deliberate and courageous effort to focus the attention of the central-station industry on the facts which he has uncovered. It is perhaps unfortunate that he cited specific figures on only one appliance and that this discussion has centered on washing machines, when the principle at issue involves all appliances and what is needed is cost facts on central-station and dealer merchandising throughout the country. The Gilchrist papers and this statement should be studied by every central-station executive, for merchandising efficiency, adequate turnover and the pricing of goods must all be based on a true knowledge of what it does cost and should cost to sell.

THIS is no attempt to start a controversy by debating with John F. Gilchrist the various issues raised by him in his recent address at French Lick Springs before the Great Lakes Division of the National Electric Light Association, which address was printed in the *Electrical World*. My purpose in issuing this statement is twofold — first, to emphasize the gospel truth of the major part of Mr. Gilchrist's views as expressed in this address; second, to point out wherein, in my judgment, Mr. Gilchrist is in error.

It is after considerable hesitation that this statement is given to the public, this hesitancy having been based on an unwillingness to detract one jot from what I interpret to be Mr. Gilchrist's real purpose, that is, to impress on central-station companies the imperativeness of a separate accounting of their commercial business and their regular energy-selling business. And if Mr. Gilchrist had not singled out washing machines and had not shown the very expensive operation of the Commonwealth Edison Company in merchandising washing machines, and had there not been such widespread publicity given to his address which contained the statements concerning washing machines, this article would not have been prepared.

Points in Agreement. — Both manufacturers and those engaged in selling will, I believe, agree with Mr. Gilchrist on the following points:

1. That central stations can be leaders in appliance merchandising.
2. That central stations should co-operate with and encourage independent dealers and should set a pattern of ethical and profitable conduct of business.
3. That merchandising of appliances should be done at a profit above all charges which would prevail in a separately maintained business, provided, first, that the division of overhead is reasonable, and, second, that there is aggressive salesmanship.
4. That business should be vigorously pushed by using advertising and outside sales force.
5. That washing machines are a specialty and must be merchandised as such.
6. That retailers should know their cost and understand what "spread" is necessary.
7. That there is danger of educating the public to a fictitious price that cannot in reason endure.
8. That price is not such an essential as many believe it to be, for it has been proved that low prices will not necessarily produce volume.
9. That central stations can obtain a volume on appliance sales equal to the sale of electricity to residence consumers.

In discussing more fully the above-named points of agreement it should be noted that the central station that is going seriously about the business of selling appliances and has a commercial manager who is trained in merchandising is for the most part a leader in the community in appliance merchandising.

The Real Co-operation.—Central stations can develop a very friendly co-operative spirit with independent dealers as the Commonwealth Edison Company in Chicago has done. It is good business from the standpoint of selling energy to encourage the scores of smaller dealers in each community to help load the lines during that part of the twenty-four hours that is usually a valley in the load curve of the system. But it is an impossibility to develop such co-operation if the central station company is a "price cutter" and fails to conduct its appliance business under a "live and let live" policy.

It has been my observation, especially in smaller communities, that in the past much of the opposition to central stations in their applications for a revision of their rates has emanated from the independent dealers of electrical merchandise because the dealers have been incensed over the merchandising policies of the central station. This is fast being remedied, and it is much to be wished that for the sake of the great electrical development program of this country the broader co-operative spirit shall universally supplant the selfish one.

Dividing Overhead the Problem.—In the segregation of accounts, or, in other words, in making a business stand on its own foundation, comes the very intricate question of dividing overhead. Since the cost of promoting energy sales and the expense of appliance merchandising are interwoven so thoroughly, the point of division remains too much a matter of opinion. Perhaps no agreement can be arrived at nor any solution found until figures are obtained not only from central stations but from allied lines selling appliances. I think it is apparent that this is both the rub and the crux of the entire matter. Overhead is such a large percentage that one can show either a profit or a loss on this separated appliance business by his determination of just how overhead is to be divided. When all of these data—which we hope will be collected—are obtainable, this segregated central-station appliance business can not be compared exactly with that of a dealer unless there has been just as aggressive salesmanship on the part of the central station as there has been on the part of the independent dealer.

Manufacturers Must Be Prosperous

Satisfactory Profits Necessary.—Washing machines are not self-selling staples. This has been brought very much to mind since we have entered a buyers' market. As regards the merchandising treatment which washing machines can receive, retailers must know positively on the basis of their margins to what expense they are able to go to obtain volume. Manufacturers of washing machines are just as desirous as any other group that dealers shall know their cost. The growth of the industry depends upon the satisfaction and prosperity of those engaged in the manufacture and distribution of its product. There can be no argument on this point.

Standardizing a Fictitious Price.—There is not yet in the minds of the public a standardized price on washing machines. There is grave danger that the public may be educated to a price that cannot permit of the manufacture and merchandising of washing machines at a profit. There has been genuine interest in watching the experiment of the Commonwealth Edison Company of lengthening its "spread" on washing machines, but it is to be regretted that the experiment is somewhat upset by the company's having saddled on its washer, as is manifest in Mr. Gilchrist's chart of figures, the enormous burden of a costly merchandising system. Further reference will be made to this subject later.

Consumer Pays Cost of Payment Plan

Cost of Time-Paper.—Mr. Gilchrist states that "the deferred-payment plan means high cost of financing, for it introduces the cost for carrying of accounts." Yet in his chart of figures he does not show where his company has absorbed any deficit caused by that operation. Then we are to assume that the additional charge of $17.22 contained in the deferred payment price of $192.20 is sufficient, and that in this company's case, as in practically all deferred-payment prices, the real cost of the privilege of paying over a period of months has been passed on to the consumer.

Cost of Doing Business.—The statement is made, first, that it is "suspicioned" that the average cost of doing business was somewhere in the neighborhood of 37½ per cent. Later the statement is made that the cost of doing business *is* 37½ per cent. It is our contention that this quoted figure is a guess pure and simple, for in the absence of segregated accounting, which Mr. Gilchrist so warmly urges, how can it be other than a guess?

"Spread" on Washing Machines.—The alleged absorption of merchandising losses of central stations has not misled manufacturers. If there exists in the washing-machine business too low a "spread" between factory cost and list price, it is a fault that has been handed down since the earliest days of the industry and which existed long before central stations became a factor in the merchandising of washing machines. The manufacturers have not ignored the question of what spread is essential, and our group, at least, has been giving during the past year very active thought and investigation to the study of costs. This forward-looking movement has been undertaken that we may be ready when the time comes for all factors to gather about the conference table.

Price Levels.—While it is quite true that economists and students of affairs say that we are in for a long period of declining prices, this does not apply to electrical appliances in general. Back in the days of the little red schoolhouse, there used to be a saying at the water bucket, when the dipper of water was tossed in the air, "All that goes up must come down on head or ground," but in the case of appliances there has been nothing that has gone up, that is, in relation to prevailing costs. So they cannot be expected to come down.

Prices Advanced 72 per Cent Since 1913

In the period from 1913 to the peak it has been proved that the electrical industry showed an advance of about 72 per cent in prices. Washing machines during this period had an advance of 59 per cent. When this is compared with the peak level of all commodities it appears quite low, and when compared with the present level it is found to be still under the advance of all commodities over 1913. A joint analysis of cost will undoubtedly show that the manufacturer cannot absorb all of any reduction in factory prices.

Are They Losing Money?—I am loath to believe that Mr. Gilchrist subscribes to the content of the letter which he cities as having been received from a Middle West dealer. This is not a typical letter, but an exaggerated case of a dealer who acknowledges that a persuasive salesman "loaded him up." In September, 1922, there were 42,000 electric washing machines sold. How long would the washing-machine dealers of this country continue if they incurred a monthly loss of $345,240, at the rate of $8.22 per machine, or of $1,050,000, at the rate of $25 per machine, which Mr. Gilchrist puts as a maximum for their loss? The fact that, with the exception of July, the sale of electric washing machines has gained each month in 1922 over the sales of the preceding month would further contribute to the belief that dealers on the whole are finding the merchandising of washing machines to be a profitable business. They could not absorb such terrific losses as those mentioned above—that is, from one-third of a million to over one million dollars monthly—and continue to come back for more.

Type of Salesmanship.—While much depends upon the definition of salesmanship, it is seriously doubted that, be the definition what it may, the statement that "the highest type of salesman's service is required to sell washing machines" can stand as correct. Washing machines have not been sold by highly trained salesmen, and even the very generous commissions indicated as paid by Mr. Gilchrist would not procure the services of the highest type of salesman.

Turnover.—Mr. Gilchrist quite ignores the importance of turnover. Yet making capital work many times is just as sound in the business of selling washing machines as in any other business. It is better to sell monthly twenty machines at a net profit of $5 per machine than four machines at $15 net per machine or one machine at a loss of $5. Also, according to our figures, Mr. Gilchrist is in error when he states that his company is selling over one-half of the washers that are sold in Chicago.

Whose Operation Costs the Less?—The assumption on the part of Mr. Gilchrist that the independent dealer's cost of doing business is greater than the central station's cost of doing business we must disagree with. He states that if independent dealers buy at the same price that central stations do and central stations sell at the same price that independent dealers do, the much larger profit of the central stations could be well spent in assuming greater responsibility in publicity—the advertising of washing machines to the community.

I believe it is quite commonly appreciated among the trade that independent dealers, not having the burden of overhead that central stations have in the past been throwing on their appliances, can merchandise much more cheaply. This higher cost will in the main be equalized when central-station accounting recognizes in the division of the overhead burden the dual capacity of a central station—namely, the two functions of selling energy and merchandising electrical products and appliances that use that energy and produce new consumers for the company. The major part of the overhead burden should attend the first of these two operations, for the executives are engaged largely in fostering and retaining good will for the prerogatives of their company's franchise.

COMMONWEALTH COSTS IN DOLLARS

I believe the most grievous wrong that Mr. Gilchrist has done the washing-machine industry is giving publicity to a chart of figures showing the operative cost of the Commonwealth Edison Company in merchandising washing machines, when that chart does not include more detailed information. Let us look first at the chart of figures reproduced here on the "average cost of selling type 'L' washers," reducing his precentages to dollars and cents.

The comparison is difficult because the chart presents its figures on the percentage basis. A charge of 2.5 per cent for buying in July does not look so bad written as a percentage, but when it is known that this means that the washing machine must carry a cost of $4.37½ for the support of a purchasing department whose sole duty in buying the Federal electric washer consists of ordering from the Federal Electric Company, a company closely allied with the Commonwealth Edison Company, what independent dealer or even central station manager is going to see anything in that load that is comparable with his own case?

Again, occupancy for July is 4.2 per cent, but this in dollars and cents means that for the very high-priced floor space that the washing machine occupies in the Commonwealth Edison's "Loop" and branch stores each must carry the burden of $7.35. In his chart of figures he has allowed for commissions, bonuses, demonstrating, delivery and salesmen's automobiles together with salaries, yet in addition to this comes the administration burden in July of $21.35 per machine. The point of cleavage for all overhead will have to be moved several notches in the opposite direction before the washing-machine merchandisers of this country will have much sympathy for a great company that by its books can show a loss of $24.85 per machine in July as long as that machine carries with it an overhead of $21.35 for administration alone.

TABLE I AVERAGE COST OF SELLING TYPE "L" WASHER BY COMMONWEALTH EDISON COMPANY

(List Price $175)

	June		July	
	Percentage	Amount	Percentage	Amount
Average allowance	1 2	$2 10	2 9	$4 57½
Average premium	1 7	2 97½	2 5	3 87½
Average cash discount...	0 3	52½	0 6	1 05
Average price reduction	3 2	5 60	6 0	10.50
Average selling price	96 8	169 40	94 0	164 50
Cost of type "L" washer	54 0	94 50	54 0	94 50
Gross profit per type "L" washer ...	42 8	74 90	40 0	70 00
EXPENSES:				
Selling:				
Commissions	17 8	31 15	18 7	32 72½
Bonus	0 8	1 40	0 8	1 40
Demonstrating	1 4	2 45	1 7	2 97½
Salaries, adjustments and sundries	1 6	2 80	2 2	3 85
Delivery and salesmen's automobiles	4 0	7 00	5 7	9 97½
Repairs	1 1	1 92½	1.6	2 80
Total selling	26 7	$46 72½	30 7	$53 72½
Buying	2 1	3 67½	2 5	4 37½
Occupancy	3 6	6 30	4 2	7 35
Publicity	4 9	8 57½	4 6	8 05
Administration	8 5	14 87½	12 2	21 35
Overhead expenses	19 1	$33 42½	23.5	$41 12½
Total expenses	45 8	80 15	49 4	94 85
Average loss	3 0	5 25	14 2	24 85

ANOTHER CHICAGO RETAILER'S COST

For the purpose of comparison I obtained a chart from the books of another company that is doing a retail business in Chicago. The comparison of these two charts is fair for the reasons that they reflect practically the same amount of business for the month taken, that they cover the same midsummer month, and that in each instance the management of the store is very closely allied with the manufacturer of the machine handled.

TABLE II —COST OF SELLING WASHERS BY ANOTHER CHICAGO RETAILER—SAME MONTH

	Amount	Percentage
Net sales	$52,964 10	100 00
Cost of machine	33,773 40	63.76
Gross	$19,190 70	36 24
EXPENSE:		
Selling:		
Commission	$2,970 11	5 61
Salaries	5,211 66	9 84
Demonstrations	333 44	0.63
Services and repairs	239 38	0.46
Delivery	631 19	1 29
Miscellaneous: postage, telephone, lights, sundries	1,184 81	2 13
Total	$10,570 59	19 96
ADMINISTRATIVE:		
Rent	$3,310 00	6.25
Reserve for bad accounts	264 56	0 50
Advertising	1,689 99	3 19
Insurance	41 00	0 07
Total	$5,305 55	10.02
Total expense	15,876 14	29 98
Net profit	3,314 56	6 26

For further comparison still a third chart is shown which reflects the September operations of a Kansas City store also very closely allied to the manufacturer of the washing machines which it sold.

TABLE III COST OF SELLING WASHERS BY KANSAS CITY RETAILER IN SEPTEMBER

	Amount	Percentage
Net sales	$17,835 25	100 00
Cost of machines	10,701 15	60 00
Gross	7,134 10	40 00
EXPENSE:		
Advertising	747 50	4 19
Automobile expense	40 87	0 23
Depreciation	87 30	0.49
Freight, express and drayage	268 38	1 5
General expense	183 09	1 02
Telephones, light and water	34 74	0 19
Insurance	27 88	0 15
Interest	175 20	0 98
Office expense (including postage)	39 77	0.22
Rent	376 42	2 11
Salaries	906 82	5 08
Selling expense	1,453 10	8 14
Taxes	41 34	0 23
Discounts	20 01	0 11
	$4,402 42	24 67
Gross profit	$7,134 10	40 00
Total expense	4,402 42	24 67
Net profit	$2,731 68	15 33
Merchandise inventory	$8,960 22	

Where the Solution Lies.—Other charts are obtainable that would reflect much the same story. No doubt, too, Mr. Gilchrist could obtain charts from other large central stations that would reflect expensive operating costs similar to those of the Commonwealth Edison Company, *but to what avail?* The real solution includes the program announced by Mr. Gilchrist, that retailers must set up accounting that will show accurately their cost of operating and that central stations must separate their accounts so as to reflect the true cost of merchandising appliances, but it does not end there. Manufacturers have just as keen interest as the merchandiser in seeing that the accounting system reflects the cost of every service rendered in the merchandising of washing machines, because the spread and the discounts depend entirely on, first, the total cost of all of these services, and, second, on how many of the total services the dealer performs. For it all sooner or later comes down to this: *Discounts on washing machines must be based upon services rendered.* This applies to the jobber as well as to the dealer.

It is wholly unfair that the dealer who waits for a limited amount of business to come to him and obtains it because of the aggressiveness of the other fellow's advertising and the general washing-machine atmosphere that has been created in his community by his competitor should receive the same discounts as those who do sales-creative merchandising. I believe that the time is not far distant when jobbers and dealers in this country will be classified according to the services they are prepared to render and do render, and that discounts will be graded accordingly.

And finally, in the consideration of all that Mr. Gilchrist has said and that I have written here, it must be kept in mind that executives of our country's great central stations must fully comprehend the profound import of this fundamental axiom: "The future of the central-station industry depends upon the invention, development and general application of devices designed to utilize electrical energy in the accomplishment of the tasks of human existence."

Survey of Business Conditions

Printers' Motors Total 53,614, Census Report Shows

Only three lines of industry in the United States exceeded printing establishments in the use of electric motors for power, according to a late census report. The number of offices reporting the use of electricity for power were 12,735. There were more planing-mill customers, a few more bakers and a few more automobile-repair shops, but none of these had as many motors installed. Printers' motors numbered 53,614 and were exceeded only by iron and steel mills and foundries, by cotton mills and by electric shops. All told, 1,483,039 electric motors were working in 237,855 industrial plants in the country, an average of about six per plant.

◆

Tree Lamp Sales Will Be Ten Times Larger than in 1916

Christmas-tree lamp sales in 1922 will be ten times the amount of sales in the year 1916, according to an estimate just issued by the National Lamp Works of the General Electric Company. In 1917 there was an approximate increase of 80 per cent, it is stated. During 1918, the war year, and 1919 the sales rose to over 100 per cent above the 1916 level and soon mounted to the 675 per cent mark. At the end of 1921 sales were at 725 per cent and rising to 850 for later seasons. According to the company, the turnover on Christmas tree lamps is more rapid than two years ago, as people are more and more utilizing these little decorative lamps at other holidays than the Christmas season.

◆

Prevailing Conditions Affecting Cost and Volume

Fuel Situation Stabilized.—The fuel situation has become stabilized to such an extent that the Chamber of Commerce of the United States last week notified its members that the program adopted last September to equalize coal distribution has been successful. The chamber points out the present adequate distribution of supplies and the steady reduction of prices the last few months.

Car Shortage Reaches Record.—A new record in railroad history was established by the report from the American Railway Association showing a shortage on Oct. 30 of 179,239 cars. This was an increase of 12,890 over the previous week's total and compares with 146,070, the high record for 1920, reached on Sept. 1 of that year.

Improvement in Wholesale Distribution.—Reports received by the Commerce Department indicate that the most important development of recent weeks is the marked increase in the demand for goods. Current wholesale business is said to be far in excess of this time last year. Retailers have been buying largely on a hand-to-mouth basis for months and their stocks have been depleted by the renewed buying.

October Construction 14 per Cent Heavier.—Building contracts awarded during October in the twenty-seven Northeastern states, which include about three-fourths of the total construction in the country, amounted to $253,137,000, according to the F. W. Dodge Company. This figure is 14 per cent ahead of that reported in October of last year. The progress of the seasonal decline in October is shown in the drop of 7 per cent from September.

Fewer Failures Reported.—Failures for last week in the United States totaled 387, compared with 407 in the previous week, according to reports received by R. G. Dun & Company. The total for the corresponding week a year ago was 364.

Bank Clearings Gain 9.5 per Cent.—Returns of bank clearings last week, which were for five business days only, show an aggregate of $6,243,834,000 at 20 cities in the United States, as reported to *Dun's Review*, which is 9.5 per cent more than the total for the five-day period of last year.

Late Orders Cause Congestion in Toy Market

The present situation in the electrical toy market is termed unfavorable to both the makers and buyers because of the many orders now being placed, so late in the season.

Last-minute orders for toys continue to be placed with manufacturers, but it appears to be an open question whether most of such business can be filled. In contrast with the situation which prevailed in the toy market last spring, many factories are operating on a day and night schedule in an effort to catch up with demand in the intervening time before the holidays.

The present situation has called forth a large amount of criticism by the manufacturers. The makers claim that the buyers, with the figures of the past year's sales before them, can place orders covering at least 60 per cent of their requirements by June of the year. This, it is said, will result in stability of production and be of marked benefit to the industry as a whole.

South African Electrical Imports Drop 37 per Cent

Imports of electrical materials and machinery into South Africa during the first half of 1922 show a downward tendency, which has been prevalent since the second half of 1920. In fact, the total was only 63 per cent of the figure for the preceding six-month period, which would indicate that the trade must have "touched bottom" and that there should be some recovery recorded in the total imports for the entire year.

In the second half of 1920 imports of electrical materials and machinery were £1,634,428, and in the three succeeding six-month periods they declined to £1,140,780, £735,450 and £442,740 respectively. While the decrease in volume is probably not so great, relatively, because of the lower price levels now prevailing, it is also true that local stocks are about normal, and no great increase in imports can be looked for as the result of a necessity of replenishing low stocks.

The large number of bids received where quotations have been asked for indicates the keenness of competition in the South African market. A recent tender for lamps put out by the Johannesburg municipality brought fifteen offers covering products from six different countries—the United Kingdom, the Netherlands, Germany, Switzerland, Austria and the United States. The total value of this award was only £1,342.

The trade publications of South Africa see a distinct improvement in the local market for electrical supplies, and it is noted that inquiries are numerous and orders increasing. Prices are generally firmer. There is also the promise of considerable expansion in business, in view of the installation of new electric lighting plants and extensions of existing power stations. It is also an encouraging fact that many municipal building schemes, requiring considerable electrical equipment, are still to be completed.

Electric Sign Field Far from Potential Development

The field of electric sign advertising is still far from its potential development, according to first reports received in a survey now being made.

Increasing keenness of business competition, coupled with a growing realization of the value of this form of advertising. is, however, resulting in rapid progress in the electric sign industry.

Sixteen cities, ranging from 5,000 to 340,000 inhabitants, have so far reported in the survey. For a total population of 1,573,000 there are 3,591 electric signs, valued at $1,544,600, a sign investment of approximately $1 per inhabitant. The number of signs per thousand population is 2.28. These statistics are for exposed lamp signs only and do not include translucent letter and glass-faced box signs and illuminated panelboards.

The average value of these signs is $290.60. They represent a total of 618,718 sockets, an average per sign of 173. Figuring on a basis of 10-watt lamps, the total sign load is 6,187 kw., or 3.91 per thousand population.

Portugal Re-establishes ad Valorem Duties

A law published in the *Diario do Governo*, Lisbon, for Sept. 23, 1922, re-establishes the ad valorem duty of 30 per cent on machines for generating electrical current (continuous or alternating), static or rotary transformers and electric motors of less than 20 hp., imported into Portugal.

The duty of 30 per cent ad valorem was levied on all electrical apparatus and machinery until a decree of Nov. 17, 1921, made such articles subject to certain specific duties for a period of five years from Jan. 1, 1921. These specific duties remain unchanged for electrical goods other than those mentioned above.

Chicago Motor Trade Brisk

Reports from four motor manufacturers show that sales in the Chicago territory for October on the small sizes have been good. The market at present on large sizes is limited to central-station developments, which, however, is steady. But the call for motors ranging from 1 hp. to 10 hp. is very active and the distribution is scattered, since motors are going to the pump, printing, elevator and unit-power-driven machine industries.

One firm states that the first ten months of 1922 averaged better than 30 per cent of the business transacted in 1921. For the past month its sales have doubled the sales of October, 1921. This company says that its main volume is going to industrials planning new factory locations and expansions next spring.

Another firm reports an average increase of 25 per cent during the past year. This company says that it has doubled motor sales for the first ten months in 1922 over 1921. Stocks of all manufacturers are in excellent shape, and prices are firm with an upward tendency.

The Metal Market

No Changes of Importance Have Occurred—Export Trade Depressed —Zinc Trading Active

No changes of importance have occurred in the metal market this week, with the exception of a somewhat violent advance in lead. Copper has sold in larger volume, but the demand for zinc and tin has been quiet. Consumption of all metals keeps up wonderfully well, but transportation is not yet adequate to serve the needs of the industry.

There has been more of a tendency to come to the 13.75-cents delivered price than had previously been exhibited, and not more than two or three producers were still adhering to the higher levels previously quoted. Scattering sales were made at premium prices, but they were not a drop in the bucket compared with the large business that was done at 13.75 cents.

The export market was rather depressed during the last week as to volume of sales. Prices netted producers here slightly more than could be obtained for domestic sales. The decline in foreign exchange—in French and German currency in particular—will without doubt have an adverse effect on the ability of European purchasers to buy American copper. The copper industry cannot expand materially until conditions in the export market become more favorable.

Trading in zinc was active during the week at prices slightly under those of the preceding week. The metal is still in a strong statistical position, and the softening in price appears to be a minor reaction and not due to any change in fundamental conditions. One producer was able to obtain 7.10 cents per pound for his zinc without any difficulty, but the largest amount of business was done at the prices we quote. The volume of business in the aggregate was better than last week. Prices are as follows:

NEW YORK METAL MARKET PRICES

	Nov. 9, 1922 Cents per Pound	Nov. 16, 1922 Cents per Pound
Copper		
Prime Lake	13.87½	13.75
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	5.75	5.75
Antimony	5.25	5.25
Nickel, ingot	36.00	36.00
Zinc, spot	6.50	6.50
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	19.10	19.10
OLD METALS		
Heavy copper and wire	11.00–11.25	11.00–11.25
Brass, heavy	5.75– 6.25	5.75– 6.25
Brass, light	5.25– 5.50	5.25– 5.50
Lead, heavy	4.62½–4.75	4.62½–4.75
Zinc, old scrap	3.00– 3.37½	3.00– 3.37½

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

DECIDED improvement is to be noted in this week's market. Holiday buying is bringing in considerable business, and some jobbers say that the volume of orders will be record-breaking. All sections of New England are responding to the improved conditions in commerce and manufacturing. Deliveries are better. Lamp sales are active with ample stocks and firm prices. A 10 per cent advance on schedule material is reported in the Chicago field. Manufacturers of high-tension equipment report another active business week.

New York

Jobbers Report Fair Demand for Rubber Covered Wire—Replacements Helping Lamp Business

Demand continues to improve with the added interest in holiday buying. Collections are improving and there is renewed activity all along the line. Some buying is being done by the central stations in poles and pole-line hardware in anticipation of winter storms. Heaters and irons are most favored in the appliance market. Conduit stocks cannot be called satisfactory.

Wire.—Jobbers report a fair demand for the rubber-covered. Bare wire for use in radio is improving. Stocks generally are good. Prices are steady.

Lamps.—Lamps for commercial purposes are in steady demand. Stocks are reported ample. Replacements in signs constitute most of the business.

Appliances.—Sales are reported better for this period than for the corresponding week in 1921. High competition prevails in the market.

Fuses.—Jobbers are reporting an improved business with ample stocks.

Flexible Armored Conductor.—Much rewiring is increasing sales of this material. Stocks are fair and prices generally steady.

Motors.—Smaller sizes of motors for the appliance market are being consumed in large numbers. Competition is keen and prices firm.

Chicago

Schedule Material Advances—Lamp Sales Active—High-Tension Demand Brisk

Along with the continuing demand for wiring materials comes a 10 per cent advance in price on schedule material. The conduit supply market is still low and prices are firm. Fall buying of lamps is progressing, according to reports from jobbers. Newly completed buildings require a steady quota of standard fuses and lamps. Manufacturers of high-tension equipment report another active business week.

Wire.—Demand for wire is reported good by jobbers. Stocks are good. Movement of bare wire is hastened by the call for radio aërials.

Conduit.—Very little improvement in the supply situation of conduit is noticed since the building requirements are still active and shipments are sluggish.

Flexible Armored Conductor.—Fall extensions and rewiring are increasing the demand for this material. Stocks are good.

High-Tension Equipment.—Volume of this material is still heavy. One company reports sales on two 600-kva., 13,200-volt outdoor substations for the Middle West and three 1,200-kva., 33,000-volt substations for an oil-refining company in the Southwest. Another firm sold twenty 200-amp., 70,000-volt fuses during the week.

Lamps.—An active fall business is calling for all sizes of lamps, especially in the higher wattages, for use in industrial plants. The railroad buying also is good. Stocks are in good condition.

Fuses.—Jobbers report a brisk call for fuses which they attribute to both the building construction and the normal fall demand by the industrials to rehabilitate their lighting systems. Stocks are good.

Schedule Material.—An advance of about 10 per cent recently went into effect.

Boston

Motors Showing Considerable Life—Lamp Sales Active—Appliance Business Highly Diversified

Gains in trade continue from week to week, all sections of New England responding to improved conditions in commerce and manufacturing. Deliveries are holding their own, on the whole. Unskilled labor is scarcer and price trends are upward for the time being. Weatherprooof wire stiffened last week and rubber-covered wire shows signs of advancing. Building contracts in this section reflect continued improvement, qualified, however, by future price movements. Local stocks are depleted in many lines, but less complaint of shortages is heard, deliveries having noticeably improved at least temporarily. Retail stocks are well prepared for the holiday trade.

Wire.—Weatherproof has advanced to an 18-cent base, in response to upward movements in cotton. Demand is moderate. Stocks are meeting current requirements, which are increasing. Bare wire is very quiet.

Motors. — Sales of direct-current motors for cloth-finishing machine devices, printing-press and envelope machine service demanding variable speeds are showing considerable life. Prices are firm. Stocks of alternating-current motors are rather heavy for the volume of trade now evident and competition is sharp.

Lamps.—Sales are active in various lines, with ample stocks and firm prices. "Blue lamps" for sign service are in greater demand in New England, especially for theatrical work. One large manufacturer has more than 1,500,000 lamps in stock in Boston alone and deliveries are on a very satisfactory basis. Mill-type lamps are in healthy demand.

Sockets.—Trade is active, as in all common lines of wiring supply. Good stocks prevail.

Appliances.—Sales are highly diversified, washers and cleaners showing improvement in response to vigorous retail efforts. Smaller socket devices are moving faster.

Radio Apparatus.—Improved trade is reported, with large stocks and a tendency to unload at cut prices in some retail quarters. One large dealer sold fifteen thousand dollars' worth of sets de luxe at full price during the recent radio show. Interest in parts for amateur assembly is very active.

Atlanta

Hollow-Ware Stocks and Deliveries Are Satisfactory—Large Companies Placing Heavy Pole Orders

Cotton has reached the new high of 26.80 cents, stimulating sales of the staple in the rural districts, which in turn will help collections throughout the territory. Collections up to date have not been all that might be desired. Brisk activity is to be noted in all lines of electric materials, the holiday trade beginning to evidence itself. There is some shortage in conduit and rubber-covered wire, but this is expected to be overcome in the near future. Price advancing is to be noted in some lines.

Hollow-Ware.—More active than for many months past, with evidences of dealers stocking adequately for the holiday demand. Flatirons as usual are leading in popularity. Stocks and deliveries are both satisfactory.

Radio Equipment.—Generally, stocks have been kept in good shape but deliveries are slowing up slightly. One jobber, however, reports only fair sales with good stocks on hand. Prices are steady.

Dry Batteries.—There is a failure to respond to the usual fall activity, though heavy stocks were accumulated in anticipation of a brisk demand. Shipments are satisfactory, with no recent price changes reported.

Poles.—The larger companies have placed some heavy orders recently, but the smaller companies and municipalities are buying rather lightly. Pole-yard stocks are good, with the chestnut variety the most popular in the small towns and the Western red cedar and creosoted pine leading in the larger centers. Shipments and deliveries good.

Pole-Line Hardware.—Sales are reported brisk throughout the entire line with sufficient stocks on hand. Shipments and deliveries are satisfactory with prices steady.

Cross Arms.—A good movement in this line is reported with the standard arms going to the smaller stations and the N. E. L. A. type to the larger. Continued activity is expected for the next sixty days. Stocks are good, with shipments and deliveries satisfactory.

Refrigerating Equipment.—More activity is being taken on, with an increasing tendency toward the installation of house types of refrigerators in the homes of the well-to-do. No recent price changes are reported.

St. Louis

Cross-Arms Stocks Good—Normal Demand for Insulators—Pole-Line Hardware Slow

Trade for the week showed a tendency toward stiffer prices and consisted of a good volume of small orders. Some deliveries continue slow, but these are principally due to transportation conditions. Power companies are buying reasonably good amounts of pole-line equipment and supplies for seasonal maintenance in preparation for winter storms, but there are no extensive line construction jobs now in progress. Investigations show, however, that a large amount of transmission and distribution work is planned for next year, especially in Missouri and Arkansas.

Cross-Arms.—Local stocks are good with conservative and good shipments.

Insulators.—Normal demand is reported with stocks conservatively maintained and good deliveries obtainable from manufacturers. Prices are firm.

Pole-Line Hardware.—Factory shipments are somewhat slow, and rail conditions further interfere with maintenance of complete stocks. Demand is reasonably active in small orders and users are keeping only minimum stocks.

Cleveland

Smaller Type Motors Active—Prompt Wire Deliveries—Keen Competition in Appliance Market

Electrical business continues to show improvement with brisk movement in all lines. Prices are firm and deliveries good.

Motors.—The smaller type has been active but stocks are good and deliveries prompt.

Radio Equipment.—While no appreciable sales increase is noticeable, business continues in fair volume and indications are that the season will not be a poor one. Stocks are heavy, but demand does not permit over-accumulation.

Wire.—Rubber-covered has been active, but stocks are maintained to standard and deliveries are prompt.

Heaters.—Demand for the small portable type has resumed, and stocks, recently recovered, are beginning to diminish. Deliveries are extended and substantial orders for December delivery are being placed.

Appliances.—Dealers and jobbers report sales to be satisfactory, with especial interest in washers and cleaners. Competition is keen and campaigning evident.

Denver

Good Prospects for Holiday Business—Light Demand for Sewing Machines—Wire Is Steady

A severe touch of winter has slowed business up, especially in new construction work. Weather conditions have not helped freight movements, but jobbers feel that condition of supply will be improved. Prospects for holiday business are good, especially in radio lines.

Pole-Line Hardware.—Stock orders are holding up, but an increase is expected due to breakdowns and repairs necessitated by heavy snow in mountains. Practically no new work or extensions are reported at this time.

Sewing Machines. — Light demand. Department stores and jobbers report ample stocks.

Portable Lamps.—Considerable advertising has increased demand. No unusual sales reported, however.

Wire.—Call on rubber-covered is holding up.

San Francisco

Construction Materials Moving Well—Conduit Boxes Active—Radiators in Strong Position

All construction materials are moving rapidly without serious shortages except for conduit. Much power-line construction and associated building will be released by the result of the state vote on the water and power bill. This proposed constitutional amendment would have authorized the issue of $500,000,000 in bonds for the state purchase of public utilities and have placed practically unrestricted powers in an appointed commission of five men. It was beaten by approximately two to one, the ratio being evenly maintained throughout the state, despite the fact that Los Angeles was cited by the advocates of the bill as a favorable evidence of what the act would do.

Conduit.—There is practically no ½-in. or ¾-in. conduit in the state. Not only are stock orders held up by this shortage, but some dealers have actually found it necessary to take their men off jobs. No immediate relief is in sight.

Boxes and Covers.—Stocks so far are adequate. Factory shipments are fair with some substitutions. No serious shortages will be felt this season despite the steel situation.

Schedule Material.—Stocks are good.

Radiators.—Local manufacturers report a better season than last. Warm weather has continued with no cold spells yet.

Salt Lake City

Lamp Business Reported Brisk—Prices of Heaters Reduced—Vacuum Cleaner Sales Spotty

Bank clearings show steady and substantial gain. Credit is easier and collections are correspondingly improved. Building has slowed up considerably and will probably not resume on a large scale till spring opens. Big improvement projects promise unusual activity for the coming year in Intermountain development. Farmers have more money than for several years, but their relative purchasing power is low, commodity prices tending upward. Sales of electrical merchandise show steady gain in almost all lines.

Lamps.—Business reported brisk from all quarters. Nearly all wattage units in good demand. Stocks are ample.

Heaters.—Recent price cuts from $2 to $3 reported. Standard lines show decreased sales in some cases on account of competition of inferior grades. Jobbers are handicapped for stocks in some instances, factories not having reported on initial orders.

Vacuum Cleaners.—Sales reported good but somewhat spotty. An intensive selling campaign is creating great interest in some cities. Stocks of cleaners and washers are just fair.

Portland-Seattle

Increase of 8 per Cent in Conduit—Improvement in Stocks—Radio Is Better

Lumber production for the Northwest still continues above normal. New business is slightly greater and shipments are less than for the week previous. The car shortage still seriously hampers mills, particularly those off the main lines of the railroad, and stocks are piling up. Following election, building activity is experiencing a slight lull. While temporary conditions are somewhat unfavorable at this time, the total lumber shipments by water from the Pacific Northwest for the first nine months of 1922 were 91 per cent in excess of a similar period in 1921.

Shipments of other commodities also show a very large increase over a year ago, and building activity is at least equal to that af a year ago. Electrical jobbers report business conditions good, with a slight tendency toward easing up. Prices continue to stiffen.

Conduit has increased approximately 8 per cent during the past week. The demand is active for both wire and conduit, particularly of the smaller sizes, and conduit stocks are improving somewhat. Heater stocks are in fair shape and the demand is active. The movement in radio equipment is improving slightly. The demand for all kinds of wire continues good.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Simplex Wire & Cable Branch Established in New York

On Nov. 1 the Simplex Wire & Cable Company, Boston, established a branch office in New York City at 120 West Thirty-second Street, with Joseph G. Brobeck as sales manager. Mr. Brobeck has sold the company's wires and cables in the New York territory since March, 1920, and previous to that time he was connected with the Simplex company's sales organization at Boston during nineteen years.

◆

Black & Decker Manufacturing Moves Philadelphia Branch

The Black & Decker Manufacturing Company, Towson Heights, Baltimore, announces that its branch office and service station at Philadelphia, formerly at 318 North Broad Street, has been moved to 824 North Broad Street. The new quarters are more commodious and modern, according to the announcement.

◆

International G. E. Receives Brazilian Generator Order

The International General Electric Company has received an order for two 25,000-kva. alternating-current generators for installation in the Parahyba station of the Brazilian Hydro-Electric Company.

This station is on the Parahyba River about 100 miles from Rio and will operate in connection with the existing generating and transmission systems of the Rio de Janeiro Tramway, Light & Power Company. Power will be transmitted at 132,000 volts. The ultimate capacity of the station will be approximately 125,000 kva.

◆

Westinghouse Company Establishes New Plant at Seattle

A new plant, which includes an assembling and repair shop, a warehouse and a district sales office, was recently opened in Seattle, Wash., by the Westinghouse Electric & Manufacturing Company. All the activities of the Westinghouse company in the Seattle district are now assembled in one plant, making possible close co-ordination by the sales organization, the service department and the warehouse.

The plant's location along the waterfront district permits the use of a spur railroad track for the loading and unloading of equipment at the warehouse door. The grounds are 300 ft. x 232 ft. and afford ample space for future growth.

The arrangement of the sales office, by which the offices of the district manager and the department heads form a semicircle around the main office, where the general salesmen are, enables a customer to see the representative of any department upon entering the general office and the salesmen within the organization to confer privately with the district manager and the various department heads.

The shop of the service department can be reached from the general office as well as through the warehouse. The service department is divided into four sections, one for repair work, another for assembly work, a third for manufacturing switchboards and a fourth for making coils for the general repair work.

◆

Transfers Appliance and Lamp Business to Addison Electric

Announcement has been made that the good will of the appliance and lamp agency business of the Addison Electric Light & Power Company, Addison, N. Y., has been transferred to the Addison Electric Company. M. G. Hubbs is secretary of the latter company and will take charge of this business in the future.

◆

General Electric Operating at 60 to 65 per Cent Capacity

The General Electric Company, it is announced, is operating at from 60 to 65 per cent of capacity at the present time. It should be borne in mind that this means 60 per cent to 65 per cent of a capacity which has been greatly enlarged over the past few years. The company is now a hundred-thousand-man-power concern, and there are on the payrolls today about 65,000 names.

The peak of incoming orders of the company was reached in 1920, when the sales force booked $318,470,438 of new business. Naturally, the company had to expand physically in order to cope with its filled-up order books. Thus in the following year General Electric owned or had under lease more than 25,000,000 sq.ft. of factory space, which compares with less than 15,000,000 sq.ft. immediately prior to the war and with 7,000,000 sq.ft. in 1908. This increase of plant represented an effort to meet the extraordinary bulge of orders, and as this bulge was in a sense temporary the company elected to lease rather than to build or buy some 1,841,000 sq.ft. of floor space.

In 1921 the company billed $221,000,000 of sales, whereas new business booked during the year was a little less than $180,000,000. This year the tables will be reversed—sales actually billed will be considerably less than bookings.

Johns-Pratt Company Appoints G. Saylor Western Manager

Announcement is made by the Johns-Pratt Company, Hartford, Conn., that it has appointed George Saylor as Western sales manager of its electrical division. Mr. Saylor will make his headquarters at 36 South Desplaines Street, Chicago.

◆

Eureka Vacuum Cleaner Company to Hold $40,000 Selling Drive

The Eureka Vacuum Cleaner Company, Detroit, is setting a forty-thousand-dollar quota in its Christmas selling drive, which begins Nov. 20 and closes Dec. 23.

The company's slogan is, "Eureka vacuum cleaner is the ideal gift." In a bulletin to its sales force the company says:

"Fully 75 per cent of the gifts presented at Christmas are of a practical nature, those to children excepted. Only in the homes of the wealthy few are luxury gifts a custom. But in the homes of moderate incomes—the homes of thrifty, substantial citizens—the homes that just about comprise the entire market—father gives mother at least one thing that will lessen the burden of her daily tasks; mother gives father something that will make him more comfortable, and the children chip in to buy something for their parents of exactly the same nature! Reflect a moment! Among your own friends, isn't this true? Aren't electric appliances, lamps, pieces of furniture, kitchen equipment, auto accessories and the like always under the tree on Christmas morning? Aren't those gifts of an intensely practical nature? Gifts that save labor and give greater comfort because they can be used, instead of merely because they can be looked at."

◆

Galvin Electric Manufacturing Purchases Larger Factory

J. F. Galvin, president of the Galvin Electric Manufacturing Company, St. Louis, announces that his company has purchased a larger factory at 3320 South Broadway in that city and will soon remove to this new location. The Galvin firm is engaged in the manufacture of small motors and radio parts. The new plant affords approximately four times greater floor space.

◆

Mutual Electric & Machine Appoints G. R. Watson to Cincinnati Sales

The Mutual Electric & Machine Company, manufacturer of switches and panelboards, Detroit, announces the appointment of G. R. Watson as district sales manager with headquarters in Cincinnati. Mr. Watson's former connections were with the Pullman Company, headquarters in Chicago; the Crouse-Hinds Company, Syracuse, N. Y., and the Wadsworth Electric Manufacturing Company, Covington, Ky., as general sales manager.

Foreign Trade Notes

PROPOSED ELECTRICAL SYSTEMS IN FRANCE.—A concession has been asked by the Société Hydro-Electrique de la Tardoire for the construction of an electric distributing system to supply electricity in thirteen communes in the Departments of Charente and Dordogne. The Electricité de Strasbourg Company has applied for permission to install an extensive distribution scheme in the country bordering on the Upper and Lower Rhine. Application has been made by the Société Agricole d'Electricité du Canton de la Ferté-Alais for permission to erect a high-tension and low-tension distribution system to serve eighteen communes in the Department of Seine-et-Oise. The Société Co-operative Agricole d'Electricité de Versailles Ouest has petitioned the government for permission to establish a distribution system in the Department of Seine-et-Oise to serve electricity to twelve communes in the Versailles region.

PROPOSED ELECTRIC DISTRIBUTION SYSTEM FOR THE MANAWATU-OROUA DISTRICT, NEW ZEALAND.—The Power Board in the Manawatu-Oroua district (North Island) will soon submit to the ratepayers a proposal to authorize a loan of £500,000 to provide funds for the installation of an electrical distribution system in this district. The project would include about 700 miles of transmission lines, with transformers, equipment, etc.

ELECTRICAL SYSTEM PROPOSED FOR GRAAF-REINET, SOUTH AFRICA.—The municipality of Graaf-Reinet, South Africa, has applied to the provincial government for permission to authorize a loan of £57,000 for various municipal improvements, including the installation of an electric system.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Denmark (No. 4,266) of radio receiving sets and parts and "loud speakers."

Purchase is desired in Spain (No. 4,269) of 60 tons of electrolytic copper wire of high conductibility, 50 sq.mm., in rolls of 250 m. to 300 m.

Purchase and agency is desired in Norway (No. 4,271) of paints, insulating materials, etc.

Purchase is desired in China (No. 4,277) of clay-working machinery suitable for making pottery, fancy tiles, and particularly electric porcelains, and also glazing material of various colors for the above articles.

Purchase and agency is desired in South Africa (No. 4,278) of batteries and magnetos for motor cars, lighting, etc.

Information is desired in Australia (No. 4,302) on electric elevators, high-tension insulators, automatic electric refrigerators for domestic and hotel use, electric kettles, hot plates, toasters, radiators, vacuum cleaners, dishwashers, clothes washers, grillers, irons, floor polishers, ranch-lighting sets, X-ray equipment, radio telephones, radio telegraphs and valves, electrical measuring instruments, burglar-alarm systems, high-tension switches and transformers, light and power machinery such as turbo-generators and hydro-electric machinery, enameled wires and resistance wires for domestic heating apparatus and ventilating plants.

TRANSMISSION LINE TO BE ERECTED FROM HORAHORA TO AUCKLAND, NEW ZEALAND.—Arrangements have been made whereby the Department of Public Works, Auckland, New Zealand, will proceed with the erection of an electric transmission line from Horahora to Auckland.

EXTENSION TO THE AUCKLAND (NEW ZEALAND) TRAMWAY SYSTEM CONTEMPLATED.—Work will be started early in January, 1923, it is stated, on the extension of the Auckland (New Zealand) city tramway service along the Great South Road. The cost, including equipment, is estimated at £75,000.

EQUIPMENT FOR THE MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by R. Liddelow, secretary of the State Electricity Commission of Victoria, Australia, until Jan. 15, 1923, for switchgear and accessories (Specification No. 23/3); also until Jan. 19, 1923, for steam turbine-driven boiler-feed pumps (Specification No. 23/4); also, until Jan. 26, 1923, for high-pressure steam, drain and feed piping, valves, traps, etc. (Specification No. 23/5)—all for the Morwell power scheme.

SWITCHGEAR AND TRANSFORMERS FOR WELLINGTON, NEW ZEALAND.—Tenders will be received by the Public Works Department, Wellington, New Zealand, until Jan. 9 for five sets of 11,000-volt switchgear (substation) and five sets of transformers for the Mangahao power scheme.

TURBO-ALTERNATOR FOR BRIQUETTING WORKS, VICTORIA, AUSTRALIA.—Tenders will be received by R. Liddelow, secretary of the State Electricity Commission of Victoria, Australia, until Jan. 31, 1923, for one 1,500-kw. back-pressure turbo-alternator and accessories for the Yallourn briquetting works, Victoria.

New Apparatus and Publications

ELECTRIC STOVE.—The Gem Manufacturing Company, Detroit, has recently placed on the market an aluminum-electric table stove known as the "Radio."

POWER AMPLIFIER. — The Bristol Company, Waterbury, Conn., is distributing bulletin No. 3,000, describing the "Bristol" one-stage power amplifier recently developed by the company.

OIL PURIFIER.—The Industrial Products Company, Goshen, Ind., is distributing bulletin No. 1,001, covering its "Hydroil" centrifugal oil purifier for purifying liquid lubricants, oils, etc., for use in central stations, refrigerating plants, railroads, etc. This device detects the presence of the slightest particle of water in the oil because of a leak in the cooling coils and removes the water instantly by utilizing centrifugal forces.

SMALL ELECTRIC FURNACES. — The Op-al Electric & Manufacturing Company, Thirty-sixth and Kentucky Avenues, Indianapolis, has brought out a small electric furnace for heating soldering irons, etc.

ELECTRIC CLOTHES WASHER. — The Albaugh-Dover Company, 2100 Marshall Boulevard, Chicago, has recently developed an electrically driven washing machine, "Pal o' Mine," which will be marketed by W. S. Ireland of the same address.

COMBINED PHONOGRAPH AND RADIO RECEIVING SET.—The Serenado Manufacturing Company, Cedar Rapids, Iowa, has recently placed on the market a combination phonograph and radio receiving set.

ELECTRIC BILGE PUMP.—An electric bilge pump has recently been placed on the market by Hubbard H. Erickson & Company, 3,037 North Western Avenue, Chicago.

VACUUM CLEANER. — A new vacuum cleaner, known as the "Duplex," has been brought out by the Electric Vacuum Cleaner Company, Cleveland.

TABLE LAMP RADIO RECEIVER. — The Capitol Phonolier Corporation, 89 Fulton Street, New York City, has placed on the market a combined ornamental table lamp and radio receiving set.

AUTOMATIC WATER SYSTEM. — The Western Pump Company, Davenport, Iowa, is manufacturing an automatic water system, consisting of a pump, motor, automatic electric control switch, etc. These units are made in three sizes, with ¼-hp., ½-hp. and 1-hp. motors.

New Incorporations

THE HOLT (MO.) ELECTRIC LIGHT COMPANY has been incorporated by W. A. McGee, John A. Eby and Myrl M. Johnson. The company is capitalized at $5,000.

THE GATESVILLE (N. C.) LIGHT COMPANY has been chartered with a capital stock of $10,000 by O. C. Turner, C. M. Lawrence and W. J. Davis, all of Gatesville.

THE LINDSAY LIGHT & POWER COMPANY, Mapawa, Wis., has been incorporated with a capital stock of $60,000 by Harold W. Connell, Edward V. Molloy and Herman E. Friedrich.

THE AURORA (WIS.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by P. G. Hovig, Louis Frigo and Carl H. Carlson. The company is capitalized at $3,000 and proposes to supply electricity for light and power in Aurora. Postoffice address is Ironwood Mich.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTLAND, ME.—The installation of an ornamental lighting system on Baxter Boulevard is under consideration by the Park Commission.

NORTH BILLERICA, MASS.—The Lowell Electric Light Corporation has contracted to supply electricity to operate the new factory of the Talbot Mills. A 13,000-volt transmission line will be erected from its plant in Lowell to furnish the service, which will eventually be extended to Billerica Center. A substation will be installed here.

PAWTUCKET, R. I.—The Phillips Insulated Wire Company is erecting an addition to its power house, to cost about $25,000.

HARTFORD, CONN.—Plans for the new office of the Aetna Life Insurance Company 650 Main Street, provide for a power house and an electrical department. The cost is estimated at $3,000,000. James G. Rogers, 367 Lexington Avenue, is architect.

STAMFORD, CONN. — The Charles H. Phillips Chemical Company will build a one-story power house at its factory.

Middle Atlantic States

ALDEN, N. Y.—Plans for the proposed new county home to be erected at Alden by the Erie County Board of Supervisors, City Hall, Buffalo, provide for a power house and refrigerating plant. Kidd & Kidd, 234 Delaware Avenue, Buffalo, are architects.

AUBURN, N. Y.—The Firth Carpet Company is preparing plans for a power plant in connection with other extensions to cost $140,000. Lockwood, Greene & Company, 101 Park Avenue, New York, are engineers.

BROOKLYN, N. Y.—The Rubel Coal & Ice Company, Glenmore Avenue, will install electric power equipment, ice and refrigerating machinery at its proposed ice-manufacturing plant at Dahill and Cortelyou Roads, to cost about $200,000.

BUFFALO, N. Y.—The Buffalo Steel Car Company, East Walden Avenue, has completed plans for a one-story power plant at its works, 25 ft. x 100 ft. Plumer & Mann, 700 Main Street, are architects.

LYONS, N. Y.—Preparations are being made by the Empire Gas & Electric Company, Geneva, to enlarge its local plant and to erect a new high-tension transmission line between Lyons and Geneva.

MONTICELLO, N. Y. — Improvements contemplated by the Murray Electric Light Company include overhauling a 33,000-volt line from Cuddebackville to Monticello, 16 miles long, and a 4-mile line from Kiamesha to Monticello; the erection of a 6-mile transmission line from Mongaup Falls to the present line of the Orange County Public Service Company, from near Kiamesha to the Liberty Light & Power Company, and building substations at Monticello, Liberty and Kiamesha.

NEWARK, N. Y.—The installation of a new street-lighting system is under consideration by the Village Board.

NEW YORK, N. Y.—The Solomon Independent Ice Company will install electric power equipment at its proposed 500-ton ice-manufacturing plant, 100 ft. x 150 ft., at East Fifth Street and the East River.

NEW YORK MILLS, N. Y.—The Walcott & Campbell Spinning Company will make extensions and improvements to its power plant to cost about $50,000. The C. B. Roberts Engineering Company, 19 Milk Street, Boston, is engineer.

JERSEY CITY, N. J.—Plans for the proposed new building to be erected at 652-69 Bergen Avenue by the Young Men's Christian Association provide for a power house. The cost is estimated at $500,000. John F. Jackson, '1819 Broadway, New York City, is architect.

MORRISTOWN, N. J. — The Morris & Somerset Electric Light Company will make improvements in the local street-lighting system, including the installation of 600-cp arc lamps, to replace the 400-cp. lamps now in use. The cost is estimated at about $15,000.

TRENTON, N. J.—Electric power equipment will be installed in the proposed sewerage disposal plant, to cost $1,250,000. The George A. Johnson Company, 150 Nassau Street, New York, is consulting engineer.

ALTOONA, PA.—Plans are being prepared by the Altoona & Logan Valley Electric Railway Company for an addition to its power plant. New equipment, including a generator, condensing engine, surface condenser and auxiliary, apparatus will be installed.

ERIE, PA.—The extension of the ornamental lighting system on State Street from Fourteenth to Thirty-fourth Street is under consideration.

MARCUS HOOK, PA.—The Union Petroleum Company, Widener Building, Philadelphia, will install electric power equipment in connection with additions to its local refining plant, to cost about $500,000.

MIDDLESEX, PA.—The Middlesex Electric Light, Heat & Power Company, recently organized, has made a power contract with the Union Electric Company. A substation will be built at Middlesex and a distributing system erected. C. L. Spahr is secretary. Middlesex has not a postoffice.

NEW BRIGHTON, PA.—Plans are being prepared by the Beaver County Light Company for the erection of a new power house, to cost about $35,000. H. L. Fullerton, 5,444 Kincaid Street, Pittsburgh, is engineer.

PHILADELPHIA, PA.—The L. N. Gilmer Company will build a new power house at its plant at Keystone and Cottman Streets, in connection with a factory addition, to cost about $75,000.

PHILADELPHIA, PA. — Electric power equipment will be installed at the printing plant to be constructed by the Chilton Company at Fifty-sixth and Chestnut Streets, to cost about $200,000. The Ballinger Company, Twelfth and Chestnut Streets, is architect.

PITTSBURGH, PA. — Plans have been prepared by the Franklin Institute, 15 South Seventh Street, for the erection of an electrical laboratory building at Nineteenth and Cherry Streets, to cost with equipment about $250,000.

PITTSBURGH, PA.—A power house will be erected in connection with the proposed new hospital to be erected at the Leech Farms by the Board of Works, to cost about $180,000. J. P. Brennan, Municipal Building, Northside, is architect.

HUNTINGTON, W. VA.—The Huntington Coal & Mining Company will build a power plant at its mining properties and will equip all mines for electrical operation.

WASHINGTON, D. C.—Bids will soon be called by the Bureau of Yards and Docks, Navy Department, for a refrigerating and ice-manufacturing plant at the Pearl Harbor (T. H.) Navy Yard, including power equipment, motor-driven machinery, etc.

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North Central States

BATTLE CREEK, MICH.—Bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 4 for conduit and wiring, with lighting fixtures at the local postoffice.

DETROIT, MICH.—The Detroit Edison Company is arranging for a bond issue of $15,000,000, part of the proceeds to be used for extensions and improvements.

DETROIT, MICH.—The Detroit Edison Company is planning to supply electricity in Harsen's and Russell's Island and St. Clair Flats. The cables furnishing the service will be laid under the St. Clair River. The company is also extending its electric lighting system in St. Clair. All outlying districts will be connected with the city street-lighting system.

JACKSON, MICH. — The Riverside Machine Company is preparing plans for a power house in connection with other plant additions.

VANDERBILT, MICH.—The Cheboygan Electric Light & Power Company is planning to furnish electricity for lamps and motors in Vanderbilt.

GALION, OHIO.—Work has started on the construction of the new municipal electric light plant.

OAK HARBOR, OHIO.—The Northwestern Ohio Railway & Power Company contemplates extending its transmission lines to Catawba Island next year.

LEXINGTON, KY.—The Lexington Utilities Company has applied to the County Commissioners for permission to extend its street-lighting service from the city limits at Mentelle Park out on the Richmond Boulevard and beyond Ashland.

SMALLEY, KY.—The Elkhorn Gas Coal Company, Bluefield W. Va., is considering the electrification of its properties, and will install substation, motors, etc. F. W. Gessling, Ashland, Ky., is consulting engineer.

AUBURN, IND.—Bids will be received by the city of Auburn at the office of G. Potter, city clerk, until Nov. 23 for furnishing and installing equipment and machinery at the municipal water and electric light plant, including three 500-kva. transformers, one generator switchboard panel, one centrifugal pump of 700 gal. per minute capacity and one 75-hp. synchronous motor.

INDIANAPOLIS, IND. — The Indiana Power Company has been granted permission to issue $250,000 in bonds and $92,000 in capital stock, part of the proceeds to be used for extensions and improvements.

LAFAYETTE, IND. — The Council has contracted with the Northern Indiana Gas & Electric Company for electricity to operate the municipal waterworks. The city power plant will be discontinued. Additional electric equipment will be installed at the water plant.

NEW ALBANY, IND.—Steps have been taken by the Chamber of Commerce to establish an ornamental lighting system on three streets in the business section of the city.

BATAVIA, ILL.—The Chicago, Aurora & Elgin Railroad will make extensions and improvements to its local power plant, to cost about $50,000. A transformer station will be erected at Forest Park, to cost $40,000.

SHELBYVILLE, ILL.—Arrangements are being made by the City Council for the construction of a municipal electric light plant, to cost about $100,000.

JANESVILLE, WIS. — The Janesville Electric Company has issued $520,000 in bonds, part of the proceeds to be used for extensions and improvements.

SHOREWOOD, WIS.—The Village Board is considering changing the street-lighting system from gas to electricity. The voters will be asked to authorize an issue of $75,000 in bonds to provide funds for the proposed change. Shorewood has not a postoffice.

PRESTON, IOWA. — The Rural Power Company has applied to the Board of County Supervisors for permission to erect transmission lines along Harrison Street, Green Tree and Bettendorf Roads.

EXCELSIOR SPRINGS, MO.—The North Missouri Power Company, recently organized, has purchased the Excelsior Springs (Mo.) Water, Gas & Electric Company, the Edina (Mo.) Light Company, the Merchants' Light & Power Company at Novinger and the Brookfield (Mo.) Electric Light Company. Application has been made to the State Public Service Commission to merge the properties under the name of the North Missouri Power Company. The company is to be capitalized at $1,500,000.

FAUCETT, MO.—The Board of Directors of the consolidated school district No. 3 is planning to build an electric light and power plant in connection with an extension to the local school building.

FULTON, MO.—Bids will be received by the Council until Nov. 22 for a municipal electric lighting plant, to cost about $35,000. Hugo K. Graf, Chemical Building, St. Louis, is architect.

HOLT, MO. — The Holt Electric Light Company, recently organized, plans to operate a local system. W. A. McGee heads the company.

RICH HILL, MO.—The City Council has engaged Arthur L. Mullergren, Kansas City, Mo., consulting engineer, to prepare plans for improvements to the municipal electric light plant.

REYNOLDS, NEB.—The Councils of Reynolds and Gilead have approved plans for the construction of a joint transmission line to Fairbury to furnish electricity for light and power service in both towns.

SUMNER, NEB.—The Councils at Sumner, Miller and Eddyville have contracted with the United Electric Company, Lexington, for local service. A transmission line will be operated from Lexington.

KINSLEY, KAN. — The Public Utilities Commission has granted the Pawnee Power & Water Company, Larned, permission to increase its capital stock, the proceeds to be used for the purchase of the municipal electric light plant.

LEAVENWORTH, KAN.—Bids will be received by the Board of Education until Nov. 21 for a power house, to be used in connection with two grade school buildings, to be built at the same time. Charles A. Smith, 602 Finance Building, Kansas City, Mo., is architect.

Southern States

ASHEVILLE, N. C.—The Carolina-Tennessee Power Company contemplates the construction of two dams on the Hiwassee River, to develop 30,000 hp. E. B. Norvell Murphy, is secretary.

KINSTON, N. C.—The Kennedy Memorial Home will build a transmission line, about 5 miles long, from the city to the home site, for local service.

STATESVILLE, N. C.—J. C. Steele & Sons, manufacturers of machinery, are planning to install electrical equipment, including a generator, motors, etc.

WHITEVILLE, N. C.—Plans are under way for a municipal electric power plant and waterworks system, the latter to include an electrically operated pumping station.

WILMINGTON, N. C. — The Broadfoot Iron Works will install electric power equipment, including a traveling crane, in connection with plant additions, now in course of construction.

SAVANNAH, GA.—Plans are under consideration by the Dunlevi Lumber Company for the erection of new mills, with power plant and machine shop, to increase its capacity to 50,000,000 ft. per year.

JACKSONVILLE, FLA.—The Board of Electric Light Commissioners is considering extensions to the municipal electric light plant involving an expenditure of about $500,000. The work will include an addition to the main power plant, the installation of a 12,500-kw. turbo-generator, improvements to all substations and placing high-tension lines underground from the main plant on Talleyrand Avenue to substation at Main and First Streets. The Scofield Engineering Company, Philadelphia, is consulting engineer.

STARKE, FLA.—Bonds to the amount of $36,000 have been authorized for extensions to the electric light and water systems.

TALLAHASSEE, FLA.—An election will be held Nov. 21 to vote on the proposal to issue $145,000 in bonds for extensions to the electric light and sewerage systems.

FLORENCE, ALA.—The Council is considering calling an election to submit to the voters the proposal to build a municipal hydro-electric plant on Cyprus Creek, to develop from 200 hp. to 500 hp.

SMACKOVER, ARK.—Arrangements have been made with the Arkansas Light & Power Company for the installation of a local power plant, to cost about $25,000.

SPRINGDALE, ARK.—The Welch Grape Juice Company, Westfield, N. Y., will build a power house in connection with its proposed local plant, to cost about $300,000.

NEW ORLEANS, LA.—The Cloverland Dairy Company will install electrical equipment in connection with a new refrigerating plant and other improvements, to cost about $200,000.

MUSKOGEE, OKLA.—The Oklahoma Gas & Electric Company, Oklahoma City, contemplates increasing the initial capacity of its electric power plant on the Arkansas River, east of Muskogee, from 10,000 hp. to 30,000 hp. The cost of the plant is estimated at about $3,000,000.

DALLAS, TEX.—The Stickle Lumber Corporation, Maple Avenue, is considering the construction of a new mill and power house, to cost about $80,000. R. O. Jameson, American National Bank Building, is consulting engineer.

McLEAN, TEX.—Work will soon begin on the construction of the municipal electric light plant. Funds to the amount of $30,000 are available.

SHERMAN, TEX. — Plans have been completed for extensions to the lighting system in the Greenmount and Christian College districts.

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Pacific and Mountain States

OKANOGAN, WASH.—Application has been made to the County Commissioners by the United States Reclamation Service for permission to erect electric transmission lines along the roads of the main lateral of the Okanogan Irrigation District to the upper main lateral.

SEATTLE, WASH. — The Council has appropriated $60,000 for the installation of a 15,000-volt circuit for the municipal light and power system.

SPOKANE, WASH.—The Boundary Red Mountain Mining Company plans to triple the present output of its power plant.

VANCOUVER, WASH.—Plans are being considered by Beers & Bennett, Vancouver, for the construction of a lumber mill including a power plant, on the Nehalem River, near St. Helens, Ore., to be equipped for a daily capacity of 20,000 ft.

WALLA WALLA, WASH. Preparations are being made by the Pacific Power & Light Company to rebuild the flume to the Walla Walla River plant, at a cost of about $79,000.

CANBY, ORE.—Owing to the failure of the Mollala Electric Company to meet the terms offered by the city for its plant, the City Council has made arrangements to install a new electric lighting and power plant independent of the present system.

MEDFORD, ORE. — The California & Oregon Power Company has applied for permission to erect three hydro-electric power plants, with capacities of 9,000 to 15,000 and 20,400 hp. respectively, in the vicinity of Bradley Falls and Ireland Falls.

PORTLAND, ORE.—The Lincoln County Light & Power Company, recently organized, plans to install a system in a section of Lincoln County. The company is headed by H. A. Holland and Maurice W. Seitz, both of Portland.

PORTLAND, ORE. — The Northwestern Electric Company is completing plans for an addition to its steam-driven generating plant at the foot of Lincoln Street, to cost about $500,000. New transmission and distributing lines will be built to cost $400,000.

BAKERSFIELD, CAL.—Bids will be received by the Board of County Supervisors until Dec. 18 for electric work, refrigerating plant and other electrical and mechanical installations in the proposed County Hospital group, Flower Street, East Bakersfield. Charles H. Bigger, Bank of Italy Building, Bakersfield, is architect. F. E. Smith is clerk.

DINUBA, CAL.—The Central California Ice Company, Fresno, will install electric power equipment at its proposed ice-manufacturing plant at South M and Ventura Streets, to have a capacity of 30 tons daily.

FRESNO, CAL.—The Fresno Paper Company will install electric power equipment at its proposed paper-boxboard mill, to cost about $500,000.

SAN FRANCISCO, CAL.—The Board of Supervisors is arranging a fund of $10,000 for the installation of a street-lighting system on Valencia Street from Market to Twenty-eighth Street.

VISALIA, CAL.—The Chamber of Commerce is perfecting plans for the installation of an ornamental lighting system in the business section, covering nine city blocks.

WILMINGTON, CAL.—The Pacific Coast Borax Company, Oakland, will take bids early in January for a factory and power plant in the local harbor district, to cost about $1,000,000. Albert C. Martin, Higgins Building, Los Angeles, is architect.

COEUR D'ALENE, IDAHO.—The Home Builder Mining & Development Company, Spokane, Wash., has applied for permission to construct hydro-electric power plants in Phanton and Blue Grouse Creeks, with initial capacity of about 250 hp.

ST. GEORGE, UTAH.—The Public Utilities Commission has granted the Dixie Power Company permission to extend its transmission lines to Summit.

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Canada

WANETA, B. C. — The Waneta Power Company contemplates the contsruction of diversion dam, 40 ft. high, 75 ft. wide, 115 ft. head to develop 4,000 hp., in connection with a hydro-electric development in 1923. The cost is estimated at $3,000,000. E. K. Scot, Waneta, is engineer.

ST. JOHN, N. B.—Electric power equipment will be installed by the Stephen Brick Company, Ltd., in connection with the proposed rebuilding of its local plant, recently destroyed by fire, causing a loss of about $100,000.

GUELPH, ONT.—The fire, light and water committee of the City Council have recommended that a bylaw authorizing an expenditure of $550,000 for a new fire hall, fire-alarm system and triple combination engine be submitted to the ratepayers.

NORTH BAY, ONT.—A report has been submitted to Premier Drury by G. Lee, chairman of the Temiskaming & Northern Ontario Railway Company, recommending the electrification of 253 miles of main line and 40 miles of branch lines. The cost, including trolley line, transmission lines, substations, locomotives and possibly hydro-electric generating stations, is estimated at about $9,000,000. S. B. Clement, North Bay, is chief engineer.

TORONTO, ONT.—The erection of a one-story automobile and truck building, machinery, etc., at Exhibition Park is under consideration by the Canadian National Exhibition, King Street East.

Electrical Patents

Announced by U. S. Patent Office

(Issue Oct. 24, 1922)

1,432,938. Battery Separator; W. H. Wood, South Euclid, and H. E. Smith, Cleveland, Ohio. App. filed Feb. 9, 1920. Flexible insoluble reinforcing fibers and flexible, porous, wick-forming fibers combined together.

1,432,939. Separator for Storage Batteries; W. H. Wood, Cleveland, Ohio. App. filed April 17, 1920. Fabric made of rubber composition traversed by strands of mamalian hair.

1,432,965. Electric Circuits; W. L. Casper, Brooklyn, N. Y. App. filed Sept. 3, 1919. Filters employed to limit the frequency range.

1,432,978. Printing Telegraph System; A. D. Dowd, Hoboken, N. J. App. filed April 17, 1918. Combined perforator and transmitter.

1,432,989. Electromagnetic Clock; M. P. Favre-Bulle, Boulogne, and M. A. Moulin (deceased), Besancon, France. App. filed Aug. 23, 1920. Mechanical device for actuating hands and electromagnetic device for maintaining oscillations of pendulum.

1,432,992. Vacuum-Tube Socket. J. O. Gargan, Brooklyn, N. Y. App. filed Sept. 5, 1918. Resilient holder for carrying tubes.

1,433,017. Electrode; R. H. McKee, New York, N. Y. App. filed Nov. 5, 1920. Electrode for electrolytic cells with conductive base and adherent, acid-resisting coating.

1,433,037. Motor; C. H. Reid, Somerset, West South Africa. App. filed Nov. 26, 1918. Packing-gland construction for direct-connected pump used to pump acids or alkalis.

1,433,055. Combined Steamer, Still and Burner for Battery Repairing; E. R. Williams, Springfield, Mo. App. filed July 15, 1922. Apparatus for cleaning, repairing and building storage batteries.

1,433,061. Electric Flatiron; E. S. Avery and O. O. Fusch, San José, Calif. App. filed July 22, 1920. Automatic cut-out when temperature reaches predetermined limit.

1,433,070. Method and Apparatus for Determining the Actual Location and Actual Movement of Bodies; W. W. Conners, Elizabeth, N. J. App. filed June 6, 1918. Ascertains position of receiving station with respect of plurality of transmitting stations emitting radiant energy.

1,433,073. Thermostat for Searchlights; A. P. Davis, New York, N. Y. App. filed April 13, 1916. Automatic means for maintaining arc in focus of projector.

1,433,078. Electric Indicating Device; F. Hülss, Halensee, Germany. App. filed Oct. 19, 1920. Indicates condition of discharge in submarine batteries.

1,433,089. Three-Phase Driving System for Marine Propellers; W. Mollier, Vienna, Austria. App. filed Jan. 7, 1921. Generators and motors of two frequencies used.

1,433,136. Electric Battery; F. M. Holmes, Wichita Falls, Tex. App. filed June 19, 1922. Composition of active material for primary and secondary batteries.

1,433,155. Electric Installation; M. Schenkel, Charlottenburg, Germany. App. filed Dec. 4, 1920. Control apparatus for mercury-vapor rectifier.

1,433,184. Electric Massage Apparatus; H. Csanyi, New York, N. Y. App. filed June 24, 1921. Induction coil, interrupter and battery mounted in flashlight casing.

1,433,224. Variable Condenser; J. Parkin, Jr., San Rafael, Calif. App. filed March 29, 1920. Stationary mercury plate and rotatable plate.

1,433,264. Electrical Testing Instrument; H. Fahlenberg, Pankow, near Berlin, Germany. App. filed Oct. 2, 1919. For locating faulty circuits.

1,433,286. Physician's Heating Appliance; R. M. Kannenstine, Chicago, Ill. App. filed Nov 1, 1920. For physicians use in applying heat to interior parts of body.

1,433,298. Telephone Switching Apparatus; L. Polinkowsky, Antwerp, Belgium. App. filed Nov. 11, 1919. Method of testing and seizing connecting circuits of selective switches.

1,433,305. Loaded Telephone-Line System; T. Shaw, Hackensack, N. J., and William Fondiller, New York, N. Y. App filed July 16, 1918. Loading coils and amplifying apparatus comprise an artificial line for balancing line.

1,433,311 Signal Device; J. E. Sumpter, St. Paul, Minn. App. filed Dec. 21, 1917. Semaphore arm operated by electromagnet.

1,433,331. Device for Transmitting Electric Current Between Rotating and Non-Rotating Members; H. K. Angstrom, Malmo, Sweden. App. filed March 12, 1921. Applied to journal and journal box of electric cars.

1,433,358. Means for Warming the Radiators of Motor Cars, P. Elphick, Balcombe, England. App. filed April 26, 1921. Electric heating element to prevent freezing of water in radiators and water jackets of motor cars.

1,433,388. Water Heater; R. G. Ledig, Philadelphia, Pa. App. filed March 24, 1922. Water completes circuit of heating element.

1,433,397. Electric Connector; A. Meyer, New York, N. Y. App. filed Dec. 26, 1919. Connector for single-wire circuit.

1,433,403. Process of Making Ferro-Uranium; F. F. Mueller and R. W. Harris, Washington, Pa. App. filed Oct. 20, 1920. By reducing uranium oxide in electric furnace.

1,433,404. Electric Furnace; F. F. Mueller and R. W. Harris, Washington, Pa. App. filed Oct. 20, 1920. Ferro-uranium furnace lining of uranium oxide combined with binder.

1,433,448. Electric Furnace; T. S. Curtis, Providence, R. I. App. filed Aug. 7, 1920. Apparatus for treating magnesite and other ores for highly refractory material.

1,433,455. Battery-Charging Apparatus; A. J. Horton, White Plains, N. Y. App. filed Feb. 25, 1918. Charging rack for portable batteries comprising a metallic skeleton frame.

1,433,464. Dental Radiograph Device; C. A. LeMaster, St. Louis, Mo. App. filed March 17, 1921. Film holder with radiolucent abutment determining bearing plane.

1,433,465. Electric Heater; E. N. Lightfoot, New York, N. Y. App. filed July 29, 1920. Resistor element wound around core wire having insulating covering.

1,433,472. Electric Heater; R. J. Patterson, Boston, Mass. App. filed Nov. 21, 1921. Electric water heaters of immersion type.

1,433,488. Testing Device; G. E. Smith, New York, N. Y. App. filed May 9, 1919. Portable apparatus adapted for testing motor-vehicle accessories.

1,433,492. Trolley Catcher; P. N. Van Epp, Cleveland, Ohio. App. filed Feb. 2, 1922. Spring-actuated rope-winding reel.

(Issued Oct. 31, 1922)

1,433,526. Dry Cell; R. C. Benner and H. F. French, Fremont, Ohio. App. filed Nov. 14, 1918. Suitable for heavy current drains.

1,433,541. Method of Extraction of Metals from Their Compounds; P. Freedman, London, and E. Greetham, Hull, England. App. filed April 10, 1922. By reduction in an evacuated electric furnace.

1,433,542. Cover Construction for Storage Batteries; W. Gardiner, Chicago, Ill. App. filed March 28, 1921. Evaporation of electrolyte reduced.

1,433,543. Electrical Combination Lock; L. Garrison, Salt Lake City, Utah. App. filed Sept. 20, 1920. Combination lock for safes, vaults, houses, etc.

1,433,568. Aluminum Body for Magnetic Chucks; F. L. Simmons, Woonsocket, R. I. App. filed Feb. 26, 1918. Housing and support for pole pieces made from non-magnetic material.

1,433,570. Battery Hand Lamp; F. G. Stimson, New Haven, Conn. App. filed Oct. 20, 1921. Variable focus.

1,433,578. Electric Transformer; E. Vedovelli, Paris, France. App. filed March 30, 1921. High-voltage transformer.

1,433,594. Telephone Exchange System; R. S. Bailey, Montclair, N. J. App. filed Jan. 7, 1920. Cord circuit for private branches arranged for through supervision.

1,433,597. Dynamo-Electric Direct-Current Generator; R. Boin, Argenteuil, France. App. filed Oct. 4, 1918. Variable air gap.

1,433,599. Radio Circuit; R. Bown, East Orange, N. J. App. filed July 2, 1921 Sends and receives simultaneously.

1,433,600. Clamping Mechanism; W. M. Brown and H. F. A. Kleinschmidt, Johnstown, Pa. App. filed Feb. 11, 1921. To force track rails together for electrically butt-welding.

1,433,602. Battery Element and Process of Forming the Same; A. Cellino, Buenos Aires, Argentina. App. filed June 15, 1916. Battery element of immunized zinc.

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Distribution—Who Will Cheapen It?

CLOSE to 80 per cent of all the books and pamphlets written on business subjects in the last three years, it is said, have dealt with the problem of distribution. At every industrial convention the need for better distribution comes up for discussion. We hear it constantly the topic of conversation.

There can be no doubt as to what all this talk means. It means that public opinion is becoming steadily more attentive, more definite and more determined on the subject. And, in the end, public opinion compels and controls in these United States.

THE man on the street is no expert on economic problems. He does not know what is wrong with the business organism. But it so happens that it affects him in a very personal and a persistent way.

He buys a certain electric labor-saving appliance for his home for, say, $125 and finds out by chance that the cost of manufacturing that device was but $50. The retailer assures him that he is not profiteering, but agrees that the price is too high. The jobber admits that the price is too high, but tells him that he has taken virtually no profit at all. The householder can make no head or tail of it, but only knows that somewhere between the factory and his back door $75 has been spent on a commodity that cost just $50 to produce.

This example is but typical of a thousand others like it, and all the explaining in the world cannot make this sort of thing seem right in the minds of the buying public. Apparently nobody is taking too much in profit, but the money is being spent just the same. Therefore the public demands with growing insistence some new sort of a "set-up" in the system of distribution that will not cost so much to get the goods to the consumer. It puts it up to management to find the way.

MEN who have thought deep into this situation agree that this high cost of distribution in all industries is not caused by profiteering. Dealers today want 50 or 60 per cent where a few years ago 25 per cent was ample, but it is because of the excessive cost of doing business that these larger margins are exacted. Then, again, too many styles and varieties are made in too many duplicating factories in too small volume. Too many like lines are stocked and shipped out on too many small orders. And it costs too much compared with what it would cost for mass production and mass distribution. Prices are high, it seems, because manufacturers', wholesalers' and retailers' expenses are so high.

But the public demands relief. Will electrical men and other industries, we wonder, find ways to cut down their costs by co-operation among themselves or will they wait until Congress is driven by public clamor to tackle the whole job with many perhaps ill-considered laws?

Paul Martyn Lincoln

A pioneer in electrical generation and transmission who is the new director of the School of Electrical Engineering at Cornell University.

BOTH Cornell University and Paul M. Lincoln are to be congratulated on the appointment of the latter to be director of the School of Electrical Engineering at Ithaca, N. Y. Since the death of Alexander Gray, Cornell has been seeking a director who incorporated the qualities found in Mr. Lincoln. The appointment now made will be greeted with satisfaction by the profession as showing breadth of view on the part of those responsible for the choice. He is an engineer with an international reputation, and his accomplishments have a historical background in his intimate knowledge of the developments in his profession. Through his personal contributions to the profession in the design and operation of electrical equipment and through his extensive acquaintanceship, writings and affiliations with engineering organizations he has had a marked influence on the activities of the electrical industry. His training, judgment, standing and administrative ability augur a future for electrical engineering at Cornell that will add to the prestige of the past.

Born in Norwood, Mich., Jan. 1, 1870, Mr. Lincoln was educated in the public schools and at Ohio State University, where he received the degree of E.E. in 1892. After a brief term with the Short Electric Company in Cleveland, he became connected with the Westinghouse Electric & Manufacturing Company and interested himself in the pioneer problems connected with the alternating-current system. In 1895 he joined the Niagara Falls Power Company to supervise the electrical installation of that company, and here he gained worldwide fame through his invention of the Lincoln synchronizer. For this achievement he received a bronze medal at the Buffalo exposition in 1901 and the John Scott medal of the Franklin Institute in 1902.

Mr. Lincoln returned to the Westinghouse company in 1902 and was occupied with power department developments and allied commercial problems until 1919, when he resigned to take up consulting work and active participation in the development of the Lincoln Electric Company. He has been connected with many societies, being a fellow and past-president of the A. I. E. E. and a member of A. S. M. E., S. P. E. E., Franklin Institute, American Electrochemical Society and other organizations. He is affiliated with several social clubs and has served as a director of the engineering department of the University of Pittsburgh.

Still a young man, Mr. Lincoln has the talent and experience to contribute largely to the upbuilding of American engineering education.

Editorial Comment

Electrical World, November 25, 1922

Volume 80 Number 22

In Defense of the Water-Power Law

WHATEVER shortcoming there may be in the water-power law, two things about it are certain—it is workable and just, and it commands the support of bankers, engineers, conservationists and the electrical industry. The law was a long time in preparation, and it has been a cause of congratulation that so wise and broad a measure was finally enacted. Apparently, however, the public did not fully appreciate the fact that by the passage of the law the government had adopted a policy of fifty-year leases, for the act was hardly in effect when along came Henry Ford with his Muscle Shoals offer, demanding a hundred-year lease. That his efforts have thus far been unsuccessful is significant, but still more significant is the fact that the water-power law had few to do it reverence even in Congress: for the main arguments against the Ford offer were not predicated on its contravention of the legislation so hardly won, but on things foreign to it.

Fortunately the danger of this attitude has been recognized, and a group of public-spirited citizens and statesmen interested in water power and conservation has been marshaled to defend the law against insidious attacks. Development can be and is being made under the act as it now stands—the records of the Federal Power Commission show that—and not until development comes to a standstill because of the law should any modifications be permitted. Deplorable as it is, the tendency of the day is to regard all law lightly. None the less, government cannot break faith with those who have accepted fifty-year leases, and it is well that men of standing outside of Congress have drawn attention to this obligation.

Superpower in Russia Now Under Way

IN THIS country superpower brings to mind mammoth generating stations. In Russia the new Kashira station comes under this classification. The difference is one of degree, not of principle. We use a great deal of electrical power in a comparatively circumscribed district, while the Russians are really only getting to know electricity as an agent for light, heat and power.

One must at least commend the spirit and ambition of the soviet government with respect to its attitude and accomplishments in engineering. A really valuable power survey of Russia has been made by a competent group of Russian engineers under governmental auspices. This was followed up by the building of the Kashira station and transmission line—the first link in the contemplated chain.

These results were accomplished despite many handicaps. As pointed out by Dr. Steinmetz in his article in this issue, the chaotic industrial condition necessitated makeshifts in the construction of the station and line. The use of a wooden pipe line, of many types of line towers and insulators and of other improvised materials showed the ingenuity of the engineers. The information may be of value to other engineers who cannot obtain the materials for standard American construction when working in foreign countries.

Otherwise than in the display of initiative and ingenuity with respect to construction materials and methods, the new station embodies no radical departure from American standards. It seems to follow American ideas of layout to a very great extent. The engineering difficulties met by Russians in electrical power problems can best be solved by a study of American engineering methods and practice, because this country has similar dimensional conditions as regards territorial area and has passed through similar pioneer experiences with respect to low-load densities and transmission distances.

Accounting Classification Changed Once More

AS REPORTED elsewhere in this issue, the classification of accounts of electric light and power companies has been changed once more by agreement between the National Electric Light Association and the National Association of Railway and Utilities Commissioners. Similar changes were made for water and gas utilities. There will be some who will wonder why the 1920 classification adopted by the commissioners and later accepted by the N. E. L. A. had to be modified again. The answer is that while the 1920 classification was logical and entirely satisfactory to both commissioners and companies, the present change is made in the interest of uniformity and to reconcile certain elements brought into the situation by the Federal Power Commission's regulation.

While the commissioners and utility accountants were coming to an agreement the accounting authorities of the Federal Power Commission were, in accordance with the law, framing a classification for the use of federal licensees. The federal commission's staff were limited in their discretion by the terms of the act, which provided that fixed capital accounts were to be set up on the basis of the road and equipment accounts of the Interstate Commerce Commission for the use of steam roads as of 1914, and furthermore by Regulation 16 of the form of application for license, relating to depreciation.

The accounting committee of the commissioners' association could not accept accounts based on these modifications, and to that extent uniformity in regard to fixed capital accounts and so-called depreciation could not be accomplished. There will also be some further necessary variations from uniformity on account of special requirements of some state laws. Aside from these two matters, however, there was a great mass of accounting detail in which uniformity could and should be brought about, and to this end meetings of the power commission were held in September at which the Association of Railway and Utilities Commissioners, the National Electric Light Association and the Interstate Commerce Commission were all represented. As a result of these meetings certain modifications of the previous classification were agreed to. Aside from changes in handling depreciation, most of the modifications are principally changes in wording or minor changes of detail.

The classification of accounts now resulting from these modifications and adopted by the utility commissioners at their recent convention in Detroit is an adequate, logical and sound classification, and accounting officials of the National Electric Light Association hope and believe that it will remain the last word in electric light accounting procedure.

Coal Situation Still Menacing

WITH no desire to appear pessimistic or to cause undue alarm over the coal situation, we should be recreant to our duty if we did not advise public utilities and others to keep a careful watch on developments and take advantage of every opportunity to obtain and store coal. The outlook is far from reassuring. Indeed, the signs indicate a recurrence of the coal strike next spring, and at the present rate of production and shipment the shortage will be acute.

No matter what is done now, next year there will be no great surplus to draw on, and if a strike comes, the effect on all industry, unless the disturbance is of short duration, will be depressing. It will be a great service to the country if the fact-finding commission shall have made public by that time the vital facts bearing on the situation, but even the knowledge of such facts will be of little comfort when weighed against the one outstanding fact that coal will be hard to get. Therefore plans should be laid now for systematic storage of whatever surplus fuel is available.

Motor-Generator Must Look to Its Laurels in Mining Service

SIGNIFICANT improvements in the design of synchronous converters during the past decade have put this type of machinery upon a new plane of usefulness for general industrial service, according to J. L. McK. Yardley, who in this issue of the *Electrical World* skillfully sums up the importance of these advances in relation to mining applications and intimates that the time has come for the wider use of rotaries in this arduous field. The author points out that the high-reluctance commutating pole has increased by about 100 per cent the ability of the synchronous converter to operate without flashover under momentary overload conditions; that progress in the development of quick-action circuit breakers with inductance properly related thereto has literally "beaten the flashover to it" in choking back the rush of energy under short-circuit conditions and cutting off the rotary before harm can be done, and finally, that the automatic substation applied to mining service offers a further means of protection. It follows that the motor-generator must look to its laurels, since it suffers materially in efficiency comparisons with the synchronous converter and at substantially equal investment costs can be justified only on the ground of more reliable service.

Mr. Yardley has made out a very strong case for the rotary designed along these newer lines, and engineers will do well to obtain and make public available data upon performance in mining service as the use of such equipment grows. If operating gains of 3.5 to 9.5 per cent in energy consumption can be realized with little or no increase in investment and with virtually the same reliability of service, the motor-generator will find its popularity sharply restricted as time passes in mining activities.

However excellent a given machine, its ultimate value to the user depends in large measure upon its proper selection for the work in hand, to say nothing of adequate maintenance. Thorough engineering analyses of load conditions, feeder requirements and over-all costs should be made in applying either rotaries or motor-generators to particular mining installations. The problems of the mining load are well known today, but combinations of load conditions and geographical layouts deserve very careful study in selecting transforming equipment for this industry in particular cases. Mr. Yardley's article challenges electrical engineers on mining properties to undertake precisely these analytical comparisons when considering the applicability of synchronous converters. It is to be hoped that the results of such comparisons, and even more in the way of service records, will soon be forthcoming for the benefit of this important branch of electrical engineering.

Automatic Substation Applied to Alternating-Current Service for First Time

OPERATORS who have had experience with automatic substations for feeding direct-current circuits have in general expressed their belief that these stations improve service and have an economic advantage. This is because properly arranged automatic equipment goes through its cycle of operations in a small fraction of the time the human operator requires to clear his circuits, test them out, isolate such as may be in serious trouble and get the others back into service. The problem for the human operator is complicated still further if he must act under the direction of a dispatcher to protect the other parts of a large interconnected system. An automatic substation goes through the predetermined cycle of operations at such intervals as may have been found best, and at the end of the cycle the circuits in good condition are in service and those in serious trouble are locked out. The operation is measured in seconds rather than minutes, and there are no false moves and no excitement.

Just recently the Kansas City company applied the automatic substation to alternating-current service for the first time on a scale which aims to consider city territory as so many small towns or zones and to control each substation automatically. The description of its substation practice on another page of this issue reveals an almost complete replacement of the human operator by automatic apparatus. A drum controller handles the high-tension oil switches so that changes from one line to another can be made without interruption to service under normal conditions. Under abnormal conditions, with a transformer and its lines out of commission, the service lines are automatically switched to the spare bank and its lines. When the load on a station reaches a predetermined low limit, the unneeded transformers are automatically disconnected and their loads switched to the remaining transformers. These operations are handled through drum controllers by contact-making devices on the switchboard that reflect the condition of each line and piece of apparatus and act independently of the relays called upon to interrupt circuits during abnormal conditions. This removes one source of possible trouble and permits complete separation of the control and relay circuits, and at the same time it keeps the control wiring largely in simple circuits.

In the Kansas City station particular attention has been paid to protection of adjoining circuits or apparatus from troubles occurring on any equipment in the substation. This has been done by arrangement of barriers and apparatus in such a way that the probable effects of even the most severe trouble cannot spread. The installation is an extremely interesting one, and its operating results point to the experience with automatic machinery that has been so often repeated—that when properly arranged the results obtained are superior to those from human labor because automatic equipment can be placed under absolute control and the human factor is eliminated.

The Discussion of the Cost of Merchandising—Where Will It Lead?

MORE men have thought and talked about the cost of merchandising electrical appliances in the last few weeks than ever before. This is well. John F. Gilchrist has shown that nine of the largest central-station companies have lost great sums of money on their retail selling and has given detailed figures on how much is lost on every washing machine sold by the Commonwealth Edison Company in Chicago. The American Washing Machine Manufacturers' Association has submitted figures on the cost of selling washers out of three other stores, claiming that the Gilchrist figures are excessively high. It is but accidental that the discussion has focused so closely on washing machines, and there seems to be no issue between Mr. Gilchrist and E. B. Seitz of the manufacturers. Both are arguing to the same point, which is that the central stations are not doing a good job of merchandising, because it is costing them too much to sell and they are losing money. They agree that there is urgent need for a thorough, fearless study of merchandising costs, that central stations may know what they are spending in appliance selling and what they must do to make this business profitable.

Mr. Gilchrist has recommended a general increase in prices to provide more profit for the central station. We have disagreed with this suggestion, in a former editorial, believing that a more efficient merchandising operation and an increased turnover will provide relief along more constructive lines and to the better interests of the central station, the independent dealer, the jobber, the manufacturer and the public. For neither Mr. Gilchrist's detailed costs on one appliance in one store nor his total figures on the total merchandising of nine large central stations nor the cost figures from the three stores cited by the washing machine association provide enough real data to give a true basis for analysis. There are three different ways to increase profits in retailing. You can improve the efficiency of the selling, increase the number of turnovers, or raise prices. But too little is known about the actual cost of merchandising electrical appliances today to make it sure just how much can be accomplished in any one of these directions toward reducing the losses of these nine large central stations.

What the industry needs is cost facts, developed by a study that embraces the entire country and all classes of electrical retailers. Perhaps smaller central stations are selling appliances more economically than large ones. Perhaps independent dealers are as a class making still larger profits. Who knows, today? But these facts must be found out before any central-station company can be certain that it is charging proper costs against its merchandising or doing its selling in the right way.

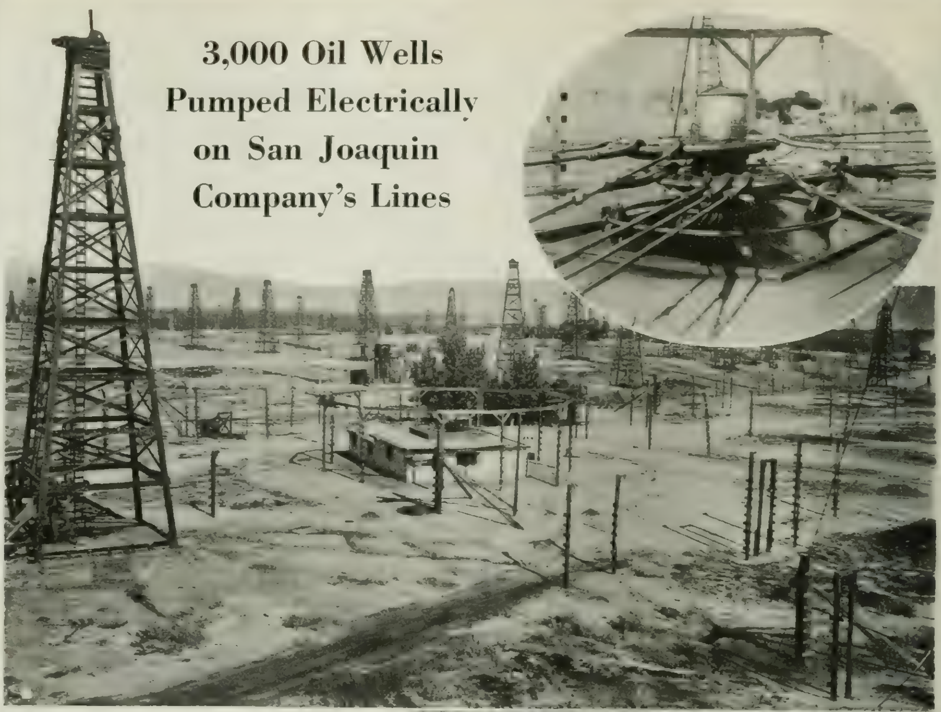
The Electrical Manufacturers' Council is endeavoring to perfect a plan for developing and disseminating cost statistics on electrical products. The Electrical Supply Jobbers' Association has made an elaborate study of distributing costs. The Association of Electragists International has established a cost system for dealers. The National Electric Light Association and the Association of Edison Illuminating Companies are showing concern. Here is a common interest, a common problem which the entire industry realizes must be solved sooner or later. These organizations could do no better work next year than to direct their leadership to this important purpose and make a concentrated effort to determine what it does cost to sell electrical merchandise. Meanwhile this general discussion of merchandising policies and costs is encouraging. It is making men realize that something must be done. But unless out of it comes a full knowledge of cost facts the industry will not profit much.

Typical Costs in Electrical Construction

ALTHOUGH reports on costs in various lines of electrical work are not uncommon, the facts are rarely definite enough to permit easy comparison. The paper by Campbell Higgins which we published last week is especially useful in that itemized labor costs are so reduced to a unit basis as to give very direct guidance to those having work in hand. The job from which the figures were taken was a big one—a group of modern concrete and steel industrial buildings, with something over forty acres in aggregate floor space, nearly 60 miles of conduit and other things in proportion. The work was evidently planned with much forethought and executed with the help of all labor-saving devices feasible. It was carried out in 1920 and 1921 and pushed at high speed, so that in most respects it may be taken as typical of the best recent practice. One of the striking features of the cost data is the relatively large amount of so-called unproductive labor—in results probably the most productive, showing the value of orderly and skillful administration in putting through the task.

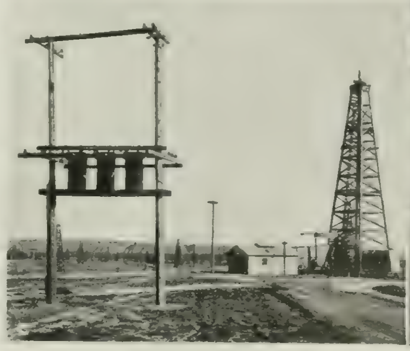
In bringing the facts into usable form when considering this kind of work the separation of material and labor is all-important, since the variations in these items are considerable and may be in opposite directions. For maximum convenience it might be well to segregate the wages of various classes of workers more than has here been done, because here again the pay of several groups may vary unevenly. In every class of electrical work the cost of units in labor and material is the proper basis of comparison, but each class is a special problem in classification. Data such as are here given —all too rare—are not only of great importance to constructors but furnish a full and decisive record of costs for the purpose of estimating reconstruction values and depreciation in the consideration of plants under examination as public utilities. Many an acrimonious quarrel would have been cut short had reliable cost data been available during the last twenty-five or thirty years.

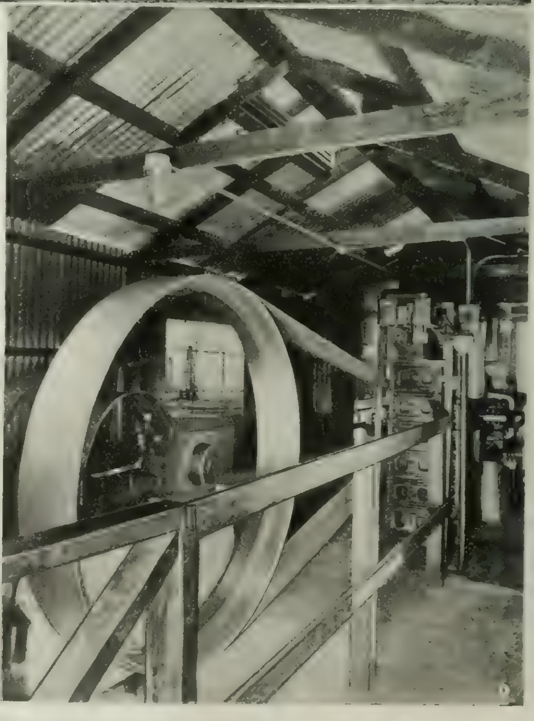
3,000 Oil Wells Pumped Electrically on San Joaquin Company's Lines



OWING to the greater economies effected, electric drive is rapidly displacing steam and gas engines for pumping the oil wells of California. On the lines of the San Joaquin Light & Power Corporation alone there are now 3,000 oil wells so operated. This is a particularly striking demonstration of the merits of electric operation in view of the fact that oil and gas are here available without transportation. The relative costs per day per well operating with electricity, gas engines and steam engines are $1, $2.16 and $5 respectively.

A typical electrically operated oil field is shown in B, with a closeup view of one of the motor-driven jacks operating twenty-seven wells in A. A typical transformer service is illustrated in C. D is a combination pumping and drilling plant, showing resistor stacks and control panels at the right.





Heat Flow in Armature Coils

A Physical Interpretation of the Heat Phenomena Occurring in Armature Coils and in the Core—The Influence of Iron and Copper Losses, Core Dimensions and Ventilation on Heating Shown in Graphical Form

By **C. J. FECHHEIMER**
Power Engineer Westinghouse Electric & Manufacturing Company

PERHAPS no problem which arises in the design of electrical machinery is more important or more difficult than that of temperature rise. It is important because too high temperature frequently results in eventual destruction of the insulation and too low temperature often means that the machine is more expensive than necessary. It is difficult for many reasons, such as the uncertainties of the constants of thermal conductivities of the insulation and of the steel laminations, of the rates at which heat is "picked up" by the moving streams of air, etc. It is especially difficult because the paths for heat conduction and for ventilation involve such intricacies that fundamental mathematical solutions are generally impossible. For any portion of the problem assumptions must be made, and usually some empirical data must be relied upon.

Difference in temperature between points in a given material gives rise to the flow of heat by conduction. In most electrical machinery nearly all of the heat is carried away by moving air, and the heat that is conducted away through the feet or other fastenings is nearly negligible. However, conduction does play a very important part in heat transmission within the apparatus. Conduction is the means whereby the large temperature differences are reduced. For example, were it not for the flow of heat by conduction through the insulating walls of armature coils the copper would reach infinitely high temperatures. Hence in the solution of any temperature problem in electrical machinery heat flow should receive proper consideration by designers and operators.

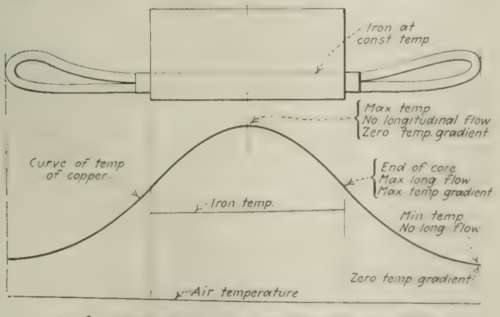


FIG. 1—LONGITUDINAL TEMPERATURE DISTRIBUTION

The quantity of heat which flows between two points is proportional to the difference in temperature (difference of thermal potential) and inversely proportional to the thermal resistance of the path—that is, Ohm's law for the heat circuit. The thermal resistance is directly proportional to the length and inversely to the area, just as in the electrical conductor. However, owing to the necessity of considering three dimensions and since the areas and lengths are usually not simple, the heat-conduction problem is fraught with great difficulties. To add to the complexity, the thermal conductivities of the materials are considerably greater with than across the layers, and the constants of conductivity frequently differ for corresponding parts within a given machine. Thus the transverse thermal conductivity of the insulating wrapper on coils is less than the longitudinal and may vary as much as 50 per cent for the armature coils in a given machine. The resistance to the flow of heat is known to be about fifty times as great perpendicular to the planes of the steel laminations as along them. Consequently, in any analytical solution it is necessary to make assumptions, and generally some part of the solution is empirical.

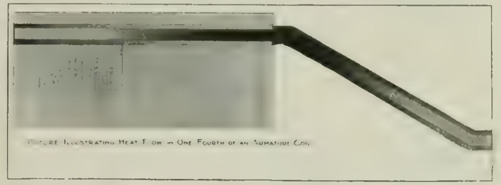

Picture Illustrating Heat Flow in One Fourth of an Armature Coil

FIG. 2—A GREAT AMOUNT OF THE HEAT FLOWS LONGITUDINALLY TO THE END OF THE COIL, WHERE THE AIR REMOVES IT

When a mathematical solution of a complicated phenomenon is obtained, the tendency is to lead one quite far from the physical conception of the relations of the quantities that enter. Since the physical picture assists materially toward a qualitative understanding of a phenomenon, interpretations are given in this article of the mathematical expressions contained in a paper entitled "Longitudinal and Transverse Heat Flow in Slot-Wound Armature Coils."* The importance of the subject will be recognized by all who are familiar with the fact that the machine having a short core is far easier to cool than one with a long core, owing largely to the influence of the longitudinal heat flow in the copper.

By longitudinal heat flow is meant the heat that is conducted along the copper in the coil from the embedded portion to the ends or vice versa, depending upon the relative rates of heat dissipation from the two. The transverse flow is the heat that is conducted across the wall of insulation for the embedded or end portion.

The physical picture is made clearer by regarding heat as a fluid and imagining a conductor of heat to be analogous to a channel for the fluid. The good conductor of heat such as copper offers relatively small resistance to the fluid flow, like a river in a long open channel; the poor conductor of heat, like the thin insulating walls, offers large resistance, somewhat analogous, except for thickness, to seepage of water through the soil. When heat is generated within a conductor it is analogous to supplying water from springs distributed along the river bottom.

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*A. I. E. E. Transactions, 1921, page 589.

In perhaps more than 50 per cent of the cases, the heat generated in the embedded copper by I^2R and eddy-current losses causes the copper to be at higher temperature than the iron. Considering that case, some of that generated heat is conducted transversely through the insulating wall to the cooler iron in the core and the remainder of that heat must flow longitudinally along the copper. The coil ends are cooled by air streams at a relatively rapid rate, so that the copper there is cooler than that which is embedded; consequently heat flows from the copper in the embedded parts to the copper in the ends. Just as in the case of the river fed by springs, the quantity of flow along the channel (copper) increases the farther one goes down stream; the total longitudinal flow is the summation of all that portion of the water fed from the springs (or heat generated) that has been added from the beginning up to that point. Meanwhile, water is seeping away (the transverse flow through the insulating wall) all the way along. If the flow longitudinally is confined within a constant section of channel, the velocity, and therefore the pressure drop, increase as the quantity of flow increases. Similarly, in the embedded part of the coil, the quantity of longitudinal flow continually increases as the ends are approached, and therefore the fall of potential—that is, the drop in temperature—continually increases. As the copper temperature decreases the transverse flow must necessarily decrease. As the transverse flow decreases a larger percentage of the generated heat per inch of length must be conducted longitudinally, and that means that the longitudinal temperature drop per inch of length (temperature gradient) must increase, and so on. Consequently the temperature longitudinally diminishes at an ever-increasing rate until the end of the core is reached. The curve for copper temperature (Fig. 1) will help to clarify the picture, being a maximum at the center.

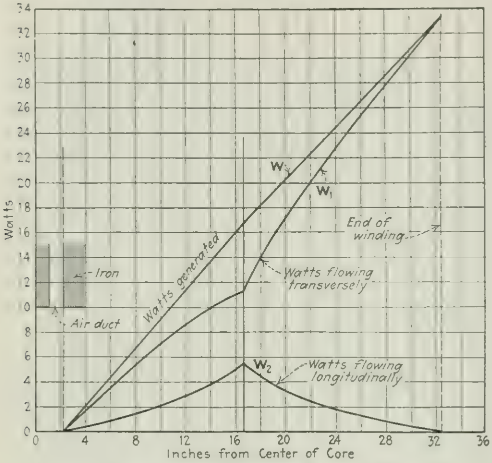

FIG. 3—TOTAL WATTS GENERATED AND FLOWING AT ANY POINT

Considering the total quantity of heat as flux, there is evidently a maximum density of heat flux in the copper at the end of the core as up to that point all of that generated heat in the copper which was "picked up" for longitudinal transmission has collected and must pass through the copper at the end of the core. The temperature gradient (slope of the temperature curve in Fig. 1) is consequently maximum there.

With the beginning of the well-ventilated end windings, just beyond the end of the core, and their consequently relatively low surface temperatures, the transverse thermal drop is suddenly augmented, and the resultant density of transverse heat-flow flux increases to a maximum. The falling off in copper temperatures from the end of the core to the extreme end of the winding is accompanied by a diminishing rate of transverse heat flow.

It will be remembered that there was high heat flux density in the copper at the end of the core due to longitudinal flow from the embedded part. This is gradually converted in the end windings to transverse flow, and all of it must be thus transmitted between the end of the core and the extreme end of the winding. To that longitudinal heat which is converted to transverse in the end windings must be added the heat generated by I^2R and eddy currents in the copper in the ends, and all must be dissipated from the ends. The longitudinal heat flux density diminishes as the extremity of the ends is approached; therefore the temperature gradient diminishes, as will be seen in Fig. 1.

The physical picture is made clearer by an inspection of Fig. 2, which shows by shading the intensity (or density) of heat flux. Thus the density of transverse flow has two maxima—at the center of the core and at the beginning of the ends adjacent to the core. There are likewise two minima—in the embedded part at the end of the core and at the extremity of the ends. The longitudinal flow is zero at the middle of the core and at the extremity of the ends and is maximum at the end of core.

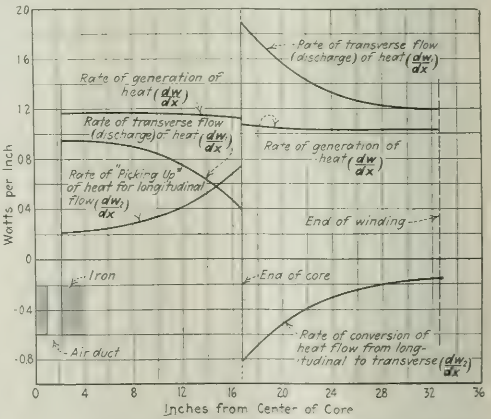

FIG. 4—RATE OF GENERATION OF HEAT AND THE RATES OF DISCHARGE AND "PICKING UP" OF HEAT

In Fig. 3 numerical values are plotted for a particular turbo-alternator and should further assist in understanding the phenomenon shown qualitatively in Fig. 2. (The end of the air duct is taken as the point of maximum temperature.) The unit chosen is the watt, which is the same kind of unit as the British thermal unit per second.* At any value of abscissa the total watts generated equals the sum of the watts flowing longitudinally and transversely; for example, at the end of the core, $16.72 = 5.4 + 11.32$. In Fig. 3 the ordinates represent the summation of heat from $X = 0$ (the end of the air duct) up to the particular point. This will be quite clear for the curves of watts generated and the transverse flow. For the longitudinal flow curve watts are continuously added up to the end of the core. From that point to the extremity of the winding the longitudinal heat received from the embedded part is gradually converted to transverse flow, and therefore the longitudinal flow gradually decreases and finally becomes zero at the extremity. In the case of the longitudinal flow the ordinates are a measure of the heat-flux density. For the transverse flow that statement does not apply.

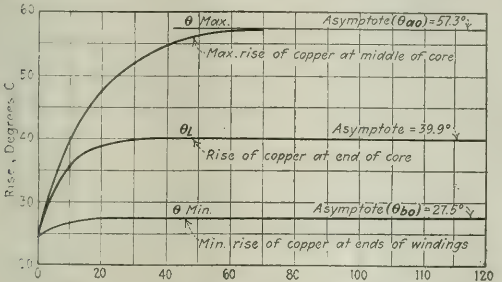

Fig. 5

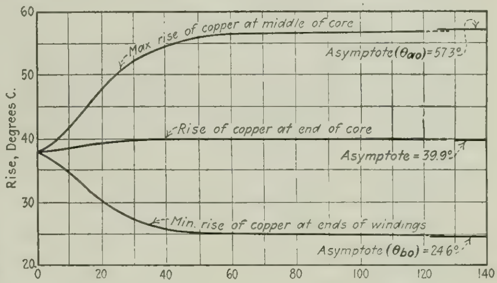

Fig. 6

INFLUENCE OF CORE LENGTH UPON TEMPERATURE RISE

Fig. 5—Based on constant length of end windings. Fig. 6—Based on constant ratio of length of ends to embedded parts.

It is interesting to note the changes in the slopes of the curves in Fig. 3 and the meaning thereof. They are given in Fig. 4. The slope of the "watts-generated" curve gives the watts per inch of length; that is, the ordinary I^2R and eddy-current losses per unit length. Were it not for the influence of temperature upon resistance and the sudden decrease in eddy-current loss at the end of the core, the generated watts per inch would be constant. The influence of those two factors in causing the generated loss per inch to depart from a constant value will be seen from an inspection of Fig. 4.

The slopes of the transverse heat-flow curve in Fig. 3 (as plotted in Fig. 4) are the transverse watts per inch of length; that is, the ordinates indicate the density of transverse heat flux. That density decreases from the left to the right end, because the copper temperature decreases (see Fig. 1) and therefore the temperature difference between the copper and the iron decreases up to the end of the core. Then, as previously explained, the transverse flow suddenly increases. As the copper temperatures in the ends decrease as the extremity is approached, the transverse drop, and therefore the transverse flow per inch likewise decreases. That rate of transverse flow is evidently the rate of discharge of heat.

The meaning of the slope of the longitudinal flow curve in Fig. 3, as plotted in Fig. 4, is, for the embedded part, the heat per inch that is "picked up" for longitudinal transmission. For the ends it means the watts per inch of longitudinal flow that are converted from longitudinal to transverse flow.

Referring to the temperature curve in Fig. 1, it will be seen that as the temperature difference betwen the copper and the iron decreases the rate of transverse flow must dcrease. That in turn means that more of the generated heat must be transmitted longitudinally; consequently the rate of "picking up" of heat for longitudinal transmission must increase. As a result there is more rapid decrease in copper temperature, which causes a faster lowering in the rate of transverse flow. That again causes a larger percentage of heat to flow longitudinally, and so on. For the ends, as the difference between the copper and the air temperature decreases, the transverse flow per inch must correspondingly decrease. Some of the longitudinal heat is converted to transverse, thereby decreasing the density of heat flux in the copper and decreasing the temperature gradient along the copper. The ordinates of the rate of longitudinal conversion curve (for the ends) are shown as negative, because now heat is to be discharged (transversely) instead of accumulated, as for the embedded part.

For any value of abscissa the rate of generation of heat equals the rate of transverse flow plus the rate of "picking up" for longitudinal flow, or conversion from longitudinal flow. The differential equation in the mathematical derivation, when simplified, is simply a short-hand expression for this statement. Thus a physical picture of the differential equations has been drawn.

A point of interest is that the longitudinal flow is only a means for diminishing the differences in temperature along the copper. It provides no means for the escape of heat from the copper. In many machines, however, it is the means whereby the so-called "hot spot" is liminated. Thus, in short-core machines, with well-ventilated ends and with large eddy-current loss in the embedded copper, the longitudinal flow reduces the maximum copper temperature considerably below that which would obtain with only transverse flow. In fact, there are cases of short-core machines in which the iron temperature is higher than that of the embedded copper.† Then there is transverse flow from the iron to the copper. The heat thus received plus the heat generated in the copper flows longitudinally to the ends, and there all of that heat plus the heat generated in the ends flows transversely to the external coil surfaces, where it is carried away by moving air. As another example, in the case of certain direct-current railway motors the ends were very poorly ventilated—to avoid the collection of dirt—and then the heat generated in the end windings was only partly dissipated from the coil-end surfaces. The remainder flowed longitudinally to the embedded part, where it, plus the generated heat, flowed transversely to the cooler iron.

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*It should be noted that the conditions are for the steady state only, which means also steady flow of heat; therefore the watt may be considered as the unit instead of the joule or B.t.u. or calorie.

†This condition also obtains in many machines operated at light loads.

It will readily be seen from foregoing explanations why the difference between the maximum and minimum copper temperatures increases rapidly as the core length is increased. For any given proportions of shape of slot, current density, ventilation constants, thickness of insulation, etc., the influence of core length upon temperature will differ. The same turbo-alternator for which Figs. 3 and 4 were plotted was selected for the curves in Figs. 5 and 6, and they illustrate the influence of core length. In both are shown the copper temperatures near the center of the core (maximum), near the end of the winding (minimum) and at the end of the core. In Fig. 5 they are drawn for constant length of ends. In Fig. 6 the ratio of the length of the ends to the embedded part has been taken to be constant. The shapes of the curves for the two cases are different, but in both the maximum temperature (for a core of infinite length) is the same, as all generated heat at the center flows transversely. For the minimum temperature the longitudinal flow influences that at the extreme ends, with constant (finite) length. When the ratio of length of ends to embedded parts is constant, as the embedded parts approach infinite length, the ends must do so likewise; consequently at the extremity longitudinal flow has no influence upon temperature, and all the heat must flow transversely, the result being lower temperature there.

Use of Converter in Mining Service

Former Apprehension Had Basis, but Recent Developments, Chiefly the Introduction of High-Reluctance Magnetic Circuit, High-Speed Breakers and Automatic Substations, Have Changed the Situation

By **J. L. McK. YARDLEY**
General Engineer Westinghouse Electric & Manufacturing Company

SYNCHRONOUS converters have apparently given satisfaction in the comparatively small number of mining installations in which they have been employed for the conversion of alternating current into direct current, yet it is a fact that in the great majority of mining installations motor-generator sets only have continued to be employed for this purpose. Such a situation can only be the result of a marked preference for one type of equipment over the other. This preference cannot be due to difference in costs, since the cost of both installations is practically the same. Complete mining units to operate from a 2,200-volt, 60-cycle supply circuit, whether motor-generator sets or synchronous converters, may be obtained at the present time at approximately the following figures: 100-kw. unit, $4,000; 150-kw. unit, $4,400; 200-kw. unit, $5,200; 300-kw. unit, $6,300.

The preference for motor-generator sets seems to be the result of a belief which has developed through experience that they are the most reliable and economical type of equipment obtainable for operation under the service conditions existing in mines, where extreme load variations occur and coincidentally big voltage drops. The preference has, of course, had a basis. It is that the frequency of dead grounds and dead short circuits and other high instantaneous overloads has been greater in mining service than in any other industrial service, or even in the usual electric railway service. These conditions tended to produce an overload which greatly exceeded the normal capacity of the equipment because the converting unit is usually small. Owing to the fact that the insulating clearances and spacing factors have been smaller in the small units than in the large, the ability to withstand flashovers without excessive destructive burning has been weak. Hence mining engineers have been entirely logical in not following the growing tendency of engineers in other industries to use converters.

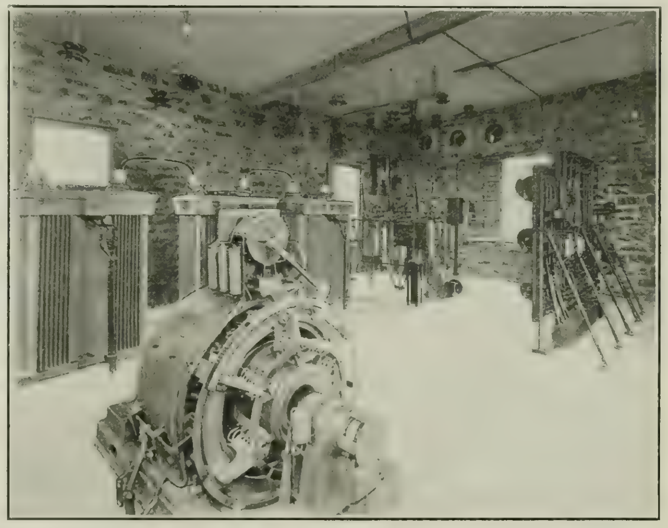
However, some comparatively recent developments have been made in the design and operation of the synchronous converter that make it opportune at the present time to consider the application of this type of equipment to mining service more seriously than ever before. Reference is made particularly to the introduction of comparatively high reluctance in the magnetic circuit of the commuting poles of synchronous converters. Then there is also the possible use of higher-speed direct-current circuit breakers and of automatic substations for the greater protection as well as more economical operation of synchronous converters. Comparatively little can be said that is new regarding the fundamental requirements of mining service. This subject has been quite thoroughly analyzed in the past, and the various merits and disadvantages of the types of equipments which may be employed have become well understood. The principal fundamental argument remains about the same, namely, that the synchronous-converter-transformer installation is inherently more efficient than the motor-generator installation. This difference amounts to from 3½ to 9½ per cent for the sizes of units employed and the load factors ordinarily experienced in mining service. The saving which this difference in efficiency represents has been well worth striving to attain, and naturally efforts have been expanded to make the synchronous-converter transformer installation meet all the requirements.

Contrary to rather general impressions, the development and success of the commutating-pole synchronous converter required only a short interval of time. All the advantages of the new type of design were practically obtained in one jump. The first high-speed commutating-pole synchronous converter* was 100 per cent higher in speed than the non-commutating-pole type of machine it superseded, and it embodies all the advantages of increased efficiency, reduced weight and cost and improved general performance which were found to accompany the new type of design.

For 60 cycles, it is true, the full advantages of the commutating-pole design were not at once obtained. There was a rather general apprehension that the 60-cycle machine would flash worse with commutating poles than without. Owing to this hesitation, the first 60-cycle synchronous converter equipped with commutating poles was an old design which had been successful in operation without commutating poles. This machine was scarcely improved by the addition of commutating poles, but gave promise of the results which might be expected at 60 cycles from good commutating-pole design; so that by 1914† the manufacturer of synchronous converters was entirely on a commutating-pole basis, both for 25-cycle and for 60-cycle service. It is important to appreciate, therefore, in considering the matter of reliability, that the synchronous converter has been developed substantially as at present for a period of years approaching, if not equaling, that of the modern motor-generator set.

A number of small synchronous converters were designed for general industrial service back in 1914, but of ratings which also meet the usual conditions of mining service. These machines, rated at 100, 150, 200 and 300 kw., 275 volts, 60 cycles and 1,200 r.p.m., were in the main very satisfactory. They were amply rated for general industrial service, as they would carry 25 per cent overload for two hours and would comfortably carry momentary overloads of 100 per cent. However, when considered for mining service, owing to the comparatively large amounts of power which would usually be behind them and the frequent instantaneous loads far in excess of their capacity to which they would be subjected, these machines were not generally favored under conditions in which practically their only protection would have been their own limited amount of resistance and inductance and the then usual comparatively slow-acting types of substation switching equipment. In fact, when tested out under such conditions, the flashovers which occurred tended to result in considerable destructive burning.

The high-reluctance commutating pole has increased by about 100 per cent the ability of the synchronous converter to operate without flashover under momentary overload conditions. The increase in the instantaneous load capacity of these machines from 200 per cent to around 400 per cent of rating by means of high-reluctance commutating poles seems likely to bring the synchronous converter to such a position of reliability, in the opinion of practical mining men, as to cause them to avail themselves to a greater extent of its economies. As already mentioned, the use of higher-speed direct-current circuit breakers or the advantages of automatic substation operation will probably also influence the situation. It should also be mentioned that details of construction and insulation clearances have been modified on these small machines so that flashovers do not cause the same amount of destructive burning. The earlier design tended to confine the arcing so as to burn the brushes and brush rigging very badly, but the later design is much more open, does not restrict the arc, and in fact tends to assist it to dissipate without excessive burning of the machine itself.



EXCAVATION FOR THIS 300-KW. AUTOMATIC CONVERTER STATION COULD BE REDUCED TO 150 YARDS FOR MINE SERVICE

This is a 600-volt, 60-cycle commutating-pole synchronous-converter station serving an electric railway. In the foreground is the converter with automatic brush-lifting equipment and thermal relay on the bearing. To the right is the control panel carrying contactors, relays and meters.

Although the effect of high reluctance in commutating-pole circuits was fully understood back in 1914 and was being considered for use in booster-type synchronous converters, there was no attempt to employ this feature for the purpose of increasing the instantaneous overload capacity in any of the earlier commutating-pole machines. Commutating poles and windings were introduced primarily to meet normal operating conditions in general industrial and railway service. They were proportioned to compensate for armature reaction and provide necessary commutating flux under such conditions, and, as has been mentioned, they resulted in decidedly better performances. The commercial value of increasing the reluctance in the magnetic circuit of the commutating pole and increasing the strength of the commutating-pole winding so as more nearly to compensate the armature reaction under instantaneous load conditions was not appreciated. This is mentioned because it is rather surprising, particularly in view of the fact that the need for greater protection for synchronous-converter installations under instantaneous

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*This machine, a 1,500-kw., 600-volt, 25-cycle, 500-r.p.m. synchronous converter, designed and built in the early part of 1911, was described and illustrated by the author in the *Electric Journal*, August, 1912, pages 704 and 705.

†An article on "High-Speed Rotary Converters" by the author in the *Electric Journal*, October, 1914, gave details of the general results which had been accomplished at that time.

load conditions was recognized and efforts were being made to develop protection by one means or another.

Most of the efforts to secure greatest continuity of service and safety for the converting equipment were along the line of developing the relative assistance of various auxiliaries. One of the most promising of these was a higher-speed direct-current circuit breaker. It was appreciated that there is an interval of delay in the application of an overload, however great, to an electrical machine, owing to the inherent inductance of the intervening circuit, and that a synchronous converter would be fully protected against flashover if it could be disconnected from the load circuit in the interval between the beginning of an excessive overload and the time of the overload's reaching the flashover capacity of the machine. It became obvious that practically it was a matter of introducing an inductance and a quick-opening breaker in the direct-current circuit, the inductance to increase the time interval and the circuit breaker to take advantage of that interval and automatically open the circuit. Some very satisfactory tests were made‡ using an inductance of approximately 15.25 milli-henries and a higher-speed circuit breaker in connection with a 500-kw., 1,250-volt, 60-cycle non-commutating-pole synchronous converter. However, difficulty was experienced in obtaining a circuit breaker with a time element less than 0.015 second, whereas it was demonstrated that a time element of 0.01 second or less would be necessary in order to permit the use of a comparatively inexpensive inductance. The combination of circuit breaker and inductance limited the current to around 1,400 amp., or three and one-half times normal.

TABLE I—TYPICAL ECONOMIES IN RAILWAY SERVICE

Headway between cars	1 hour
Length of line (single-track 70-lb. rails), miles	25
Number of substations	3
Capacity of substations, kw	300
Size of trolley	0000
Size of feeder, circ mil...	300,000
Distance between substations, miles	10
Schedule speed, miles per hour	25
Length of operating day, hours	20
Total substation hours (manual operation	60
Total substation hours (automatic operation	34
Running light loss per station, kw.	15
Energy saved per day with automatic operation, kw.-hr	390
Energy saved per year at 1 cent per kw.-hr.	$1,424
Labor saving per year, six operators at $90 per month	6,480
Investment in converting units exclusive of switchboards	20,500
Investment in automatic control, three stations	21,000
Maintenance, interest, insurance, depreciation taxes (15 per cent	3,150
Cost of inspection per year....................	900
Total annual charges	4,050
Net saving	3,854
Net return on investment in automatic equipment, — per cent	18.3

Since that time a 1,200-amp. direct-current circuit breaker has been developed which, when tested in connection with a 500-kw., 600-volt, 60-cycle, 1,200-r.p.m. synchronous converter, equipped with high-reluctance commutating poles, under short-circuit conditions, limited the current to 6,000 amp.—that is, 7.2 times normal—in 0.005 second and entirely cleared the circuit in 0.0085 second. The inductance in circuit was only 0.15 milli-henry, or, taking into account the different current capacity, the inductance coil employed was only about 20 per cent of the size employed in 1914.

It has been established, therefore, that by means of comparatively inexpensive equipment a synchronous converter or direct-current generator can be absolutely protected against being flashed over by direct-current load conditions. Now, if this protection should be combined with the automatic substation so as to eliminate the human element introduced by the station operator, nearly all the objections raised against synchronous converters in mining service would be removed. Of course, the automatic substation‖ can be and is being used in connection with motor generator sets in mining service.

The remaining objection to synchronous converters is due to the rather meager amounts of copper strung in the alternating-current and direct-current feeders. The claim is that voltage is not held up so well and that as a consequence work slows up in the workings remote from the power station. Since the compound-wound synchronous converter will take care of direct-current feeder drop within reasonable limits as well as it is taken care of by the motor-generator set, the answer to this objection would seem to be that some of the efficiency to be obtained through increasing size of feeders, reducing feeder losses and employing synchronous converters should be capitalized and the capital invested in increased copper in the alternating-current feeders, with probably some additional investment also in the direct-current feeders. In this respect the problem in mining service does not seem to be materially different from the problem in connection with the surface railway. Perhaps, at least in coal mining, more of the mining substations in the future will be placed on the surface instead of underground. At any rate, the need of sufficient copper in the feeders for the sake of economy has been appreciated in electric railway service, and this need has been met and service benefited by the automatic synchronous-converter substation.

In regard to costs and the savings to be effected, conditions vary to such an extent in the individual mining properties that a general statement, however approximate, can scarcely be made. Figures are given here, however (Table I), on a typical example of a suburban electric railway, simply to show the various points which should be considered in calculations made to justify installing automatic substations.

Possibly in attempting to derive figures which would represent at least some mining service conditions a conservative assumption would be that all substations would be operating continuously six days per week at around 30 per cent load factor, so that there would be no saving of light-load running losses. Probably also a somewhat less completely automatic form of automatic substation§ would be satisfactory inasmuch as it would save attendance, give protection to the equipment and would not cost more than half the figure used in the above table. In such an installation 6 per cent of the total kilowatt-hours supplied to the converting equipment would be an approximate figure to represent the saving effected by employing synchronous converters instead of motor-generator sets. The typical economies then would be those indicated in Table II.

TABLE II—ESTIMATED ECONOMIES IN MINING SERVICE

Energy saved per year, automatic operation....................	0
Yearly saving through using synchronous converters instead of motor-generator sets: 30 per cent × 310 × 24 × 3 × 300 × 0.06 × 0.01..	$1,200
Labor saving per year, six operators at $90 per month	6,480
Investment in converting units without switchboards	20,500
Investment in automatic control equipment, three stations	10,500
Maintenance, insurance, interest, depreciation, taxes (20 per cent).	2,100
Cost of inspection per year	900
Total annual charges........ ...	3,000
Net saving.....................	4,680
Net return on investment in automatic equipment, - per cent	44.5
Per cent saving due to rotary converters	11.4

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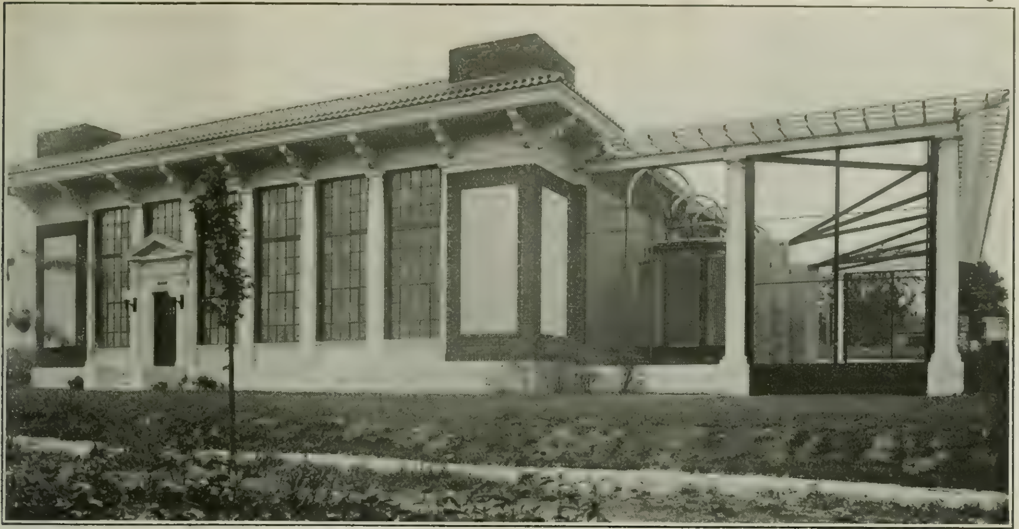
‡*Proceedings A. I. E. E.*, Oct. 9, 1914, "Use of Reactance with Synchronous Converters," page 1521, J. L. McK. Yardley.

‖A description of such equipment recently developed is given in the *Engineering and Mining Journal*, Oct. 8, 1921, page 599.

§*Mining and Metallurgy*, September, 1921, page 44.



Automatic Control of A.-C. Distribution

Operating Features of the Kansas City Power & Light Company's New Self-Operating Substation Recently Placed in Service in the Big Western Missouri City

By A. E. BETTIS* and C. W. PLACE†

THE increased use of electrical appliances in the home, the introduction of motion-picture theaters in the residence districts and the increased use of electric drive, heating and lighting in factories have in recent years changed the problem of supplying energy to large cities. Load growth now seems to be around centers, with all the characteristics of medium-sized cities surrounded by outlying zones which merge into adjacent zones. The problem of supplying these various centers and their surrounding zones is of exactly the same nature as supplying a group of small cities spread through a large countryside, and it looks most economical at present to treat the power supply in exactly the same way as if these centers were separated by considerable distances.

This situation has led to dividing the larger cities into zones, each operating company figuring out the economic size of the zone and building the distribution accordingly. This process was started in Kansas City about four years ago, the first step being to equip the inner group of such zones with transforming and distributing facilities. These stations were installed as hand-operated stations and were immediately loaded up to their capacity. It then became necessary to begin

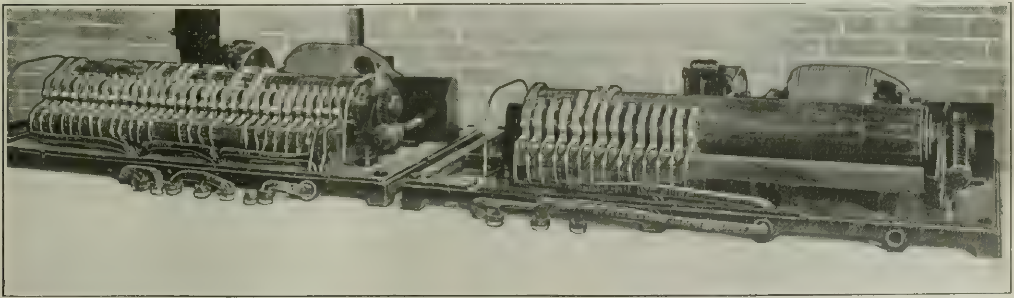


FIG. 1—MASTER CONTROLLERS FOR AUTOMATIC OPERATION. LEFT, FOR 13,200-VOLT PRIMARY SWITCH CONTROL. RIGHT, FOR 4,000-VOLT FEEDER CONTROL

the equipment of the next group surrounding these inner zones.

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†Engineering Department, General Electric Company.

After a careful analysis of the situation it was decided to install two additional stations and so to equip them that they would operate without attendants. Following out its policy of doing everything within reason to assure continuity of service, the Kansas City Power & Light Company decided that the natural step in operation was to do away with as many chances of human error and misunderstanding, or inattention to business, as possible.

To the previous stations had been brought a double equipment of high-tension cables, frequently over different routes, and reserve sets which could be switched into service during times of trouble. The low-tension feeders were grouped in such a way that with their connection to the high-tension feeders radial distribution was obtained from the power house. This gives the least interruption to the customer when troubles occur on circuits other than the one feeding the particular customer.

TIME SAVED IN RECONNECTING

By making the new stations automatic and at the same time following the established main circuit connections it was felt that reconnections and rearrange-

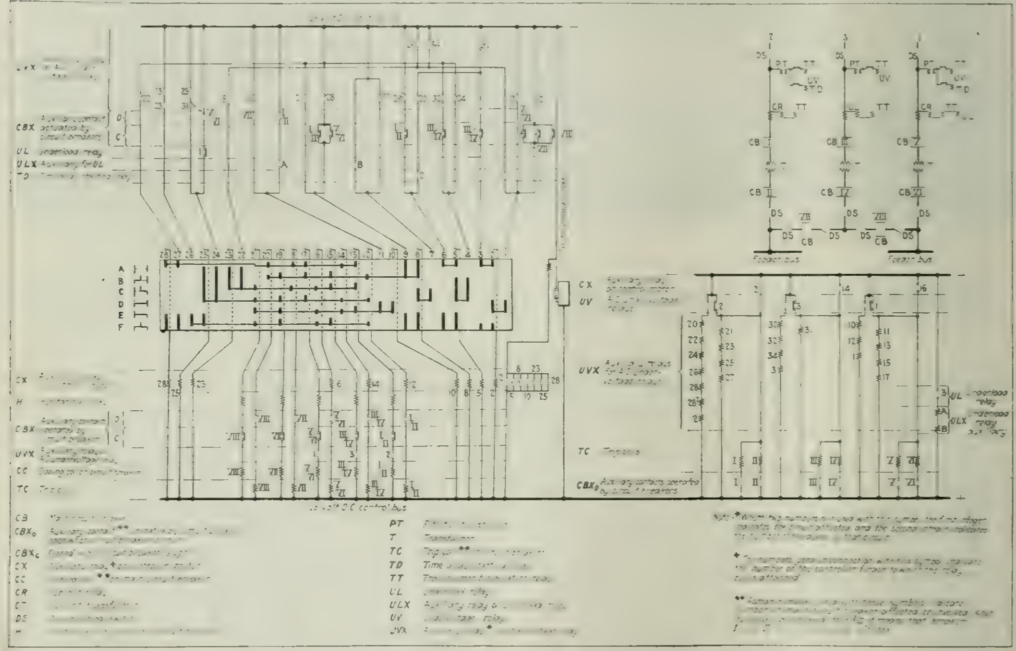

FIG. 2—SIMPLE LAYOUT MADE POSSIBLE WITH AUTOMATIC CONTROL

During the peak lines Nos. 1 and 2, with the transformer for each, are feeding independently their groups of feeder circuits. The controller will be in position *A*. On the decrease of the load it is the intention to take off one bank of transformers while the other is to carry the whole load. This is accomplished by a contact-making ammeter on line No. 1, making contact at a predetermined low-current setting, and when this contact is made, energizing the motor driving the controller which moves the controller drum from position *A* to position *D*. As the segments on the drum come in contact with the fingers as position *D* is approached, the various oil switches operate in the proper sequence so as to transfer the group of feeders being fed by line No. 2 to line No. 1 and disconnect line No. 2 and its transformer. When the load comes back to a point where line No. 2 should be reconnected, a different source of power for the controller driving the motor is given by the contact-making ammeter on line No. 1, making contact at a high current value and bringing the controller from position *D* around again to position *A* and throwing the proper oil switches. It will be noted that these various combinations cover all the combinations which can be legitimately required.

The sequence in obtaining two combinations is as follows: consider that from position *F*, the "off" position, because of a heavy load, the controller motor is energized to move the drum into position *A*. As the controller moves, segment 13 makes contact and energizes hesitating control relay *H* through the contacts of undervoltage relay *UVX2*, and the auxiliary switches CBX_cI/II of oil circuit breakers I and II. This closes breakers I and II of line 1. In the same way segment 17 makes contact and energizes relay *H* through the contacts of undervoltage relay *UVX-1* and the auxiliary switches CBX_cV/VI of oil circuit breakers V and VI, closing breakers V and VI. Segments 18 and 20 complete a circuit through the tripping coils *TCVII/VIII* of breakers VII and VIII, and open the bus-tie breakers VII and VIII. Segment 14 energizes relay *CX-14*, which completes the circuit through the tripping coils, *T.C.* III and IV, of breakers III and IV, opening these breakers. Thus lines 1 and 2 are connected directly to the two feeder buses.

As the controller continues to revolve, the circuit of segment 9 and of segment 6, which furnished the initial impulse through relay *CX-5*, to start the motor are broken through the opening of $CBX_cI/II\ V/VI$. The controller is then kept in motion by the circuits through segments 27 and 28, which energize relay *CX-28*.

Before the controller has run off the short segments of division *A*, segments 22, 23, 24 and 25 make contact. Segments 23 and 25 are connected through the coils of relays *CX-23* and *CX-25*, to the positive bus, but the circuit of 22 is broken by the relay *UVX-15*, an auxiliary of *UV-1*. If there is sufficient load on line 1 the circuit of segment 24 is opened by the action of underload relay *UL-1*. Therefore, when the fingers have run off all the short segments of division *A*, all the *CX* relays will be de-energized and controller will come to rest.

This leaves line 1 energizing the right-hand feeder bus through oil circuit breakers V and VI, and line 2 energizing the left-hand feeder bus through oil circuit breakers I and II. The bus tie breakers VII and VIII are open, and line 3 may or may not be energized.

With the station in position *A*, if the load decreases until one feeder can carry it all, the controller is moved to position *D*, as follows: The underload relay *UL-1* closes its contacts and completes the circuit through the CBX_0V/VI auxiliary switches of breakers V and VI to segment 24. Segment 23 completes the circuit through relay *CX-23* to start the controller motor, segments 22 and 9 being still de-energized. The controller moves to position *D*, where the short segments of division *D*, 21, 19, 17, 14 and 12, complete circuits that open oil circuit breakers I and II on line 2, and close bus tie breakers VII and VIII. This leaves the equipment in position *D*, where line 1 energizes the right-hand feeder bus through breakers V and VI, and also energizes the left-hand feeder bus through breakers V, VI, VII and VIII. The oil circuit breakers I, II, III and IV are open.

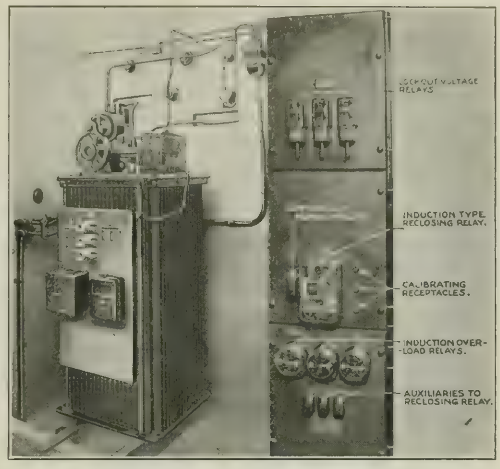
LOCKOUT VOLTAGE RELAYS
INDUCTION TYPE RECLOSING RELAY.
CALIBRATING RECEPTACLES.
INDUCTION OVERLOAD RELAYS.
AUXILIARIES TO RECLOSING RELAY.

FIG. 4—INDIVIDUAL REGULATOR PANEL AND AUTOMATIC RECLOSING PANEL FOR THREE-PHASE, FOUR-WIRE, 4,000-VOLT CIRCUIT

ments required by load changes and faults could be more readily made than by hand. For instance, the loss of power on one line would immediately change the load over to another line with only the lapse of an interval for clearing the first line. The outage with automatic operation would be exceedingly small as compared with hand operation. It was felt that when a transformer and a line were loaded to a point where additional capacity was required a second line could be brought on more promptly and with less interference to the voltage regulation than if this condition were left to be discovered by an operator and corrected after he had communicated with the load dispatcher.

On the low-tension distribution the individual circuits were to be handled so as to duplicate the present hand practice, but instead of waiting for the operator to arrive at the switch and reclose the feeder switch after it had opened, the automatic equipment would immediately put this reclosing into motion and thus save considerable time in restoring the service on individual circuits. While the kilowatt-hours gained by these various precautions will not be very great, still they will amount to something and the effect on the customer should be very good. Since the time of an outage will be measured in seconds before power is restored if the line is in condition to be energized after trouble, the uncertainty in the consumer's mind at the time of loss of power will be removed. Thus the psychological effect of line trouble on the customer will be entirely different from the effect where the hand-operated station is concerned.

One of these stations has just gone into operation, and since this is to all appearances a new departure in an engineering and economic way, it is thought that a general description of what it was intended to accomplish, the method of attack and some of the details of the equipment will be of general interest.

This particular station is in a fast-growing residential district and was consequently laid out with a view of conforming to the type of architecture which would probably surround it.

The general plan of the electrical equipment is to bring in two main high-tension transmission circuits from the central power station and one reserve or emergency circuit. Each main transmission line will feed its step-down transformer and a group of 4,000/2,300-volt, three-phase, four-wire feeder circuits, each single-phase feeder having its voltage regulator. Arrangements are made so that during the period of light loads this radial method of distribution will be continued, but one line and its transformer will be cut out after its group of distribution feeders is thrown over on the remaining line. Arrangements are also made so that in case of trouble on either of the main lines the group of distribution feeders will be thrown over to the spare line and its transformer energized. This spare line takes in every way the characteristics and receives the treatment of the line and transformer which it temporarily replaces. Since all of these operations are to be carried on without the assistance of an operator, the control devices necessarily take a different form from those usually found in a hand-operated lighting substation.

The handling of the line and transformer connections and the tying and breaking of the two groups of feeder circuits are of particular interest. The general scheme is to arrange the connections so that service will not be interrupted during a change-over under

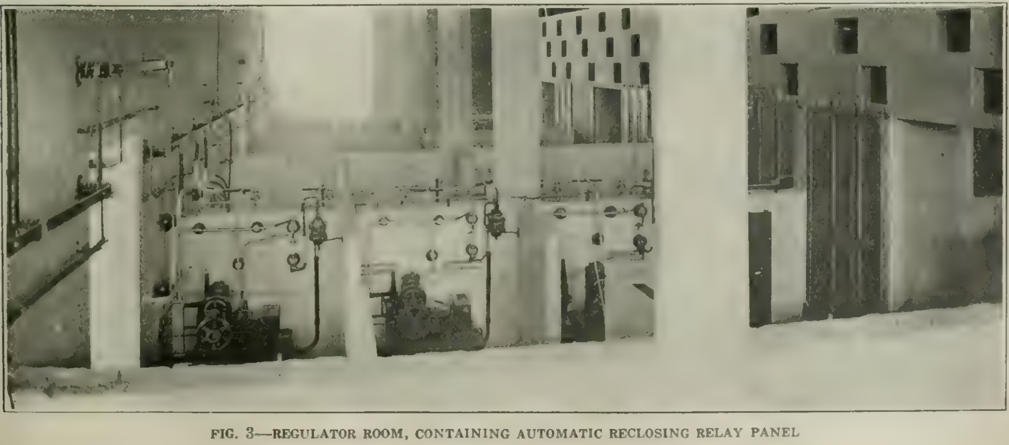

FIG. 3—REGULATOR ROOM, CONTAINING AUTOMATIC RECLOSING RELAY PANEL

normal operating conditions. In case of line or transformer trouble the load will be transferred immediately to the reserve equipment. This is accomplished by means of a motor-driven drum controller, the development of which will be noted at the left of the connections in Fig. 2. The controller closes and opens the various high-tension oil switches demanded for each set of conditions. The impulse for this controller to move from one position to another comes from the contact-making devices on the control board. These various impulses are independent of each other, and the action of the controller is such that it takes up a definite position for each condition.

The application of a drum controller to this type of service gives the greatest degree of flexibility in the operations which may be desired. The sequence of opening and closing of oil switches is definitely determined by the location of the segments on the controller. It is only necessary to determine what should be done, provide the impulse to move the controller to the proper position, and the oil-switch connection arrangement is effected as decided upon. This mechanical interlocking of the closing of switches through a drum controller allows the entire separation of the control circuits of the main switching equipment from the relays interpreting the conditions.

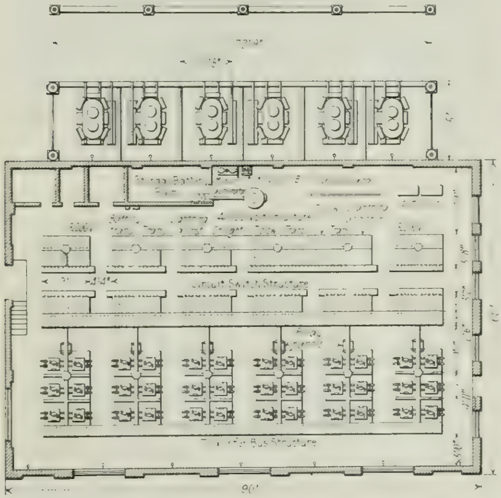

FIG. 5—ARRANGEMENT OF SUBSTATION EQUIPMENT

Transformers are indicated at the top of the drawing and feeder regulators in groups of six separated by barriers below.

Each group of feeder circuits and equipment forming a three-phase group is separated by barriers from adjacent groups. Included in such groups are three feeder regulators, oil switches, the control panel and a group of compartments fed by a spur bus from the main bus. This group of three single-phase feeders is arranged so that the usual practice in keeping such circuits alive if possible is followed. That is, in case of opening of a single-phase feeder switch it is reclosed; if it again reopens, another trial is made, and should it open a third time, it is locked out and line conditions are investigated. This feeder group is handled by the control equipment indicated in Fig. 2.

This equipment is of interest in that first, the overload relay has a special time-current characteristic which corresponds very closely to the time-current characteristics of various distribution transformer protective fuses; second, it has a small timing controller which recloses the oil switches and locks out any one which is open after the third trial. This controller is made so that the time interval between closing can be varied most nearly to fit the operating characteristics desired on different types of circuits. Each of these feeder circuits is handled by a heavy oil switch, its rupturing capacity being greater than ordinarily found in similar hand-operated service because of the fact that this switch may be called upon to open a short circuit three times in succession before it is locked out. All of these oil switches are solenoid-operated from a storage battery. In order to keep down the size of this battery an additional controller was introduced so that only one of these feeder groups could come into action at any one time.

The general cost of this installation is not excessive when compared with the usual method of handling such stations if the same degree of isolation of feeders and circuits is accomplished. It will be noted that while there are certain control equipments to take the place of the operator, savings are effected in the amount of control wire, conduit indicating instruments and space which would not be possible if an operator was required to handle the station. With the method of control used, what appears to be quite a large number of circuits are not in reality complicated, since these circuits are practically all simple circuits. This is due to the fact that the drum controller physically does a large share of the interlocking by the location of the segments on the drum and makes it possible to use simple circuits, thus avoiding the chance interference of sneak circuits.

From all indications this type of station, properly proportioned to the weight of the service and the economical size for each community, is going to be a very popular type of equipment. It is felt that the little additional expense is warranted by the increased reliability in the service. With the connections maintained and the contacts in order, there will be no misunderstanding of load dispatcher's instructions or hesitation in throwing the switches which would correspond to the time taken by an operator in finding out what had happened, making a decision as to what he should do, getting in touch with the load dispatcher, receiving and executing his instructions. It is felt that the effect on the user of the power of this quick return of service aften an interruption will be decidedly beneficial.

This station represents a type of alternating-current automatic station which the authors believe will become very popular in large cities. For smaller groups the same general type of equipment is proving quite popular. The application of the principle to the maintenance of power on a single circuit is, of course, alike in high-tension equipment when the circuit is thrown over from a dead to a live line and in low-tension equipment when a switch is reclosed after an outage. This general practice most nearly fits the present-day distributing conditions because such a large proportion of the interruptions are due to temporary short circuits caused by accidents trifling in themselves or else are the result of lightning. In the latter case, if the switch is allowed to remain open a few seconds, the trouble which caused it to trip will have disappeared and the switch will then remain closed; thus the service can be maintained.

Russia's First Regional Power Station

Transmission Line 80 Miles Long and Operating at 110,000 Volts Is Completed Between Kashira and Moscow, Supplying the Soviet Capital with Energy Generated from Low-Grade Coal

By **CHARLES P. STEINMETZ**
Consulting Engineer General Electric Company

THE first regional power station designed and built in accordance with the comprehensive plan for Russian electrification drawn up for the Russian government by a committee of engineers came into being on June 11 last, when the Kashira central station began operation, transmitting electrical energy at 115,000 volts over a 130-km. (80.7-mile) line to Moscow.

Oil from Baku, 2,000 km. (1,240 miles) away, and anthracite and bituminous coal from the Donetz basin, 1,000 km. (620 miles) away, are the sources of fuel and power on which the city of Moscow has heretofore relied. Not far away, to the south of Moscow, however, lie extensive brown-coal deposits estimated at 8,000,000 tons. This is low-grade coal, of about 3,000 to 3,500 calories heating value and containing 40 per cent ash. It is soft and friable, and this, with its low caloric value and high ash, makes it unsuitable for long-distance transportation.

The Kashira station, which was built to burn this low-grade coal and transmit its energy electrically, is situated on the right bank of the River Oka, 7 km. (4.3 miles) below the Kashir Mountains, at the place where the railroad to Moscow connects with two branch railroads leading to Scopin and Bobrikow, the two main centers of the brown-coal deposits south of Moscow.

If Moscow were considered as the main market for electrical energy, then it might be more economical to place the Kashira station nearer to the supply of coal, but since in the future this station will have to supply the entire central industrial district, the location of the station in the center of the district is the best plan. With respect to Sepouchov, Podolsk, "the Lakes" and Kolomna the Kashira station occupies such a central position. The nearness to the Kashir River is also advantageous, the river supplying the station with water and furnishing a route for future shipments of fuel.

RAILROAD CARS CARRY COAL TO BOILER ROOM

The Kashira power house is connected with the railroad station by a branch line 5 km. (3 miles) long, which ends in front of the power house. The system of tracks includes several branches, one of which makes a loop, as is shown in Fig. 1, gradually rises and then crosses an estacade, permitting the cars laden with coal to enter directly into the boiler room for discharge into the bunkers. In the future bridge cranes and conveyors will be installed, but for the present use is made of pits. These simplify the work of unloading and conveying the coal, which is carried to the bunkers by a moving platform. All the auxiliary railways are to be electrified and the cars are to be moved by electric locomotives rated at 1,200 volts, direct current, with a truck having two axles, on each of which a 120-hp. motor will be mounted.

Fig. 1 shows the general plan of the central station. The office building is situated near the power house Right above the station on a slope a workers' village is planned, and across the ravine beside the station will be the main village, in which it is planned to build a club house, a hospital, a school and other public buildings.

WOODEN PIPE USED IN WATER SUPPLY

As the electric station is on a high elevation with respect to the midsummer water level, it was necessary to build a pumping system on the shore of the river. Since in the spring the water rises very high on this part of the river, the pump house is built in the form of a tower, and it is also adapted for an ice-cutting plant. The pump house contains three 260-hp., three-phase, 50-cycle, 3,000-volt motor pumps, each having an output of 2,500 cu.m. (88,290 cu.ft.) per minute. In view of the present lack in Russia of a sufficient quantity of cast-iron piping, the water is conveyed in wooden piping held together by iron rings. The pipes have a diameter of 91 cm. (36 in.) and the wood is 50 mm. (1.9 in.) thick. Round iron rings with a diameter of 22 mm. (⅞ in.) are used at a distance of 200 mm. (7.8 in.) from each other.

Fig. 2 shows the general plan of the power house as it will be when all the projected extensions are made. The figure also shows the part already built. At the present time there are in operation two turbo-generator sets with a temporary transformer house and one boiler house. An extension of the building to contain two more turbo-generator sets, another boiler plant and a house for transformers, distributing boards and high-tension apparatus are under construction.

The coal used in the Kashira power station is Moscow low-grade brown coal containing 30 per cent water, 21 per cent ash and up to 4 per cent sulphur—i.e., about 55 per cent of useless elements, which sometimes rises to 60 per cent. Such a fuel necessitates careful attention to the mechanical features of stoking, and for this purpose the builders compiled data as to the speed of the grates, the air pressure and the thickness and form of the fuel layer.

The boiler house is 56 m. long and 42 m. wide (183 ft. x 141 ft.). The plan and cross-section are shown in Fig. 2. The walls of the building are of brick with the bunkers, columns, etc., of reinforced concrete. At the present time there are installed three Garbé boilers with a heating surface of 450 sq.m. (4,815 sq.ft.) each, two B. & W. boilers with horizontal tubes and a heating surface of 302 sq.m. (3,230 sq.ft.), and two Sterling boilers with a heating surface of 515 sq.m. (5,510 sq.ft.) each, making a total heating surface of 3,434 sq.m. (36,740 sq.ft.). Each of the boilers is fitted with economizers, the three Garbé boilers having Green economizers, all the others having Kabletz economizers. The total surface of the Green economizers is

740 sq.m. (7,910 sq.ft.) and that of the Kabletz economizers is 3,234 sq.m. (34,600 sq.ft.).

In the boiler room adjoining the turbine room are the feed-water heaters and four pumps, two electric pumps and two turbo pumps, with an output of 135 cu.m. and 120 cu.m. (4,765 cu.ft. and 4,236 cu.ft.) respectively. Wherever necessary water meters are installed. For the supply of air to the grates three electric motor-driven blowers (45 hp. each) are installed, each supplying about 500 cu.m. (17,650 cu.ft.) per hour. The ashes are taken out by means of wagons, each having a capacity of 10 cu.m. (353 cu.ft.) of hard ashes.

In the turbine room are installed two three-phase, 3,000-volt, 50-cycle Brown-Boveri turbo-generators, rated at 6,000 kw. each and separately excited. Railroad tracks are laid directly into the turbine room. The plan and cross-section are shown in Fig. 2. For its own needs the power station has two 750-kva., 3,000/210-volt transformers and one reserve motor-generator set for excitation purposes. Close by is the distributing board to supply the station with its power and light.

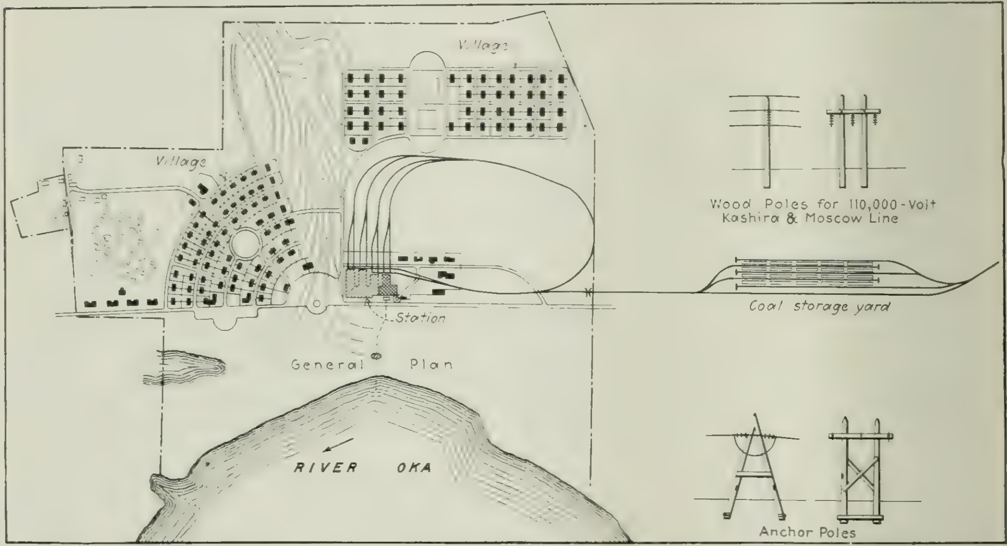

FIG. 1—THE KASHIRA STATION IS DESIGNED TO BURN LOW-GRADE COAL. ON RIGHT, DETAILS OF THE 110,000-VOLT LINE FROM THE STATION TO MOSCOW ARE SHOWN

On the second floor is the main distributing board, which controls the station generators and the outgoing lines. The diagram of electrical connections for the station as it is to be and for the part completed is shown in Fig. 2.

Under the switchboard are 3,000-volt oil switches and connecting switches. Close by is a temporary accommodation for single-phase, 4,000-kva., delta-star-connected step-up transformers with 3,000/115,000 volts between phases. All these transformers are of the shell type, copper losses being 48 kva., iron losses 38 kva., impedance drop 7.8 per cent. They have oil circulation, water-cooled.

All the oil switches are calculated to trip out 40,000 kva., under short circuit, the whole output of the station. This is calculated by taking into consideration the reactance of generators, transformers and leads. The high-tension lines before leaving the transformer station pass through the oil switches and other apparatus. A transformer house will be built later. The building will correspond to the Koszuchow substation, described below.

This Koszuchow substation is situated in the south of Moscow close to the station of the Moscow-Okrouszny railroad. The substation transforms the voltage received from Kashira into the city voltage (6,600) and into that of the high-voltage ring which is to surround the town, following the lines of the Okrouszny railroad. The plan is the separation of the high-tension energy received and the high-tension energy transformed, while the control of all the switches will be on a special switchboard.

It is not proposed to install synchronous condensers in the station. It is intended to receive the necessary wattless current at first from the station of the former company "1886" (a Moscow electric power-station company) and in the future from the Symonovs station, for which special generators of corresponding apparent capacity will be used.

The transmission line which carries the power of the Kashira station to Moscow is noteworthy because it is the first 110,000-volt transmission line built in Russia and because it has been constructed entirely by Russian engineers of Russian material, with the exception of the high-tension insulators, and under the most trying conditions. The line starts at Kashira and terminates at the substation at Koszuchow. Another high-tension line will be built from Kashira and two high-tension lines from Shatourka to Moscow. From the Koszuchow substation underground cables carry the energy to the Moscow lines.

Copper-conductor stranded cable is used with a cross-section of 70 sq.mm. (0.11 sq.in.) and a diameter of 11 mm. (0.4 in.). Instead of iron supports wooden poles 11 m. (36 ft.) high, with a top diameter of 22 cm. (8.8 in.) are used. Cables are laid in the horizontal plane 3 m. (9.8 ft.) apart. The lowest point of sag is 6 m. (19.6 ft.) instead of 7 m. (22.9 ft.) as prescribed by standard rules. To protect the line an overhead steel wire is used, grounded at intervals of 1,000 m. (3,280 ft.).

The calculations for this line have shown that without any apparatus for improving power factor and with a terminal voltage of 105,000 it is possible to transmit 10,000 kw. at 80 per cent power factor on the transformer secondaries and the corresponding station voltage will not be higher than 115,000. In transmitting 15,000 kw. at a terminal voltage of 105,000 the station voltage will be above the limit (120,000 volts, the limit being 115,000). In transmitting 5,000 kw. with the same line voltage of 105,000 the station voltage will be about 110,000. With no load on the line the pressure at the central station will be about 104,000 volts.

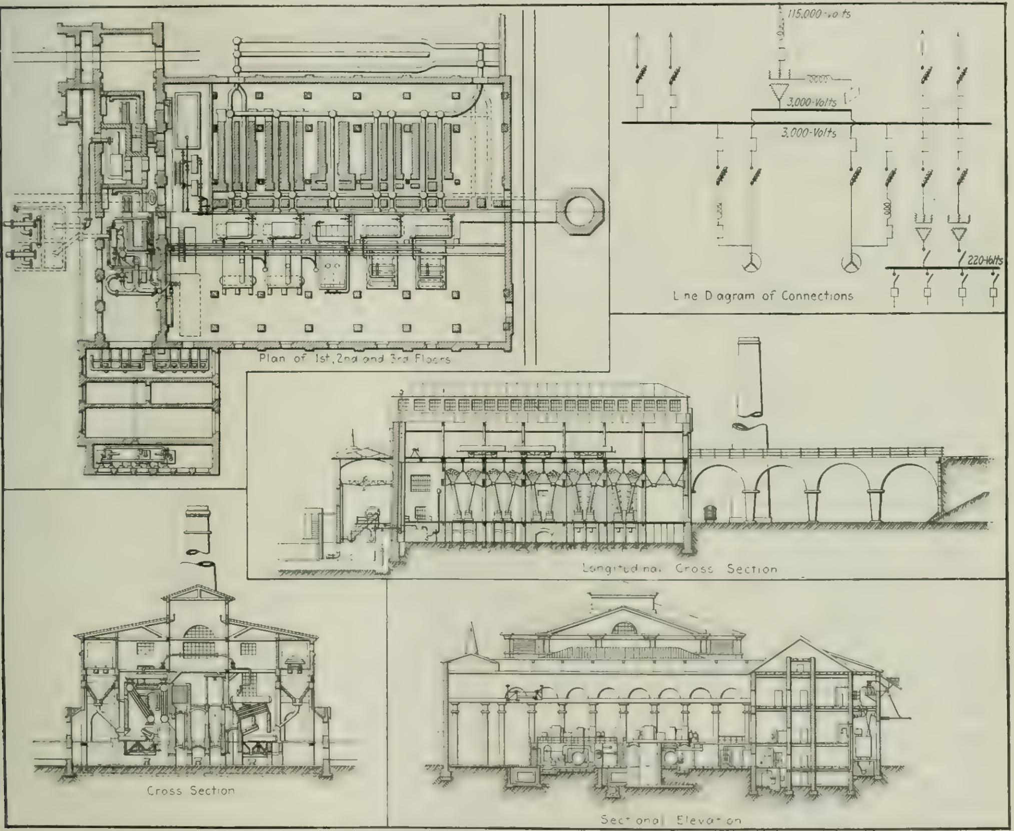
Plan of 1st, 2nd and 3rd Floors
115,000 Volts
3,000-Volts
3,000-Volts
220-Volts
Line Diagram of Connections
Longitudinal Cross Section
Cross Section
Sectional Elevation

FIG. 2—THE KASHIRA STATION FOLLOWS AMERICAN PRACTICE IN DESIGN DETAILS AND CONTAINS A GREAT AMOUNT OF AMERICAN EQUIPMENT, ALTHOUGH THE 50-CYCLE TURBINES WERE MADE BY BROWN-BOVERI

The transmission line follows the highway at a short distance from it. To insure rapid receipt of material and better future control, six stores have been established at intervals to carry small line apparatus, conductors and other material. The transmission line is kept at a distance from dwellings and villages, which necessitated constructing angles averaging not more than 15 deg. but sometimes as large as 30 deg. The line crosses three railways, three rivers and one lake.

The distance between the supports is 100 m. (328 ft.). The standard support is two 11-m. (36-ft.) poles connected on the top by means of iron pins 19 mm. (¾ in.) in diameter. The steel cable is attached on the top of the pole by iron clips. No measures to prolong the life of the poles were taken through lack of proper impregnating materials. The average weight of the standard support is about 60 kg. (132 lb.).

At every 1,000 m. (3,280 ft.) an anchor support has been erected calculated to support the line even should all three cables break. The anchor support is made of four standard poles held together by keys and pins. An adjustable wooden bracket is used at the height of the angle formed by the poles and is so arranged that it cannot move sideways. To take up the side stresses due to wind pressure diagonal struts are used, and to get a greater resistance in the ground the poles are connected to a wooden base. All connections except those in the ground are made by means of iron pins.

To insure a proper distance between the cable and the steel guy on the anchor, shaped iron cross-arms are used. As already stated, the anchor support will hold with all the three cables broken, taking into consideration that no relief is given the wire through movement of the insulator strings, as is the case on the intermediate poles. The safety factor both of the anchor and the intermediate poles is equal to two and a half. The weight that the poles can sustain is 200 kg. (440 lb.) and the average weight of the anchor support is about 90 kg. (198 lb.). Special tests of the anchor supports were made before their erection. The load was increased to three times that which would be caused by the breaking of all the conductors, and the support stood the test.

Calculation has shown that the standard anchor support could be used at angles of not more than 3 deg. At big angles up to 30 deg. the anchor support is reinforced by struts. The distance between cables is increased at the angles. As large angles make the support rather bulky, angles of 30 deg. were taken as the limit. However, at one point an angle of 90 deg. had to be used. This was accomplished by using two sets of poles of different heights with struts, the conductors being laid one over the other and connected by means of vertical cables.

The transmission line crosses the River Oka by the bridge of the Ryazan-Ural railroad. The necessity of crossing the river at a high elevation because of the high water level in the spring and the difficulty of getting iron supports compelled the builders to attach cables to the bridge structure. On both sides of the river stone piers are used as the foundation of supports for the cables, which are carried on the bridge in a vertical plane, one under the other, by means of special iron arms. The length of these arms is such that the minimum distance of the cables from the iron frame of the bridge when there is a deviation between the bridge and the insulator string of 22.5 deg. would be 1.35 m. (4.4 ft.). The arms were fitted to the bridge by special attachments without drilling the structure itself. Over the whole length of the bridge the cable pull was decreased for safety reasons, and no steel pipes were used for grounding—the iron bridge serving the purpose. Leaving the bridge, the cables return again to the horizontal position.

The position of the cables in one horizontal plane has a bad effect on their mutual induction and capacity. To overcome this the cables are transposed at two points, dividing the line into three equal parts.

The insulators used on the line are of the suspension string type on intermediate supports and the suspension strain type on anchor and angular supports. At first an attempt was made to manufacture the high-tension insulators in Russia, but as this would have caused delay and the need for haste was urgent they were bought abroad.

It should be stated, in conclusion, that wooden supports were used only because the present position of Russian industry makes it very difficult to procure steel supports. It is recognized that wooden supports require replacement on an average once every seven years, and that this will interfere with the operation of the line. For this reason steel supports will be used later on. They are only a little more expensive than wooden ones.

For the information and data in this article I am indebted to material sent me by Engineer B. W. Lassoff, to a report made by Engineer M. K. Polivanoff to the eighth all-Russian electrical convention, and to information kindly supplied by Prof. G. Krizizhanovsky, chairman of the government Commission for the Electrification of Russia.

Proper Ratio of Tooth Width to Slot Width

Theoretical Treatment Brings the Conclusion that the Best Results from Standpoint of Economy Come When the Two Are Equal

By F. S. Dellenbaugh, Jr.
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OUTSIDE of efficiencies, the economics of electrical design—that is, maximum output for minimum material, labor, etc.—has usually been left to manufacturing experience and empirical rules. This is often necessary since the effects upon labor cost of various parts of the design cannot readily be included in theoretical formulas. But certain parts of it can be attacked from the point of view of optimum use of materials, and the following is presented as a method of attack which it is believed can be extended to other parts. The results indicate that the minimum amount of core material will be necessary when the slot width is equal to the tooth width. It is true that this result is usually approximated in practice, but is arrived at from entirely different considerations, and these results are therefore in confirmation of existing practice from a new point of view, rather than an extension of design possibilities.

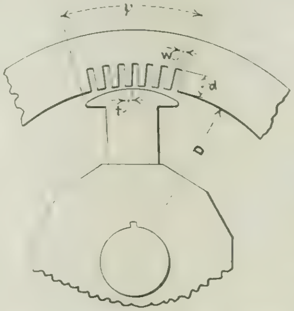

FIG. 1—ARRANGEMENT AND SYMBOLS USED IN REVOLVING-FIELD MACHINE

It is assumed that the design deals with dynamo-electric machinery and has progressed to the point where the first approximations have been made of the armature diameter and the coil and slot size. The division of electric and magnetic loading must then be made. A large number of slots and low flux or the reverse may be chosen. It is obvious that if the number of slots be large enough, a point will be reached where the minimum tooth width will be zero and the flux density in the teeth thus infinite. If, on the other hand, the number of slots be decreased to zero, the flux must be infinite and therefore the density in the teeth will again become infinite. It would thus appear that somewhere between the two extremes the flux density in the teeth would be minimum, and conversely, the minimum amount of core material would be required to carry the flux at the desired density. This point of minimum tooth density, or optimum ratio of slot to tooth width, can easily be arrived at as follows:

Let:

ϕ = flux per pole.
B = tooth density.
E = generated emf.
C = number of circuits in armature winding.
N = revolutions per minute.
p = number of poles.
n = number of slots.

A = area of teeth per pole carrying flux.
γ = turns per coil in armature winding.
ν = coils per slot in armature winding.
d = slot depth.
w = slot width.
ψ = polar embrasure, or arc expressed in percentage.
L = armature core length, net iron.
D = armature (air gap) diameter.
t = tooth width.

If all dimensions are in inches, B is in lines per square inch. If all dimensions are in centimeters, B is in gausses, or lines per square centimeter. Flux fringing is neglected, and it is assumed that the tooth density B is that at the point of minimum tooth width and is the average value assuming that $\psi n/p$ teeth per pole are the only ones carrying flux.

The minimum tooth area for the revolving-field type of machines will be at the tip and is equal to the total internal periphery of the armature core less the amount cut away by the slots, assuming a straight side slot and open top. Thus:

$$A = (\pi D - wn)(L\psi/p) \qquad (1)$$

If the machine is of the revolving-armature type, as is common practice with direct-current machinery, then the diameter at the bottom of the teeth must be substituted for D, but otherwise the formula will hold. If the slots are not straight with parallel sides, then special diameters must be substituted, but with this restriction the results may be considered perfectly general.

Then

$$B = \varphi/A = \phi p/(\pi D - wn)(L\psi). \qquad (2)$$

The formula for generated voltage may be expressed:

$$E = 2\phi pNn\gamma\nu/(C \times 60 \times 10^8)$$

Or:

$$n = EC \times 60 \times 10^8/(2\phi pN\gamma\nu) \qquad (3)$$

Substituting (3) in (2) and simplifying:

$$B = (2\phi^2p^2N\gamma\nu)/(2\pi D\phi pN\gamma\nu - wEC \times 60 \times 10^8)L\psi \qquad (4)$$

In this last equation B and ϕ are the only variables for a given set of dimensions, and so it may be written:

$$B = \phi^2/(K_a\phi - K_b), \qquad (5)$$

where $K_a = \pi DL\psi/p$

and $K_b = 30wECL\psi 10^8/(p^2N\gamma\nu)$.

In order to determine the minimum value of B the first derivative is equated to zero, which gives:

$$dB/d\phi = (d/d\phi)\left[\frac{K_a\phi - K_b}{\phi^2}\right] = 0,$$

whence $\phi_o = 2K_b/K_a$ (6)

and $B_o = 4K_b/K_a^2$, (7)

ϕ_o and B_o being the values for minimum density. Substituting the actual values of the constants we get:

$$\phi_o = (60wEC \times 10^8)/(pN\gamma\nu\pi D). \qquad (8)$$

$$B_o = (120wEC \times 10^8)/(N\gamma\nu\pi^2D^2L\psi). \qquad (9)$$

It is interesting to note that the proper value of flux according to this reasoning is independent of the core length, depending entirely upon the punching design, while the actual density may be varied by changing the core length in the usual way. Fig. 2 shows how the actual values of flux and tooth density vary in a commercial design if the number of slots be changed, other dimensions being maintained the same. The point at which the machine actually operated, having been designed from other criteria, is very near that of minimum core weight. Other machines have been found which do not check so closely. Any point between the two vertical lines would be considered satisfactory from the standpoint of ratio of magnetic to electric loading. In general, the less the flux, the cheaper the machine and the poorer its electric characteristics. If the flux is reduced below the minimum tooth-density point, these densities are seen to rise very rapidly, but for fluxes too high the effect upon tooth density is not so marked.

Data from another actual machine give the following:

E = 120, γ = 1,
C = 8, ν = 2,
N = 200, w = 0.4 in.
p = 8, ψ = 0.712,
*D = 36.9 in., L = 10 in.

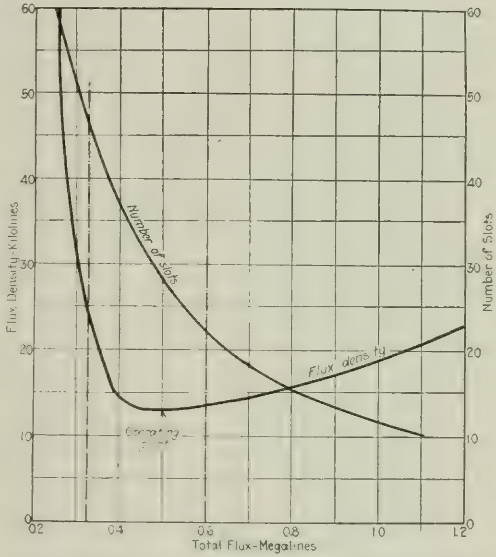

FIG. 2—VARIATION OF MAXIMUM FLUX DENSITY IN THE TEETH WITH THE TOTAL FLUX PER POLE AND NUMBER OF SLOTS CHANGED

These data were taken from actual design and the operating point is shown as used. As concerns questions of electrical and mechanical loading any point between the two vertical dot-dash lines would theoretically be satisfactory.

Substituting in (9), (8) and (3) respectively, we get:

B_o = 120,000 lines per square inch.
ϕ_o = 6.2 $\times 10^{-6}$ lines per pole.
n = 145 slots.

From which the tooth width at root should be:

$$(\pi 36.9 - 145 \times 0.4)/145 = 0.4 \text{ in.}$$

Or, the width of tooth and slot should be equal.

That this is always the case may be shown as follows:

$$t = (\pi D - nw)/n.$$

If the value of D be determined from (8) and substituted with the values of n in the numerator from (3), this expression will reduce to:

$$t/w = 1.$$

Therefore this ratio will hold regardless of other dimensions. There are, of course, many approximations included in the argument, but it gives another guide in design, which is always useful, and so far as the writer is aware is the first time this ratio has been determined solely from considerations of the amount of material required.

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*This being an engine-type direct-current generator, the diameter is taken at the inside, or roots of the teeth.

Obsolescence in Distribution Transformers

Method for Its Determination—Economics of Transformer Replacement—Specific Analysis of Transformer Characteristics and the Application to a Distribution System

By R. E. Curtis
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Kingston, Pa.

IT IS a generally recognized fact that it pays to replace old transformers having a high core loss with modern designs, but when the engineer has to show the manager exactly how many dollars will be saved by making a certain investment the amount is not always easy to calculate. It is necessary to have the nameplate data on the transformers and also the manufacturer's data on core loss, which may have to be corrected for aging of the old cores. In making a study of this nature for the Harvey's Lake Light Company, a utility under the management of A. J. Sordoni, the writer found the following method helpful:

Transformers should be replaced when the interest on the additional investment is less than the value of the kilowatt-hour core loss per year. The following expression represents the difference between these two quantities, and the annual saving (S) in dollars which can be expected. When this value is negative the change is not warranted.

$S = 8.76r(w_2 - w_1) - i(A - B)/100$ dollars per year.

Where

r = value of one kilowatt-hour as delivered from the distribution primary in dollars.
w_2 = core loss in watts of the new transformer to be erected.
w_1 = core loss in watts of the old transformer to be removed.
i = annual interest on additional investment in per cent.
A = cost of new transformer in dollars.
B = cost of old transformer in dollars.

Discussion of the Terms

The cost of energy (r) per kilowatt-hour delivered to the transformer should include a proportion of all operating costs up to this point, including generation, transmission, substation and distribution (primary). Those utilities purchasing energy wholesale and distributing should add to the wholesale cost price an amount to cover the maintenance of the substation and the distribution primary.

The core losses (w_2, w_1) of the various makes of transformers at the date of manufacture may be obtained from the maker and should be corrected for operation today, allowing for aging of the iron. All core losses should be referred to normal voltage rating (2,300 to 230-115 volts) at 75 deg. C., in accordance with A. I. E. E. standards.

To facilitate using the above formula we tabulated the differences in core loss ($w_2 - w_1$) as shown in the table herewith. In this particular case all of the equipment was of General Electric Company manufacture, so the accompanying table applies only to General Electric transformers. Any engineer may make up a similar table to apply to his own equipment by obtaining the necessary data from the manufacturers. In this connection note that for General Electric transformers the form letter must be known, and correspondingly for Westinghouse transformers the style number.

The annual interest (i) on the investment is generally fixed by commission rulings. Where a depreciation fund or renewal and replacement reserve is being built up the value i must be large enough to cover this item in addition to the interest on the investment in the transformers.

The cost of the new transformer (A) should include freight, handling, testing and storeroom charges. It should not include the labor of erection unless this labor is allowed in capital accounts.

The cost of the obsolete transformer (B) is its value appearing on the books of the company and should include freight, handling, testing and storeroom charges.

DIFFERENCE IN CORE LOSS IN WATTS BETWEEN OLD AND PRESENT DESIGNS

(General Electric Company type H distribution transformers, 60 cycles single-phase)

All figures based on operation at 2,300 230-115 volts at 75 deg. C.

Kva. Rating		Difference in Core Loss ($w_2 - w_1$)		
New Transformer, Forms K & N	Old Transformer, Forms E, F, I, C, A, G & H	Forms E, F, I, C, A*	Form G	Form H
1½	0.6	14	7	3
1½	1	25	13	10
1½	1½	33	20	16
1½	2	45	28	22
3	2	36	19	13
3	2½	39	23	17
3	3	43	24	23
3	4	63	37	32
5	4	55	29	24
5	5	60	45	32
7½	7½	94	53	46
10	10	112	73	59
15	15	144	97	69
25	25	180	104	77
25	30	222	143	102
37½	30	180	101	60
37½	40	250	152	123
50	40	208	110	81
50	50	296	160	133

* Forms E, F, I, C and A have 25 per cent added to core loss at date of manufacture to allow for aging of the iron

The labor cost of erection should be omitted unless it is already included in capital accounts and is allowed by the commission.

The salvage value of the old transformer should not be deducted in arriving at this cost. The only increase in total capitalization by making any change is the difference between A and B. The difference between cost B and the salvage value of the old transformer is indicative of the depreciation of this transformer and should be made up out of the depreciation fund. If no fund is in reserve for depreciation, it may be inferred that past earnings have been diverted from this fund to dividends. This additional capital, however, cannot be added to the capital account, as it does not represent any tangible property.

Specific Example of Application

The following examples will illustrate the application of this method and formula:

A. A utility purchases energy wholesale at $0.02 per kilowatt-hour. It is estimated that $0.001 per kilowatt-hour will provide maintenance charges on the conversion equipment (substation) and $0.004 per kilowatt-hour will provide maintenance charges on the distribution poles and primary lines. What annual saving will occur if a 10-kw. General Electric form E transformer costing $92.14 is replaced with a modern General Electric transformer of the same size costing $106.80 including freight and handling? Interest may be figured at 10 per cent, allowing 7 per cent for interest on the investment and 3 per cent for depreciation.

Solution:

$S = 8.76r(w_2 - w_1) - [i/100(A - B)].$
$r = \$0.02 + 0.001 + 0.004 = \$0.025.$
$w_2 - w_1 = 112$ watts (from table).
$i = 7 + 3 = 10.$
$A = \$106.80.$
$B = \$92.14.$
$S = 8.76 \times 0.025 \times 112 - 0.1 \times (106.80 - 92.14)$
$= 24.53 - 1.47$
$= \$23.06$ per year.

B. Assume the conditions of problem 1, except that a recent inventory of this company's property recognized the obsolete condition of this transformer, and its book value appears as $22, which is practically equivalent to its salvage value.

$r = \$0.025.$
$w_2 - w_1 = 112.$
$i = 10.$
$A = \$106.80.$
$B = \$22.00.$
$S = 8.76 \times 0.025 \times 112 - 0.1 \times (106.80 - 22.00).$
$= 24.53 - 8.48$
$= \$16.05$ per year.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

A Difficulty in Distribution

To the Editors of the Electrical World:

I am a small manufacturer of an electrical device which has a growing use in the central-station industry, and as the *Electrical World* has opened its pages to the discussion of distribution problems in a frank and constructive fashion, I look upon this as an opportunity to point out a real need as I see it. My product has been on the market for several years; it is well standardized on the basis of thorough engineering design and careful selection of materials, is carefully made and renders excellent service when intelligently handled. It is used by technically or semi-technically trained men and is certainly in a small way one of the staple devices of the trade. How can I get the best distribution of this product?

Writing as frankly as I do, it is unnecessary to identify our commodity, for the problems which I encounter in its distribution are also those of other small manufacturers. For some time I have been trying to sell this device more widely through the electrical supply jobber and have had connections with several large houses of wide reputation and extensive resources. Those connections continue, but for some time our organization has been handicapped by the lack of intensive service on the part of the jobber-agent. We find it to be the case that many customers who purchase direct from us make their payments much more quickly than do the large jobbing houses. The latter do not show the interest in our product, which is increasing in diversity and popularity, that we believe should qualify an "honest-to-goodness" sales policy.

Our resources are modest, and we cannot afford an extensive staff of traveling salesmen to represent our factory direct in different parts of the country. We have spent some years and many hard-earned dollars in developing our line to a point where it is, without overstatement, the standard of its kind in its particular field. Naturally we would expect to secure the best results in distribution through a high-grade jobbing representation, but our product sells for say a few hundred dollars or so, and in any one city the market once sold is not very open for additional equipment. Yet we are expanding our line, as I said, and our experience in the central-station field emboldens us to branch out in the number and variety of our products, so that we shall soon be making on a larger scale devices that have more than an academic application to the distribution systems of utilities.

The difficulty seems to be that the jobber is so busy selling material in bulk that he has little time to undertake the engineering salesmanship which would push our line. I may exaggerate the situation, and yet we need more active representation. Our jobber friends are "sure pay" in due course, but it does prove inconvenient to have them lag behind some of our other customers. It may be said, "Why does this manufacturer sell direct at all?" I think it is in a way up to the jobber to answer this question, for if he can show by his commercial service and interest that we would do better to route all sales through him, our minds are open on the subject. Perhaps we should abandon jobber representation in view of the fact that there is comparatively little need of the jobber's carrying a stock of our best-known product; but, considering the selling abilities of the modern jobbing organization of high grade and the expansion of our own line into broader fields, that does not seem to be the answer.

We can accomplish a good deal, no doubt, through intelligent technical press advertising; but here in the electrical industry are great mechanisms of distribution that should function more efficiently in broadcasting the products of small manufacturers no less than of larger ones. It may be that the answer is through the so-called "manufacturer's agent" who maintains offices in this city or that and covers a wide territory with little stock requirements. I am frank to say that the present situation is unsatisfactory, and I shall be much interested if some suggestions as to its improvement can be presented in these columns for the benefit of the small manufacturer. Every little helps, and I believe that through closer co-operation by distributors men of manufacturing size can play the game more effectively and to the mutual advantage of the branches of the industry concerned. A SMALL MANUFACTURER.

Boston, Mass.

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Professor Jackson Hopeful About Engineering Schools and Training

To the Editors of the Electrical World:

At the present time much discussion of engineering education and its relation to the industries is being carried on. Witness, for instance, the appointment of the committee on engineering education by the National Industrial Conference Board, the activities of various universities in co-operative courses and similar movements. There is also great activity in the engineering schools themselves in the way of studying curricula and methods of teaching, for the purpose of making sure that the practices are the best adapted for laying the foundation for fine, competent engineering.

The line of discussion that N. A. Carle suggests in the *Electrical World* for Nov. 4 is one that might be well worth while taking up, but I am not so pessimistic as he is regarding the degree of learning in the profession which is now characteristic of engineering schools. DUGALD C. JACKSON.

Massachusetts Institute of Technology,
Cambridge, Mass.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of
Economically Utilizing Electrical Energy

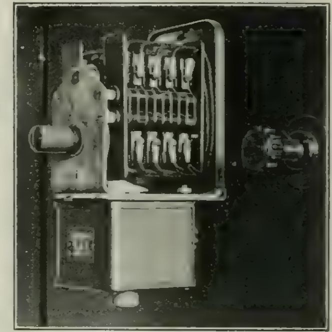
Multi-Contact Auxiliary Relay Provides Differential Protection

THE protection of electrical equipment against internal short circuits and grounds by relays actuated from current transformers differentially connected around the equipment is rapidly gaining favor, particularly when used with the larger classes of apparatus such as generators, transformers and motors on important duty. In the case of generator protection the tripping of the relays by differential action is required to perform a number of separate operations in proper sequence, such as opening the main oil circuit breakers, the field circuit breaker and the circuit breaker in the neutral ground connection, closing the main steam throttle valve and the generator air-dampers, and also sounding an alarm. It is, of course, very important that the relays perform their functions with a high degree of reliability and with a minimum chance of failure.

Relays heretofore available for performing these functions have not seemed to be sufficiently rugged and reliable, considering the importance of the service they were to provide. Several instances are in mind where such relay equipment has failed to function satisfactorily because of imperfect alignment or oxidation of contacts, with the result that the tripping circuits have not been energized.

In an attempt to remedy this condition, an auxiliary multi-contact relay was designed in co-operation with engineers of the General Electric Company. This is a relay which must be used in conjunction with other relays of the instantaneous or time-limit type connected in the differential current-transformer secondaries. The tripping of these relays actuates the auxiliary relay.

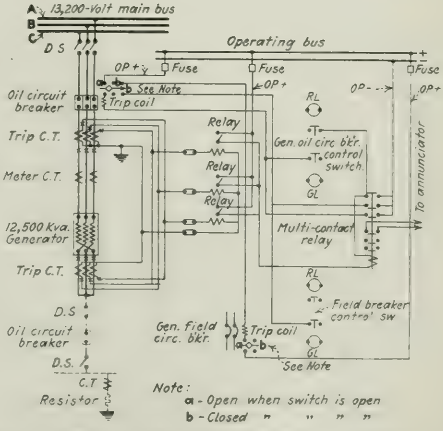
This relay is of very sturdy construction and can be equipped with contacts to close a maximum of nine separate circuits and to open one circuit. Any set of contacts, however, may be easily changed from the circuit-closing type to the circuit-opening type or vice versa. When the number of contacts required is not greater than five, only the lower contact-shaft element of the relay is furnished, but with necessary brackets for supporting the additional parts for the upper contacts if it is desired to insert them at some later time. The contacts are hand-reset by means of a handle projecting from the front of the case. A mark is provided on this handle to indicate the position of the movable contact members.



ADEQUATE PROTECTION TO APPARATUS AFFORDED BY THIS RELAY

The relay in operation trips a latch allowing the contact shaft or shafts to rotate to an angle of 90 deg. by means of a substantial spring torsion. The latch is sufficiently secure to prevent faulty action due to vibration or jar such as might be experienced on a switchboard panel and is tripped by a comparatively heavy blow. Both moving and fixed contacts are much heavier than those ordinarily used in switchboard relay construction, and a decided rubbing action is provided which insures proper contact at all times. The contacts are all mounted within an inclosed cover to keep them free from dust and foreign materials.

A representative wiring diagram



RUGGED AND RELIABLE RELAY FOR DIFFERENTIAL PROTECTION OF AN ALTERNATING-CURRENT GENERATOR OR TRANSFORMER of this relay used for differential protection of an alternating-current generator is shown in one of the accompanying illustrations. Only wiring for tripping the main oil circuit breaker and the field circuit breaker and for operating an annunciator is indicated. It is evident that additional tripping circuits may be used as desired. Proper sequence of operations is usually obtained by auxiliary switches on the affected equipment.

Relays of this type were recently installed for generator and transformer protection at the Clinton Street station of the Queens Borough Gas & Electric Company, Far Rockaway, Long Island, New York, and have been ordered for installation in the South Meadow station of the Hartford (Conn.) Electric Light Company and for the Cannon Street Station of the New Bedford (Mass.) Gas & Edison Light Company. The photograph reproduced herewith shows an installation of one of these relays at the Clinton Street station of the Queens Borough Gas & Electric Company. C. A. CORNEY.

Stone & Webster, Inc.,
Boston, Mass.

Operating Cost of 10,500-Kw. Central Station

OPERATING costs of the generating station of the Stamford (Conn.) Gas & Electric Company, as filed with the Connecticut Public Utilities Commission for the year 1921, illustrate afresh the importance of fuel economy in plant administration. The station is situated on Long Island Sound, and the present generating equipment includes six 600-hp. water-tube boilers, one 7,812-kva. and two 3,125-kva. turbogenerators. During the year the company burned 16,195 tons of coal in this plant, the average cost per ton being $8.20. The total output generated was 17,134,600 kw.-hr., and the operating costs were: Station wages, $41,367; fuel, $132,698; supplies and miscellaneous expenses, $6,326, and station repairs, $34,072, making a total of $214,465, or 1.25 cents per kilowatt-hour.

The fuel cost per kilowatt-hour was 0.775 cent and the labor cost 0.242 cent. The coal consumption per kilowatt-hour was 2.11 lb. The connected power load of the company is 13,219 hp. and the population served is 44,241.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Definite Transmission-Line Standards Recommended

SPECIFIC recommendations on transmission-line standards have been compiled by the sub-committee on transmission lines of the Empire State Gas and Electric Association. These recommendations cover insulation, wire spacing, clearance from line wire to ground, clearance for telephone wires and insulation for telephone wires.

Operating companies are frequently called on to construct new transmission lines, and it is not uncommon that the new lines come at some voltage different from the voltage at which they have been accustomed to operate. Every time a new line of any importance is to be constructed some one must decide all of the essential engineering details regarding the line. Unless the superintendent or engineer is thoroughly satisfied that he is acquainted with the best practice as regards transmission-line construction, he very often spends a large amount of time looking up data on other lines which have been constructed or recommendations in the various publications. If the search is extensive, it is found that there is such a wide variation in construction details of different companies that the construction man is still very much at sea as to the best details to follow in his particular line.

TABLE I—TRANSMISSION-LINE INSULATION

Line Voltage	Suspension-Type Number of Insulators (10-in. Disk) Suspension	Strain	Pin-Type Rating All-Wood Construction	Grounded Steel Pins
13,200	2	2	27,000	35,000
22,000	3	3	35,000	45,000
33,000	3	4	45,000	55,000
44,000	4	5	55,000	·66,000
66,000	5	7	*75,000	*88,000
110,000	8	10	. . . .	. . .

* Pin-type insulator not recommended for important lines operating at 66,000 volts and above

TABLE II—WIRE SPACING ON TRANSMISSION LINES WITH BARE COPPER WIRE

Line Voltage	Pin-Type Insulators Maximum Span, Feet 150 to 250 Ft	600 Ft	Line Voltage	Suspension-Type Insulators Maximum Span, Feet 250 Ft Vertical Arrangement	Horizontal Arrangement	600 Ft Vertical Arrangement	Horizontal Arrangement
13,200	3	4½	66,000	6	7	8	9
22,000	4	5	110,000	9	10	10	12
33,000	4½	5½					
44,000	5	6					
*66,000	6	6					

* Pin-type insulators not recommended for important lines operating at 66,000 volts.

In order to make it unnecessary for construction men to be required to follow this procedure in the future, the accompanying tables have been prepared, covering most of the essential information on transmission lines of the ordinary operating voltages. The recommendations as given in these tables cover what is considered to be high grade construction in every particular. A careful review will show that the insulators specified, the wire spacings, etc., are somewhat larger than many companies have been in the habit of using. However, some companies that have had a wide experience in transmission-line work use even higher standards than those set up in the tables.

The effects of climate, as regards lightning, sleet, wind, rainy and dry seasons, have a very large influence on the type of construction to be used. Since climatic conditions have such a large influence on the type of construction required, the recommendations given should be considered as applying to New York State and other localities having somewhat similar climatic conditions.

TABLE III—CLEARANCE FROM LINE TO GROUND AT SUPPORTS

Line Voltage	Suspension-Type Insulators Clearance to Nearest Part of Structure—Insulators Vertical to 15 Deg. Deflection (Inches)	Minimum Clearance Insulator Deflected 45 Deg (Inches)
13,200	11	9
22,000	16	14
33,000	16	14
44,000	22	19
66,000	26	22
110,000	42	36

In some cases the construction man may be justified in adopting a somewhat lower standard than has been recommended. This applies to Tables I, II, III, IV, V, and VI. Table V, which gives clearance from conductor to ground, is quite conservative, as the clearance given is in excess of that required by the National Electrical Safety Code for all voltages. One of the committee members recommends, however, that the minimum clearance be set at 25 ft. for all voltages.

The headings of Table III were somewhat hard to word clearly. "Clearance to nearest part of structure, vertical to 15 deg. deflection," is intended to mean the clearance from the conductor, when supported by suspension insulators, to the next cross-arm below or to any of the steel members of the tower when the insulating string is hanging in a

TABLE IV—MAXIMUM PERMISSIBLE SPAN LENGTHS FOR HARD-DRAWN AND MEDIUM-HARD-DRAWN BARE COPPER WIRE OF SMALLER SIZES

Wire Size	Span Length, Feet
No 6	150
No 4	300
No 2	500

vertical position or in any position from vertical to 15 deg. deflection either side of vertical. These distances were taken somewhat greater than the distances in the next column, for the reason that by far the largest part of the time the insulator string is in a vertical or nearly vertical position.

The next column of the table is "Minimum clearance, insulator deflected 45 deg." These figures represent the minimum allowable distance from the conductor to the nearest grounded metal point on the tower when the insulator string is swung over to a position 45 deg. from the vertical. It was the intention to make the striking values with the insulator string in this position somewhat greater than the over-all wet striking distance over the insulator string.

TABLE V—MINIMUM CLEARANCE TO GROUND AT LOWEST POINT IN SPAN OVER COUNTRY OR ALONG ROADS, BUT NOT OVER ROADS OR RAILROADS—AT 60 DEG. F AND NO WIND

Voltage	Clearance to Ground, Feet
Up to 50,000	23
Over 50,000	25

After these tables were prepared, they were checked against the National Electrical Safety Code and compared with the specifications of a number of operating transmission lines. It is believed that they do not violate any of the rules of the Safety Code, and in our opinion they rank among the best of the various specifications that have been tabulated in the past.

TABLE VI CLEARANCE FOR TELEPHONE LINE*

Voltage	To Ground, Feet	To Conductors, Feet
13,200	16	4½
22,000	16	5
33,000	16	5½
44,000	16	6
66,000	16	8

*Insulate telephone line for one-third line voltage when wooden arms and pins are used for telephone insulators, and insulate for one-half line voltage when grounded metal supports are used for telephone insulators. The large factor of safety provided in the transmission-line insulation is not contemplated in this recommendation. For this recommendation the insulators may be taken at the manufacturers' rating. For example, a telephone line under a 66,000-volt power line when on steel construction would be insulated with an insulator rated by the manufacturers at 35,000 volts, whereas the five suspension insulators recommended for the 66,000-volt line have been considered proper by some engineers for 110,000 volts. Transpositions are recommended every 500 ft. to 600 ft. in telephone lines. Insulating transformers and lightning arresters are essential and drainage coils are recommended.

In preparing these tables the committee has gone, perhaps, somewhat farther than any such recommendations have been carried in the past. This was thought over very carefully as regards the question of establishing precedents, and it was decided that the value of the tables as prepared would more than compensate for any criticism which might arise from going beyond previous work that had been accomplished along this line.

The recommendations are not in any sense original, and there is nothing new in the recommendations except that we have never before seen a set-up so complete as this for transmission-line and telephone-line construction. These remarks perhaps apply more particularly to Table VI, giving the data on telephone lines. Recommendations on telephone-line standards have not previously been published as far as we are aware. Consequently this particular end of line construction has perhaps been a source of more trouble on the part of the operating man than almost any portion of the transmission line.

E. P. PECK.

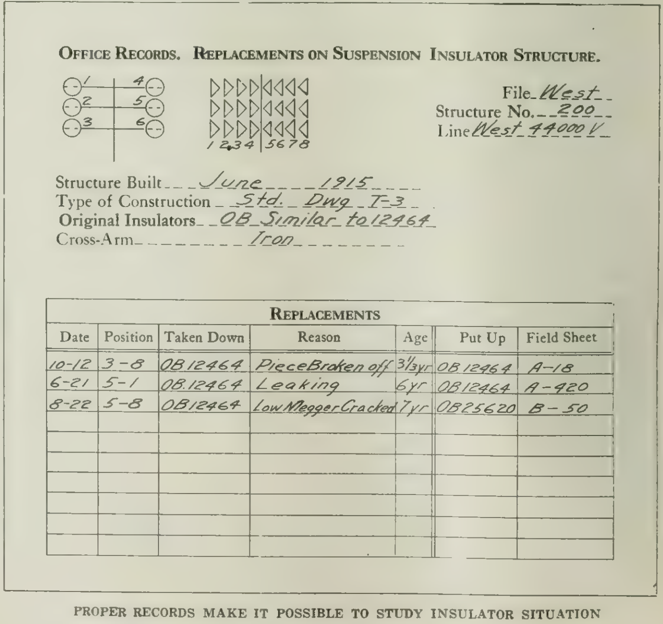
Chairman sub-committee on transmission lines, Empire State Gas and Electric Association.

General superintendent electrical department, Utica Gas & Electric Company, Utica, N. Y.

Insulator Service Records

These Records Are Usually So Meager as to Afford No Basis for Purchases—Specifications for Orders Should Require Date to Be Imprinted in Porcelain

IT IS a fact hard to understand that so many central-station properties operating high-tension transmission lines keep such incomplete and unsatisfactory records of insulator service. The insulators are admittedly the most vulnerable of all the items entering into the make-up of a high-tension transmission system, yet how many companies having perhaps 50 miles or more of high-tension lines really know to what extent their various makes and types of insulators have given satisfactory service? In very many cases the extent of the operating superintendent's knowledge is that he has had lots of trouble on a section of line with certain insulators, and he has reached the conclusion that he wants no more of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OFFICE RECORDS. REPLACEMENTS ON SUSPENSION INSULATOR STRUCTURE.

File West

Structure No. 200

Line West 44000 V

Structure Built June 1915

Type of Construction Std. Dwg T-3

Original Insulators OB Similar to 12464

Cross-Arm Iron

REPLACEMENTS

Date	Position	Taken Down	Reason	Age	Put Up	Field Sheet
10-12	3-8	OB 12464	Piece Broken off	3⅓ yr	OB 12464	A-18
6-21	5-1	OB.12464	Leaking	6 yr	OB 12464	A-420
8-22	5-8	OB 12464	Low Megger Cracked	7 yr	OB 25620	B-50

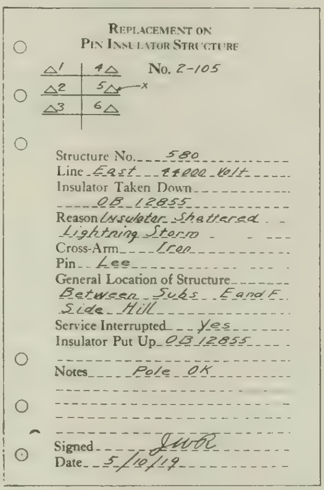
PROPER RECORDS MAKE IT POSSIBLE TO STUDY INSULATOR SITUATION that manufacturer's insulators. On the other hand, he believes such and such an insulator is a good one; only about so many failed last year. Ask him, how many up? About so many. When were they put up? Oh, some in such and such a year, some more a little later, and lately he has been using them almost entirely for replacements.

Regarding replacements—does he know anything about the life in service of the ones taken down? No, because no one in the company knows just when they were put up. Does he know what caused the failures—whether most of them failed in the spring, or during lightning storms, or whether they were taken down because of small pieces broken off? No; he knows that some exploded during lightning, and probably hunters shot a few—but that's all. In many cases he isn't even keeping any record of the location of the different replacements which are being made at intervals. When he came to the company there were no insulator records, and the probabilities are that when he leaves there will be none either.

In the meantime the system has grown. Effort is made to run the generating end as efficiently as possible. If a generator or large transformer goes up, its history is pretty well known, and they try to "hang" the blame on the manufacturer. About all they do for the transmission line, though, is to go out and put up a new insulator every time one fails. And when it comes to purchasing additional insulator units the superintendent is very much at the mercy of the plausible insulator salesman. The salesman tells about the large orders he is getting from some companies and mentions the low rate of failure another company has (which figure in itself means nothing), and about all the superintendent can say is "Yes."

To go into the average small, and perhaps medium-sized, property and find how little its managers know about their insulators, one would think that there is something difficult in setting up and keeping these service records, or that perhaps they are of no value to the average operating superintendent. As a matter of fact there is very little trouble indeed in keeping the records, and they substitute a definite set-up of facts for a lot of guessing.

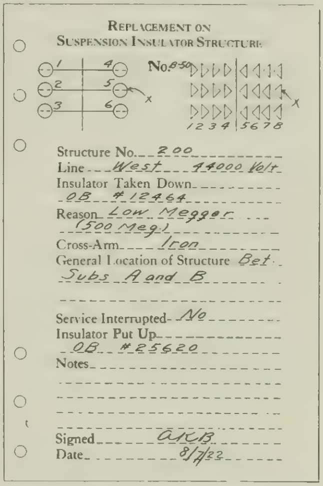
A very simple system is that in which a card is opened up for each structure the first time an insulator failure takes place. This card carries a diagram, and on this is noted as much information concerning the insulators on the structure as is available—the manufacturer and type of each, date put up, previous replacements, probable cause of previous failure. When an insulator is changed the foreman or lineman in charge notes on a similar diagram in a loose-leaf notebook all information as above outlined regarding both the insulator taken down and the one put up. The data are turned in to the superintendent and transferred to the cards. Line extensions are taken care of by making a general note on a card to the effect that all of the insulators on structures No. . . to No. . . were put in service on a certain date. Records such as this make it possible really to study the insulator situation. It is possible to say definitely whether one certain type is standing up better than another on this particular system—whether the best service is had from a heavier or lighter type, two-piece or three-piece, etc. Based on these records of past experience, the superintendent has a pretty good idea when and where to expect trouble in the future.



○ Replacement on
Pin Insulator Structure

No. 2-105

Structure No. 580
Line East 44000 Volt
Insulator Taken Down
OB 12855
Reason Insulator Shattered
Lightning Storm
Cross-Arm Iron
Pin Lee
General Location of Structure
Between Subs E and F
Side Hill
Service Interrupted Yes
Insulator Put Up OB 12855
Notes Pole OK
Signed JWR
Date 5/10/19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x
1 2 3 4
5 6 7 8
x

Replacement on
Suspension Insulator Structure

No. 850

Structure No. 200
Line West 44000 Volt
Insulator Taken Down
OB #12464
Reason Low Megger
(500 Meg.)
Cross-Arm Iron
General Location of Structure Bet
Subs A and B
Service Interrupted No
Insulator Put Up
OB #25620
Notes
Signed AKB
Date 8/7/22

SIMILAR REPLACEMENT RECORDS SHOULD BE KEPT BY EVERY COMPANY FOR EVERY INSULATOR ON ITS LINES

One of the explanations for the continued neglect of adequate records undoubtedly lies in the fact that so many of the present-day superintendents find themselves confronted with an existing system of which no records have ever been kept. They are inclined to use the neglect of the past as an excuse to carry on in the same careless way. Of course, as a matter of fact, the longer it is put off the longer it will be before a really valuable system of records is built up. It is always possible at any time to start keeping a record of replacements and new construction.

Unfortunately, insulators in themselves have no individuality—carry no nameplate—cannot be distinguished one from another. Once an insulator is put up and in service it looses its identity—unless records are kept. The age of an insulator cannot be determined by inspection. It is the difficulty of establishing this point of age that makes it hard to get so many properties started keeping an insulator record.

Because the element of life and service of line insulators is such a variable and unreliable one the writer believes that something should be done to enable identifying or classifying them by inspection. We have various methods of test to determine the insulating value of a piece, and as a general rule we can determine by inspection the manufacturer and style number. It would be of great advantage to be able to determine the approximate age or length of time in service also by inspection. This could be done very simply by imprinting in the porcelain the year of manufacture, this being done at the same time the manufacturer's name or mark is stamped on.

If the year of firing were to be shown on each insulator, it would be of much value as a means of checking the records and in helping out those operators who, in spite of the manifest importance and advantage of these records, are not sufficiently alive and progressive to keep them. It is true that the time elapsed since firing and the age in service are not exactly the same, but these two periods are sufficiently close together for most purposes. There would be objection on the part of the manufacturers to adopting this date imprint as standard because of its prejudicial effect on stock insulators. However, there should be no difficulty in supplying this imprint in the case of large orders, because such orders are filled from the manufacturing floor and not from stock. It is believed that it would be a step forward if large purchasers would start to require this imprint in their specifications. One of the larger manufacturers has asserted that this date imprint would be very easy to supply and has expressed a willingness to comply with a purchase specification requiring it. If large purchasers start to require it, the time may come when it will be standard for all high-tension insulators. M. J. IDAIL,

F. R. Weller, Electrical Engineer.
Consulting Engineer,
Washington, D. C.

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Design of Lighting Units Affects Maintenance

IF CLEANING be given proper consideration during the design of the luminaire, the cost of maintenance can be reduced to a minimum, according to the committee of the Illuminating Engineering Society's committee appointed under the chairmanship of M. Luckiesh to co-operate with fixture manufacturers. The luminaire when new and first installed should deliver and direct light in the quantity and direction for which it was designed. To assure sustained performance over a period of time the luminaire should be designed with maintenance in mind.

Losses due to the dust with the open bowl may be analyzed as follows: (1) Light leaving the filament suffers loss upon passing through the dust layer on the bulb. (2) A considerable part of the light leaving the bulb strikes the bowl, which is dust covered; in passing through this layer to the bowl there is a loss. (3) That part which has gone through the dust layer is reflected back and passes again through this same layer with resultant loss. (4) Some of the light reflected from the interior of the bowl passes through the dust-covered lamp bulb before leaving the luminaire, and further losses follow both on entering the bulb and on leaving it.

In comparison with these losses take the same bowl, inclosed with a clear-glass top so as not appreciably to alter the distribution of light. With this condition the light from the source that passes through the bulb to the bowl is reflected to the glass top with no appreciable loss due to dust. In passing through the clear-glass top there is a single loss due to dust collection on the outside surface of this cover. In both cases there is a loss of the same order of magnitude due to the dust collection on the outside of the bottom of the bowl when transmitting media are used.

When the luminaire itself has openings in it, such as holes in the bottom or in the holder, or a combination of both, the heated air in the luminaire rises rapidly through the holes at the top with an inrush of dust-laden cooler air through the bottom openings. This results in a coating of dust over the interior of the luminaire and lamp bulb. Consequently, if a luminaire is purposely designed to surround the light source so as to reduce losses from dust accumulation, a considerable part of its effectiveness is destroyed when openings of this kind are added.

Aside from these losses due to dust collection, deterioration of surfaces, such as the tarnish of silver, the yellowing of some white paints and so on, may result in further losses. In fact a gradual deterioration takes place with some material which ultimately results in the loss of the greater part of the light controlled by the luminaire. For the media most commonly used in luminaires the accompanying table shows the permanency, ease of cleaning and other factors that enter into depreciation.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

MAINTENANCE FACTORS OF COMMONLY USED LUMINAIRE MEDIA

Material	Deterioration*	Restoration	Ease of Cleaning
Crystal glass.	None	Excellent	Excellent
Etched glass....	None	Good	Fair
Opal glass. .	None	Excellent	Excellent
Enamel glass (fired)..........	None	Excellent	Excellent
Silvered glass .	Very slight	Excellent	Excellent
Prism glass. .	None	Excellent	Fair
Rippled glass.....	None	Excellent	Fair
Paper............	Gradual	Poor	Poor
Parchment.......	Gradual	Fair	Fair
Mica (art)........	None	Excellent	Excellent
Textiles..........	Gradual	Fair	Poor
Porcelain enamel	None	Excellent	Excellent
Painted surface (matt . . .	Gradual	Fair	Fair
Painted surface (glossy)........	Gradual	Good	Good
Polished silver	Rapid	Fair	Fair
Polished aluminum	Gradual	Fair	Fair
Plaster	Gradual	Good	Fair
Enamel glass (unfired)	Gradual	Good	Excellent

*Normal interior atmospheric conditions are assumed. Of course, all materials will suffer deterioration under extreme conditions.

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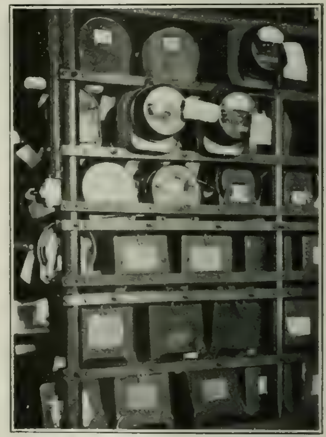
Racking 1,100 Meters in 720-Cu.Ft. Space

BY MEANS of a pipe frame and bar rack erected in two sections, each 10 ft. long and 12 ft. high, with a total width over rack ends of 6 ft., the United Illuminating Company, New Haven, Conn., stores 1,100 meters in limited quarters devoted to testing and other meter work. A section of the rack is illustrated herewith. It is composed of 1¼-in. vertical iron pipes to which are clamped 1-in.x¼-in. iron bars fitted at intervals with 1¼-in.x $\frac{10}{24}$-in. bolts upon which the meters are hung. Between each vertical pipe a space of 2 ft. is allowed, and the friction obtained by clamping the bars to these uprights holds the bars and meters in place without the need of drilling holes in the verticals. This gives an excellent means of adjusting the spacing between horizontal bars to meet the requirements of different types of meters. The rack consists of sections providing four planes of meter suspension, 270 meters per section being easily cared for and there is sufficient space between the front and rear rack sections to permit easy access by meter department employees.



EACH METER AVERAGES A RACK SPACE OF 1,130 CU.IN

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Danger in Municipal Ownership

Agitation Strikes at Foundations of Our Established Government, City Managers Are Told by a Former Member of the Public Service Commission of Indiana

AN INDICTMENT of agitation for municipal ownership as a menace which threatens to destroy the whole fabric of our national government was made by Paul P. Haynes of Indianapolis, formerly a member of the Public Service Commission of Indiana, in a speech before the national convention of city managers at Kansas City, Mo., on Nov. 9. In view of his former office and the nature of the convention which he addressed, Mr. Haynes' statements are of particular interest to central station men.

"The advocate of municipal ownership proceeds on the fallacious theory that because the state finds it necessary to regulate a business, it immediately follows that the city should own it," said Mr. Haynes. Pointing out that in several states grain elevators, warehouses, motor buses and other kinds of private business have been declared public utilities and subject to regulation, Mr. Haynes asserted that the next step may be regulation of the prices of coal, steel, ice and food products and other necessities and public ownership of such enterprises.

"Where will the advocates of municipal ownership halt?" asked Mr. Haynes. "Will they in their zealous pursuit of a vain idealistic fancy blindly strike at the foundations of our established government? Do they propose to carry their ill-premised argument to the inescapable demand that the cities and other governmental units should own and operate all industries and businesses which now or hereafter may be declared public utilities?

"If the municipal ownership advocate is right about electric, gas, street railway and other utilities, he must, in such a situation, demand the public ownership and operation of these additional enterprises. I cannot believe that the municipal ownership advocate would stand for such a revolutionary development in American life, and if he does not profess or stand for such a revolutionary development, he is fundamentally wrong in advocating the public ownership of those enterprises which have so far been declared to be public utilities.

"The path which the municipal ownership advocate is blazing leads inevitably to government ownership of all public necessities and to the destruction of the whole fabric of our national government. The trouble is that he does not know where he is going. He has ignored the broader aspects of the question and does not realize that, unwittingly, he may be lighting the torch which, fanned by an aroused spirit of unrest and discontent, may start the fatal conflagration which in our land the torchbearers of more revolutionary purposes has so far failed to kindle."

Rural Service Impossible

Extension of electric light and power and other utility service to small communities and to the farms would be blocked by the spread of municipal ownership in cities, Mr. Haynes said. "There is a very practical and decisive objection to municipal ownership under any form of city government," he continued. "Several classes of public utilities, in order to serve the public more adequately and at lower rates, have rapidly developed beyond municipal boundaries. Take, for example, electric utilities. The day of the isolated plant is past. The modern development which is giving the public better service at lower rates is toward the construction of superpower plants at points where fuel and transportation are cheaper and where there is an abundance of water for condensation purposes, or on streams where hydro-electric power may be generated. These superpower plants in many cases are in the open country, entirely away from cities. High-voltage transmission lines carry the electrical energy to many cities, towns and villages.

"It will be only a few years until the entire country will be webbed with interconnecting high-power transmission lines. The isolated plant will be no more and the small generating station will disappear. Maximum economies and efficiencies will be developed, service will be better and rates lower. New industries will spring up and old ones will be able to expand, and out of it all the public will be the greatest beneficiary. Municipal ownership of electric plants would make this notable achievement impossible.

"The telephone is another striking example of the impracticability of municipal ownership, and what I have said about the electric industry applies measurably to street railways, gas companies and other utilities."

Mr. Haynes declared that municipal ownership is destined to failure because of the political aspect of city government.

"It is the political foundation underlying all city governments which will always prevent successful public ownership and operation of utilities," said Mr. Haynes. "Public utilities require the constant application of sound business judgment, expert operation, skilled management, and above all continuity of wise business policies. No city primarily governed by popular rule possesses, or can be certain that it will long possess, these qualifications so essential to the utility business. No city the policies of which are determined by popular vote can long continue to apply sound economic principles and business methods to its ownership and operation of utility properties, for the simple reason that cities are essentially political agencies—not necessarily partisan, but, broadly speaking, political.

"The city manager can, and does I believe, administer the affairs of cities more efficiently and economically, but the best of super-managers cannot change the inherent political character of city government, and therein lies the failure of municipal ownership.

"State regulation has corrected the chief abuses which the original advocates of municipal ownership believed to exist. The state is the logical unit to provide regulation of public utilities. Municipal ownership is nothing more or less than an exaggerated form of municipal regulation, for the city admittedly does not go into the utility business to make money. Few will argue that we should now abandon state regulation and go back to local control. What America needs is less politics in business."

An Advantageously Situated Central-Station Office

CENTRAL-STATION companies are coming to realize the advantages of locating their offices and salesrooms in the shopping center of a city, and the new Gas and Electric Building just completed by the New York & Queens Electric Light & Power Company in Flushing, Long Island, is a fine example of this practice.

The building occupies a vantage point in the heart of Flushing's business section within a block of every bank in Flushing, it is just across the street from the post office and is only one block from the main railroad station.

The building was designed primarily to afford suitable facilities for offering customers an adequate merchandising service, and the accompanying illustrations show the appearance of the building and how the sales floor has been laid out.

Increase of Capital Stock Preferred to Bond Issue

POINTING out that his company can finance new construction at the present time more advantageously through issuance of stock rather than bonds, President Charles L. Edgar of the Edison Electric Illuminating Company of Boston discussed various financial problems bearing upon the expansion of New England's largest central station at a recent hearing before the Massachusetts Department of Public Utilities. The hearing was in connection with the proposed issue of $5,406,700 additional capital stock, which is in the proportion of one share for every five shares of the existing stock, and the directors voted to offer the new stock at $150. Mr. Edgar's presentation followed an inquiry by Commissioner Stone as to the feasibility of a bond issue in place of the proposed stock offering.

Before the war, Mr. Edgar said, the Boston Edison company had virtually no bonds, and as a result the company had ample credit from 1915 to 1921. Had the property been heavily bonded, this would not have been the case. When the work now under way on the Edison system is completed the company will have $80,000,000 in plant. In Mr. Edgar's opinion, a debt of $25,000,000 is enough to have on an eighty-million-dollar plant. The matter is largely a question of judgment. There is no intention of issuing coupon notes permanently. The witness felt that in the case of many corporations bonds have been issued in overproportion to their capitalization. The company's coupon notes amount to about $19,000,000. Practically no bonds are outstanding as compared with the total capitalization. At some future time, Mr. Edgar said, conditions may be ripe for a bond issue, but in the judgment of the management the present conditions are less favorable for a bond issue than for a stock issue. Mr. Edgar said that had the war not come on the company would undoubtedly have had a low-rate bond out by now.

Commissioner Stone intimated that the company would have saved in interest by issuing bonds. In reply Mr. Edgar said that the company could not have raised the necessary money in that way. In the last seven years it has expended $25,000,000 with nothing except its credit to go on and the issue of stock. The stockholders, he said, have never received more than 7 per cent, and the company would have had to pay more for money that it raised by bonds or notes during that time. The company paid 8 to 9 per cent for money during a part of the period.

Small Lots of Utility Stocks Appeal to Customers

LIMITATION of the number of shares of stock in special offers of utility securities to new holders has proved to be a considerable factor in promoting a wider distribution of shares among customers. F. L. Hall, secretary and treasurer of the Narragansett Electric Lighting Company, in describing the progress of customer ownership in Providence, R. I., points out that that company now has 8,000 stockholders and expects in time to have at least 25,000 investors in its

VIEWS OF GAS AND ELECTRIC BUILDING AND COMPANY'S SALESROOM IN FLUSHING, L. I.

securities. The present list of stockholders has been built up largely by selling from time to time comparatively small blocks of stock in a limited number of shares to each subscriber.

A few years ago the company's officials purchased 4,000 shares of stock in the open market for resale in small lots to new holders who paid just what the stock cost. Not over five shares were sold to any one individual. In 1920 8,400 shares were sold to new holders and 6,000 shares have been sold so far in 1922. "We shall need $1,500,000 in new money yearly for the next five years," said Mr. Hall, "and by broadening the market for our shares customer ownership will help raise this sum."

Commonwealth Edison Starts Sign Campaign

TO BUILD up its electric sign business in Chicago the Commonwealth Edison Company has adopted a plan of renting signs on a two-year contract basis. Under this arrangement the company furnishes, installs and wires standard 12-in. or 16-in. letter signs according to the customer's specifications and maintains the sign for a period of two years. The company takes out the city inspection permit and provides all the necessary wiring up to and including 80 ft. of conduit. If more conduit is required to complete the installation, the customer assumes this additional expense. New lamps are provided by the company without additional expense to the customer. The customer in turn agrees during the term of his contract not to remove, change nor hang additional panels on the sign without the consent of the company.

The various designs offered for rent include the "silveray," porcelain enameled steel, sectional lamp letter and panel types. The lamps in the panel signs number twenty-four or thirty-two with a choice of wattage of 10 or 25. The "silveray" signs are charged for according to the number of 12-in. or 16-in. panels. The rates charged for this service are shown in the accompanying table. Roof signs are also furnished by the company, and the customer is allowed five years in which to pay for them provided he owns the building or has a five-year lease.

The monthly rental charges are divided into two rates—one rate applying to the first twenty-four consecutive months and a lower rate becoming effective at the expiration of these twenty-four months. However, should a customer desire to pay the city inspection fee and do his own wiring, the company will furnish the sign and bill him monthly at the lower rate—on the same basis as though he had rented the sign for twenty-four months. These signs are wired to the house meter, and the energy consumed is charged for at the regular rates and classed as additional business.

NEWSPAPER ADVERTISING ASSISTS SALESMEN IN RENTING SIGNS

This method of renting signs has been in operation since June, 1922. The city is divided into eight districts, which are covered by eight salesmen. To aid these salesmen in canvassing their districts the company has started a newspaper advertising campaign. It has been rather difficult to obtain sign salesmen who are capable of selling signs, as it is a highly specialized branch of the business and much educational work is necessary. It also requires a great deal of study on the part of a salesman where the customer is unable to give him all the details for a proper sign installation. However, the returns during the past four months show good results in the development of this business as a revenue producer for the company.

MONTHLY RENTAL AND MAINTENANCE CHARGES FOR ELECTRIC SIGNS

Type of Sign	Charge During First Twenty-four Consecutive Months' Use	Charge After First Twenty-four Consecutive Months' Use
Panel Signs:		
Containing thirty-two 10-watt or 25-watt "Mazda" lamps, per sign, per month	$12.00	$8.00
Containing twenty-four 10-watt or 25-watt "Mazda" lamps, per sign, per month	9.85	6.25
Sectional Signs:		
Containing 10-watt or 25-watt "Mazda" lamps, per socket in the sign, per month	0.19	0.14½
Silveray Signs:		
Containing 60-watt "Mazda" lamps, per 12-in. panel in the sign, per month	1.00	0.50
Containing 60-watt "Mazda" lamps, per 16-in. panel in the sign, per month	1.25	0.75

What Other Companies Are Doing

Chicago, Ill.—Service badges have been presented to 118 employees of the Commonwealth Edison Company who have been in the employ of the company more than five years. Nine men received badges for periods of service of twenty-five years or more. Among the three men who have completed thirty-five years of service was Vice-president John F. Gilchrist. Twelve of the forty-seven employees who received five-year badges were women. Miss Helen Norris, dean of the women employees, presented the women's badges, and Homer E. Niesz, manager of industrial relations, presented the men's badges. Vice-president Louis A. Ferguson addressed the gathering.

Dallas, Tex.—C. W. Davis, general manager of the Dallas Power & Light Company, in discussing the expenditure by his company of $2,180,000 during the next eighteen months in completing its new power station, stated that Dallas had doubled its demand for electric current since 1916 and that an increase of 200 per cent is anticipated by 1924. Dallas used 84,000,000 kw.-hr. last year, and the Dallas Power & Light Company expects a consumption of 88,000,000 kw.-hr. this year. The new station will have a rating of 15,000 kw.

Malden, Mass.—Gross appliance sales by the Malden Electric Company in September totaled $10,056, against $5,936 for September, 1921. Gross electric appliance sales for the first nine months of 1922 were $84,261, against $56,362 for the same period last year. A vigorous drive is being made for new business in this and other Tenney properties.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Hydro-Electric Station at L'Isle Jourdain, France.—J. REYVAL.—The latest plant added to a 20,000-hp., 60,000-volt tie-in transmission system in southern France is the L'Isle-Jourdain station, of which a short description is given in this article. The station may well serve as a modern model for medium-head hydro-electric exploitation. It utilizes a drop of 30 ft. Four vertical-shaft, 167-r.p.m., Francis turbines of an average output of 2,400 hp. each are installed, driving direct-coupled, 50-cycle, 5,000-volt, three-phase generators and a belt-coupled exciter. A transformer bank of four single-phase, 2,000-kva. water-cooled transformers raises the generator potential to the trunk-line voltage of 60,000.—*Revue Générale de l'Electricité*, Oct. 21, 1922.

Water-Power Possibilities in the Middle West.—C. W. PLACE.—Hydro-electric developments in different parts of the country have very different physical characteristics. The author shows some aspects of the service requirements peculiar to the Middle West and then discusses the form of hydro-electric development best suited to meet these conditions.—*General Electric Review*, October, 1922.

Commercial Economy of High Pressures and Temperatures.—In the opinion of one prominent consulting engineer, steam plants operating at a pressure of 1,200 lb. per sq. in. and a total temperature of 750 deg. F. are justified as coming commercial developments. Physical conditions and thermodynamic considerations favor increasing pressures. Higher temperatures are attainable but are not so conducive to economy. Other changes which may produce savings equal to those proposed in prime-mover conditions are referred to in the article. —*Power*, Oct. 31, 1922.

Generation, Control and Switching

The Operation of Frequency Changers.—L. M. SMITH.—The author considers the two principal uses of the frequency changer—namely, to supply a certain portion of a load at a different frequency from that of the main load and to interconnect two independent systems of different frequency each having its own generating plant. The first case is comparatively simple, the operation consisting of connecting one element of the frequency changer to the supply system and the other element to the subsidiary system. In the second case the operation is more complex, depending upon the type of apparatus used and the nature of the service for which it is installed. There are three methods where this changing from one frequency to another may be accomplished. The first is known as the induction type. This consists of a wound-rotor induction motor the stator windings of which are connected to the system whose frequency is to be changed, the rotor, which is separately driven, being connected to the subsidiary system. The second method is known as the induction-synchronous type, consisting of an induction motor of either squirrel-cage or wound-rotor construction driving a synchronous generator. The third, and most common, consists of two synchronous machines which will transfer power in either direction according to the load or to the speed regulation of the governors on the prime movers of the two generating systems. The various applications of these systems are illustrated by a number of examples.—*Association of Iron and Steel Electrical Engineers*, October, 1922.

Transmission, Substations and Distribution

Influence of the Shape of the Voltage Curve Upon Tests of Suspension-Type Insulators.—M. F. DAHL.—Based upon a number of actual tests, the author shows the great influence of the shape of the voltage curve upon the results of tests made on high-voltage disk-type insulators. The voltmeter, at a certain flash-over test, showed, for example, 138,000 volts, while the evaluation of the oscillogram taken at the same time indicated a crest voltage of 152,000. The author claims that it is safe to assume that the ideal value of $\sqrt{2}$ is never reached for testing voltages as there are too many factors involved which tend to distort the shape of the originally sinusoidal form. Factories of electric porcelain know, as a rule, the exact shape of the voltage curve of their testing machines; but it is recommended that its shape be checked against an oscillographic record for different connections and arrangements of the tested objects. Discrepancies of as high as 20 per cent from the assumed value may occur and may be the cause of an unjust rejection of insulators which have no real defect.—*Bulletin de l'Association Suisse des Electriciens*, October, 1922.

Relation of the Petersen System of Grounding Power Networks to Inductive Effects in Neighboring Communication Circuits.—H. M. TRUEBLOOD.—A simple theoretical treatment of those features of the Petersen method of grounding a power network which are of principal interest from the standpoint of inductive effects in neighboring communication circuits. In the first section of the paper the behavior of the power system at the time of faults with a grounded phase is discussed, with an explanation of the principal characteristic effects of the reactor. In the second section of the paper the behavior of the power system with reactor under normal operating conditions is discussed with reference to noise and other inductive effects in neighboring communication circuits.—*Bell System Technical Journal*, Vol. 1, No. 1.

Outdoor Substation Construction.—W. S. JONES.—The author does not go into the complete design or construction of outdoor transformer stations, but touches on the few points and details which, as a rule, do not receive timely consideration during the design and installation of such stations.—*Electric Journal*, November, 1922.

Units, Measurements and Instruments

Development of Meters Since the War in Germany.—K. SCHMIEDEL.—The paper gives a detailed review of many important mechanical and electrical developments in the design of electric meters. Practically all improvements concern alternating-current meters, for hardly any changes can be observed in the direct-current models. For three-phase lines with neutral conductor (four-wire systems) the preference is being given now to meters with three measuring systems, an arrangement which gives a simpler connection between the phases. The energy consumption in the potential circuit of older types of meters amounted to 1 watt to 1½ watts for a torque of 4 to 5 gram-cm. Latest types require only about 1 watt for the same torque. The accuracy of modern meters within the limits of 5 per cent and 100 per cent is always less than 1 per cent plus or minus. The power factor affects the integration very little. New forms of measuring systems of the three-legged iron-core type are now used by Siemens, Körting, Mix and Pipersberg, all showing a minimum of magnetic resistance. The A. E. G. and Meyer use a "form G" iron core, while Firchow meters have two separate cores. A radically different system is employed in the Aron meters, which contain a combination "G" and "E" form core, with all resulting poles in one plane. The new A. E. G and Siemens meters are described in detail as to their mechanical construction. The terminals are usually molded into a compound block. No porcelain parts are used today in meters. Cylinder-type counting devices with a horizontal axis are the general rule. The use of alloy-steel laminations for the cores of meters is still being disputed. Alloy steel is very hard on the punching dies, and by proper arrangement very small core losses may be achieved with ordinary "dynamo steel." The author regrets the lack of new developments in direct-current meters. The use of iron in the series circuit would be a great improvement, but it is at present impossible, as no steel can be obtained with sufficiently uniform properties.

Permanent magnets with a stronger field would also be of great value. Cobalt-tungsten-steel, recommended recently by Honda and Saito, would be magnetically a success, but it is far too brittle.—*Zeitschrift des Vereines Deutscher Ingenieure*, Vol. 66, No. 13, 1922.

Illumination

Lighting Designs for Stores.—J. R. Colville and C. E. Weitz.—Lighting examples and recommendations for a number of store interiors, both large and small, together with suggestions and notes on the lighting of display windows are given in this booklet. Good engineering has produced lamps and standard equipment which diffuse and distribute the light, and has determined relations as to the mounting height and spacing which indicate the best location of units. Suggestions are included as to the amount of illumination which may be expected from certain sizes of lamps when used in typical reflecting equipment.—*Bulletin No. 45 of the Engineering Department, National Lamp Works of General Electric Company.*

Motors and Control

Electric Drive of Blooming Mill.—The Hadfield steel mill of Sheffield, England, has recently applied electric drive to one of its largest duo-blooming rolls. Two pairs of rolls arranged side by side in one line, both of 28½-in. diameter, are driven by a direct-current double motor of a normal output of 3,200 hp. with a peak capacity of 11,600 hp. Its speed can be regulated from zero to 60 r.p.m. The torque varies between 40 and 138 ton-meters. From full speed forward the motor can be stopped and accelerated to full reverse speed within three to four seconds. A motor-generator set with a 30-ton flywheel supplies the rolling motor. It consists of a 1,800-hp., 600-r.p.m. induction motor and two shunt-wound 650-volt, 1,300-kw. to 4,750-kw. direct-current generators. The energy demand of this set during the heaviest rolling stays within the limits of 1,800 hp. and 2,000 hp.—*Le Génie Civil*, Sept. 23, 1922.

Factors Affecting the Selection of Electric Motors for Steel-Mill Auxiliary Drives.—Part I.—L. A. Umansky.—It is essential in steel-mill work to make the motor fit the drive, and the author's analysis of the method of determining the correct motor to use should find a broad field of usefulness in the steel industry. Virtually all the mechanisms of the steel-mill auxiliary drives can be replaced for calculation purposes by simple elementary forms. The inertia force can be readily figured out, and the resultant load on the motor can then be calculated exactly in the same way as the load produced by any other force, such as gravity, friction, etc.—*General Electric Review*, October, 1922.

The Automatic-Start Polyphase Induction Motor.—James L. Hamilton.—The author covers the characteristics, electrical and mechanical designs of the automatic-start, polyphase induction motor. The article sets forth the general characteristics as compared with other standard types of motors, outlines a commercially practical method of studying the electrical design of existing motors and discusses the mechanical design. This motor consists of a field or stator of laminated toothed construction having the usual two-phase or three-phase winding. The armature or rotor has two windings, one being a progressively wound, low-resistance winding connected to a short-circuiting device and the other winding being of high resistance squirrel-cage design.—*Journal of the A. I. E. E.*, October, 1922.

Heat Applications and Material Handling

Electric Steel Furnace.—A. Grönwall and F. Horschitz.—Comparing the advantages and disadvantages of the different types of known electric furnace systems, the authors foresee the possible victory of the combined arc and resistance type as developed by Girod, Nathusius and Grönwall. The article describes the latest types of these furnaces, which are being built in standard sizes from ½ ton to 12 tons and are suitable for melting steel, ferro-silicon, brass and other metals and alloys. Two-phase current permits the use of two electrodes with the third line connected to a bottom plate in the furnace. The latter is placed on the neutral of the system, so that it carries 1.417 times the current of the electrodes. For a three-phase supply system two single-phase transformers in T-connection are recommended. For a 10-ton furnace 950 kw. to 1,400 kw. is required, consuming 700 kw.-hr. per ton of steel, starting with a cold charge.—*Elektrotechnik und Maschinenbau*, Oct. 15, 1922.

Welding Tubes Into the Tube Sheets of Boilers.—F. H. Williams.—In determining the best method of welding the tubes into the tube sheet, the writer considers the effect of the welding on the metal of both the tube and the sheet, the effect of the final outline of the tube end, and the amount of work required to perform the entire operation from start to finish.—*Power*, Oct. 10, 1922.

Electrophysics, Electrochemistry and Batteries

Measurement of the Color Temperature of the More Efficient Artificial Light Sources by Rotatory Dispersion.—Irwin G. Priest.—A new method of measuring color temperatures between 3,000 deg. and 4,000 deg. absolute centigrade is described and discussed, with data on the color temperature of the gas-filled tungsten lamp and the carbon arc. Light from a source of known spectral distribution is modified by passage through a quartz plate between nicol prisms, which constitute in effect a blue filter of adjustable spectral transmission. The spectral transmission is adjusted by rotating one of the nicols. The source and the thickness of quartz are so chosen that the energy emerging from the second nicol has the spectral distribution characteristic of a complete radiator. The light from the source whose color temperature is to be determined is color-matched by rotating one of the nicol prisms. The temperature is obtained from this rotation by a method described in the paper.—*Scientific Paper No. 443, Bureau of Standards.*

Traction

Magnetic Blow-Out as Applied to Railway Control.—L. G. Riley.—The purpose of this article is to discuss the characteristics and fundamentals of effective blow-out design and to show how these principles have been utilized in the development of a line of pneumatic switches applicable to railway control. The persistence of an arc formed by the separation of contacts under a load depends upon the speed at which the contacts are separated, the maximum distance to which they are separated, the voltage, the current drawn, the inductive characteristics of the circuit, the kind of contact material used, the degree to which the arc is confined to a limited space, etc. The practical results secured with contacts of various materials, of both high and low resistance, have led to what is considered an almost universal standardization on pure copper contacts, closed and opened with a rolling motion which establishes the arc at the tip of the contact, preserving the final seat at the heel of the contact in good condition for current-carrying duty.—*Electric Journal*, October, 1922.

Telegraphy, Telephony, Radio and Signals

High-Power Vacuum Tube.—W. Wilson.—A vacuum tube is described that is capable of delivering 100 kw. of high-frequency energy. This tube is water-cooled, about 2 ft. in length and weighs 10 lb. Another tube of similar construction with a delivery of 10 kw. is also described. The method of sealing heavy copper wire through the glass in such a way that the best vacua can be maintained is discussed.—*Bell System Technical Journal*, Vol. 1, No. 1.

Radio-Frequency Amplifiers.—P. D. Lowell.—There are three methods of coupling the output of one tube into the input of another tube so as to provide a multistage amplifier of radio frequencies. These are resistance coupling, tuned plate coupling and transformer coupling. The last named method is usually the most satisfactory and permits of amplification at almost any frequency. This paper deals for the most part with this method and gives circuits and constructional details for transformers with both air and iron cores. The iron-core transformer will usually operate satisfactorily over a much broader wave band than the air-core transformer, although the construction of a successful radio frequency amplifier is quite a difficult task.—*Scientific Paper No. 449, Bureau of Standards.*

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

New York Water Power

Governor-Elect Smith Protests Against Any Grants to Companies by Outgoing Administration

AN UNUSUAL political situation closely connected with water-power development has arisen in New York State, where Alfred E. Smith, who received more than 400,000 majority for Governor in the recent elections, has, acting on a report in an up-state newspaper, sent the following dispatch to Attorney-General C. D. Newton, a member of the State Water Power Commission:

"Nov. 22, 1922.

"HON. CHARLES D. NEWTON,
"Attorney-General, Albany, N. Y.

"MY DEAR GENERAL: It has been called to my attention that the State Water Power Commission is to meet in Albany tomorrow morning at 10 o'clock. I have been further informed by a newspaper article that it is the intention of the commission to act upon some applications for licenses to develop electrical energy by private corporations. The paper that I read says that there is a possibility that a license may be granted to some company to develop energy from the waters of Niagara below the falls.

"Before and during the campaign I took a decided position with regard to the development of electrical energy from water power owned by the state. I have held that it should not be given to private companies for private development, but should, on the other hand, be developed by the state itself under state ownership and state control for the benefit of all the people of the state.

"I would therefore ask you, in view of the decision of the people at the polls following the campaign in which this subject was a distinct issue, not to grant any license or permits to private corporations for development of electrical energy from water-power resources that belong to the state, and permit that subject to be dealt with by the incoming administration in accordance with the explicit promises made during the course of the campaign.

"ALFRED E. SMITH."

"I understand," said the Governor-elect in explanation of his action, "that in the waters of the Niagara gorge there is 200,000 potential horsepower. All I am interested in is that this vast hoard of potential energy, which might be of untold benefit to the people of the state and is worth a king's ransom, shall not be given away to any private corporation for fifty years, as under the existing statute the Water Power Commission can do if it has a mind to.

Interviewed at Albany, Attorney-General Newton intimated that there was no disposition on the part of the Water Power Commission to hurry matters or do anything that would prove embarrassing to the new Governor.

THREE APPLICATIONS BEFORE COMMISSION

"Three applications are now before the commission for action," he said, "and they can be acted upon as soon as everything is in shape. However, I do not believe that we will do anything without consideration."

The three applications to develop power are from the Niagara Gorge Railroad, the Niagara, Lockport & Ontario Power Company and Thompson & Porter. These applications have been before the commission for months, and in August last the Water Power Commission went to Niagara Falls and looked over the proposed power sites.

The commission, which contains five members, of whom four are elective state officers, is now solidly Republican. After Jan. 1 the Democratic party, to which Governor-elect Smith belongs, will control it by three to two.

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Radio Records Broken

Forty-five seconds from London, fifty-five from Norway, a little longer from France and two minutes and forty seconds from Germany—these were the periods of time taken to receive answers by radio to dispatches inquiring about the weather sent from the Engineering Societies Building, New York City, under the direction of David Sarnoff on Wednesday night. Mr. Sarnoff spoke before the New York Electrical Society, which was holding its regular monthly meeting, and predicted the coming of a "wrist-watch wireless set, or radiolet," by means of which "a man could receive in his vest pocket market reports, weather reports and details of championship games."

On the same day all amateur long-distance records were said to have been shattered at the radio station of Hiram P. Maxim, president of the American Radio Relay League, when a radiogram was sent to Wailuku, Hawaiian Islands, and the answer was received in four minutes and eighteen seconds. The radiogram was relayed at Sleepy Eye, Minn. The distance from Hartford to Sleepy Eye by air line is about 1,200 miles, and thence to Wailuku 4,000 miles.

Colorado River Treaty

Agreement Among the Seven States and the Federal Government Has Been Formulated

AGREEMENT on the main principles of a treaty to be entered into by the federal government and the seven states interested in the development of the Colorado River has been reached at the meeting of the Colorado River Commission, which assembled at Santa Fé, N. M., on Nov. 9 and has since been in session. Details are not, however, as yet available.

Secretary of Commerce Hoover is chairman of the commission, on which Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming have each one representative. The conference is the first instance in American history where several states are making use of their treaty-making powers to effect an equitable appropriation of the benefits to be derived from the use of waters of an interstate stream, prior to the development of conflict respecting established uses.

The treaty agreed upon is understood to divide the seven states into two groups, with California, Nevada and Arizona in the lower division and Utah, Wyoming, Colorado and New Mexico in the upper division, equal amounts of water being allotted to each division. Preference in right is given to the use of water on established irrigation developments and no existing rights are to be disturbed. Another commission, to meet after the lapse of several years, is recommended. No announcement was made regarding allocation of water to Mexican territory or whether water passing from the upper to the lower divisions is to be measured.

The governors of the seven states concerned have been asked to join the commission at Sante Fé to give their final views. After approval by the commission the treaty is to be submitted for ratification to the legislatures of the several states and to Congress.

Secretary Hoover stated that the matter of power had been taken entirely out of the hands of the commission by direction of the President and delegated to the Federal Power Commission. The flood-protection needs of the Imperial Valley were recognized as an extremely urgent reason for immediate erection of control works, which will probably be undertaken at Boulder Canyon by the national government when the treaty shall have been signed.

Last spring the commission held meetings at Phoenix, Ariz.; Salt Lake City, Denver and Los Angeles.

Electrical Supply Jobbers Have Record Attendance

Further impulse was given this week to the rapidly increasing interest which electrical men of all classes are showing in the problems of merchandising appliances at the annual winter convention of the Electrical Supply Jobbers' Association, held in Cleveland at the Hotel Cleveland. The entire program of the open sessions and a large part of the executive sessions were given over to the discussions of the problems of the retailer and the distributor for the purpose of focusing the attention of the industry more closely upon the vital contact with the ultimate consumer which it is the function of the local merchant to maintain.

John F. Gilchrist, vice-president Commonwealth Edison Company, Chicago, addressed the meeting Thursday morning on the subject "Merchandising Electrical Appliances" and dwelt at length on the need of greater knowledge of the cost of retailing electrical merchandise and the importance of developing a more satisfactory profit for electrical merchants.

W. R. Herstein, vice-president Electric Supply Company, Memphis, Tenn., spoke on "Electrical Merchandising Distribution" and discussed the responsibility of the jobber toward the retail trade and the opportunity for increasing the sale of appliances and accessories in the popular market by a more purposeful and effective co-operation.

W. E. Robertson, general manager Robertson-Cataract Electric Company, Buffalo, talked on "Business Promotion Activity," presenting interesting information on the work of the Joint Committee for Business Development and the successful results of the recent western New York State electrical conference held in Buffalo. He described the progress which is being made in league organization in that part of the state.

The convention opened on Monday, Nov. 20, with two days of executive committee meeting, and executive sessions of the full membership were held on Wednesday and Friday. More than five hundred were in attendance, a record number.

O. E. L. A. Business Promoters Discuss Merchandising

Insistence on better merchandising practice and higher-grade salesmanship in central-station commercial departments was the outstanding feature of an extremely well-attended meeting of the new-business co-operations committee of the Ohio Electric Light Association held at Dayton on Nov. 22. In a paper on "Central-Station Merchandising" J. E. Tills of the Commonwealth Edison Company, Chicago, emphasized the necessity of carrying selling activities directly to the customer's door and explained how this is done in Chicago through crews of salesmen operating from trucks. By this method alone that company expects to sell one million dollars' worth of electric appliances this year. J. E. North of Cleveland emphasized the fact that success in merchandising is dependent largely upon customers first being sold adequate wiring for their homes. Moreover, so-called new-business programs will almost invariably fail if not intelligently planned.

E. W. Hake, commercial manager of the Union Gas & Electric Company, Cincinnati, warned against employing salesmen of inferior quality to the detriment of the company's business and its standing in the community. He advocated most careful selection of men for such positions, which should offer sufficient remuneration to attract high-class salesmen, not peddlers.

J. Hall Truman, Jr., of New Philadelphia, Ohio, chairman of the new-business co-operations committee, in summing up the situation declared that if central-station companies are to become commercial institutions they must learn to be merchants, adopt logically planned sales programs and employ real salesmen trained by the companies to this field of endeavor.

The next meeting of this committee will be held at Columbus on Feb. 15, when commercial and home lighting will be discussed.

Ontario Hydro Accused of Deception

Gregory Commission, Appointed by Ontario Government, Estimates Loss at Nipigon at $750,000 a Year, Which Must Be Borne by the Province—History of the Venture

The Hydro-Electric Inquiry Commission, locally known as the Gregory Commission, has issued an interim report covering its investigations into the Nipigon power project of the Hydro-Electric Power Commission of Ontario. It will be recalled that this commission was appointed by the Lieutenant-Governor in Council of the province to inquire into the report upon the Queenston-Chippawa power development and all other power developments undertaken by the Ontario commission and, generally, all matters of expenditure and administration by the commission.

The interim report just issued deals with the history of the Nipigon venture, the early stages of which, according to the report, were marked by some irregular procedure on the part of the commission. This development, it will be recalled, formed part of the investigation of the Hydro-Electric Power Commission of Ontario made by W. S. Murray and Henry Flood, Jr., for the National Electric Light Association. It is significant that the royal commission, composed entirely of Canadians, corroborates the general findings of the Murray and Flood report in that it also shows the Nipigon development to be unprofitable.

The present deficit, according to the Gregory Commission, is $340,000 a year and is likely to be nearer $750,000 annually before the tide turns. This burden, the commission suggests, cannot be carried by the Hydro-Electric Power Commission of Ontario, nor by the municipality of Port Arthur, for which the system was primarily promoted. The Province of Ontario, according to the report, borrowed the money for the work on behalf of the Hydro-Electric Power Commission of Ontario; the province signed the bonds, and willingly or unwillingly the province will have to make good the loss.

The Gregory report also suggests that the time has arrived for the provincial government to insist that the present standard contract adhered to by the Hydro-Electric Power Commission be not allowed to bar out responsible customers for power. The recommendation appears to apply to the case of the Great Lakes Pulp & Paper Company, which has refused on the advice of counsel to take 10,000 hp. from the commission, owing to details of the standard power contract.

Dealing with the history of the Nipigon development, the Gregory report points out that the Hydro-Electric Power Commission of Ontario omitted to publish an estimate of the maximum price at which power would be supplied and of the probable cost of the development. The reason for such omission, the report hazards, was the desire on the part of the commission to escape possible legal action should the figures ultimately exceed those given to the people when by-laws were submitted.

The original project, the report continues, was for a three-million-dollar development at Dog Lake. After the bylaws had been passed, however, the Hydro-Electric Power Commission of Ontario changed its plans and entered into a twelve-million-dollar enterprise at Cameron Falls on the Nipigon River. The power rights on the Nipigon were held by the Great Lakes company, and Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, was anxious, the report concludes, to secure those rights for the commission. He therefore negotiated a deal with the Great Lakes company which obligated the Ontario commission to supply it with power but failed to bind the company to take the power when it was available. This failure on the part of the company has been a severe blow to the Hydro-Electric Power Commission's revenue account. It is suggested by the Gregory Commission that the advances which the Province of Ontario must make to meet the annual losses at Nipigon be carried in a suspension account, with the hope that some day there may be a profitable market for the power, at which time these advances can be returned.

State Commissioners Hear Utility Officers

President Smith, Manager Aylesworth, Henry L. Doherty and Martin J. Insull Address Detroit Convention—New Classification of Accounts Adopted—Indeterminate Franchise Favored

AT THE final sessions of the annual convention of the National Association of Railway and Utilities Commissioners at Detroit last week, the first two days of whose proceedings were reported in last week's issue of the *Electrical World*, four representatives of public utility interests addressed the commissioners upon invitation. The commissioners also discussed and adopted new classifications of accounts for electric, gas and water utilities, passed a resolution urging more uniformity in regulatory laws in various states, and adopted another strong resolution urging the adoption of the principle of the indeterminate permit in the operation of public utility companies.

RESPONSIBILITIES OF OPERATORS

In picturing the future immediately ahead of the electric light and power industry, Frank W. Smith, president of the National Electric Light Association, showed that the executives of a company as well as the public service commissions are charged with certain responsibilities. The officers and directors of the great public service corporation, he said, are no longer, if they ever were, a little group of men who own the enterprise and agree to run it in a narrow-minded, selfish way for their own profit. The utility has become a great human institution, a vital part of the life and welfare of thousands of men and women who are as much a part of the public as are any leaders of political activity.

While the public service commissions represent the public interests, Mr. Smith maintained that this responsibility was also shared by the board of directors of the present-day utility. These men are vested with responsibility to thousands of investors, on the one hand, and, on the other hand, to patrons and customers. The first tribunal, therefore, whose members sit dispassionately and try to keep a balance between these large elements of the public is the directorate of the utility. There the great mass of questions arising in public utility operation and management are decided soundly and fairly in the interests of all concerned.

According to Mr. Smith, if private ownership and operation of public utilities is to succeed and endure, public regulation must succeed and command a generous measure of public confidence. If public regulation is to endure, private ownership and operation of the utilities must ever be alert to conform its policies to the American spirit of fair play and the American desire for the best in public service. If private ownership departs from this course or if public regulation fails to achieve its intended purpose, our industries and our governmental institutions will be at the mercy of men whose views are alien to American traditions.

PLEA FOR SOUND SECURITIES

M. H. Aylesworth, executive manager of the National Electric Light Association, showed the extent and advantages of customer ownership of utility securities.

Mr. Aylesworth defined true public ownership as that where a substantial percentage of people in the community served own a financial interest in the utility company, register their complaints and protest against imperfect service with their own managing employees, share in the earnings and have a direct voice in shaping the policies.

In view of the favorable public attitude toward utility securities and their widespread purchase by customers and employees, Mr. Aylesworth asked the commissioners to see to it that only stocks of unquestioned merit and stability, backed by good value and good management, be made available for customer-ownership campaigns. This, he maintained, is necessary in order to safeguard the priceless public support which electric public utilities now enjoy, and it is manifestly in the public interest.

DOHERTY ON REGULATION

Henry L. Doherty, head of Henry L. Doherty & Company, who was scheduled to speak, was detained by a court procedure in Virginia from actually attending, but he sent a personal representative who delivered his message to the convention. In this message Mr. Doherty declared that when the public takes the advice of the state utility commissions instead of expecting the commissions to follow its dictation, then and then only will the full benefit of intelligent regulation be realized. He said that the progressive and constructive public service companies want intelligent regulation and that they do not want to "fool with politics."

Mr. Doherty asserted that probably the utility operators themselves are to blame for the fact that "a large part of our citizens still think it is the duty of the state commissions to give the public services hell instead of justice." Reviewing the period of regulation without responsibility through which the public service companies have passed, he said that agitations for reductions in rates were formerly "a daily diet but an infrequent accomplishment," and that in the old days "a bill or ordinance would be passed which was generally intended by the agitators to be so drastic that it could not be accepted, an injunction would be issued, and then, after a long and expensive legal battle, the courts would be compelled to declare the rate confiscatory and the issue would still be alive as the basis for another political campaign.

Mr. Doherty called attention to the necessity for the adoption of a fair method of profit sharing, suggesting the adoption of a standard rate for utility service, with the understanding that all profits above a certain fair return upon the capital invested in the business be shared on a dividend basis with the consumers of the service provided. In championing the theory of control by state commissions he criticised the division of authority now existing between the state commissions, city governments and state legislatures. "If it is necessary to reserve any control for the citizens of the city or the municipal government," Mr. Doherty declared, "then this control should not be of a character to prevent the utility from functioning. I know the cry of home rule is potent, but it should not prevail with thinking people in this instance."

NEW OFFICERS OF RAILWAY AND UTILITIES COMMISSIONERS' ASSOCIATION

Left to right: Front row—Alex. Forward (Virginia), first vice-president; D. N. Lewis (Iowa), president; H. G. Taylor (Nebraska), second vice-president. Back row—J. B. Walker (New York), secretary; J. H. Corbitt (Tennessee), assistant secretary.

The "readiness-to-serve" method of charging was favored by the speaker.

ADVANTAGES OF HOLDING OR INVESTMENT COMPANIES

Martin J. Insull of Chicago, in his address before the commissioners, drew attention to the enormous amount of money necessary in the development of the electric light and power business. In providing these large amounts use is made of holding or, as he expressed it, investment companies. These investment companies raise money on their own securities with which to purchase the junior securities of operating companies. Were it not for this form of financing, he said, many small towns, hamlets and rural districts now enjoying twenty-four-hour electric service would be without any electric service whatsoever.

Owing to the large aggregate purchasing power of such groups of operating companies they can buy machinery and supplies at lowest market prices. In addition, the investment company, through its financial influence and as a result of its credit, can arrange for the placing of the bonds and preferred stock of its operating property on a better basis than the operating companies themselves. It was pointed out that in times of financial stress, when it may be practically impossible for small companies to finance themselves at all, the investment company can provide money temporarily or permanently. This an investment company can do because the risk is so spread and because of its higher credit rating with banks and investment houses and with the investors themselves.

Mr. Insull stated that one of the functions served by the investment company is to stabilize the whole financial structure of the operating companies. Such investment companies must make the other securities, all senior to theirs, secure both as to principal and return before they can earn a cent. They take the chief risk of the business, Mr. Insull said, and are entitled as a result of this risk, as well as through knowledge of the utility business and their responsibility to the investors and the public, to dominate and direct the operating companies they have organized and financed. Without these investment companies with their vast capital, he maintained, it would be practically impossible for a very large part of the population of the country to enjoy the advantages of electric service.

AT THE BANQUET

At the banquet on Thursday evening Carl D. Jackson, retiring president, received as a token of respect from his colleagues a set of platinum and pearl shirt studs and cuff links. The toastmaster, James Schermerhorn, who spoke with no little wit and humor, told of Detroit's experiment with municipal ownership, saying that all the people were led to believe that when once they had municipal ownership their troubles would be ended, but that at the recent election they found out that they had still to spend five million dollars more for extensions, to build a subway, to have the interurban cars stop at the city limits and to shift the paving charges from the Department of Street Railways to the general city expenses, and they were not therefore so sure that their troubles had ended. "But," said Mr. Schermerhorn, "this is an age of experimentation, and if we live through it we shall at least know that we were part of the experiment."

Mr. Jackson said that the commissioners were all interested in watching Detroit. "For Detroit," he said, "may solve what we as commissioners have not yet been able to do—to make money transporting people at less than cost."

The principal address of the evening was made by H. H. Emmons, now president of the Detroit Board of Commerce, who was an officer in the air service during the war.

RESOLUTIONS PASSED

The last session of the convention was concerned chiefly with consideration of resolutions recommended to it by the executive committee. Many of these had to do with railroad regulation. Two of these suggested an amendment of the Esch-Cummins act so that rights and duties of state commissions will be more clearly defined.

Of particular interest to electrical men, however, were two other resolutions, one supporting the indeterminate permit and the other urging uniformity in regulatory laws of the several states.

The first of these, after reciting existing limitations to the possibility of uniform treatment of the utilities on the part of the commissions and the difficulty met by utilities in financing themselves on limited-term franchises, and after stating that the principle of the indeterminate permit goes far toward solving these difficulties, provided ample safeguards be made for the protection of both the public and the investors in the case of the determination of such permits, includes the following clauses:

"Now, therefore, be it resolved, That it is the sense of the National Association of Railway and Utilities Commissioners that the principle of the indeterminate permit is economic and sound and should be adopted in the legislation of the various states relating to public utilities;

"And resolved further, That this association do, and it does hereby, urge the legislatures of the various states which have not as yet adopted the principle of the indeterminate permit to enact legislation recognizing and putting such principle into effect."

The second resolution authorizes a committee of the association "to consider carefully the various forms and practices of utility regulation and report from time to time to this association conclusions and recommendations for a desirable uniform system of public utility regulatory law."

Final decision to hold the next convention at Miami, Fla., Dec. 4, 1923, was reached.

New Power Board Policies

Federal Commission Will Revoke Permits When Delay Is Too Long—Los Angeles Gets License

IN CONNECTION with several cases on which action was taken, the Federal Power Commission at its meeting on Nov. 20 inaugurated two new policies of administration and at the same time was confronted with new questions involving interpretation of the water-power act.

The commission put into effect a policy of revoking preliminary permits in cases where specified engineering investigations are not carried out within a reasonable time. A preliminary permit which was issued on Oct. 12, 1921, to A. Reed Bingham of Pensacola, Fla., looking toward developments on the Perdido, Blackwater and Styx Rivers in Florida and Alabama, was revoked on the ground that stream gaging had not been done as required. A preliminary permit issued March 14, 1922, to J. F. Myser and E. E. Drach of Denver, Col., was revoked because engineering investigations had not been carried out.

Another new policy was marked by the commission's action in waiving the question of valuation and approving a license for the Western States Gas & Electric Company of San Francisco for a constructed project on the Trinity River in northern California, in a national forest. Heretofore the commission has insisted upon valuation being determined before a license was granted. In this case the question of valuation was left for the future and the commission agreed to accept the valuation fixed by the state commission.

Questions of interpretation of the water-power act arose in connection with the application of the city of Los Angeles for a license for its two constructed plants on the city aqueduct about 40 miles north of Los Angeles, affecting both a national forest and public lands. The plants develop about 40,000 hp., which supplies the base-load for the city. The license was granted. This is the first license that has been issued to a municipality. The question has arisen whether the act in providing that licenses shall be issued to municipalities without charge provided the project is to be operated without profits means that such municipality shall be free from all charges under the license or only from administrative charges and that charges for the use of public lands or public structures shall operate against it just as any other concern. No decision on this point was reached. The broad question of "operation without profit" was raised, and although not decided the indications are that the burden of proof will rest upon the licensee to establish that it is not operating at a profit.

Along somewhat similar lines, the question was raised as to proper interpretation of the act in providing that there shall be no charge for licenses for projects of less than 100 hp., the point being whether only administrative charges or all are to be canceled.

Investigation of Radio

N. E. L. A. Committee Delving Into Its Possibilities in Connection with Lighting Circuits

UNDER the chairmanship of N. F. Brady, president of the New York Edison Company, the radio policy sub-committee of the public policy committee of the National Electric Light Association has undertaken an exhaustive study of the "wired wireless" situation, and, in fact, of the entire radio field, in an effort to establish a uniform policy for electric light and power company properties with respect to the radio art.

The committee holds that electric light and power companies of the country are interested in radio from two aspects—radio as it is known today and radio as it may be in future. It feels that today's problems are comparatively simple, in most cases purely mechanical or technical ones dealing with the safeguarding of electric light and power company transmission lines and distribution systems from interference and the simultaneous guarding of radio amateurs from injury or possible death, and the safeguarding of property from damage through thoughtless or careless installations of antennas or unwarranted uses of electric light or power lines.

PROBLEMS FOR SOLUTION

Some of the questions connected with present-day radio practice for which the committee is endeavoring to find an answer satisfactory to the public and the association membership as a whole are:

"Shall the central station get back of the movement and foster radio telephony in the home by installing broadcasting stations and advocating the use of electric lines as antennas?

"Shall it offer the use of its poles for antenna supports?

"Or, on the other hand, shall it discourage the use of socket antenna attachments and foster municipal ordinances restricting and licensing the installation of radio receiving sets?"

The committee feels that there is great diversity of opinion upon these points both from the viewpoint of building good will and from the viewpoint of safety and service standards.

With respect to future developments the committee is now collecting data and having experiments made by leading manufacturers in order to find answers to the following problems and questions, and it confidently expects to have those answers in hand within the next year:

"Will the development of 'carrier current' make possible the use of existing light and power lines for purposes never before contemplated?

"Will the transmission line serve also as a telephone and control channel to communicate with the distant station and to operate its equipment?

"Will the street lights of the future be controlled by carrier current transmitted over the distribution mains?

"Will the radio set of the future operate on the lighting circuits in the home and receive its impulses over the same circuits by means of carrier currents?"

Frequent meetings of this committee are being held in New York, and reports are being received regularly from those conducting the experiments. From time to time announcements will be made by Mr. Brady on behalf of the committee.

Electrical Credit Men Meet at St. Louis

By holding its convention last week at the Statler Hotel, St. Louis, the Electrical Credit Association, Central Division, broke a precedent of twenty-seven years, for during all that period it had met only at Chicago. The program included subjects that ranged from the personal contact of the credit man with his customers and the cheapness of credit to the value of membership in the association. Augustus L. Abbott of the St. Louis bar gave a practical talk on "Credit and Collections Viewed from the Lawyer's Standpoint." At the annual banquet State Attorney-General Jesse W. Barrett delivered an address on "Ethics in the Conduct of Business" and John F. Leahy spoke on the subject of "Electricity and Credits." The attendance numbered two hundred, fifty members coming from territory outside St. Louis. Chicago was represented by twenty-seven.

The total number of claims that were reported on form No. 1 to Nov. 1 was 115,131, involving $1,828,233.29, an increase of 14 per cent in number and a decrease of 20 per cent in the amount involved as compared with the preceding year. The total number of claims adjusted to Nov. 1 was 69,316, involving $6,027,192.25, an increase of 26 per cent in number and a decrease of 18 per cent in amount.

A resolution was passed which authorized the executive committee to spread an assessment not to exceed $5 apiece over the entire membership of the central division in order to provide funds for the National Electrical Credit Association to resume the monthly publication of the national *Bulletin* and the printing of *The Viewpoint*. It was further resolved that, in the judgment of the members of the central division, the members would be willing to pay an annual subscription into the national treasury to insure the regular printing and distribution of *The Viewpoint*.

The following officers were elected for the ensuing year: President, J. H. Taylor, Benjamin Electric Manufacturing Company, Chicago; vice-president, W. Scott Long, Westinghouse Electric & Manufacturing Company, Chicago; secretary-treasurer, Frederic P. Vose; assistant secretary and treasurer, Walter S. Vose; national board member, B. P. George, Beardslee Chandelier Manufacturing Company, Chicago.

California-Oregon Power Company Starts Up Copco Plant

NEARLY 1,500 persons were guests of the California-Oregon Power Company on Nov. 5, when the second generating unit at the Copco hydro-electric plant of the company on the Klamath River in northern California was put into service. The new unit, which is a duplicate of one which has been in service since 1917, is rated at 12,500 kva. and operates under a head of 132 ft. The dam has been raised 14 ft. to give greater head and storage. The dedication ceremony was presided over by John D. McKee, president of the company. A delegation of fifty from San Francisco and twenty-five from the Northwest traveled by special cars to be present at the opening. In addition more than a thousand people came in their cars from 60 miles around.

Education of Employees

This Topic Forms the Keynote of the N. E. L. A. Commercial Bureau Meetings Held at Boston

STEPS toward the better education of the rank and file of central-station employees and new courses for the more experienced ones were outlined last week at the meetings of various bureaus of the Commercial Section of the National Electric Light Association at Boston. Progress in illuminating engineering, advances in electric vehicle application and improvements in wiring practice and facilities also received detailed attention at these meetings, which occupied the greater part of three days, with headquarters at the Hotel Somerset. At times five simultaneous sessions were under way.

At the opening session on Nov. 15 of the Lighting Sales Bureau, G. Bertrand Regar presiding, R. S. Hale, chairman of the wiring committee, announced that the National Electrical Code committee had just approved an allowance of 15 amp. per branch circuit and the use of the solid neutral. A long discussion of the desirability of stimulating ornamental street lighting by the co-operation of local electrical leagues followed. It was the general opinion that contracts for such service should always be made with municipalities, owing to heavy losses frequently entailed through the irresponsibility of merchants' associations.

Preston S. Millar, New York, outlined a plan for training lighting specialists in central stations which will probably go into effect in the near future. Lectures on better lighting are also to be given shortly at the Armour Institute, Chicago, under the auspices of the Illuminating Engineering Society, for the particular benefit of architects. The importance of training contractors to lay out better lighting work was emphasized, and instances were cited of the benefits of illuminating engineering in connection with outputs and revenue. Floodlighting of windows to overcome daylight reflection was discussed. J. Daniels, Boston, said that the local Bureau for Better Illumination had stimulated more new business than can quickly be handled.

ELECTRICALLY EQUIPPED FURNITURE

Within three months important new fittings for electrically equipped furniture will probably be on the market, the Hubbell and General Electric companies having designed attachments with multiple outlets which can be applied by the residence customer to furniture without the aid of a wiring contractor. Tests are to be made of the capacity of No. 18 cord for 15-amp. service. If it overheats, it appears that No. 14 cord with special fittings may have to be used; otherwise standard attachment plugs and cords will suffice.

F. R. Jenkins, Chicago, announced a new commercial course for central-station men, contractor-dealers, jobbers' salesmen, etc., which will impart the fundamentals of salesmanship, public relations, rates, wiring and electrical principles. With C. E. Skinner presiding, E. S. Mansfield, Boston, announced the particulars of a factory course in electric transportation for central-station power sales engineers, which will in a measure parallel the industrial electric heating courses given of late under the auspices of the National Electric Light Association.

An electric vehicle luncheon was held on Thursday noon under the auspices of the Electric Vehicle Bureau of the New England division. More than 1,000 new electric vehicles have been purchased in the New York district within the past eighteen months, adding 6,000,000 kw.-hr. per year to the central-station load. A. Jackson Marshall, W. L. Goodwin and H. A. Lane, New York, spoke about the work of the Joint Committee on Business Development and the co-operative efforts of the N. E. L. A. and the Society for Electrical Development, and on behalf of the Electrical Supply Jobbers' Association and the National Association of Electragists Harry Grant and A. J. Hixon pledged their co-operation in the enlargement of the industry's business.

R. S. Hale outlined the work of the testing sub-committee of the wiring committee at the closing session on Friday. The next meetings of the Commercial Section bureaus will be at Denver, Col., Jan. 24-26, 1923, at the offices of the Denver Gas & Electric Light Company.

A. I. E. E. Adds "Liaison Officer" to Its Staff

The board of directors of the American Institute of Electrical Engineers at its regular meeting last month approved a recommendation of its special committee on headquarters personnel that a qualified man be added to the staff of the Institute to perform the duties outlined by the committee in a resolution suggesting administrative plans and concluding as follows:

"To carry out these plans, it is, in our opinion, desirable to add to the staff a thoroughly competent man, who can act, for example, as the secretary of the meetings and papers committee and as liaison officer between that committee and the various sections, thus being in a position to offer good papers to various sections as opportunity occurs and to arrange with the authors for the presentation of their papers at such meetings, thereby relieving the crowded programs of the limited number of general conventions of the Institute. The duties of this employee would naturally include close co-operation with the publication committee, inasmuch as all the papers and discussions presented both at section and Institute meetings are, in accordance with the policy already adopted, equally available for publication in the *Journal*. Furthermore, it is generally agreed that the publication of an increasing number of the papers presented at section meetings will be a large factor in raising the standard of section meetings."

N. E. L. A. Wiring Committee Making Progress

Great satisfaction in the acceptance by the National Electrical Code committee of the solid neutral and 15-amp. branch-circuit fuse recommendations marked the meeting of the N. E. L. A. wiring committee at the Harvard Club, Boston, on Nov. 16. Chairman R. S. Hale presided. Discussing the polarization and grounding of the frames of portable devices, it was found that no one seriously suggested grounding flatiron frames or those of percolators, toasters, etc., but that occasionally rules are suggested that seem to indicate that this might be required. The consensus of opinion was that to attempt to have a third wire for the frames of devices like flatirons is entirely unnecessary.

On heater cords recent tests indicate that a standard test for durability, inflammability and conductivity is practicable, and it was decided to have about ten cords tested and the results published without the names of the makers, thus furnishing at least a basis of comparison. Steps were taken to prepare a report on the relationships between central-station companies and wiring contractors. The committee has under consideration the determination of the minimum quantity of wiring that should permit a house to be properly described as wired, the dissemination of data on the advantages of unit prices for wiring, the determination of the advisability of locating service switches for the convenience of police and firemen, and the safety of running the neutral of a grounded system bare when mechanically protected, as in rigid conduit.

Majority of 25,000 Against South Dakota Project

Although complete returns on the defeat of the proposal for state development and operation of a hydro-electric plant on the Missouri River near Mobridge, S. D., are not yet available, it is estimated that the measure lost by about 25,000 votes. State construction of a system of transmission lines to serve cities and towns in the eastern part of the state was involved. To do this the voters were asked to authorize an issue of $16,000,000 of bonds. It was admitted that the estimates of the state's engineers showed that the project could not possibly approach a self-supporting basis for a number of years. Undoubtedly the unsuccessful experiments in the operation of industries in North Dakota made by the Non-partisan League were a powerful factor in convincing the people of South Dakota that they should not become entangled with political ownership of the electric light and power industry.

Columbia River Power

Its Development Held by Engineering Board to Be Secondary to Irrigation Plans

THE majority and minority reports on upper Columbia River water power made by a board of engineers appointed at the instance of the Federal Power Commission will be available for distribution before the end of the year. Among the conclusions of the majority report are these:

Freedom should be given to fullest irrigation expansion in Montana, Idaho and Washington, and no rights should be allowed to accrue to lower interests which would legalize limitation of or interference with irrigation above.

The Columbia Basin gravity project can be adequately supplied by the aid of storage in Pend Oreille and Priest Lakes in Idaho, conditioned upon maintenance of natural flow from Flathead Lake when needed.

Information upon which to base a final decision between a gravity and a pumped supply for a Columbia Basin irrigation project should be completed. Any decision should take into account the effect upon potential power. Pending such decision no permament rights of storage should be granted in Pend Oreille and Priest Lakes. If ultimately the decision is in favor of a Columbia Basin gravity project, storage rights in Pend Oreille and Priest Lakes should be granted to such project, but should be limited to storage of inflow in excess of 7,000 second-feet. If ultimately the decision is in favor of a Columbia Basin pumping project, storage rights in Pend Oreille and Priest Lakes should be granted to the joint power interests on the lower Clark Fork and the Columbia River, subject to limitations in the interests of irrigation.

Storage rights in Flathead Lake should be granted to Flathead power interests, subject to the fullest development found practicable after complete investigation. Prior to such development rights may be advantageously granted to power interests on Clark Fork subject to conditions protecting ultimate control for Flathead power and natural-flow release when needed for the protection of the Columbia Basin project if built on the gravity plan.

A permit to develop power at the Grand Coulee site or at any point on the Columbia River as far downstream as the Foster Creek site should not be granted to power interests until it is known that such site will not be needed by the Columbia Basin project.

MINORITY REPORT CRITICISES BOARD

The minority report, submitted by Marvin Chase, Supervisor of Hydraulics for the State of Washington, takes vigorous exception to what is alleged to be an effort on the part of the Federal Power Commission to exceed its authority and declares that the commission should recognize the superiority of right for irrigation inhering in this project and should grant no power rights which might conflict with irrigation projects. The Columbia River Board, Mr. Chase holds, has evaded its duty by not recommending an arrangement of power development on the Flathead, Clark Fork, Spokane and upper Columbia River which would yield the maximum commercial power, near existing and probable markets, subject to the superior use of the waters for irrigation of the greatest possible area. The State of Washington, he says, having officially adopted the gravity project for the reclamation of the Columbia Basin lands, the Federal Power Commission should not become involved in any controversy as to other possible means of reclamation, but should co-operate with the state to forward the early development of this area, thereby creating new power markets and leading to the maximum utilization of the water resources of the Columbia River.

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California Electrical Co-operative Campaign Plans

The advisory committee of the California Electrical Co-operative Campaign at a meeting held in San Francisco on Nov. 10 decided that in 1923 it would double its effort to promote electrification of homes. Data furnished by the state housing committee indicated that thirty thousand residences will be erected in California next year. An intensive drive will be made to electrify all these homes. With this object it is hoped to build ten model electric homes in as many strategically situated cities, and an effort will be made to reach one-tenth of the entire population of the state, particularly that portion interested in home building.

The central-station companies are greatly interested in the movement because its success will, of course, mean enlarged business for them. It is even estimated that with proper education the occupants of these new homes may be induced to increase their use of electrical energy from the present average of 250 kw.-hr. a year to somewhere between 2,000 kw.-hr. and 3,000 kw.-hr. a year. On what is held to be a conservative basis the additional consumption of energy will reach 30,000,000 kw.-hr., which at an average rate of 2 cents per kilowatt-hour means an additional gross revenue for the electric light and power companies of the state totaling $600,000.

To the manufacturer, jobber and contractor-dealer the campaign is also of outstanding interest. It is thought reasonable to expect that the average expenditure for wiring and electrical equipment of the new homes will be raised from the former average in California of $250 to $500, thus making possible an additional market for electrical merchandise in 1923 of $7,500,000.

The entire staff of the California Electrical Co-operative Campaign will be almost doubled, and a thoroughly organized effort will be made in every nook and corner of the state.

Sloan Talks on Publicity

In Notable Address to Newspaper Men. Head of Brooklyn Edison Urges the Value of Utility News

AN ADDRESS that attracted more than ordinary newspaper attention was given before Westchester County (N. Y.) journalists and representatives of public service corporations last week at the Westchester-Biltmore Country Club, Rye, N. Y., by M. S. Sloan, who is at the head of the New York State Committee on Public Utility Information as well as president of the Brooklyn Edison Company. Among other things, Mr. Sloan said:

"Our business with its great investment and widespread service, which touches so very intimately the domestic, social, commercial and industrial life of the people, is a matter of concern to the public, and the public are entitled to know about it. They should be informed about our organization, income, needs and possibilities. We should tell them about the bigness, the importance, the necessity, the growth and development of our business; about the payroll, the amount of materials purchased and taxes paid; about the physical condition of the properties, and about the stability and permanency of our business. Few other American industrial operations can show such a record of stability and fundamental soundness.

INFORMATION DUE TO PUBLIC

"We should tell why we are natural monopolies, of the demands for our service, the importance of our companies to the communities, how we are financed, how the utilities are taking the customer into partnership or ownership of our properties, our obligation to furnish good, adequate and continuous service at fair and reasonable rates, and the steady demand for new necessary capital in our business in order that we may keep up with the progress and growth of the various communities in which we operate.

"We believe that our committee, which collects facts about the industry and makes them available to the newspapers in regulation newspaper form, is in some degree at least a service to the newspapers. The reception our matter has had generally among the newspapers in the state seems to justify that belief.

"The committee is working along two other lines. It is endeavoring to establish a condition where each individual company will give out its own local news items, where it will see to it that each newspaper in the community in which it operates is informed of any event of general interest which happens in the business life of that company. We believe this is due the newspapers as news-gathering organizations and to the public which they serve. Moreover, we are endeavoring to show to the companies the advantage of more extensive and more regular and continuous advertising. Each company has many things to tell its customers which are of interest to them and of importance to the community. These things, however, are not always news items or information of a character which a newspaper could or should print in its news or editorial columns. Space for information of this nature should be paid for as a matter of business, and it is good business for the companies to buy space in order to tell these things to the public.

"Behind the investments in utilities there is a history of human study and investigation and achievement in all the sciences, of improvement in service rendered and in accuracy of performance, and of a growth of and demand for a necessity that is not yet ended. The world can never think how to live without the utilities again. They are the very heart of every community, furnishing a vitally necessary service as cheaply as human skill and brains and experience permit.

Need Help of Communities

"The communities need us and by the same token we need the communities. We need their understanding of our business, our problems and our ideals. I do not know a single utility executive who is not animated by a genuine ideal of public service.

"We know that the prosperity of every institution patronized by the public is dependent upon the good will of the people. Good will is the most valued asset of any business. It follows prestige, which is reputation for excellence of performance. We fully acknowledge that it is our duty to give the best and most efficient service, and we know by doing this we best serve the public, our stockholders and the interests committed to our charge.

"What we seek is the genuine friendship of our customers, built on a knowledge of exact facts and understanding of our business, and we are willing to go as far toward the other fellow as we know how. That is, as briefly as I know how to tell, the reason for the existence of our committee."

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Salt River Water Users Contend Before Commission

The Federal Power Commission at an early meeting will consider the application of F. G. Baum of San Francisco covering a project on Black River in eastern Arizona. He plans to develop power for the Silver City (N. M.) mining area at that point. Objection is being offered to Mr. Baum's application by the Salt River Water Users' Association. This organization contends that the two or three reservoirs which Mr. Baum proposes to build 150 miles above the Roosevelt Dam will diminish the water supply at the dam by increasing evaporation and seepage losses. The power applicant and his engineers have submitted arguments and data to show that the reverse will result. Regulating the flow of the Black River, they contend, will prevent waste of water in the years when the supply is greater than can be stored at the Roosevelt Dam and in the dry years will increase the amount of the water available below.

Particular significance is attached to this situation as it is typical of many others. In this case the Salt River Water Users' Association has been able to postpone action in the matter at least six times. Many applicants are anxious to see the Federal Power Commission adopt a policy which will dispose promptly of such protests, otherwise it is feared that the users of water on the lower stretches of the river will continue to make protests and delay power developments above.

Brief News Notes

Hornell May Get Niagara Power.—An option on the controlling stock of the Hornell (N. Y.) Electric Company is said to have been taken by a representative of E. L. Phillips & Company of New York City, owners of plants in several New York State communities. Plans to bring Niagara power to Hornell are said to be in contemplation.

Water-Power Applications Fall Off.—During the year ended Oct. 31 ninety-six applications for licenses and preliminary permits were received by the Federal Power Commission. This is a material decrease, for in the first sixteen months of the commission's existence 260 applications were received. It is estimated that applications in the future will be received at a fairly constant rate of about seventy-five annually.

New Japanese-American Cable Is Planned.—The Japanese government has asked the Diet for an appropriation to construct a new cable between the Island Empire and America. If the Diet refuses to grant the necessary funds, it will be asked to authorize the government to contract with a private concern to construct the cable. A business group headed by Baron Shibusawa is said to be ready to undertake the work.

Engineering Division of National Research Council Issues Booklet.—The division of engineering of the National Research Council has just issued a booklet giving much information about its organization, the work done and contemplated, and containing its by-laws and lists of its officers, committees and members. Copies of the pamphlet may be had from Alfred D. Flinn, chairman, or William Spraragen, secretary, 29 West Thirty-ninth Street, New York.

"Service" the Unique Name of Kansas Town.—"Service" is the name of the newest town in Kansas—a town which will be built by the Kansas Gas & Electric Company adjacent to the power house it plans to construct east of Parsons on the bank of the Neosho River. Not only does Kansas contain no other town by that name, but there is no such post office in the entire United States. Work already has been started on the steel-tower transmission line between El Dorado and the site of the new plant.

Radio Saves the Day and Moves Trains.—Saturday, Nov. 4, found northern Colorado and a zone about 60 miles wide in every direction from Cheyenne, Wyo., in the throes of the season's first blizzard. Several hundred telegraph poles were blown down, and wires were broken in thousands of places. The railroad company at Cheyenne lost track of several trains and appealed to the Cheyenne radio mail service, for help. The trains were quickly located by wireless and normal service restored.

Newspaper Radio Service Grows.—For the first time in history, radio telegraphy was utilized this month to transmit a full press association news report across the continent. Owing to severe sleet, snow and wind storms in the Rocky Mountain region and the crippled service on land lines, the International News Service transmitted a full election service from New York to San Francisco by wireless through the co-operation of the Radio Corporation of America. The service was reported to be as fast as that obtained over land lines under ordinary conditions.

Detroit Edison Stock Holders Approve Fifteen-Million-Dollar Issue. — More than 73 per cent of the stockholders of the Detroit Edison Company voted at a special meeting in favor of an issue of $15,000,000 of 6 per cent ten-year convertible debenture bonds. Following the meeting, directors offered to the stockholders rights to subscribe to the debenture bonds equal to 20 per cent of their holdings of record on Nov. 20, 1922. The debenture bonds so offered will be dated Dec. 15, 1922, and will be convertible at par at the option of the holders into stock.

San Francisco to Have New Central-Station Office Building.—The Pacific Gas & Electric Company has announced plans for the construction of a seventeen-story office building at Beal and Market Streets, San Francisco. The building will cost about $1,500,000 and will be the third highest office building in that city. An auditorium will be provided on the ground floor with a seating capacity for five hundred people. On the top floor social rooms for the employees will be provided. The date of starting construction has not been set.

New Power Plant of Counties Gas & Electric Nears Completion.—Rapid progress is being made on the Barbadoes Island electric power plant of the Counties Gas & Electric Company of Norristown, Pa., and announcement is made that the first unit will probably go into operation in January. This unit, which will eventually be one of five, is rated at 25,000 kva. It will be steam-driven with a very small augmentation from water power developed in the Schuylkill River, which is not expected to exceed 750 hp. maximum and will average about 300 hp. The station in its ultimate form will be one of the largest in Pennsylvania.

Lafayette Electrifies Its Pumping Plant.—The municipal water plant at Lafayette, Ind., is to be operated by electric power. At the main and auxiliary pumping stations steam power now is used. The equipment is old and it would cost a large sum to replace it. The city has arranged with the Northern Indiana Gas & Electric Company to provide energy at a low rate and new apparatus will be brought to operate the pumps. The electrical equipment will be so arranged that the city can add a generating unit at any time, the Mayor asserting that by this means the city will be able to generate its own energy for street lighting should this prove desirable.

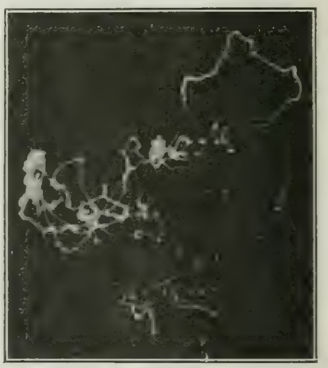
C., M. & St. P. Considering Electrification of Mississippi Division.—According to a statement made in an address to the Kiwanis Club at Sparta, Wis., by A. C. Crandall, commercial and purchasing agent of the Wisconsin-Minnesota Light & Power Company, negotiations have been opened between that company and the Chicago, Milwaukee & St. Paul Railway Company to provide total electrification of the Mississippi division of the railroad. The Wisconsin-Minnesota company has available at present to meet such a demand, Mr. Crandall said, 60,000 hp. from its five-million-dollar Wissota water-power plant.

Los Angeles Moves to Take Over Private System.—Steps have been taken by the city of Los Angeles to institute condemnation proceedings for the purpose of taking over the generating plant and distribution system of the Los Angeles Gas & Electric Corporation. This action follows failure of the city and the company to agree upon a basis of sale. The private utility's system is said to be worth between six and seven million dollars. It consists of a generating plant of approximately 70,000 hp., five substations and a distribution system covering the main body of the city and supplying between 25 to 30 per cent of the electricity used in Los Angeles. Engineers for the city estimate that the acquisition of the private system will add to the revenue of the city nearly $1,000,000 a year.

To Bring Government and Commercial Specifications Into Harmony.—An important step toward the elimination of the differences between specifications for government purchases and the usual specification practice of commercial suppliers, differences responsible for the saying common in commercial circles that it costs 10 per cent more to do business with the government than with other customers, has been taken through the appointment by the American Engineering Standards Committee of a standing committee on co-operation with the Federal Specifications Board. Work carried out under the general direction of this committee will give industry, it is believed, a better opportunity to participate in the development of specifications for government purchases. It will at the same time bring to the government, to a greater degree than has heretofore been possible, the talent of the two hundred industrial organizations co-operating in the work of the American Engineering Standards Committee.

Build 130 Miles of Transmission Line in Six Months.—A few days prior to the opening of the California-Oregon Power Company's Copco plant the new 130-mile transmission line between Springfield, Ore., and the company's Prospect plant, built in the record time of six months, was placed in operation. This added a northern extension of nearly 200 miles to the interconnected transmission system of the West, already the greatest in the world. This interconnected system now extends a distance of more than 1,300 miles from the Mexican border on the south to Albany, Ore., on the north. The line is designed for 110,000-volt operation and was constructed to deliver power from the system of the California-Oregon Power Company to that of the Mountain States Power Company, which serves the towns in the upper Willamette Valley in Oregon.

Another Remarkable Photograph.—The peculiarity of this picture, taken by Lawrence B. Philpot, an electrical engineer of Vancouver, British Columbia, will be seen to be that the lightning flash is apparently made up of a multiplicity of small discharges, giving the appearance of a dotted line. The photograph was taken with a stereoscopic camera, and there is no doubt that the picture is a true one of an electrical discharge.



United States Supreme Court Will Review Southern Power Case.—The Supreme Court of the United States has granted a writ of certiorari by which the Southern Power Company may appeal from the decisions in suits brought against it by the North Carolina Public Service Company and the cities of Greensboro and High Point, N. C. The cities and the public service company, which resells electrical energy furnished it by the Southern Power Company, sued the latter company to compel it to continue supplying electrical energy under expired contracts. A question of jurisdiction arose between the state and federal courts, but the latter finally assumed jurisdiction. The lower court held that the power company could not be compelled to continue the sale of energy for general distribution, especially for domestic use, but that it should continue to supply motive power for the street railways of Greensboro and High Point.

Associations and Societies

Wisconsin State Contractors.—The annual convention of the Wisconsin State Association of Electragists will be held at the Hotel Pfister, Milwaukee, on Jan. 24, 25 and 26, 1923.

American Physical Society.—The one hundred and seventeenth regular meeting of the American Physical Society will be held in Chicago on Saturday, Dec. 2. There will be sessions also on Dec. 1 if the length of the program requires it. The annual meeting of the society will be held at Boston on Dec. 26-30 and subsequent meetings at New York on Feb. 24, 1923, and at Washington on April 21.

Utility Accountants Hold Conference at Eau Claire.—Electric and other utility companies of Wisconsin sent the heads of their accounting and auditing departments to the first conference of the accounting section of the Wisconsin Utilities Association, held on Nov. 22 and 23 at Eau Claire for the purpose of discussing the new classification of accounts prescribed by the Railroad Commission and other accounting problems. George C. Mathews, chief statistician of the Wisconsin Railroad Commission, was announced as the principal speaker.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

American Physical Society—Chicago, Dec. 1 and 2. D. C. Miller, Case School of Applied Science, Cleveland.

American Society of Mechanical Engineers—New York, Dec. 4-8.

Electrical Supply Jobbers' Association, Pacific Coast Division—Coronado, Cal., Dec 7-9. A. H. Elliot, 502 Flatiron Bldg., San Francisco.

New York Electrical Credit Association—New York, Dec. 14. W. J. Kreger, 47 W. 34th St., New York.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Western Association of Electrical Inspectors—Chicago, Jan 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Wisconsin State Association of Electragists—Milwaukee, Jan. 24-26.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Commission Rulings

Arbitrary Discontinuance of Service Forbidden.—By ordering the San Diego Electric Railway Company to restore service on Adams Avenue, in the city of San Diego, the California Railroad Commission has ruled that no utility can arbitrarily discontinue its service and withdraw property voluntarily dedicated to public use. A dispute had arisen between the company and the city over the tearing up of about three-quarters of a mile of single track.

No Return Allowed on Property Donated by Patrons.—No return should be allowed an electric utility on the value of property contributed by its consumers when no interest is paid to the consumers for such use, according to a decision of the Wisconsin Railroad Commission in a case affecting the Rio Electric Company. The return was computed upon the company's equity only, but since it was the obligation of the company to maintain and replace all the physical property when worn out the entire value was used as the base on which to compute allowances for retirement expense and for taxes.

Underground Service Not Required in Residential District.—In view of the lower cost of overhead service in a residential district in the Charlestown section of Boston, the Massachusetts Department of Public Utilities has refused to grant the petition of Smith vs. Charlestown Gas & Electric Company for underground service in the Bunker Hill district. The company was willing to supply overhead service, but the petitioner objected to the installation of poles and outside wires, on the ground of appearance. There are few if any underground conduits in the district, and the commission declared its belief that the residents of the region affected would rather obtain service by overhead lines at less cost than pay more for underground runs.

Commission's Power to Raise Rate Above Franchise Limitation.—In approving a service-at-cost contract entered into by the Rochester street railway with the municipality, the New York Public Service Commission said, in answer to an objection raised that it could not permit the fare to be raised above the limitations imposed by the company's franchise: "This raises a question of law which must be submitted to the proper tribunal for determination. . . . The amendment to the Public Service Commissions law expressly gives the commission power to approve a service-at-cost contract as defined by the act, or any agreement purporting to be such a contract. It may, however, be fit and proper for this commission to state that it knows of no rule of law which forbids parties to a contract, even though one be a municipal corporation, from modifying by mutual consent the terms of their contract. . . . The amendment of 1921 empowered the commission to determine just and reasonable rates, notwithstanding that a higher or lower rate had been theretofore prescribed by statute, grant, franchise or other agreement."

Municipality Must Not Ask for One Certificate Covering Two Separate Enterprises.—The municipality of Crook, Col., having asked for a joint certificate of convenience and necessity covering extensions to both its electric and its waterworks plant, the Colorado Public Utilities Commission refused the application, pointing out that neither should an electric utility be financed from waterworks funds nor a water utility from electric department funds. Application, it insisted, must be made separately.

Capitalizing a Deficit.—A sum representing a capitalized deficiency in earning an amount necessary to represent the accrued depreciation figured upon the property of a street-railway company was allowed by the New York Public Service Commission against the protest of the municipality concerned in a case affecting the New York State Railways. The commission held that the decision of the United States Supreme Court in Galveston Electric Company vs. Galveston did not apply and said that it could not undertake to reduce the rate base by the capitalized sum involved, in the face of conflicting interpretations of the law, until the entire valuation had been reconsidered.

Approval of Security Issues Withheld on Ground that They Would Mean Disproportion Between Bonds and Stock.—The New Jersey Board of Public Utility Commissioners has withheld approval of proposed security issues by the Commonwealth Electric Company of Summit, the Commonwealth Water Company and the Lakewood & Coast Electric Company on the ground that such issues would make the total par value of outstanding bonds equal approximately 80 per cent of the securities outstanding, the stock representing only 20 per cent. The board ruled that it would give consideration to applications representing 70 per cent of the value of the property and stock to the amount of 30 per cent.

Would-Be Customers Cannot Be Forced to Buy Stock as a Condition of Service.—The Board of Railroad Commissioners of South Dakota has forbidden the White River Telephone Company to make the purchase of stock a condition precedent to furnishing service. In this connection the commission said: "The reason for the company's position is perfectly obvious, and it is easily understood, where a number of farmers band themselves together for the purpose of securing telephone service and where they by their own efforts alone have built a telephone system, that they should desire each and every subscriber for service thereon to invest a sum equal to that invested by them individually. While we appreciate fully the attitude of the company in this regard and realize that in many cases it is desirable and in the interest of all concerned that the intending subscriber, if he is in a position to do so, purchase stock in the company, such purchase, however, must be voluntary."

Recent Court Decisions

No Appeal to Supreme Court Permitted Where Commission Grants Permit for Dam.—In Royal Glen Land & Lumber Company vs. Public Service Commission of West Virginia it was attempted, because of alleged errors in the award, to force the suspension of a commission order awarding a permit to the Community Power Company to construct a dam across the south branch of the Potomac River for hydro-electric purposes. The Supreme Court of Appeals of the state disavowed jurisdiction, declaring that under the statutes of West Virginia no direct appeal to it could lie. (113 S. E. 749.)*

Highest Court Decrees that Changes of Rates Must Be Based on Findings of Injustice or Discrimination.—Orders of the Kansas Public Utilities Commission changing rates to be charged for service must be predicated upon findings of fact that rates are unjust or discriminatory, according to a decision of the United States Supreme Court rendered Nov. 13. The decision enjoins surcharges granted by the Kansas commission to the Kansas Gas & Electric Company in 1918. The suit was instituted by the Wichita Railway & Light Company, which won in the District Court, lost in the Court of Appeals and has finally won in the Supreme Court. The Wichita company in 1910 entered into a contract for electricity with the Kansas company, to run until 1930. In December, 1916, the Kansas company filed a lower schedule of rates for its general business and put them into effect in 1917. Later it filed a petition claiming heavy loss owing to increased expenses and asked that further enforcement of its lowered schedule be stopped and that a graduated surcharge be imposed for consumption in excess of 100 kw.-hr. per month. The commission made changes in the proposed surcharge schedule and granted the new rates. The Wichita company filed suit for an injunction, charging that it was the heaviest single purchaser of electrical energy from the Kansas company and that the surcharge reached it alone in its highest form. The decision of the Supreme Court declares that the Wichita company was deprived of just redress when the commission acted without going fully into the facts and establishing that the existing rates were of an inequitable character.

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*The left-hand numbers refer to the volume and the right hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

D. N. Lewis President Railroad and Utilities Commissioners

D. N. LEWIS

It is a rare thing in America for a man to train for public office, filling subordinate posts with ability and devotion, and finally reach a position of responsibility and honor. Too often men appointed or elected to political office owe their success to other accomplishments. Not so, however, in the case of Dwight N. Lewis, a member of the Iowa Board of Railroad Commissioners, who has just been elected president of the National Association of Railroad and Utilities Commissioners. For twenty-five years he has been connected in one form or another with the Iowa commission. A lawyer by profession, he entered the employ of the commission twenty-five years ago, when he was the whole office force in charge of its accounting, secretarial work, rate work and reporting. He went into training as a commissioner right then and gradually advanced to be secretary and later counsel for the commission, holding the latter position for six years. He was then appointed a member of the body to fill out an unexpired term and was elected in 1918 for a four-year term. He has just been re-elected for another four-year term by one of the largest Republican majorities in Iowa, 200,000.

Mr. Lewis is noted for his thorough and consistent work as commissioner. The chairman of the commission, Charles Webster, says they think so much of Lewis because he does all the work. Not only does he stand high in the estimation of Iowans, but also in the estimation of every public service commissioner in the United States. For twenty-three years he has been a member of the national association, and he has done an immense amount of committee work and all the other things which go to make association activities useful. The election of Mr. Lewis at Detroit to the presidency of the association for the ensuing year was one of the most popular selections which that association has made.

Mr. Lewis is a native Iowan and was graduated from the Drake University Law School at Des Moines. He has high ideals as to the duties of public service commissioners in the regulation of public utilities for the adequate service of the public.

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C. G. Schluederberg to Study Business Conditions in Orient

Carl G. Schluederberg, assistant to the managers of the supply and merchandising departments of the Westinghouse Electric & Manufacturing Company and special representative of that company in foreign countries, left recently for a four months' trip in the Orient to study business conditions. Mr. Schluederberg will visit Japan, the Philippines and China to make a sales survey, investigating especially the possibilities of expansion of the market for household appliances. Not long ago he spent three months in South America investigating electrical merchandising conditions there.

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Westerners Traveling East

Quite a number of executives from the Pacific Coast are at present in the East and others will shortly be en route. J. B. Miller and R. H. Ballard, president and vice-president and general manager respectively of the Southern California Edison Company of Los Angeles, and Mortimer Fleishhacker of the Great Western Power Company are at present in New York. Others who expect to be in New York in a week or so are W. E. Creed, president of the Pacific Gas & Electric Company of San Francisco, and F. T. Griffith, president of the Portland (Ore.) Railway & Light Company. Most of these will stay over for important meetings at N. E. L. A. headquarters early in December.

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E. W. Rice, Jr., honorary chairman of the board of directors, and Dr. W. R. Whitney, director of the research laboratory, of the General Electric Company, sailed yesterday on an extended European trip, during which they will visit various universities and industries in England, France, Italy, Switzerland, Germany, Denmark and other lands. Their first stop will be made in England, where they will remain for some time, visiting universities to get in touch with men doing research work and also inspecting research laboratories in various industries. They also expect to find much of interest in Denmark. They will be gone four or five months.

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General Harbord to Head Radio Corporation

J. G. HARBORD

Major General John G. Harbord, Deputy Chief of Staff and one of the distinguished officers of the United States Army, will retire on Dec. 29 to become president of the Radio Corporation of America, succeeding Edward J. Nally, who has resigned the presidency to become the corporation's managing director of international relations, with headquarters in Paris. Army circles and official Washington in general say the corporation could not have obtained a more fitting man for its head. Equipped with a college education, General Harbord enlisted as a private in the army at twenty-three years of age and has reached his present position through sheer merit. He is a former Rough Rider, a veteran of war in Cuba and the Philippines, was chief of staff under General Pershing in France and later in command of the marines at Château Thierry. He was made a major-general, and in 1918 he commanded the service of supply responsible for all the supplies of the A. E. F. In May, 1919, he was reappointed chief of staff, and he served as such until sent by President Wilson to the Near East as chief of the military mission to Armenia. He has been deputy chief of staff since June, 1921. General Harbord will leave Washington about Dec. 15 and will take charge of his new duties with the Radio Corporation on Jan. 1. The post to which he has been elected is regarded as of vital importance to the government as well as to the public since the Radio Corporation was formed at the suggestion of representatives of the United States Navy in order that worldwide wireless communication, free from foreign domination, might be built up under American ownership and control.

R. A. Lundquist Returns from Europe

After an absence of over three months, during which time he visited the Scandinavian countries, Germany and Great Britain, R. A. Lundquist, chief of the electrical equipment division of the Bureau of Foreign and Domestic Commerce, will return to his work in Washington in the near future. Mr. Lundquist has made a careful study of the market conditions for electrical goods in Sweden and Great Britain and will have interesting news for the American electrical industry regarding these countries. His investigations in Germany were directed more with regard to the competition which the German exporters are offering in foreign markets.

Henry Schade, who for a number of years has been manager of the electric store for the Portland Railway, Light & Power Company, has been made manager of the investment department.

George McClellan, for two years manager of the Southern Wisconsin Electric Company at Walworth, Wis., has been made assistant general superintendent of the company with headquarters at Lake Geneva. Elmer Ravin of Delavan, Wis., who has been with the company for four years, is the new manager at Walworth.

R. L. Beers has recently been appointed chief engineer of the Detroit Stoker Company, Detroit. Four years ago Mr. Beers was appointed testing engineer of the Underfeed Stoker Company of America and was later promoted to the position of assistant chief engineer. In his new position he will be in direct charge of the design and application of the Detroit Stoker Company's single-retort and multiple-retort underfeed stokers.

James G. Hogan, sales manager of the Empire District Electric Company in Joplin, Mo., has been promoted and transferred to the position of power engineer for the Ohio Public Service Company in Cleveland. The plant of which he will have charge serves Cleveland, Massillon, Mansfield, Lorain, Elyria, Alliance, Ashland, Orrville and other places in that state. Mr. Hogan will take up his new duties this month. He has been with the Empire company at Joplin five years.

Theodore Randolph Norris, who has been in charge of the engineering department of the Monongahela Power & Railway Company at Clarksburg, W. Va., for five years, has been promoted to the position of superintendent of the company's properties in the Clarksburg district. Mr. Norris will be in charge of railways, succeeding J. I. Beals, general superintendent, who has been transferred to the Fairmont office. A native of South Carolina, Mr. Norris spent his early days in that state. Later be became associated with a railroad at Erwin, Tenn. He is considered one of the best engineers in the country, and in connection with his engineering work he has had considerable experience in general railway and traction company operation.

F. J. McEniry Appointed Representative of Electrical League

Frank J. McEniry, vice-president of the Denver Press Club and for several years a staff member of the *Rocky Mountain News* in Denver, has been appointed field representative of the Denver Electrical Co-operative League. He will assist S. W. Bishop, executive manager of the league, in an intensive campaign for closer co-operation between the public and the central station, jobbers, contractor-dealers and manufacturers. Mr. McEniry is a graduate of the University of Denver and has a large acquaintance in Denver and throughout the state.

F. J. McENIRY

R. C. Lightcap, chief clerk in the treasury department, was elected an additional assistant treasurer of the West Penn Power Company and West Penn Railways Company last month. Mr. Lightcap became associated with the West Penn system in 1907, when he entered the accounting department. Two years later he was transferred to the department handling irrigation projects, which was segregated from the West Penn companies in 1913. In 1916 Mr. Lightcap re-entered the service of the West Penn as chief clerk in the accounting department, a position he held for two years. In 1918 he became a clerk in the treasury department and was made chief clerk a year later.

Sidney W. Farnsworth has been appointed to the recently created position of chief engineer of the United States Post Office Department. Mr. Farnsworth was graduated from Worcester Polytechnic Institute in 1906 and became associated with the Underwriters' Laboratories, Chicago, in 1909. He left the laboratories to ally himself with the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., where he remained until 1917 directing a portion of the company's high-voltage development work. Mr. Farnsworth, together with C. L. Fortescue, developed the use of the sphere spark gap as a standard of measurement for high voltage, and that method was adopted as an A.I.E.E. standard. replacing the needle-gap standard which had been used for many years. In 1919 he became assistant plant manager at the Evanston (Ill.) plant of the Steel & Tube Company of America and eighteen months later was transferred to the operating vice-president's office. In his new position at the Post Office Department Mr. Farnsworth will have general supervision over mechanical equipment and labor-saving devices in all branches of the service.

W. S. Hill, who has been electrical engineer for the Missouri Water & Power Company, with offices in Lebanon, Mo., has been selected as the general superintendent of the Grays Harbor Railway & Light Company at Aberdeen, Wash., and has departed for that city to enter upon his duties. Mr. Hill was formerly superintendent of the Springfield (Mo.) Gas & Electric Company and was connected with the Springfield utility for five years in that capacity and as manager of the commercial department. He went from Springfield to Stuttgart, Ark., where he was adopted as an A. I. E. E. standard, & Power Company for two years. He had been in Lebanon since last June.

Obituary

John Herget, treasurer of the Century Electric Company, St. Louis, died Nov. 14 of pneumonia. Mr. Herget had been connected with the company continuously since he joined it in 1904 as treasurer and had taken an active part in its growth. He was born in Hamburg, Germany, and was seventy-seven years of age.

J. C. Kirkpatrick, president of the National Pole & Tie Company, died at Escanaba, Mich., on Nov. 17 after an illness of four months. Mr. Kirkpatrick was born in Pittsburgh in 1863 and at the age of fourteen went to Escanaba with his father, who was then president of the Pittsburgh-Lake Superior Coal & Iron Company. It was while clearing timber lands for this company that Mr. Kirkpatrick first became associated with the pole industry, a business which he made his life work and in which he became widely known. He had been president of the National Pole & Tie Company for more than twenty-five years and at the time of his death was president of the Escanaba National Bank and the Escanaba Veneer Company. Mr. Kirkpatrick was a graduate of Lake Forest University and a member of the Union League and Chicago Athletic clubs, Chicago.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Linking Up Production and Consumption*

How Commodities Should Be Distributed Depends Upon the Nature of the Goods—Only Knowledge of Cost Can Lead to a Proper Determination of the Right Way

By O. D. Street

General Manager of Distribution, Western Electric Company

Distribution is too often thought of, not only by the public at large but sometimes by the distributors and producers as well, as being a standardized method available for use in the process of transferring commodities from the factory to the consumer. As a matter of fact, there is no such thing as a standard plan by means of which commodities may be distributed most economically. Instead of there being one right way of marketing, there are many right ways. What the right way is for any producer can and must be determined by the producer—not by chance, not by rule of thumb, but as the result of a comprehensive, intelligent analysis of his own problems and products.

Such an analysis may not prove that it is wise for a given manufacturer to sell all his products direct to the consumer, nor will it of necessity prove that he should work through wholesalers in marketing all his lines. Instead, it may prove that, for a manufacturer who is not making just one thing but many things, the best plan would to be work directly with the consumer on one or more of his commodities, to go direct to retailers on others of his commodities, and to work exclusively through wholesalers on still another group of his commodities. If the analysis is made as carefully as present-day intelligence permits it to be made, the one best way for marketing each product of each manufacturer should be determined rightly nine times out of ten.

Four Controlling Factors

O. D. STREET

I have heard it said that about 80 per cent of our merchandise is sold by the makers to wholesalers, who in turn supply the retailers. A smaller percentage is sold direct by the makers to the retailers, and a still smaller percentage is sold direct by the makers to the consumers. All these methods are good and will continue to be employed. Which method to use is the problem each producer must decide for himself, and the problem will be solved first by those concerns which possess a type of management wherein is to be found the searching mind and wherein lies the will to find the correct answer.

Among the more controlling factors which must be considered by each producer who would get the right answer are these:

I. *The Nature of the Product.*—A large steam engine should be sold direct to the user, whereas hairpins, to be marketed economically, must be sold to wholesalers and possibly to large retailers.

II. *The Number of Customers Served.*—A few users, even though these may be widely scattered, can usually be served best by dealing directly with the factory, provided the money value in each sale is large. A great many customers scattered all over the country can, as a rule, be served best through jobbers, particularly if the value of each sale is relatively small.

III. *The Aptitude of the Management.*—Some executive families are experts at production but ought never to try distribution. The two require quite different commercial characteristics, and management should know its weaknesses as well as its strength.

IV. *The Financial Resources.*—Where capital is limited, it is often preferable to use all that is available in production rather than to skimp on plant, tools and other instruments of economical productions in order to carry the capital obligations involved in distribution.

At the present time too many concerns are selling their own products direct which would be better off if they worked with jobbers. There are also too many of another class which would be better off if they cut out the jobber and dealt direct with the retailers and consumers. By the same token, there are jobbers who would be better off if they would limit themselves to those items which they can handle better and more cheaply than the factory and not try to be all things to all men.

Cost Knowledge Needed

The reason why so many uneconomical methods of distributing are employed today is because so little is known, even by the most expert, of what it costs to sell and distribute merchandise. The monthly or annual costs of distributing all the products of a mill, or all the lines of a jobber, are known, but while these figures tell us how much money is made or lost on the entire business, they do not tell us how this money is made or lost. How antiquated is such a condition in production activities! Methods are available today, as a result of the development of the accounting art, which will show us almost exactly what it costs to manufacture each item and each part in an item, but there is scarcely a concern in the country which knows what it costs to sell any one of its articles, unless it makes only one article, nor a concern which knows what it costs to sell to any one of its customers. A knowledge of what it costs us to sell each article we make and what it costs us to do business with each customer we serve is a prerequisite for determining whether we can distribute these articles and serve these customers cheaper and better than we can hire the work done for us. The facts must be determined by the producer —by each producer for himself—as he alone can get at the facts.

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*A paper read before the National Conference of Business Paper Editors, New York City, Oct. 11 and 12, 1922.

The very first thing, then, which is needed is the development of a cost-finding system which will give to each manufacturer a statement as to what it costs him to distribute each individual article he manufactures and what it costs him to serve each customer he sells to. Our shop cost systems have been highly developed, but little or nothing has as yet been done by accountants in any line of industry toward the development of a cost-finding system which will give to management even an approximate conception of what expense is involved in the sale and distribution of its individual commodities or of what it costs to sell to its individual customers.

I venture the prediction that a study of this sort will prove to many executives that many commodities which they have thought were highly profitable are, at least under the methods of distribution now employed, money losers rather than money makers. It may well be that even after that knowledge is secured management will still feel that it must continue to sell these articles because they are necessary to complete the line. However, the chances are that the method of selling these things will be changed, or else less money will be spent in attempting to sell them. Having an item to offer to one's trade in order to complete one's line is one thing; making that item a leader through ignorance of costs is another thing.

Business is far from being a pure science. It is a science, nevertheless, but the trouble with business men is that they have confined their scientific research largely to the field of production and have applied little or none of it to the problems of distribution. As an inevitable result, the superior skill which has been applied to production problems has caused production efficiency to get far ahead of distribution. The production skill which industry has developed has gone out and started competing factories until today we find ourselves confronted with a situation where the capacity to produce, and to produce skillfully, in most industries vastly exceeds the country's capacity to absorb—at least to absorb at the prices now quoted to the consumer.

Overbuilt Capacity

The new competing factories turn out no more if as many units as did the original factories. Hence, as a rule, they do not produce at a lower cost; in fact, too often the tendency is to make production costs rise, since the new competition, rather than dispose of its products by creating new markets, usually cuts into the business held by the older factories. New producers, in order to market their products, often appoint a separate group of wholesalers and dealers, and these in turn cut into the business done by the old established distributors. At first competition—one maker with his distributors fighting to hold their business, another group fighting to get this business away from them—may and often does tend to reduce the price to the public. Soon, however, the heat of contest cools. Each organization decides to add the increased overhead cost incident to a lower volume of sales into its selling price, and thus it is passed along to the public. As time passes still more producers enter the field to share the new business and divide the old, and these in turn create new distributors whose competition tends still further to complicate the situation and add to the ultimate cost of the product.

Producing and production capacity, distribution and distribution facilities, have all multiplied during the last ten years, and now in spite of the reduced demand, all are trying to make a living, and nearly all are finding the going pretty slow. All cannot survive, and it is not to the interest of the public at large that all should survive.

This situation we are in would indicate that, for the good of the public at large, too much competition may well be as bad as too much monopoly; for it is a recognized fact that mass production, up to a certain point at least, is required in order to effect low production costs. Too much distribution—that is, too many middlemen—is just as bad, for a low volume of sales increases the distributing expenses per unit sold just the same as, at the factory, a small output increases the costs per unit produced, and in both of these instances there is the natural tendency to pass the increases on to the consumer.

There are too many commodities, which are being produced in too many factories and are being distributed by too many agencies, for the best interest of the public. I feel that many of these could be made and marketed more economically if some advantageous mergers were effected or some failures took place. This would by no means solve all our troubles nor eliminate all the waste in merchandising. However, it would help considerably, for production is not done at low cost unless the output is reasonably large, nor can a jobbing business be conducted cheaply unless the units of sale are relatively large and frequent. Retailing can be done cheaply if the units of sale are small, provided enough units are sold.

We must not forget that we are confronted with a changed economic condition, and management will do well if it falls in line, for that business which falls in line with an economic purpose bigger than itself has far and away the best chance of remaining permanently in business and of making steady profits.

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Safe Automatic Control of Circuit Fusing

A Suggestion Concerning One Way to Prevent Overloading by Making Each Fuse Fit Only Its Own Block

By J. M. Fried
President Mississippi State Association Electrical Contractors and Dealers

Although various methods of preventing customers from using slugs in the place of fuses have been considered, the problem of controlling fire hazards due to overloading of circuits still exists. The mere fact that there does exist in any degree the practice of inserting various kinds of shorting devices to obtain service when the fuses blow indicates that this is the weak spot in the situation. It is not enough just to designate what size of fuse shall go with a given size of wire, because almost invariably when a 10-amp. fuse is lacking a 20-amp. fuse will be used if that is the only one available, and when no fuse is at hand pennies are often inserted. Then the customer, without much serious thought to the risk he is assuming, wonders why trouble follows. The fault lies in the fact that the electrical industry does not build equipment so that an ordinary layman cannot possibly harm it by negligence and wrong fusing.

There is, however, one way that this difficulty can be solved. When manufacturers design a fuse and block of different dimensions for each size of wire, with the block so constructed as to prevent jumping across the fuse, then a step will be taken toward the settlement of this perplexing problem. This construction would make possible the use of only one size of fuse in any block, and this in return would be determined by the maximum current capacity of the wire itself. With such an installation there could be no overloading, since the fuse would blow before overheating the circuit, or before serious damage was done, thereby preventing fire. As the 660-watt rule now stands, there is always the possibility of overloading circuits, with all of the attendant fire hazards.

Under the system just recommended inspection would also be simplified because wire inspectors would not need to look up the connected load; for by glancing at the wire size and fuse block they would immediately know whether proper protection was furnished. It would also be an advantage to small towns having no inspection departments, because an installation as completed would be sure of passing inspection in so far as fusing is concerned. This would be especially true should this type of construction be required by the National Electrical Code, making the service-entrance and branch-circuit protection uniform throughout the country.

DISTRIBUTION NOT SERIOUS DRAWBACK

The problem of distributing this type of fuse block once it is manufactured is not so serious as first thought might suggest. As an example, the improvement in the installation of service entrances has been advancing steadily during the past years, but there has been nothing done toward branch-circuit protection or overfusing. Once the protection is known to be nearly 100 per cent foolproof, it will merely be a matter of time before this type of construction will be obligatory. Just as the industry now insists upon the inclosed safety switch, so it will accept a medium for improving the safety of its house wiring. The 660-watt rule is now receiving attention from the rules committee of the national association, and while the matter is up this problem should be solved to the best interests of all concerned and no temporary changes or half-way measures should be put into effect.

[Mr. Fried's suggestion has good precedent in the system of fuse control which is extensively in use in Germany and the amperage of which is indicated in both fuses and blocks by a color, so that even the illiterate may re-fuse a panel by selecting fuse plugs bearing color marks corresponding to the color on the block. At the same time, wrong fusing is prevented mechanically by a projecting pin on the plug which can be used only in proper block.—EDITORS.]

Survey of Business Conditions

High-Tension Equipment Market Showing Much Activity

Sales of high-tension equipment are still brisk in the Western territory. One company reports a steady volume of high-tension fuses up to 150,000 volts and lightning arresters up to 115,000 volts. Australian inquiries are also lively. Another company has sold 22,000-volt equipment to a utility in Indiana and a complete substation for Garfield Park, Chicago. Orders for two 44,000-volt, 1,500-kva. substations for the Middle West and one 66,000-volt, 3,000-kva. substation for a Western utility were received by another company.

The sales rate on poles has been active and most of this equipment has gone to central-station companies building line extensions. The freight-car shortage is seriously impeding rapid deliveries. Stocks are in good condition. Prices are firm and unchanged.

Demand for cross-arms parallels that for poles and the call is good. Prices remain the same with the 3-ft., 3¼x4¼-in. arm selling for $49.35 per 100 in lots of 1,000 f.o.b. Chicago.

Useful Market Data Being Issued by Boston Bank

The First National Bank of Boston is publishing a supplement to the booklet which it issued two years ago, entitled "Markets of the World." It is made up of a series of commercial maps and statistical data concerning the United States and Canada and embraces an unusual compilation of useful commercial information conveniently presented. While it contains an immense amount of information of interest to the student of commercial geography, it has been prepared especially for the use of the sales manager in determining the market possibilities of any given state, province or territory. There are detailed figures covering area and topography, population, education, minerals, timber, fisheries, water power, agriculture, industry, transportation, finances, principal cities and legal holidays.

Like the former series, it is in loose-leaf form and designed to be inserted in the original binder. The supplement is being sent to all holders of the first edition, and a limited number of copies are available for general distribution upon application to the service department of the First National Bank of Boston.

Control Hinders Radio Development in Czechoslovakia

Radio development in Czechoslovakia has not yet passed the stage of infancy, according to dispatches to the Department of Commerce from Consul Winans at Prague. He states, however, that the government has taken an active interest in radio development and in view of a more extensive and popular acceptance of this form of communication at home has sent a special commission of experts to study the progress made in other countries. Whether a sending station for radio messages will be established in Czecho-

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0295	$0.0285	$0.0273
Cold finished shafting, per lb.	0.0378	0.0373	0.0379
Brass rods, per lb.	0.171	0.1700	0.148
Solder (half and half), per lb.	0.23	0.228	0.20
Cotton waste, per lb.	0.11	0.11	0.112
Washers, cast iron (½-in.), per 100 lb	4.33	4.33	5.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.11	3.11	. . .
Machine oil, per gal	0.36	0.36	. . .
Belting, leather, medium, off list	40-5@50%	40-5@50%	. . .
Machine bolts, up to 1-in. x 30-in., off list	55@60%	50@65-10%	50@60-10%

slovakia will depend upon the findings of this commission.

Even when finally introduced, however, the local industry cannot be expected to attain the state of development reached in the United States. It is stated by the Ministry of Posts and Telegraphs that all messages sent by radio will be subject to strict control by the government; not every person will be permitted to own a receiving or sending apparatus. High duty will be assessed on radio outfits and supplies of foreign make, and each radio set, whether of domestic or foreign manufacture, will have to be registered at the Ministry of Posts and Telegraphs. Many local factories are said to be interested in the future of radio telephony and to be awaiting a favorable moment for producing the necessary requirements of the industry.

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Prevailing Conditions Affecting Cost and Volume

Coal Output Curtailed.—Preliminary estimates on coal production for the week ended Nov. 11, as revised by later reports reflecting the curtailed output because of election day and Armistice Day, put the total amount of coal raised at 11,939,000 net tons. Early returns on car loadings at mines for the week ended Nov. 18 indicate 13,200,000 net tons, comprising 11,100,000 tons of soft coal and 2,100,000 tons of anthracite.

Decrease in Number of Freight Cars Loaded.—Loading of revenue freight on American railroads during the week which ended Nov. 4 totaled 994,827 cars, according to reports received today by the American Railway Association from the carriers of the country. This was a decrease of 19,653 cars compared with the week before, due to the usual seasonal decline in traffic. But even in the face of this reduction this was the largest number of cars ever loaded during the first part of November in the history of the railroads of this country.

Bank Clearings Gain Appreciably.—The ratio of increase in bank clearings over last year's figures widened appreciably this week, an aggregate of $6,876,176,000 at twenty cities of the United States, as reported in *Dun's Review*, being 17.1 per cent in excess of the total of a year ago. Last week the gain over the clearings of the same period of 1921 was 9.5 per cent. Compared with the clearings of two years ago, a reduction of 10.9 per cent appears this week, but there was a decrease last week of 16.4 per cent.

Large Increase in Number of Failures.—Large increases are evident in the number of failures reported to R. G. Dun & Company from the East, South and West of the United States this week, while the Pacific section shows a marked decrease. As a result the total for this six-day week, 431, is much larger than the aggregate reported for the five-day week preceding, which was 387. This week's total is, however, more than 100 less than the 536 reported for the corresponding week last year. Both the number and the proportion of defaults with liabilities of more than $5,000 in each case have increased this week, there being 249 as against 214 last week, and the percentage being 57.7 as against 55.2 last week. A year ago similar insolvencies numbered 281 and were 52.4 per cent of the total for that week.

Decrease in Copper Smelting.—The Department of Commerce announces that reports made to the Bureau of the Census show a decrease in the activities of the establishments engaged primarily in the smelting and refining of copper during 1921, as compared with the year 1919. The total value of products reported amounted to $234,895,200 in 1921, and to $651,101,600 in 1919, a decrease of 63.9 per cent. Of the twenty-eight establishments reported for 1921, eight were located in Arizona; four each in Michigan and New Jersey; three in Montana; two in Tennessee, and one each in Maryland, Nevada, New York, Utah, Texas, Virginia and Washington.

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British Electrical Exports Continue Decline

Figures for the September foreign trade in electrical goods of Great Britain show a total of £524,142 worth shipped during that month. This shows a decrease of £400,625, as compared with the previous year, bringing the nine-month decrease up to £5,247,233.

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Electrical Slate Shipments 25 per Cent Higher

September shipments of electrical slate were 25 per cent higher than those in August, according to officials of the National Slate Association. Many large projects and buildings have reached the stage where electrical switchboards, panelboards, switch bases, etc., must be supplied.

Slate prices are holding firm. While fuel embargoes and car shortage materially delayed shipments during September and October, the acute situation is now somewhat relieved. Although considerable trouble in getting cars sufficient for shipments is still the rule, contractors and other slate users, appreciating the situation, are anticipating their slate needs and allowing more time between placement of their orders and the time the slate is required.

September slate sales keep up the pace set by August, running over $750,000, and are 2 per cent above 1920 and 4 per cent above 1921, according to sixty-one producing companies reporting to the National Slate Association. Thirty of the concerns reporting show that September is the first month when the cumulative year's total of shipments in 1922 has been 20 per cent above 1921 and 10 per cent above 1920.

The Metal Market

All Available Copper at 13.75 Cents Is Absorbed—Pronounced Premium Reported for Prompt Lead

Sales have been very satisfactory throughout the week, and all of the copper available at 13.75 cents delivered has been absorbed. Practically all producers are quoting 13.87½ cents. At least two producers are now quoting 14 cents, but are practically out of the market, and the quotation is purely a nominal one. Consumers report that business continues excellent, and many of them have booked more business into the new year than is usual at this period.

Foreign conditions are unsettled, and there seems little hope of a satisfactory foreign consumption in the immediate future.

Lead sales have been of about normal volume during the week, with regular customers of the larger producers able to book lead for December shipment at 7 cents. For prompt lead there is a pronounced premium, and small orders for November shipment have been booked at from 7.15 cents to 7.25 cents. This business represents only a small proportion of the total sales, however, the average price realized on all sales for the next two months being about 7.05 cents. October production was much better than that for the preceding month, and there is now an indication that increased prices are having an effect on increasing the supply of domestic lead in addition to furthering the entrance of Mexican lead into this country.

The zinc market is strong, and the present tendency is to continue the advance that has occurred during the week. Heavier tonnages were sold for export than during the previous seven days, but generally for forward delivery —in some cases as far ahead as next March. One or two producers with a small supply of prompt zinc have remained out of the market. The largest proportion of business was done for future delivery, and spot metal commands a premium of 5 to 10 points. The market has been difficult to quote for that reason. Small spot tonnages might have been sold each day at prices slightly higher than those we indicate.

The statistics of the American Zinc Institute for October show that, although production increased, consumption remains above it: Stock on hand Oct. 1, 1922, 18,806 tons; production, 39,940; shipments, 40,703; stock on hand Oct. 31, 18,043; reported sold for export during October, 1,038 tons.

NEW YORK METAL MARKET PRICES

	Nov. 16, 1922	Nov. 23, 1922
	Cents per Pound	Cents per Pound
Copper		
Prime Lake	13.75	13.87½
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	7.00	7.00
Antimony	6.50	6.50
Nickel, ingot	36.00	36.00
Zinc, spot	7.25	8.25
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	21.50	21.50

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

HOLIDAY business is taking on more life in all sections of the United States, but some cities report shortages of certain stocks of heaters and ironers, a few manufacturers blaming poor transportation conditions for the lack of sufficient raw materials. Central-station activity in making line extensions is taking much high-tension equipment. Motors in all sizes are moving well. Radio jobbers report better sales, saying that much Christmas business is being carried through for parts and head sets. Vacuum cleaners are in much demand and washers are selling in better volume. Owing to the recent mild weather and some improvement in the coal situation, sales of heaters are not at all spectacular at the present, although sales are frequent.

New York

Lamp Sales Improving—Warm Weather Slowing Down Heater Sales—Vacuum Cleaners Active

Demand for all articles has not increased materially over conditions of one or two weeks ago, although there are many expressions throughout the trade that the holiday buying will tax the present local stocks to the limit. Placing of orders at this late period and inability to receive certain iron and steel products are said to be to blame for present conditions. Central-station companies are buying in goodly amounts for repairing and extending their lines in preparation for the winter months.

Lamps.—Sales are improving each week, the commercial-purpose lamps selling in best volume. Much replacement business is reported.

Radiant Heaters. — The warmer weather during the past two weeks is said to have had much effect in slowing down sales. Improved conditions in the fuel situation are causing less anxiety for those who depend on coal.

Vacuum Cleaners. — Vigorous sales campaigns helped by advertising campaigns in the consumers' magazines are resulting in a good volume of sales. Much competition in the field has reduced profits to a minimum.

Chicago

Wire Demand Slackened—Car Shortage Hinders Conduit Shipments—Heating Appliances Active

Business in the electrical trade is still continuing to move at a steady rate. Demand for wiring material has become slackened just a little, but the main volume remains good. Freight car shortage is continuing to hinder shipments of conduit. Manufacturers of high-tension equipment are unanimous in reporting very brisk business. The call for poles is good and nearly all construction is for new power lines. Heating appliances are selling well and stocks are ample to supply the trade.

Conduit. — Jobbers report a slight easing in the scarcity of conduit since shipments from manufacturers have improved silghtly. The ½-in. black pipe in lots of 5,000 ft. or more sells between $57 and $60 per 1,000 ft. An active demand, however, is keeping stocks rather low.

Wire.—Action on wire is still steady, but with a slight tendency toward a decreasing demand. The rubber-covered No. 14 is quoted at $6.40 per 1,000 ft. in 5,000-ft. lots. Stocks are normal.

Flexible Armored Conductor.—Movement has fallen off, but the main volume is firm. No. 14 two-wire, single-strip conductor is available for $47 per 1,000 ft. in lots of 5,000 ft. Stocks are ample.

Heating Appliances.—The call for open air heaters is growing, colder weather creating more interest, Stocks are in good shape.

Boston

Cross-Arm Sales Showing Improvement—Portable Lamps Active—Lighting Set Business Brisk

Business continues at about the same level as last week. Deliveries on products manufactured outside New England are impaired by embargoes, but current stocks are meeting present demands reasonably well. Prices are firm. Improvement in general manufacturing circles is well sustained, and retail trade is active. Central-station outputs are growing by leaps and bounds, and additions to plants are being considered and installed to meet anticipated heavier requirements in the coming year.

Cross-Arms. — Sales are showing some improvement, although business is not in striking volume.

Pole-Line Hardware.—Recent buying has been good with deliveries out of stock satisfying immediate needs. Prices are firm.

Lamps.—Portable lamps are selling with marked activity, one dealer recently disposing of 1,400 to a single customer. Stocks are varied and attractive.

Wire.—Slow-burning weatherproof is moving in fair volume on an 18-cent base. Rubber-covered No. 14 is active at $6.25 per 1,000 ft. in 5,000-ft. lots.

Starting and Lighting Sets.—Business is brisk, one manufacturer having on hand three million dollars' worth of unfilled orders. The demand for magnetos is also very active.

Vacuum Cleaners. — Eight central-station retail departments sold 153 cleaners of a single make in six weeks. Business is responding to vigorous sales efforts, and competition is very active. Freight embargoes are giving trouble on some outside New England factory shipments.

Radiant Heaters. — Owing to mild weather and some improvement in the fuel situation, the sale of heaters is not at all spectacular at present, although sales are frequent. Stocks are in good shape, from outward appearances.

Wiring Devices.—Large quantities of sockets, switches, etc., are being absorbed by new building construction in Boston and the suburban territory. New England factory shipments are coming through well. Prices are firm, with minor readjustments in various fittings.

Atlanta

Volume of Lamp Sales Greater—Heating Pads More Popular—Insulator Stocks Satisfactory

Business continues to improve throughout the section, excellent weather conditions permitting builders to push construction and farmers to harvest crops. This has virtually served to eliminate non-employment and speed up material purchases. In the electrical business certain materials are short, particularly conduit.

Sales campaigns being made by manufacturers, dealers and central stations are serving to stimulate the movement in appliance lines. Considerable heavy construction by industries is being talked of, though as yet no definite plans have been announced, the tendency being to wait until after the first of the year.

Lamps.—The fall movement is in full swing with stocks in good shape and deliveries prompt. The volume of sales is somewhat greater than it was last fall. The 100-watt and 200-watt type C lamps are the best sellers.

Flashlights.—Sales of cases are only fair, but a reasonably satisfactory volume of batteries and lamps is reported, though not up to the seasonal volume. Stocks are adequate and deliveries good.

Heating Pads.—This specialty shows an increase in popularity and jobbers report the movement more active than for some time. Sufficient stocks to meet the holiday demand are on hand.

Panelboards.—An excellent volume of orders is reported in this line in all variety of sizes. Factory shipments are very good.

Insulators.—The 2,300-volt porcelain type is quite active, with the glass telephone types continuing their steady movement. High-tension insulator sales are fair to good. Stocks of the 2,300-volt type are fair with shipments satisfactory.

Air Heaters.—Owing to mild weather, jobbers have had little success in disposing of this specialty to date. Excellent stocks are on hand in anticipation of a brisk movement when cold weather arrives.

Wire.—Sales of both weatherproof and rubber-covered are good, with low stocks reported on No. 12 and No. 14 rubber-covered. A price advance of 5 per cent on rubber-covered is announced this week.

Cleveland

Jobbers Report Fair Movement in All Sizes of Motors—Strong Fixture Market

That a favorable holiday season for appliances is anticipated is evident in dealers' orders.

Motors.—Jobbers report a fair movement in all sizes. Stocks are good and deliveries prompt.

Washers.—Sales have been in good volume. Ironer sales have fallen off slightly but not sufficiently to be alarming. Competition is keen.

Heaters.—Dealers report a renewal of activity in the smaller type and attribute it to cooler weather. Stocks, recovered from the last rush, are sufficient to meet the demand easily.

Fixtures.—Although the end of the building season is in sight, fixtures continue to be in demand. Lamps are accordingly holding up well, and lamp-cord sales have experienced some acceleration.

St. Louis

Power-Generating Equipment Sales Good—Prices Show Upward Trend—Conduit Active

Sales of power-generating equipment have been especially good this week, one of the railroads being the buyer of about $100,000 of equipment. Inquiries on such items are quite attractive, and the next few months should bring in sizable orders. Prices have shown upward tendencies, increases of about 10 per cent being made in sockets and conduit and smaller increases in wire and flexible armored conductor. Demand for supplies is in general active, and sales of merchandising supplies are especially good.

Conduit. — Prices continue upward with low stocks and strong demand.

Wire. — No. 14 rubber-covered is higher by about 5 cents per 1,000 ft., selling for $6.25 per 1,000 ft. in 5,000-ft. lots. Other prices are unchanged. Demand is steady and stocks are in good condition.

Flexible Armored Conductor.—An increase from $4.80 to $5.00 per 100 ft. in 250-ft. lots is found in No. 14 two-wire conductor. Stocks have a tendency to be low.

Lamp Cord.—Better business is reported. Stocks are ample and prices stable. Cotton cord, twisted, in 1,000-ft. lots, is priced as follows per 1,000 ft: No. 18, $11.50; No. 16, $15.23; No. 14, $23.02.

Portland-Seattle

Lamp Business Greater Than a Year Ago—Less Activity in Farm Lighting

Lumber production shows a slight decrease but is still above normal. Electrical jobbers report business conditions good. They are much better than they were a year ago and probably approach pre-war conditions. Prices continue to stiffen in copper and steel products. The volume of lamp business is in excess of a year ago, although the value is not materially changed because of a decrease in the price of lamps. Decreased activity is reported in regard to farm-lighting plants because of low prices for crops and inability to move them in some sections. Deliveries are gradually improving and stocks are in better shape. Active buying of hollow ware, heating devices, flashlights and other holiday stocks for delivery after the first of the month is reported throughout the district.

Porcelain.—Demand for knobs, tubes and cleats continues active. Prices are practically unchanged and ample stocks are maintained at all times.

Salt Lake City

Interest Centering on Holiday Trade—Reduction on High-Grade Radio Head Sets

Interest in electrical circles is centering on the holiday trade. Dealers are ordering better than for several years, and as a result jobbers are hard put to it in some cases to meet orders. Manufacturers are unable to fill all orders for hollow ware and in some instances they have resorted to cancellation.

The dearth of business during the past three years has resulted in a steady depletion of stocks and no one seems to be ready for the sudden activity. There is a persistent and quite general upward trend in prices on electrical merchandise, the result being a quickened demand. Railroad schedules are reported improved and metal prices are firmer.

Radio.—Interest in radio still lags. A 25 per cent reduction on high-grade head sets was announced this week by a local manufacturer. With the steady increase of broadcasting stations and shortened distances, the cheaper receiving apparatus is acquiring a competitive advantage over the high-priced apparatus.

Washers.—Several aggressive washer and vacuum-cleaner campaigns are now in progress. The response, however, is not entirely gratifying. Stocks are good.

Denver

Stocks of Ranges Are Small But Ample—Splendid Prospects for Christmas Business

Increased business in manufacturing and mechanical industries and a large amount of new construction work have benefited electrical industry. Severe storms have temporarily embarrassed nearly every line of business. Transportation tie-ups are now untangled and building activities continue as before.

Ranges.—Some interest is being manifested outside of the city, though local sales are negligible. The cost of installations in comparison with that of gas ranges is believed to be the principal deterrent. Small but ample stocks exist in local territory.

Meters. — Central stations are well supplied. No outside demand has developed. Prices stable with supply satisfactory.

Radio.—Interest is greater in radio sets and parts. Local jobbers are stabilizing activity and standardizing on supply. Splendid prospects are reported for christmas business.

Toasters.—Standard lines in demand with one type reduced on local market to $5.95. Jobbers' stocks are ample while retailers are buying in lesser amounts.

Safety Panels.—Several large residence installations have stimulated local interest in this line. Standard equipment is conservatively stocked by manufacturers subject to jobbers' calls. Special jobs are being turned out locally on a few days' notice. Prices are steady.

San Francisco

Electrical Collections Improved—Appliance Stocks Sufficient—October Washer Sales Set New Record

Electrical men are jubilant over the recent decisive defeat of the power and water act, declaring the result of the vote to be public confirmation and appreciation of their endeavors to provide efficient and economical electrical service. The outlook for the future is decidedly optimistic. Resulting construction will maintain a high level for another year at least. Labor conditions are much improved and there is little lack of employment. Collections have again improved.

Appliances. — The California Electrical Co-operative Campaign has prepared some excellent display material for holidays. The tendency is not to rush this business this season. Some nice orders from dealers are reported, and improved appliances and combination devices are featured. Fairly large stocks are carried over.

Washers.—October business has set new records for the past twelve months. In some cases dealers report rather poor November sales. One crew of thirty men sold 120 machines last month assisted by lists of "prospects" secured at fairs.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including **Important Orders**
and Contracts for Apparatus and Equipment

Western Electric Company's Sales Were $170,000,000

President Charles G. DuBois of the Western Electric Company announces sales for the first ten months of 1922 amounting to $170,000,000, indicating a volume of business for the year slightly in excess of the sales in 1920, which was the largest year in the history of the company.

The orders received during the first ten months of the year have amounted to $152,000,000, or approximately $24,000,000 more than for the same period in 1921. On Oct. 31, 1922, the company had on its payrolls the largest number of employees in its history, 50,177, representing an increase of nearly 5,000 as compared with the first of the year.

Association Awards $500 for Electric Truck Slogan

Selected from more than 6,000 suggestions in the slogan contest held by the Electric Motor Truck Association, that submitted by J. H. Anderson, 111 Broadway, has been adjudged the winner of the five-hundred-dollar prize. The winning slogan consisted of seven words, "Use Electric Trucks—Why? Ask All Owners."

C. W. Curtiss and Carl T. Mason Organize Metropolitan Radio

C. W. Curtiss, Newark, N. J., formerly general manager of the Splitdorf Electrical Company, 98 Warren Street, and Carl T. Mason, previously chief engineer of the same company, have organized the Metropolitan Radio Corporation to operate a plant at 67 Goble Street for the manufacture of receiving sets, head telephones, jacks and other radio apparatus. Mr. Curtiss is president and Mr. Mason is chief engineer of the company.

Apex Firm Points Out Saving Feature of Cleaners

In comparing costs between keeping house with and without an electric suction sweeper, the Apex Electrical Distributing Company, Cleveland, has issued information to its sales force as follows:

Cleaning house with a broom and dust cloth requires ten hours per week, the company estimates. "Every housewife should value her time at 30 cents an hour. Ten hours a week at 30 cents an hour for fifty-two weeks amounts to $156."

The company points out that ten hours' work by hand is done in four hours with an electric vacuum cleaner. The cost of labor for operating a cleaner amounts to $62.40 for a year. The cost of energy is placed at $3.33, and the cost of the cleaner, prorated over ten years, amounts to $6.88. The company estimates the saving at $83.39.

Lewis Opens Sample Displays at Worcester and Salem, Mass.

To facilitate exhibiting wiring supplies, fixtures and other material to contractor-dealers and other prospective customers, the Lewis Electrical Supply Company, Boston, has recently established local sample displays at Salem and Worcester, Mass. These displays are respectively in charge of T. A. Russell and Lawrence W. Smith, resident representatives of the house in the Salem and Worcester districts.

Arrangements have been made for the permanent occupancy of quarters at the Essex House, Salem, and the Hotel Warren, Worcester, for this purpose. No warehousing is done at these quarters, but the maintenance of representative diversified local stocks of supplies greatly facilitates the examination of material by prospective purchasers apart from their usual home office surroundings and distractions and also broadens the local conception of the range of service rendered by the modern electrical supply jobber. In some cases local newspaper advertising is keyed in with the inauguration and maintenance of the displays.

Underwriters' Laboratories to Move to Larger Quarters

The New York City offices of the Underwriters' Laboratories will be moved Dec. 1 from 25 City Hall Place, where they have been for the past five years, to new quarters in the Underwriters' Laboratories Building at 109-111 Leonard Street. They will occupy the entire two upper floors, and additional space has been provided for still further expansion.

This step has been made necessary by the rapidly increasing demands for the Laboratories' service, and also by the fact that casualty and burglary protection devices have recently been added to the list taken care of at the New York branch, until recently occupied solely with matters electrical.

At this new location will be continued the work of the electrical testing laboratories and the conducting of inspections at factories and label service in the metropolitan district, which includes New York, New Jersey and southern Connecticut. The whole will be, as formerly, under the general direction of Dana Pierce, vice-president.

Says Small Minority Plans to Upset Wagner Reorganization

Suit for an injunction to prevent the reorganization of the Wagner Electric Company under the laws of Delaware and asking that a receiver be named for the company was filed last week by owners of 1,600 shares of preferred stock. The petitioners alleged that the preferred stock of the company would be rendered valueless by the reorganization at this time.

The suit, which was filed in the state courts, also demands the removal of the company's officers. It was filed by the estates of Richard C. Kerns, former Ambassador to Austria; Jeane M. Leahy and John J. Raleigh.

The company has outstanding $1,500,000 of preferred stock of $100 par value and 80,000 shares of common stock of no par value.

President W. A. Layman authorized the following statement: "The suit filed in the Circuit Court at St. Louis, Nov. 18, asking for a receiver of the company and an injunction against the transfer of the company's assets to the new Wagner Electric Corporation, is an action by a very small minority interest in the old Wagner company, owning about 1½ per cent of the stock of that company to upset the financial reorganization of the Wagner business. The situation in substance is that the Wagner plan of financial reorganization was accomplished Aug. 11, 1922, when the properties of the old Wagner Electric Manufacturing Company, a Missouri corporation, was transferred to the Wagner Electric Corporation, a Delaware company, the latter becoming the operating company, assuming all assets and liabilities of the Missouri company. The transfer was made by authority of a special meeting of stockholders of the Missouri company held Aug. 4 for this particular purpose. At this special meeting 92 per cent of the total shares outstanding were represented and this 92 per cent, with the exception of 101 shares, voted in favor of the entire reorganization plan and authorized the directors and officers to place it in effect. The owners of the shares bringing this suit, in all about 800 shares, were not represented at the meeting and this stock was not voted either for or against the reorganization plan. The officers and directors are assured by the attorneys of the company that every step taken in the process of reorganization has complied with the law, that all steps taken have been approved by a larger percentage of stock than the law requires, and that there need be no apprehensions of the outcome of the litigation. Through the reorganization plan, the bank obligations of the old company were entirely paid off and the new Wagner corporation's total current obligations were for current merchandise requirements only, which obligations are substantially less than the company's cash in bank."

Stockholders will vote on ratification Dec. 29.

Gibb Instrument Company Will Locate in Bay City, Mich.

The Gibb Instrument Company, Detroit, manufacturer of electric welding equipment, announces the removal of its plant and offices to Bay City, Mich., effective Dec. 1. The purpose of this move is to provide greatly increased manufacturing facilities to take care of a rapidly increasing business. For the past two years this company has concentrated on the development of automatic and semi-automatic arc, spot and seam welders.

Monitor Controller Company Establishes Southern Branch

The Monitor Controller Company, manufacturer of the "Just Press a Button" system of automatic control for all motor-driven apparatus, has recently established in the South a branch sales office at Birmingham, Ala. The main office and works of the company are at Baltimore. Other branch offices are established in a number of the larger cities.

Goggin and Ripley Form Personal Service Corporation

Announcement is made that Victor T. Goggin and James H. Ripley, formerly contracting engineers with Dwight P. Robinson & Company, Inc., have formed a partnership under the name of Goggin & Ripley, Inc., with headquarters at 350 Madison Avenue, New York City, as a personal service corporation to assist business executives, bankers and engineers in conceiving, financing and developing construction projects.

United Electric Company Is Holding Sales Contest

The United Electric Company, Canton, Ohio, manufacturer of cleaners, announces that it is presenting as a gift to each of the forty salesmen selling individually most cleaners between Nov. 6 and Dec. 16 one of its cleaners. The "Salesmen's Christmas Tree," as the company has named the present contest, has attracted more entries than any other sales contest put on by this company, it is stated.

Radio Shop of Sunnyvale, Cal., Establishes St. Louis Factory

The Radio Shop of Sunnyvale, Cal., announces the establishment of a branch factory at St. Louis. This company has been engaged in the manufacture of Armstrong regenerative circuit radio equipment on the Pacific Coast, and the increase in business has made it necessary to establish another factory in the Middle West.

A. B. Dorman, manager of the company for the Eastern part of the United States, has established his office in St. Louis. He reports that the Echo Radio Corporation has been organized to take over the national distribution of the products of his company. Jobbers are being selected to handle the line. The offices of the Echo Radio Corporation are at 315 International Life Building, St. Louis.

Electrical Products Firm Adds Frank Foley to Sales Force

The Electrical Products Company, 17 East Forty-second Street, New York City, announces that it has recently added Frank Foley to its sales force. Mr. Foley was formerly associated with the Western Electric Company and the H. C. Roberts Electric Company. He will sell the National Metal Molding Company's products under the direction of the Electrical Products Company.

The Walker Vehicle Company, Chicago, manufacturer of electric trucks, has arranged for the construction of a three-story reinforced-concrete service station building to be erected on a plot, 100 ft. x 115 ft., at the southwest corner of Ely Avenue and Thirteenth Street, Long Island City.

The Keifer Electrical Supply Company, Peoria, Ill., which was recently incorporated with a capital of $30,000 to manufacture electrical equipment and supplies, announces that it does not purpose to do any manufacturing, at least for the time being. It will act as a distributor.

The Westinghouse Electric & Manufacturing Company has received orders for $600,000 worth of electrical locomotives, five for the New York, New Haven & Hartford Railroad and four for the Norfolk & Western Railroad. There are now 105 Westinghouse locomotives on the New Haven and twelve on the Norfolk & Western.

The Laundryette Manufacturing Company, Cleveland, announces that its factory produced more washing machines in the month of October than in any month in the company's history.

The Bussmann Manufacturing Company, manufacturer of fuses, St. Louis, has removed its New York City branch office and storeroom to 27 Warren Street. The company's other New York establishment is at 23 Murray Street.

The Dominion Asbestos & Rubber Corporation has removed its offices from 154 Nassau Street to 1780 Broadway, New York City. This company has recently added to its line the Dominion brake block for use on heavy hoisting apparatus.

Frederick Franz, who for the past four years has been chief engineer of the Terminal Engineering Company, manufacturer of trucks for both indoor and outdoor usages in shipping and industrial plants, has established an engineering office at 27 Warren Street, New York City, for the purpose of solving special problems of engineering relating to labor-saving machinery.

The Pioneer Storage Battery Company, Philadelphia, has taken title to the three-story building at 244 North Fifteenth Street for a local plant.

The Electric Cord Adjuster Corporation, 103 East 125th Street, New York City, which was recently incorporated to manufacture electrical equipment, is in the market for black steel-spring wire and tubing. A. F. Brown is manager of the company.

The Harbison-Walker Refractories Company, Oliver Building, Pittsburgh, has arranged a program for extensions and improvements at its Blandburg (Pa.) plants to cost approximately $1,000,000.

The Harrisburg Manufacturing & Boiler Company, Nineteenth and Naudain Streets, Harrisburg, Pa., has acquired property at Bolton and Blackwood Streets for expansion.

The Kokomo Steel & Wire Company, Kokomo, Ind., has started the construction of a new building, 90 ft. x 425 ft., to house its galvanizing department, estimated to cost $50,000.

The Robertson-Cataract Electric Company, Buffalo, N. Y., has disposed of a preferred stock issue of $180,000, a portion of the proceeds to be used for general operations, in connection with its subsidiary organization the Robertson Electric Construction Company, manufacturer of switchboards and other electrical equipment.

The Arey & Blount Electric Company, Worcester, Mass., recently organized by William H. Blount, formerly superintendent of Sleeper & Hartley, Inc., will operate a local plant for the manufacture of electric flashing devices and kindred specialties.

The Englert Manufacturing Company, Pittsburgh, manufacturer of batteries, etc., has awarded a contract to the Duquesne Construction Company, Bessemer Building, for the construction of a new plant on property acquired at Jane and South Twenty-fifth Streets.

The Acorn Insulated Wire Company, Brooklyn, N. Y., has disposed of its water-front property on the Gowanus Canal, Ninth Street, to the T. & T. Coal Company, for a consideration of about $125,000.

The Babcock & Wilcox Company, 85 Liberty Street, New York, manufacturer of water-tube boilers, is perfecting plans for an increase in capital from $15,000,000 to $25,000,000, a portion of the proceeds to be used for general expansion.

The Lexington Battery Company, Lexington, Ky., manufacturer of batteries, has plans in progress for the rebuilding of the portion of its plant recently destroyed by fire with loss of about $75,000. The new structure is estimated to cost close to a like amount.

The Phillips Insulated Wire Company, Pawtucket, R. I., is erecting a twenty-five-thousand-dollar addition to its power plant. The new section is to be one story high and approximately 65 ft. x 30 ft.

Foreign Trade Notes

PROPOSED ELECTRIC POWER SCHEME FOR BURMAH, INDIA.—A proposal to develop water power to generate electricity in Burmah, India, is reported to be under consideration. It is proposed to divert the waters of the Yunzalin River to generate electricity to be transmitted to Rangoon.

PROPOSED HYDRO-ELECTRIC DEVELOPMENTS ON THE RHINE RIVER.—A company has been organized by the presidents of twenty chambers of commerce for eastern France, senators and financiers for the purpose of studying the proposal to utilize the waters of the Rhine River for hydro-electric developments and irrigation projects. The company is known as the Société Régionale d'Etudes du Rhin, and is capitalized at 500,000 francs. Besides the twenty chambers of commerce, the Société des Forces Motrices du Rhin, the Port of Strasbourg and the eastern economic regions are interested in the project. The headquarters of the company are in Nancy.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Ireland (No. 4,336) for electrical goods and equipment of every kind, household and building hardware, etc.

Catalogs and price lists are desired in Czechoslovakia (No. 4,354) for all sorts of radio-telegraphic apparatus and precision instruments for radio laboratories, such as ammeters and voltmeters.

Purchase is desired in Canada (No. 4,355) of plant for the development of power facilities, or equipment for the extension of existing electric light plant through the use of crude-oil engines or water power. Quotations, literature and catalogs are requested.

Purchase is desired in Chile (No. 4,365) of electric light bulbs, rubber tires and all accessories for low-priced automobiles.

An agency is desired in Sweden (No. 4,371) for electrical goods of all kinds, labor-saving machinery, machine tools, novelties in the engineering line, etc.

An agency is desired in Spain (No. 4,372) for electrical apparatus of all kinds and machinery in general.

An agency and purchase is desired in France (No. 4,388) of household appliances, particularly electrical.

An agency is desired in Belgium (No. 4,389) for wireless apparatus and electrical appliances and implements used on ships.

New Apparatus and Publications

AUTOMOBILE AMMETER.—An automobile ammeter that has no electrical coils or connections, known as the type "BT" ammeter, has recently been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This instrument can also be adapted for use on motorboats, aërial craft, farm-lighting plants, radio plants and for charging batteries.

THERMOSTATIC SWITCH.—The Minneapolis Heat Regulator Company, Minneapolis, Minn., has recently developed the "Minneapolis" thermostatic relay switch for the thermostatic control of motors, electric heating units and other electrical circuits.

FLASHLIGHT.—A flashlight without a battery has recently been placed on the market by the Powerlite Company, Cleveland.

POTENTIOMETER.—The "Amsco" potentiometer for plate voltage control on receiving tubes has been developed by the Advance Metal Stamping Company, 17 Thompson Street, New York City.

AMPLIFYING TUBE CONTROL.—The Klcsner Improved Apparatus Company, 2024 Boston Road, New York City, has placed on the market a tube rheostat known as the "Amplitrol."

THERAPEUTIC LAMP.—A new heat and light infuser, "Stein-O-Lite," has been developed by the Frank S. Betz Company, 6 West Forty-eighth Street, New York City.

PORTABLE BAND SAW.—A new electrically driven band saw for use in carpenter and pattern shops and woodworking plants has been placed on the market by J. D. Wallace & Company, 1,401 West Jackson Boulevard, Chicago.

ELECTRIC BUTTER CHURN.—The Superior Churn & Manufacturing Company has placed on the market an electrically driven butter churn.

BATTERY CHARGER.—The Automatic Electrical Devices Company, 134 West Third Street, Cincinnati, has recently brought out the new "radio home charger de luxe" for charging "A" and "B" batteries.

VERNIER RHEOSTAT.—A drum-type rheostat, known as model "223," designed for one-hole panel mounting, has been placed on the market by the Precise Manufacturing Corporation, 254 Mill Street, Rochester, N. Y.

CABINET RECEIVING SET.—The Crosley Manufacturing Company, Cincinnati, has placed on the market a new cabinet radio receiver, known as "XX."

CONDENSER TUBES.—"Chase Condenser Tubes" is the title of a thirty-two-page booklet published by the Chase Metal Works, Waterbury, Conn., which describes and illustrates the manufacture of the Chase condenser tubes.

PORTABLE LAMP.—The Bussman Manufacturing Company, 3819 North Twenty-third Street, St. Louis, has recently developed a new portable lamp, known as the "Clamp-O-Set" lamp.

New Incorporations

THE TRI-STATE ELECTRIC COMPANY, Ashland, Ky., has been incorporated by Allen Jansen, E. L. Hillard and Hays Nelson.

THE NANSEMOND PUBLIC UTILITIES CORPORATION, Norfolk, Va., has been incorporated with a capital stock of $25,000 to distribute electricity in Nansemond County for power purposes. E. L. Myers is president and William C. Hess secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

GLOUCESTER, MASS.—The Gloucester Electric Company has been granted permission to issue $102,620, in capital stock, part of the proceeds to be used for extensions and improvements.

BETHLEHEM, CONN.—Steps have been taken by local business men to have the Litchfield (Conn.) Electric Light & Power Company extend its service to Bethlehem Center.

NEW HAVEN, CONN.—The Connecticut Company contemplates the erection of an addition to its power plant on Grand Avenue, to cost about $150,000.

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Middle Atlantic States

BLASDELL, N. Y.—An electric pumping plant will be installed in connection with proposed improvements to the sewerage system, to cost about $200,000.

BUFFALO, N. Y.—The Buffalo Steel Car Company, East Walden Avenue, is planning to erect a new power house, 25 ft. x 100 ft.

HORNELL, N. Y.—E. L. Phillips & Company, 50 Church Street, New York, are negotiating for the purchase of the property of the Hornell Electric Company. Extensions and improvements will be made.

JAMAICA, N. Y.—Electric power equipment will be installed in the printing plant to be erected by the Edward Langer Printing Compay, Inc., to cost about $300,000.

LYNBROOK, N. Y.—A movement to establish a municipal electric light and water plant has been started by the Village Board.

NEW YORK, N. Y.—Electric power equipment, ice and refrigerating machinery will be installed in the three-story plant to be erected at 9-19 West 141st Street by the Reid Ice Cream Company, 524 Waverley Avenue, to cost about $250,000.

NORTH TONAWANDA, N. Y.—The Board of Aldermen is negotiating with the Tonawanda Power Company for the installation of a new lighting system in the business district.

OLEAN, N. Y.—The Niagara, Lockport & Ontario Power Company plans to extend its transmission line from Springville to Olean via Wellsville, and also to erect transmission lines to Elmira and Binghamton, where local power plants will be acquired. Power plants have recently been purchased at Jamestown, Salamanca and Bradford, N. Y., and Meadville, Pa., which will be used for emergency service.

HAMBURG, N. J.—The Lime & Stone Products Company will equip its plant for electrical operation. Electricity will be furnished by the New Jersey Power & Light Company.

MAPLE SHADE, N. J.—Electric pumping equipment will be installed by the Maple Shade Water Company in connection with proposed extensions and improvements, to cost about $50,000.

NEWARK, N. J.—The Public Service Electric Company has received permission to issue $2,250,000 in capital stock, the proceeds to be used for extensions and improvements as follows: Installation of condensers, transformers, etc., at the Hoboken station to cost $107,600; extensions to power plant at Burlington, $270,000; motor-generator, condensers, etc., at the Paterson power plant, $106,000; transmission line, from Passaic to Athenia, $20,000; equipment for the Camden plant, $54,700 and for electric pumping machinery at Perth Amboy, $25,600.

HARRISBURG, PA.—Plans are being prepared for the installation of an improved lighting system on Walnut, South Cameron and East Market Streets and other thoroughfares in the business section.

LEWISTON, PA.—The Penn Central Light & Power Company, Altoona, is planning to erect a substation at the local "viscose" plant.

PITTSBURGH, PA.—The Patterson Township Light Company, recently organized, plans to install a transmission and distributing system in Patterson Township. C. J. Braun, Jr., 435 Sixth Avenue, is treasurer.

SCRANTON, PA.—The construction of a new power house, to cost about $60,000, is under consideration by the Scranton Lace Company.

SLATINGTON, PA.—Electric power equipment will be installed in the proposed printing plant to be erected by John A. Brush and associates, to cost about $200,000.

TITUSVILLE, PA.—The erection of a high-tension transmission line from Titusville to Hydetown and Pleasantville, and additional lines in and around the Titusville factory district, is under consideration by the Titusville Light & Power Company.

WATSONTOWN, PA.—The Watsontown Sash & Door Company plans to build a steam-driven electric power plant to cost about $300,000. A franchise has been asked for local commercial service.

BALTIMORE, MD.—The American Oil Company, American Building, will install electric power equipment in its proposed new plant at Curtis Bay to cost about $500,000.

RIDGEWAY, W. VA.—A power plant will be erected at the proposed new automobile manufacturing plant to be erected in Ridgeway, to cost about $1,500,000. A company is being organized to carry out the project. Pihl & Miller, Wabash Building, Pittsburgh, Pa., contractors, are in charge.

SOUTH CHARLESTON, W. VA.—The Evans Lead Company, a subsidiary of the Ohio Alloy Company, Fostoria, Ohio, plans to construct a power house at its proposed local plant, to cost about $150,000.

WHEELING, W. VA.—Bids will be received by the city of Wheeling until Dec. 12 for three low-service and three high-service motor-driven centrifugal pumping engine units of 10,000,000, 15,000,000 and 20,000,000 gal. capacity. C. H. Dowler is city manager.

FRONT ROYAL, VA.—The Warren Power Company has acquired a hydro-electric power plant on Morgan's Ford. Extensions and improvements will be made, and the station tied in with the company's system.

NORFOLK, VA.—Henry B. Reardon, Jr., consulting engineer, Norfolk, has been engaged by W. G. Maupin to equip his steam-driven ice plant for electrical operation. Synchronous motors will be installed and a 500-kw. (approximately) 11,000/2,200-volt substation erected. Transformers, switchboard and other equipment will be required. Motors have been purchased.

SCOTTSVILLE, VA.—Preliminary plans are being prepared by the Big Bend Power Company for six hydro-electric plants on the James River with an initial power station to develop 30,000 hp. and a transmission system. The cost of the work is estimated at $3,000,000. The Ambler Engineering Company, Richmond, is engineer.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Dec. 12 for twenty portable electric drills and nine electric grinders (Schedule 295); also for a quantity of dry cells for Eastern and Western yards (Schedule 300).

North Central States

DETROIT, MICH.—The Stroh Products Company, 909 East Elizabeth Street, will build an addition to its power house.

EATON RAPIDS, MICH.—The Consumers' Power Company, Jackson, is planning to build a new plant in Eaton Rapids.

STANTON, MICH.—The municipal electric light plant has been purchased by the Stockbridge (Mich.) Light & Power Company. A new Diesel engine will be used to furnish power until water power from Langston is available. The company will overhaul the transmission lines and complete a new street-lighting system.

WHITEHILL, MICH. — The Commonwealth Light & Power Company, 141 Broadway, New York City, has purchased the property of the White River Power & Light Company, Whitehall. This purchase will make hydro-electric power available for Ludington, which is served by the Commonwealth company.

BAIRDSTOWN, OHIO.—The town Council has granted the North Baltimore (Ohio) Service Company a franchise to extend its light and power service to Bairdstown.

CINCINNATI, OHIO.—A 10,000-kw. substation will be erected by the Union Gas & Electric Company on Mitchell Avenue between Millcreek and the Baltimore Railroad. This station will carry the load of the Winto Place district and will eventually be of much larger capacity. The cost of the building will be about $40,000. C. W. De Forrest is chief engineer of the company.

CLEVELAND, OHIO.—The City Council contemplates the purchase of cables and accessories, to cost $40,000; ducts, manholes and underground equipment, $15,000, and transformers, poles, wire, etc., $55,000. G. Beckwith, City Hall, is engineer.

MARTIN'S FERRY, OHIO.—Bonds to the amount of $400,000 have been voted for the reconstruction of the municipal electric light plant and waterworks system.

TOLEDO, OHIO.—Plans have been prepared by the Chevrolet Motor Company, General Motors Building, Detroit, for the erection of a transmission manufacturing plant, 91 ft. x 450 ft., one story; heat-treating building, 100 ft. x 120 ft., one-story, and a power house, 60 ft. x 90 ft. A. Kahn, Marquette Building, Detroit, is architect.

INDIANAPOLIS, IND.—Electric power equipment, ice and refrigerating machinery will be installed in the proposed municipal market. The cost is estimated at about $1,000,000.

TERRE HAUTE, IND.—The Central Indiana Power Company has plans under way for the construction of a 10,000-hp. plant on the Wabash River, 12 miles south of Terre Haute. Property, including a coal mine, has been purchased. The cost of the project is estimated at $7,000,000. The company has taken over the systems of the Merchants' Light & Power Company, Indianapolis; the Wabash Valley Electric Company, Clinton, and the Brewer interests.

BLUE ISLAND, ILL.—The Public Service Company of Northern Illinois will erect a transmission line 10 miles from its local power plant to Worth, Chicago Ridge and Palos Park, to supply service in these towns.

CHICAGO, ILL.—The Vassar Swiss Underwear Company, 2545 Diversey Avenue, will install an engine-driven generator set, switchboard, etc., at its power plant. Lockwood, Greene & Company, 38 South Dearborn Street, are engineers.

EAU CLAIRE, WIS.—The Wisconsin-Minnesota Light & Power Company has been granted a franchise to extend its electric light and power service in the town of Anson.

FOND DU LAC, WIS.—Plans have been completed by the Gurney Refrigerator Company for a new factory building, 60 ft. x 107 ft., and a power house. Contract for buildings have been awarded, to cost about $50,000.

GREEN BAY, WIS. — Plans are under consideration for the installation of a progressive street-lighting system.

LADYSMITH, WIS.—The Lake Superior District Power Company has opened negotiations with the town officials of Glen Flora, Hawkins, Ingram, Kennan, Catawba and Prentice to furnish electricity for lamps and motors in these towns from its Big Falls hydro-electric plant. If sufficient business is guaranteed, a transmission line will be erected to supply the service.

MARINETTE, WIS.—The Wisconsin Public Utilities Corporation has acquired a site in Marinette on which it will erect a substation which will connect the 33,000-volt transmission line of the Menominee & Marinette Light & Traction Company with the 66,000-volt line now being erected from Pound.

SUPERIOR, WIS.—The Superior Water, Light & Power Company is planning to install a 2,000-kw. motor-generator set. Among the other improvements contemplated is the changing of a primary voltage from 2,300 to 4,000.

NORTHFIELD, MINN.—Plans are being prepared for the construction of a power house at Olaf's College, to cost about $50,000. John D. Small, 127 North Dearborn Street, Chicago, is engineer.

INDEPENDENCE, IOWA.—The Northeastern Iowa Power Company, Clermont, has started work on a new power station in Independence.

KNOXVILLE, IOWA.—Bids will be received by the director of the United States Veterans Bureau, office of the quartermaster-general, 2306 Munitions Building, Washington, D. C., until Dec. 12, for construction of a Neuro-Psychiatric Hospital at Knoxville, for the Veterans Bureau. The work will include the construction of fifteen buildings, complete with water, lighting, heating and sewer systems.

FREDERICKTOWN, MO.—The installation of two oil-burning units to cost about $25,000, in the municipal electric light plant is under consideration.

POPLAR BLUFF, MO.—The Council is considering the installation of a 500-hp. turbo-generator, to cost about $20,000, in the municipal electric light plant.

ST. LOUIS, MO.—The United Railways Company will construct by day labor its proposed power house and substation at Union Avenue and Maple Street, to cost about $75,000.

ST. LOUIS, MO.—The Light & Development Company of St. Louis, Railway Exchange Building, is preparing plans for a 20,000-kw. power plant on the Mississippi River, to cost about $2,000,000.

ST. LOUIS, MO.—Plans are being prepared by the United States Public Service Company, Railway Exchange Building, for extensions of transmission lines 15 miles in southeast Missouri, 40 miles in Texas and several miles near Mitchell, S. D., to cost $125,000; enlarging various power plants, at a cost of about $200,000, and extensions and equipment for same, $200,000. The company is associated with the Light & Development Company of St. Louis.

SEDALIA, MO. — The Sedalia Light & Traction Company is preparing plans for a power plant, to cost about $350,000.

PIERPONT, S. D. — The erection of a high-tension transmission line from Pierpont to Andover is under consideration. The town has contracted with the Aberdeen (S. D.) Light & Power Company to furnish electricity here.

MILFORD, KAN.—Bonds to the amount of $6,500 have been voted for the installation of a new electric light plant.

Southern States

ELIZABETH CITY, N. C.—Bonds to the amount of $550,000 have been voted for the installation of an electric light and power plant and waterworks system.

ATLANTA, GA.—The White Provision Company plans to build a power plant in connection with its new meat-packing plant on the Howell Mill Road, to cost about $350,000. Ice and refrigerating machinery will also be installed.

CHATTANOOGA, TENN.—The Southern Sheet Steel Company, recently organized, will build a power house in connection with its proposed local mills to cost about $1,000,000. W. J. Lynch, vice-president, is in charge.

BROOKHAVEN, MISS. — Bids will be received by the Mayor and Board of Aldermen until Dec. 5 for one 500-kw. steam turbo-generator, one condenser for turbine and switchboard. R. S. Purser is superintendent of the Light and Water Department.

TUNICA, MISS.—Bids will be received by the Board of Supervisors until Dce. 4 for electrical fixtures for the new court house. Frank P. Gates, Clarkesdale, is architect. L. C. Shannon is clerk.

HOUMA, LA.—Bids will be received by the Mayor and Board of Aldermen until Dec. 19 for construction of a waterworks system with mechanical filtration plant and electric power station, including a pumping plant of 1,000,000 gal. daily capacity, consisting of three units, including fire pump, rated at 1,000 gal. per minute, all motor-driven; oil engine-driven generator sets, 10,000,000-gal. earthen storage reservoir, 1-mile transmission line, etc. Massena L. Culley, Jackson, Miss., is designing engineer; T. Baker Smith, Houma, is resident engineer.

ADA, OKLA.—The Oklahoma Portland Cement Company will build a power plant for service at its local cement mill and its branch mill at Lawrence.

HENNESSEY, OKLA. — The Oklahoma Gas & Electric Company will rebuild its transmission line from Enid to Hennessey. Work has been started on a new line to Oilton, Okla.

WETUMKA, OKLA. — Plans are being prepared for extensions to the municipal electric light plant, waterworks and sewerage system, to cost about $150,000. V. V. Long & Company, Colcord Building, Oklahoma City, are consulting engineers.

BUENA VISTA, TEX.—Plans are being prepared for a new power house for the Chickasaw County Agricultural High School to replace the one recently destroyed by fire.

PANHANDLE, TEX. — Electric power equipment will be installed at the municipal waterworks in connection with proposed extensions, to cost about $50,000.

Pacific and Mountain States

MOUNT VERNON, WASH.—A hydro-electric project with an ultimate capacity of 40,000 hp. is being developed by the Delta Electric & Water Company in Skagit County. The first unit, to be located at the outlet of Lake Cavanaugh, will be equipped with a 1,500-kw. generating unit operating under a 105-ft. head. The company will sell energy at wholesale and will also supply service to about 1,000 rural consumers in the Mount Vernon-Skagit River delta district.

SEATTLE, WASH.—Bids will be received by the Board of Public Works, County-City Building, until Dec. 8 for superstructure machinery and electrical equipment of a steel bascule bridge and two side spans over the West Waterway at West Spokane Street. C. B. Bagley is secretary.

CORONADO, CAL.—The San Diego Consolidated Gas & Electric Company will make extensions and improvements to the local street-lighting system, to cost about $15,000.

LOS ANGELES, CAL.—Application has been filed by the city of Los Angeles with the United States Government for permission to build a power house on the aqueduct at Haiwee Narrows, 2 miles below the Haiwee Reservoir. The proposed power station will have a capacity of about 6,400 hp.

SAN DIEGO, CAL.—Bids will soon be called by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for telephone conduit, cables and terminals, for use at the local shipyard. (Specification 4757.)

SAN FRANCISCO, CAL.—Bids will be received by the city and county of San Francisco until Dec. 6 for an electric traveling crane for the Moccasin Creek power plant, contract No. 70, Hetch Hetchy water supply. W. J. Fitzgerald is secretary.

SAN FRANCISCO, CAL. — The Yuba Development Company, Hobart Building has been granted permission by the State Water Commission to construct a hydro-electric power plant on the North Yuba River, to develop 19,900 hp. at a cost of about $1,500,000.

SESPE, CAL.—The Sespe Light & Power Company has been granted permission to construct a 16,800-hp. hydro-electric plant on Sespe Creek, to cost about $5,000,000.

VENICE, CAL.—The Southern California Edison Company has filed plans for the erection of a substation on Virginia Avenue, to cost about $53,000.

WALLACE, IDAHO.—The Galena Mining Company, operated by the Callahan Zinc-Lead Company, will install electric power equipment in connection with its proposed new mill in the Cœur d'Alene district.

FLORENCE, ARIZ.—At an election held recently the proposal to issue $200 000 electric power district bonds was approved. It is proposed to erect a transmission line from the system of the Salt River Valley Water Users' Association at Sacaton to the State Prison. Other lines will be extended to Casa Grande through the farming district.

RAWLINS, WYO.—The Producers' & Refiners' Corporation, California Building, Denver, will build a power house and electric pumping plants in connection with its proposed new oil refinery at Greensville, near Rawlins, to have an initial capacity of 10,000 barrels per day.

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Canada

VANCOUVER, B. C.—The British Columbia Electric Railway Company has entered into a contract with the Britannia Mining & Smelting Company to furnish from 4,500 hp. to 6,000 hp. The power company will erect a 34,000-volt transmission line from North Vancouver to the mine at Britannia, a distance of 30 miles, to cost about $150,000. Energy will be delivered to a substation to be erected by the mining company.

WEST VANCOUVER, B. C.—A bylaw has been passed authorizing a contract for light and power service from the British Columbia Electric Railway Company. A distribution system, to cost about $35,000, will be installed.

BRANDON, MAN.—The Canada Gas & Electric Company contemplates improvements to its plant including the installation of new boilers and machinery.

BRODHAGEN, ONT. — The Council of Logan Township is considering the installation of an electric lighting and power distribution system, to cost about $40,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 31, 1922)

1,433,618. Metal Anode for Electrodeposition and Process of Producing Same; G. B. Hogaboom, New Britain, Conn. App. filed Feb. 25, 1921. Nickel anode with low rate of corrosion.

1,433,622. Brazed Rotor Construction; C. E. Johnson and N. E. Brown, Los Angeles, Calif. App. filed June 1, 1920. Applied to induction motors having bar-type rotor.

1,433,646. Liquid Rheostat; D. M. Petty, Bethelhem, Pa. App. filed June 23, 1921. Adapted for regulating large three-phase induction motor of the slip-ring type.

1,433,669. Storage Battery; M. J. Towns, Tyler, Tex. App. filed April 8, 1921. Separators fastened to bottom of battery extend part way up.

1,433,674. Electrically Heated Drying Roll for Printing Presses; M. J. Carl, Cleveland, Ohio. App. filed June 14, 1921. Sheets pass over roll before delivery.

1,433,680. Plate Terminal for Storage Batteries; B. Ford, Philadelphia, Pa. App. filed June 9, 1920.

1,433,681. Secondary or Storage Battery; B. Ford, Philadelphia, Pa. App. filed March 21, 1922. Pertains to connections for storage-battery parts.

1,433,686. Device for Attaching Conductors to Brushes; W. Siebenmorgen, Westfield, N. J. App. filed Nov. 4, 1919. Pigtails on opposite side held by screws.

1,433,687. Device for Attaching Conductors to Brushes; W. Siebenmorgen, Westfield, N. J. App. filed April 3, 1922. Plates holding pigtails bolted through brush.

1,433,691. Heat Cartridge; J. C. Woodson, Mansfield, Ohio. App. filed Nov. 20, 1920. Inclosed heating element of compact form.

1,433,693. Film Cut-Out; A. L. Atherton, Edgewood Park, Pa. App. filed Aug. 10, 1918. Film cut-out for series-lighting system.

1,433,697. Resistor; A. H. Candee, Pittsburgh, Pa. App. filed Feb. 15, 1919. Arrangement by which the grids may be properly spaced.

1,433,698. Electric Water Heater; C. H. Carlson, Minneapolis, Minn. App. filed Aug. 29, 1921. Heating element placed in supply pipe.

1,433,700. Electric Tool-Tempering Furnace; O. A. Colby, Irwin, Pa. App. filed May 4, 1920. Electric resistance type.

1,433,701. Transformer; G. H. Cole, Wilkinsburg, Pa. App. filed Nov. 20, 1920. Tongue wedge constructed of non-conducting and non-magnetic material.

1,433,711. Electric Air Heater; F. F. Forshee, Flint, Mich. App. filed Dec. 2, 1920. Reflector-type room heater.

1,433,712. Circuit-Interrupting Device; C. LeG. Fortescue, Pittsburgh, Pa. App. filed June 17, 1918. Relay trips circuit when surge comes on line.

1,433,717. Electrical System; A. J. Hall, Wilkinsburg, Pa. App. filed Oct. 30, 1918. Circuit-breaking closed pneumatically and tripped electrically.

1,433,725. Control of Single-Phase Motors; O. S. Jennings, Wilkinsburg, Pa. App. filed June 13, 1917. Split-phase type operated over wide range of speed.

1,433,726. Motor-Control System; H. H. Johnston, Edgewood, Pa. App. filed Jan. 14, 1921. Automatic acceleration of industrial locomotive when operator actuates controller too rapidly.

1,433,735. Sherardizing Furnace; A. M. MacFarland, Pittsburgh, Pa. App. filed Aug. 18, 1921. Tiltable double-wall heat-insulating tubular casing.

1,433,736. Electrolytic Apparatus; R. D. Mershon, New York, N. Y. App. filed Feb. 27, 1920. Pertains to flow of electrolyte in condensers, rectifiers and lightning arresters.

1,433,739. Electrical Measuring Instrument; W. G. Mylius, Wilkinsburg, Pa. App. filed Oct. 8, 1918. Attachment for integrating watt-hour meter to constitute a maximum-demand meter.

1,433,740. Rheostat; H. C. Nagel, Wilkinsburg, Pa. App. filed Dec. 22, 1919. Pair of resistors side by side and sliding steel ball resting upon both resistors.

1,433,749. Car-Lighting System; G. F. Smith, Wilkinsburg, Pa. App. filed Dec. 22, 1919. Supplies constant voltage.

1,433,750. Rheostat; T. Spooner, Pittsburgh, Pa. App. filed Dec. 17, 1919. Slide-wire resistance.

1,433,752. Blower for Dynamo-Electric Machines; C. W. Starker, Pittsburgh, Pa. App. filed Feb. 8, 1918. Air-agitating device attachable to rotating member.

1,433,758. Electric Car-Heating System; F. Thornton, Jr., Mansfield, Ohio. App. filed May 4, 1920. Car-heating element located in seat pedestal.

1,433,760. Electric Starter for Internal-Combustion Engines; Z. R. della Veneria, Turin, Italy. App. filed March 11, 1921.

1,433,765. Single-Phase Motor; C. A. M. Weber, Edgewood Park, Pa. App. filed June 29, 1918. Split-phase type.

1,433,807. Incandescent Lamp; F. A. Feldkamp, Newark, N. J. App. filed Sept. 26, 1919. Double filament with automatic means to connect one when other is burned out.

1,433,827. Electrodeposit Winding; A. Kimble, Wausau, Wis. App. filed May 12, 1919. Galvanizing rotor core and applying electrodeposit of copper thereto.

1,433,852. Electrical Collecting Brush Structure; F. L. Sessions, Lakewood, Ohio. App. filed Jan. 3, 1921. Current collector for welding machine.

1,433,853. Method of Electric Welding; G. H. Sethman, Denver, Col. App. filed April 13, 1922. Potential wave form is such that its front face is sinusoidal, top is flat and rear face is logarithmic curve.

1,433,883. Electric Furnace; K. Friderich, Paris, France. App. filed May 14, 1920. For fixation of atmospheric nitrogen.

1,433,915. Radiator and Electric Heating Fireplace; L. M. Specht, Chicago, Ill. App. filed April 18, 1919.

1,433,932. Electric Resistance Element; W. P. Bovard, Mansfield, Ohio. App. filed Dec. 20, 1921. Unit type for controlling circuits.

1,433,948. Rheostat; J. Granz, Duluth, Minn. App. filed April 11, 1921. Slide-wire resistor wound on circular core.

1,433,951. Three-Position Tractive Relay; A. B. Kendall, Maywood, Ill. App. filed Oct. 28, 1920.

1,433,952. Locking Device for Relay Armatures; A. B. Kendall, Maywood. Ill. App. filed Oct. 28, 1920.

1,433,960. Resistance; N. D. Levin, Columbus, Ohio. App. filed March 31, 1921. For controlling traction motors.

1,433,962. Control Means for Electromagnetic Hammers and the Like; F. W. Meyer, Milwaukee, Wis. App. filed March 18, 1918. For either alternating or direct current.

1,433,973. Ramp Rail; A. G. Shaver, Chicago, Ill. App. filed May 12, 1919. Third-rail made up of two metals bolted together.

1,433,989. Automatic Speed Signal Device; A. M. Echternach, Seattle, Wash. App. filed Jan. 11, 1921. For automobiles.

1,434,010. Electric Fixtures; W. A. Harvey, Scranton, Pa. App. filed Aug. 13, 1919. Plug attachment for permanent electric wall and ceiling fixtures.

1,434,041. Electric Light; C. H. Burton, Washington. D. C. App. filed April 2, 1920. Light attachment for battery cells.

1,434,053. Electric Furnace; F. A. J. FitzGerald, Niagara Falls, N. Y. App. filed Dec. 9, 1920. Furnace for calcining carbonaceous material.

1,434,055. Motor-Control System; C. T. Henderson, Milwaukee, Wis. App. filed Sept. 14, 1908. Control of compound motor.

1,434,064. Method of and Apparatus for Fac-Simile Telegraphy; A. Monteilhet, Paris, France. App. filed Sept. 15, 1913.

1,434,072. Alarm Signal System for Automatic Water-Gas-Set Controls; J. H. Taussig, Philadelphia, Pa. App. filed Dec. 20, 1919.

1,434,136. Electromagnetic Coupling; K. Meller, Siemensstadt, near Berlin, Germany. App. filed June 21, 1921. Series regulating resistances for adjustment.

1,434,142. Signal for Autos and Other Vehicles; J. O'Donnell, Jr., Philadelphia, Pa. App. filed Sept. 11, 1920. Rear signal indicating right and left turn, stop and back.

1,434,158. Motor-Control System; W. H. Scott, Norwich, England. App. filed Jan. 30, 1920. Electric telemotor for reproducing movements at a distance.

1,434,172. Rheostat for Electric Lamps; J. H. Wagenhorst, Jackson, Mich. App. filed Feb. 23, 1922. Control of arc lamp used for blueprinting.

1,434,214. Rail Bond; J. G. Kjellgren, Cleveland, Ohio. App. filed Nov. 22, 1916. Pencil-weld method.

1,434,225. Resistance Unit; G. A. Rice, Cambridge, Mass. App. filed April 18, 1922. Self-contained unit for use alone or in series with similar units.

1,434,283. Telegraph; A. Cunningham, Brooklyn, N. Y. App. filed Dec. 14, 1917. Selenium cell used for amplifying signals on long submarine cables.

1,434,285. Electric Welding Machine; F. G. Gale, Waterville, Quebec, Can. App. filed Oct. 21, 1921. Welds the ends of a plurality of tubes or bars simultaneously to side of another tube or bar.

1,434,293. Trolley Wheel and Frog; J. Kushnier, Avella, Pa. App. filed May 27, 1922. Frog constructed to prevent wheel jumping from wire at turns and crossings.

1,434,303. Electric Battery; E. L. Marshall, Fremont, Ohio. App. filed Feb. 18, 1915. Uncooked flour between the container and lining.

1,434,307. Storage-Battery Post; E. A. Miller, Youngstown, Ohio. App. filed Oct. 28, 1920.

1,434,309. Starter for Internal-Combustion Engines; T. E. Nelson, Minneapolis, Minn. App. filed May 13, 1920.

1,434,310. Vacuum Rectifier; J. Nienhold, Berlin, Germany. App. filed Feb. 21, 1921. Mercury-vapor rectifier filled with rare gas.

1,434,316. Bearing End Plate for the Ignition Apparatus of Internal-Combustion Engines; J. Schneider F. Billon, Solothurn, and E. Hurlimann, Zuchwil, Switzerland. App. filed Aug. 22, 1919.

1,434,321. Battery Box; A. P. Taber, Red Wing, Minn. App. filed June 6, 1922. for holding "B" batteries.

1,434,346. Apparatus for Regulating the Voltage of Metal Vapor Rectifier Installations; J. Jonas, Baden, Switzerland. App. filed Oct. 4, 1920. Regulated by direct-current source.

(Issued Nov. 7, 1922)

1,434,362. System of Electrical Distribution; W. L. Bliss, Niagara Falls, N. Y. App. filed Feb. 26, 1917. Voltage regulation on variable-speed generator.

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The Quickening Spirit

THESE are great days to be alive and working in this electrical industry of ours. For a quickening spirit is abroad. The subconscious weariness and relaxation that followed the exhaustion of the great war have tapered off. We see it. We feel it. We know that this is so.

The first reaction came when men began to talk courageously and voice an optimistic confidence. Out of this phase of bolstering conversation, this twilight zone of doubting hope, we have come into the warming sunlight of belief, and men have freed their minds to do progressive things.

ALL this does not apply to the engineer so literally. While there has been cause for encouragement, there have been also delays and disappointments. In many cases his plans for progress have had to wait. The engineer has worked out the next step in expansion. Development for him takes shape in full detail on paper first and lies in readiness subject to the influences of changing times. But to the executive, the business man, the market builder it means the difference between day and night. And this has been expressed in many ways.

The N.E.L.A. Commercial Bureaus met in Boston recently and the quickening spirit exhibited itself. These men are eager for new light in their councils. They realize that their ranks are thinned, and now comes pressure from above and from within to build the central station commercially. The urge is strong. The way will be worked out.

The jobbers meet, and the dominant thought is that the electrical dealer must be helped and strengthened by a more substantial co-operation. There is a quickening spirit in the purpose, clearly expressed, to do this thing right now.

And there is a quickening spirit in the present plans and work of the organized groups of electrical manufacturers. It is seen, for instance, in a more fixed determination to develop industry statistics that will guide production and to reduce the number of excess varieties that now burden everybody's overhead.

And the continuing discussion of the unknown cost of merchandising in electric stores is another token of the quickening spirit. For it will crystallize in knowledge that will benefit the entire industry.

WE STAND upon the brink of better times and bigger opportunities. We are going forward again. Houses are being built. Factories are working back to full production. Money is cheaper and once more things can be done. The electrical industry will continue to surge ahead.

But we must not forget that it will be no war boom. We cannot hope now once again to float up-tide upon a wave of rising prices. This quickening spirit that we feel must be sustained by vigorous creative work. It must have some foundation in sound knowledge and straight thinking.

A. Emory Wishon

An active exponent of good public relations who is fertile in ideas for developing the electrical industry.

"BACK of practically every human activity," says A. Emory Wishon, general manager of the San Joaquin Light & Power Corporation of Fresno, Cal., "is self-interest. Particularly is it to be found in those activities which apparently make solely for community interest, for in community interest is self-interest best served." Of the gospel of the indissoluble business interrelationship between the electrical industry and community growth—a connection so intimate that the citizen in his own interest must become a strong supporter of his public service utility—Mr. Wishon is the original apostle. By bringing home to the individual the thought of his own welfare as served by community prosperity, progress and development, public utility corporations have established better feeling and clearer understanding with their patrons in every part of the country.

Mr. Wishon did not start life with the ambition to manage a power company. He was born in Missouri and was graduated as a mining engineer from the University of Missouri in 1908. Fate, however, and a family inclination to move, brought him soon after his college days to Coalinga, Cal. Here he promoted the Coalinga Water & Power Company and taught the oil men that it is cheaper to use electric power for pumping oil than it is to use steam power with the oil itself for fuel. Aside from one or two minor installations of direct-current motors in Eastern oil fields, this was the first application of electric power to the pumping of oil, and the fact that appropriate alternating-current motors were worked out by the manufacturers to meet practical oil-field conditions and that the oil men themselves were finally persuaded to try the experiment must be credited alone to Mr. Wishon's foresight and persistence. Since that time electric service has been generally adopted until there are now 37,000 hp. in motors engaged in oil-well pumping on the San Joaquin company's lines and the method is being generally adopted in other parts of the country.

From his Coalinga days Mr. Wishon has progressed steadily further and further away from mining and further and further along the lines of power, until now he is not only general manager of the San Joaquin Light & Power Corporation, but of the Midland Counties Public Service Corporation, the Fresno City Water Company and the Bakersfield & Kern Electric Railway Company. He was one of the originators of the California Electrical Co-operative campaign. In 1919-1920 he served as president of the Pacific Coast Electrical Association.

Editorial Comment

Electrical World, December 2, 1922
Volume 80 Number 23

Safeguarding Public Utility Securities

THE rapidity with which issues of public utility securities are being bought shows the necessity of throwing some safeguards around them in the public interest as well as in that of the industry. Unscrupulous persons can be counted on to take advantage of the situation which feverish buying creates and thereby work havoc with legitimate investments. For instance, the craze for radio was followed by the formation of thousands of spurious radio corporations and the issuance of bales of worthless stock. So monumental and scandalous became the situation that the Department of Justice was soon on the trail of the malefactors. Before a similar deluge of worthless securities overtakes the electric light and power industry every consideration of right and prudence demands that steps be taken to checkmate it.

M. H. Aylesworth, executive manager of the National Electric Light Association, did well in bringing the matter to the attention of the National Association of Railway and Utilities Commissioners and pleading with them to permit only stocks of unquestioned merit and stability to be issued. Similar action has been started by the Investment Bankers' Association, and if the industry will in turn police itself, public confidence will not be abused and much mental anguish will be avoided.

Customer-ownership campaigns are now well under way, and the temptation on the part of weak companies to float securities of doubtful value is very great. Any such tendency must be nipped in the bud, and the commissions and the public utilities which they regulate should be most concerned in bringing about action to this end.

The Rights of a Municipality Served by a Private Company

THE recent reversal by the United States Circuit Court of Appeals of a decision of the district court which had given to the city of Los Angeles the right to condemn a power site in the Owens River gorge belonging to the Southern Sierras Power Company established certain rights of a municipality in regard to water power when that municipality is served through the agency of a privately owned public utility. The lower court, holding that the use of the water by a municipality constitutes a higher use than that by a private corporation, awarded the site to Los Angeles. The Southern Sierras company contended that the power generated by it at the site was used in the service of municipalities other than Los Angeles which had an equal right to the water.

In reversing the decision of the district court the Court of Appeals held that the property of private corporations appropriated to public use in one county may not be appropriated to public use by any other county or city and county while such property is so appropriated and so used. This states clearly the rights of the municipality which is privately served as against that which develops its own power. There has been loose thinking on this subject, and it is a satisfaction to have a court decision at length supporting the reasonable side of the dispute. Every city has the right, if it so desires and expresses itself by a vote of its people, to develop its own water and power supply. By that decision, however, it does not acquire a prior right to all water and power sites as against other sections which have elected to be served by private companies. The advantages claimed by the advocates of municipal and state ownership in all parts of the country are almost entirely those based upon just such special and unjustifiable privileges. It is gradually coming to be realized that exemption from taxation of municipal bonds as well as of the systems themselves is nothing less than a subsidy of the municipality in question at the expense of the rest of the state. The decision under discussion is significant. It gives hope that the time may come when all such factors will be understood and such questions settled upon their real merits.

Unreasonableness of Rates Must Be Established Before Change

IN MANY states the filing of a changed rate schedule with the public utility commission automatically makes it effective within a specified time. Regulatory laws, however, are not uniform in this respect. There are here and there statutes which prohibit the abrogation of a contract for rates with a public utility except after a finding that they are unreasonable. That is, while all contracts are necessarily subject to the legitimate exercise of the police power of the state, it is obligatory on the commission to establish the fact by hearings and show in its finding that the contract rates are unreasonable. Mere averments will not suffice.

This principle has been established by the United States Supreme Court in the case of the Wichita Railroad & Light Company against the Public Utilities Commission of the State of Kansas. Here the Supreme Court insists that an express finding of unreasonableness by the commission was indispensable under the statutes of the state. The appellant purchased energy from the Kansas Gas & Electric Company under a contract terminating in 1930. Under a ruling of the Public Utilities Commission of Kansas, the Kansas Gas & Electric Company was permitted to add a surcharge, based on the cost of fuel, to the rates fixed by contract with the Wichita Railroad & Light Company. The rates thus fixed were substantially higher than the contract rates, and a bill of equity was filed against the commission in the United States District Court for Kansas, the appeal alleging that the order impaired the contract existing between the Kansas Gas & Electric

Company and the Wichita Railroad & Light Company and that the rates fixed were unjust and unjustly discriminatory against the Wichita company, which was the largest customer of the Kansas company, and that the increase in rates violated every equitable rule of rate making and deprived the company of its property without due process of law, besides denying it equal protection of the laws.

The district court issued a temporary injunction, which was set aside by the Circuit Court of Appeals, whereupon the Wichita company appealed to the United States Supreme Court. That court, in reviewing the case and the creation of administrative agencies of the Legislature, holds "that it is a wholesome and necessary principle that such an agency [the Public Utilities Commission] must pursue the procedure and rules enjoined and show a substantial compliance therewith to give validity to its action. When, therefore, such an administrative agency is required, as a condition precedent to an order, to make a finding of facts, the validity of the order must rest upon the needed finding. If it is lacking, the order is ineffective."

Renewed Activity in Steam-Plant Design

THE present activity in the building of power stations has served to stimulate renewed research into the properties of steam and has revived study and discussion of the economies obtainable by the use of higher pressures and superheats. Of course, any discussion of possible efficiencies is affected by the type of expansion cycle used, whether Rankine, Carnot or some other, and the deviation of the actual from the theoretical. Furthermore, with the degree of exactness now required in thermal calculations, the inaccuracies and discrepancies between the existing steam tables—for no two agree—impose limitations upon the usefulness of final results. New research is therefore directed toward acquiring exact data on the properties of steam.

Doubtless there will be found to be several economies resulting from the use of higher steam pressures and temperatures, but the latter item in particular still complicates the practical application of the theoretical principles. Materials so far developed limit the use of extremely high temperatures accompanied by pressure. The alloy steel with special treatment seems to offer opportunity for a successful development as regards boiler tubes and piping, but the superheaters and valves present more difficult problems. The valve, with its unequal expansion and contraction when subjected to temperature changes, is a particularly weak link in the steam chain. In Europe, especially with experimental installations, valve designs have been reported with the metal so distributed as to equalize temperature stresses. As far as that goes, the claim is made that, in general, European steam valves are in this particular better designed than American valves.

Still other elements of the problem are the proper type of joint to use, the question of heat insulation and the extra cost of special materials and of installation. All parts of the problem, however, are subject to an engineering solution, and, judging from the serious attacks now being made upon it by capable engineers, the future should see a degree of development which will cause a marked increase in the use of high-pressure and high-temperature steam in large stations.

How Shall the Rural-Service Problem Be Solved?

ELSEWHERE in this issue will be found a review of some of the high points of the rural-line service situation as it now exists. Conditions have changed radically in the past year. A year ago the farmer was feeling the pinch of deflation. That pinch is still felt, but it is lessening to a remarkable degree, and those who deal with agricultural territories are finding the farmer a shrewd and careful buyer and one who will get the thing he is convinced he wants. That situation is making itself evident in a decided increase in the demand for farm service. There is also evident a decided tendency to question closely the practices on which the service is established. Though this question is coming largely from the individual at the present moment, it will not be long until the organized agencies and the agricultural press will be drawn into the discussion. With this condition rapidly developing it is clearly evident that what has been largely a central-station problem will soon cease to be that and become a joint problem.

What can be done through co-operative effort and how that effort can be organized are questions that cannot yet be answered in detail. That all interested parties should attack the problem as one of common interest and find the solution on sound economic grounds no one can gainsay. In political influence and in nearly all other aspects the American farmer is perhaps the most important factor in our national life. If he demands electric service, he must either have it given to him on a sound economic basis or be shown clearly and without question why he cannot have it. He cannot be told to hunt a warmer climate as some are inclined to tell him when the subject is mentioned. The question must be faced sooner or later. Facing it voluntarily is much easier than facing it by force of public opinion under the threat of legislation which may be instigated as a result of the activities of antagonistic interests.

Reliable Switch Operation by Radio Control

WE HAVE heard a great deal during the last few years about remote control of divers things, from a gocart to a battleship, by radio. Enough experiments have been made to prove that the thing can be successfully done, as might indeed be anticipated. Given a sufficient amount of available energy, it makes no particular difference whether the apparatus to be controlled receives its directing impulses by wire or wireless—the principles of control remain quite the same. Broadly, all such equipments are worked, if more than a very few combinations are necessary, by what is practically a step-by-step mechanism, such as has been in use for many years in the automatic telephone and in the control of dirigible torpedoes. To pass from wire control to wireless is in principle and in fact a simple enough matter, but when it comes to be worked out in a practical way for every-day use the wireless control is much more delicate than the earlier method. This is chiefly because there are opportunities for interference in wireless control which are not present where a conductor is available. The big difference therefore, and the big step in advance which has to be made to reach success in wireless control, is in such elimination of interference as will enable the wireless impulses to operate the necessary relays without interruptions of service or false alarms.

The paper by F. W. Dunmore of the Bureau of Standards which we publish this week gives a very interesting view of the way in which a radio-control relay can be made to meet the necessary demands of a controlled system. The ingenuity of the experts of the bureau has apparently evolved a delicate and reliable relay capable of receiving and passing on the impulses from a distant station in an extremely efficient way. Given the relay and the means of tuning so as to receive signals selectively from a desired station, the apparatus can be put to a wide variety of uses, as Mr. Dunmore shows. By the cleverly conceived plan of working at different audio frequencies while operating at substantially the same wave length, the tuning out of undesirable stations seems to be accomplished so successfully that interference even when the received impulses are of nearly the same strength is renderd unlikely.

The connections and description of the apparatus tell their own story of successful ingenuity. The main point is that, thanks to the activity of the radio laboratory of the Bureau of Standards, an admirable relay has been developed capable of being put to a wide variety of uses in the way of remote control. With this relay, which is the secret of the whole matter, the rest of the accomplishment is relatively easy. The vital question from the standpoint of the engineer is whether this new relay is rugged enough and reliable enough to be thoroughly dependable twenty-four hours a day and fifty-two weeks in the year if it has reasonable care. Questions of this sort can be answered only by an appeal to experience which is not yet available. Remote control of an automatic substation or switching stations for various purposes is, of course, a thing very greatly to be desired, and we hope that at an early date some progressive company will try out the plan on a scale sufficient to give definite information as to its applicability. Hitherto radio as a means of communication, however convenient, has not given satisfactory proof of continuous reliability; hence the importance which we attach to this announcement of what appears to be a greatly improved receiving apparatus.

Specialized Applications in Underground Electric Systems

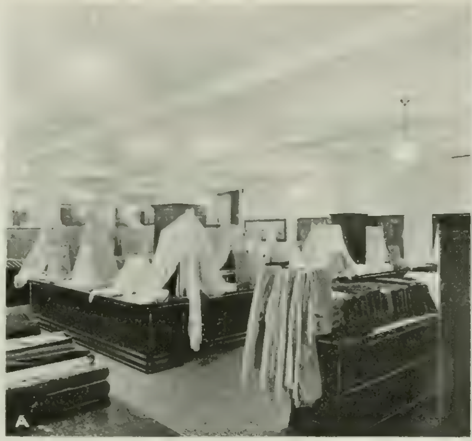
THE system for the supply of electricity in mines and similar underground workings has been developed as a specialized application and offers several contrasts to overhead installations. It has been a growth along lines dictated by the abnormal environment. It is startling as well as interesting to find substations far underground and supplied by high-tension cables installed in bore holes. Moreover, the methods of installing cables in confined spaces subject to gases, acids and moisture are distinctly specialized. Safety is a primary consideration in many of these underground installations, for a spark in a coal mine, for example, may result in an explosion. Secondary considerations are portability, flexibility and equipment that uses a minimum amount of space. Even the weight of the cable must be considered, as is brought out in the article on "Installing Pit Shaft Cables" published in this issue.

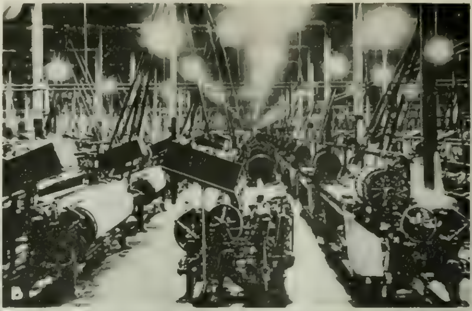
A very rapid development is occurring in installations of this type, marked by the use of automatic equipment, of new types of cables and of new methods for installation. The close co-operation of engineers in this line of endeavor with those connected with overhead systems has resulted in mutual advantages.

The Electrically Heated Boiler in Practical Use

THE proposal to utilize electrical energy for the direct heating of boilers for the production of steam is a very old one in the electrical art. It would be a matter of interest to know how many times this particular device has turned up in the Patent Office in the last forty years. Looking at the matter from the viewpoint of larger utility, using electrical energy to produce steam for industrial heating by a relatively very inefficient prime mover would seem to be about as unpromising from the standpoint of economy as any procedure which could be imagined. Yet as a matter of fact there are instances in which the electrically heated boiler may be decidedly the less of several evils, and it has actually pushed its way into use abroad. Where there exists at times in a hydro-electric plant a surplus of water which cannot itself be economically stored and which cannot conveniently be put to other than electrical purposes, there may well be a limited field for the boiler-heating scheme. In most American practice, if surplus capacity unusable in ordinary electric ways exists, it cannot be utilized indirectly by the production of steam, for lack of suitable market. In order for the boiler-heating idea to become worth considering economically one must assume conditions where hydraulic storage directly or by accumulators is not feasible, and where a storage battery is for one reason or another inadvisable for use to do the same work.

Natural or artificial water storage is the usual answer to irregularities of flow. There are conditions, however, when it becomes unreasonably expensive. The hydraulic accumulators or compressed-air distribution may furnish within narrow limits means of utilizing extra power during periods when the electric plant itself cannot meet the necessary requirements. Both these plans are somewhat inefficient and expensive. The storage battery is expensive, although efficient even where direct current is utilized. It ceases to be an efficient reliance, however, when the current must be converted from alternating to direct before the charging process and reconverted thereafter. There may exist conditions where heating a steam boiler electrically will prove a useful procedure. For example, if a hydro-electric plant have considerable surplus power at odd times, it can be stored as superheated water over part of the working day and used to assume the night load while the reservoir is filling up for the normal day's run. Or a similar process can be used where some industry has to be operated at a time otherwise very disadvantageous for the supply plant, as, for example, when it is necessary to store power for an unpleasantly great lap load. As the article which we publish this week on the subject indicates, a properly designed and insulated electrically heated boiler stores the heat with such great efficiency as to make up in simplicity of apparatus and low cost for the necessarily somewhat low efficiency of the prime mover operated. In other words, the method within certain rather close limitations has given sufficient promise of usefulness to be brought into service on a considerable scale as an auxiliary and offers some advantages in certain localities.





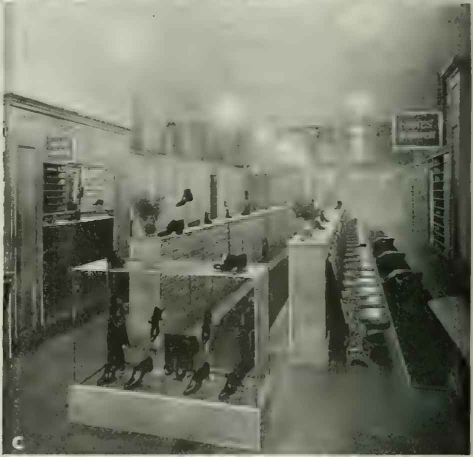
Modern Lighting Applications Result in Increased Intensity, Minimized Glare and Flexible Operation

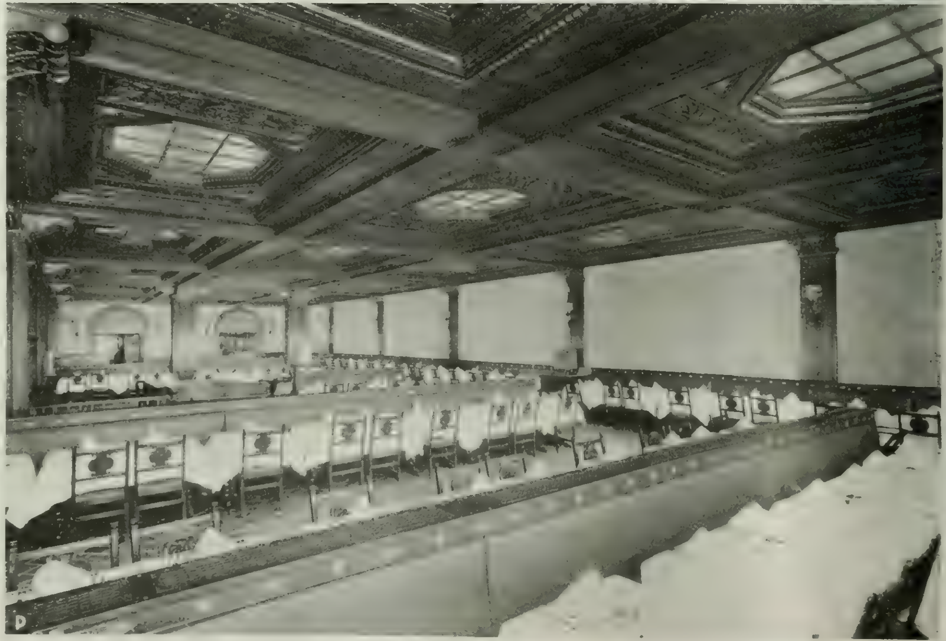
A—Uniform distribution of illumination features display space in R. H. Stearns & Company store, Boston.

B—Clear-cut illumination and absence of sharp shadows are secured by new installation in weave room of American Printing Company, Fall River, Mass.

C—Well-spaced overhead units provide good lighting for this shoe store.

D — Artificial sunlight supplemented by bracket lighting gives pleasing results in new Ambassador Restaurant, Boston.





Remote Control for Small Plants

How Parallel Operation of Two Small Hydraulic Plants Was Made Possible Without Excessive Cost to Take Care of a Load Suddenly Increased by War Requirements

By **E. S. LINCOLN**
Consulting Engineer, Portland, Me.

HYDRO-ELECTRIC AUXILIARY STATION BUILT OF REINFORCED CONCRETE FOR REMOTE-CONTROL OPERATION

DURING the late war a small power plant in Maine which was running at full load was confronted with the problem of supplying considerable additional power for use in shipyards and other new industries. The company served a small population and had a large transmission system and a limited supply of water. It had available one generating station of 400 kw. capacity and was supplying two communities, one within 3 miles of the plant and the other 17.5 miles away. In the same building with the power plant was a mill which took 50 per cent of the output of the entire plant with a load factor of nearly 100 per cent.

Additional power by steam generation was out of the question owing to the prohibitive cost of operation. The problem was solved by developing on a nearby stream a small hydro-electric plant which was controlled from the main generating station.

Fig. No. 1 shows diagrammatically the location of the power plants in relation to the various towns served. The greatest amount of energy outside of the mill at the main plant was consumed through the substation shown in the diagram and marked "Boothbay Harbor." The lines feeding this substation were protected by directional power relays, which would disconnect either transmission line in case of difficulty, thus allowing the second line to carry the entire load. The arrangement was very flexible, making it possible to supply energy from either station to any part of the system, even in case of a break in one of the transmission lines.

The main generating station contained two 200-kw. belted generators driven by two Holyoke turbines operating under a 50-ft. head. The water power consisted of a lake containing approximately a billion cubic feet of water and fed by a drainage area of 57 square miles. The development was practically based on storage, depending upon the spring rains and melting snows for its water. From this station a 2,200-volt circuit was connected to a small substation and the voltage stepped up to 11,000 for transmission.

Additional power was supplied by building a small hydro-electric station 9 miles from the main station and on a different watershed. This station was made of reinforced concrete, as was also the surge tank shown with it in the illustration above.

The water power was supplied from a chain of lakes storing about eight hundred million cubic feet of water and having a drainage area of approximately 36 square miles. This also was a storage development and worked out very satisfactorily by proper use of the water between the two stations. By building a dam 50 ft. in length on the ledge a 27-ft. head was obtained.

The waterwheel contains two runners and these are controlled by separate gates. A small belted generator of 100 kva. rating is for use during low water. As the head drops the turbine cannot maintain its rated speed with any economy. During this period one of the gates is closed and one runner of the waterwheel is allowed to operate at a lower and more economical speed. The turbine is then belted to the small generator and the larger generator allowed to operate for its flywheel effect.

OPERATING CONDITIONS ARE VARIABLE

This station can be operated either by an attendant or from the main generating station at Damariscotta by means of a "home-made" remote-control system.

The operating conditions were such that "automatic" control was out of the question since it would prove too costly for such a small system. There are times when it is necessary to operate both plants at full load and other times when the plants are operated separately. This depends entirely upon the load conditions and the amount of water available in each of the storage basins. The lower-head plant (27 ft.) was always run when it was possible to save water in the main plant, which with its higher head would produce more power than the other.

Any arrangement for operating the plant according to the level of the lake was impracticable, as in such a large storage basin the changes were very gradual. Under the circumstances it was decided to install the simplest possible control system—one that could be taken care of by the average operator. In small towns it is difficult to obtain the services of a competent operator, and with the modern plant there is very little for him to do. Under the circumstances a remote-control system was installed which would allow the operator to devote considerable time to line work, reading meters and getting new customers and to visit the plant about once a week or whenever necessity required his presence.

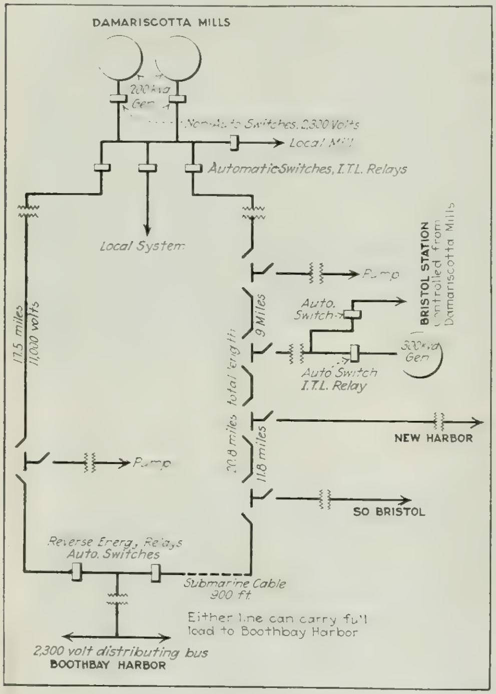


FIG. 1—AN INTERCONNECTED NETWORK WHICH NECESSITATED PARALLEL OR SEPARATE OPERATION OF THE PLANTS COMPLICATED THE CONTROL SYSTEM

Control System Uses Polarized Relays

The system decided upon is shown in Fig. 5. The principle of its operation lies in the use of polarized relays. Each relay requires only one wire, and the return circuit for any number of relays can be taken care of by a single or common wire. By means of a double-throw, single-pole switch each relay can perform two functions, such as turning a switch on or off.

The polarized relays used in this system are installed in the Bristol station and shown at *A*, *B* and *C*. The single-pole, double-throw, momentary-contact switches which control these relays are shown at *D*, *E* and *F* in the main power house. The relays are shown in Fig. No. 4 in the middle of the left-hand panel. Above these relays are shown switches and instruments which are used for charging the storage batteries used in connection with the system. These relays, when the control system is in use, operate the remote-control switch and rheostat, which are shown back of the panel. When local control of the station is desired it is taken care of by the remote-control switches on the right-hand panel. Neither method of control is affected by the other, and it is unnecessary to turn any switch to change from remote to hand control. If at any time remote control is not desired, the disconnecting switches in the station can be used.

The control system at the Bristol station stops and starts the waterwheel, regulates the generator voltage, turns the main swich on and off, synchronizes and gives the load on the station. This is done by the use of six galvanized-iron telephone wires which run parallel with the 11,000-volt high-tension system and on the same poles. Considerable difficulty from induction was experienced, but this was eliminated by transposing both transmission and control wires. Overloads on the station are taken care of in the usual way by overload relays, and bearings are protected by means of thermostats used in connection with relays in the usual way.

Wattmeters Indicate Load Conditions

At the main station a wattmeter having a zero center is connected in the line between the two stations. By means of this wattmeter the direction of power and the amount of power can be obtained. All possible conditions of load occur on the system within the limits of the station, sometimes in one direction in one transmission line and in the opposite in the other line, according to circumstances. By means of the wattmeter just mentioned and those on the other lines and the generators the exact load conditions of the system can be obtained. There are several operating problems that might arise with such a system, but they have not manifested themselves in this particular case. A question presented itself as to the method of notifying the operator in the main station in case the main switch in the Bristol station should be thrown out. Such an occurrence would undoubtedly be caused by a short circuit on the line, which in such a small system usually trips the switch in both stations. The operator would find this

LIST OF MATERIAL FOR CONTROL SYSTEM

(Total Cost $750)

Main Stations	Controlled Station
Battery 56 cells type CT, storage battery 1 voltmeter, 0-60 1 ammeter, 0-3 2 DPST switches, 30 amp.	Battery: 56 cells type CT, storage-battery 1 voltmeter, 0-150 1 ammeter, 0-3 2 DPDT switches, 30 amp.
Line: 5 lightning arresters 6 SPST 15-amp. disconnecting switches. 6 Edison fuses	Line: 5 lightning arresters 6 SPST disconnecting switches
Control System: 3 momentary-contact switches 1 DPDT switch, 30 amp. 1 reactance, 78.2 ohms. 1 250-ohm telegraph relay 1 load meter (millivoltmeter and shunt)	Control System: 3 polarized relays 1 reactor, 78.9 ohms 1 potential transformer, 2,200-354 volts

out from the load-indicating device on the waterwheel, which would show that it had lost its load. The local load near the station itself is very light.

The switch *D* in the main station operates relay *A* in the Bristol station, which would either stop or start the waterwheel and regulate its speed. Switch *E* controls relay *B*, which in turn operates the field rheostat of the generator. Switch *F* operates relay *C*, which turns on and off the main switch in the station under control. The voltage of the Bristol station is shown in the main station on the regular station voltmeter, and the plant is also synchronized from the main station. Synchronizing is done through switch *G*. This switch is thrown to the right until the voltage readings and synchronizing indications are correct for the Bristol stations. Just as soon as synchronism is reached switch *G* is thrown immediately to the left. This operates the main switch in the Bristol station. It is, of course, necessary to have switch *E* in the "on" position when switch *G* is thrown to the right. After the machines are synchronized switch *G* is maintained in its right-hand position, giving the voltage indications of the Bristol station at all times. When it is desired to disconnect the Bristol generator, switch *G* is put in the left-hand position and switch E pushed to the "off" position.

As the diagram of the station is quite complete, it is not necessary to go into detail. Connections for charging the storage batteries in the main station are shown, as is also the outline of the rheostat and switch connections in the station under control.

All equipment used is of standard make, and the only special appliance required was the "home-made" switch shown in lower corner of Fig. 5. The equipment in the Bristol station consists of a remote-control rheostat and generator switch or the ordinary solenoid-operated type with a motor-controlled governor. The control system referred to was connected to this regular remote-control system by means of the polarized relays.

In order to give the proper voltage indication in the main station from the controlled station a special potential transformer was necessary having a secondary wound for 354 volts. The cost of this, however, was practically the same as that of a standard transformer. In order that the current from the potential transformer shall not interfere with the operation of the relays, a special reactor is used in connection with relay *B* and switch *G*. This reactor does not affect their operating on direct current from the battery, but does protect them from the alternating current.

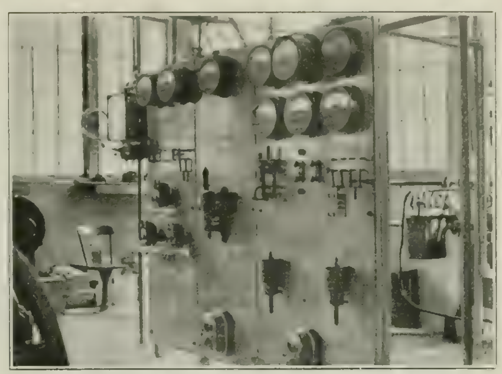


FIG. 4—CONTROL RELAYS WERE MOUNTED ON THE SWITCHBOARD PANELS

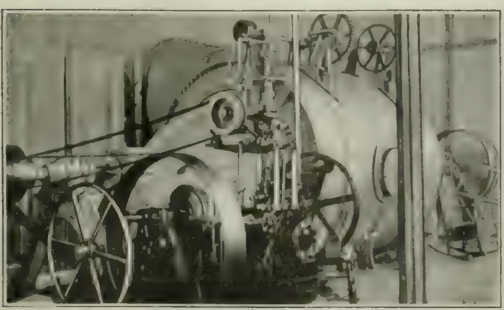
The load on the Bristol station is shown on meter *H* in the main station. It is measured by means of a movable contact on the gate-indicating device on the governor. As this indicator moves it increases and decreases the resistance in series with meter *H*. The meter is calibrated to show the gate opening on the waterwheel. The operator has a daily record of the head of water available, and from this he can tell the load on the plant.

Cost Was Very Low

Outside of the control lines between the stations the cost of the entire system was $750, and the amount of materials and labor necessary was very small. In addition to the storage batteries and other charging equipment all that was necessary in the main generating station were three momentary-contact switches, a "home-made" reactor and a Weston millivoltmeter. A small shunt was made for this meter to give the proper indications when connected in series with the governor-indicating device. Vacuum-tube arresters were used on all control lines at both stations.

In the Bristol station it was necessary to provide three polarized relays, a special potential transformer, a small reactor and the "home-made" gate-opening indicator. In some cases it might be more convenient to operate the gate-indicating device on the waterwheel gates. This, however, depends entirely upon circumstances, and in any event the arrangement is comparatively simple.

In order to protect the meter *H* in the main station,



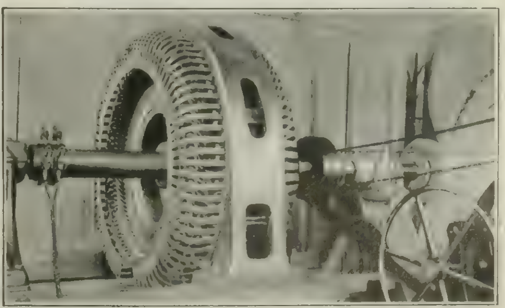


FIG. 2—THE GOVERNOR IS USED TO SUPPORT A "HOME-MADE" SWITCH. FIG. 3—AT LOW WATER THE LARGE GENERATOR OPERATES AS A FLYWHEEL AND A SMALL UNIT IS BELTED TO THE TURBINE SHAFT

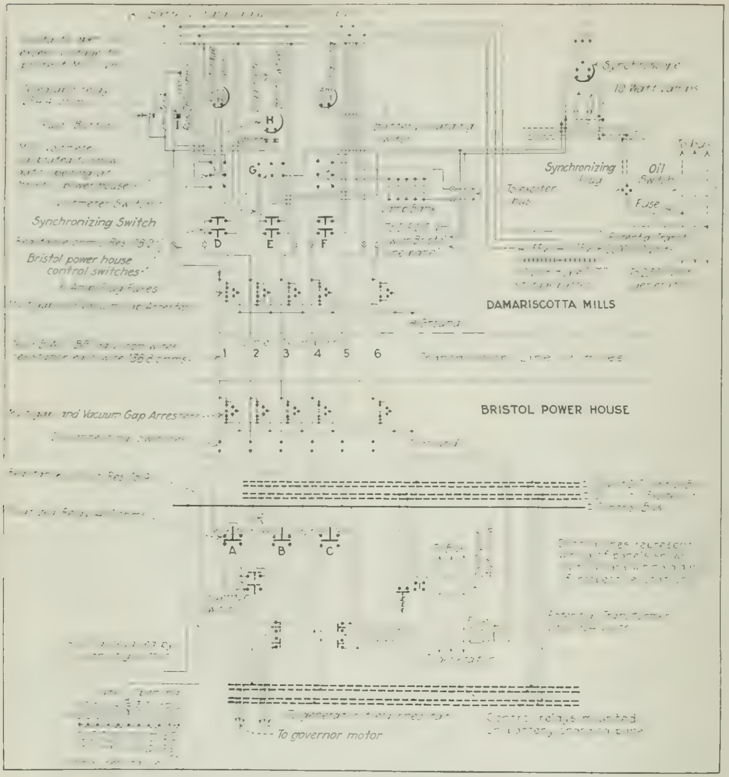


FIG. 5—POLARIZED RELAYS WERE USED IN THE CONTROL SYSTEM TO ASSURE SWITCH OPERATION

which shows the load on the Bristol station, it was connected in series with an ordinary telegraph relay shown at *I*. In case of excessive voltage of line No. 1 controlling this meter the contacts would open on the relay before the meter could be damaged. In order to reset this relay a small push-button was used to short-circuit the magnet windings.

The list of the material used is shown in the table herewith. The table does not include the material and labor used on the transmission line. The transmission line for the control system was built at the same time as the power line, and the cost of construction was approximately $3,500. This makes a total cost of $4,250. With the additional cost of the solenoid-operated rheostat and main switch in the controlled system, the total cost did not exceed $4,500. From this figure it will be seen that a considerable saving in labor can be made by using such a system. Interest, depreciation and maintenance amounting to 10 per cent would bring a yearly cost of $450. The cheapest operator that could be employed in this locality would have cost $1,000 a year.

SYSTEM OPERATES SATISFACTORILY

The system has been in operation several years and the only difficulty experienced has been caused by trees interfering with the control wires, which leave the transmission line for a short distance and run through a wooded section. Insulated wire has been used to overcome this difficulty.

The success of the system described shows that it is possible for progressive central-station operators to rig up their own control system, and by studying the situation carefully, it will be found that they could put up a very inexpensive system which, properly installed, would give them reliable service. There are a great many possibilities of applying remote control which will eliminate the use of additional labor and in many cases will give better results than can be obtained from incompetent operators.

In the company's office at Boothbay Harbor a small panel containing a recording voltmeter and frequency meter is mounted from which an indication of the operation of the system can be obtained. This panel also contains five indicating lamps for use in connection with the substation. When all the switches in the substation are "on," green lights are shown, but as soon as one of the switches trips it rings a bell in the office, showing its location by means of a red light. An indicator is also used to show when the storage batteries in the station have become nearly discharged. This gives notice immediately whenever any difficulty is experienced and makes it unnecessary to keep an attendant in the station. Thus a few simple devices add to the accuracy and convenience of the station operation and satisfy the executive that his system functions properly at all times or locates the trouble under abnormal conditions.

New Land Wireless System in Japan

APPLICATION for government sanction to establish a wireless telephone system has been made by the Daido Electric Power Company of Nagorya, Japan, according to advices received by the Department of Commerce. The company proposes to operate this wireless system primarily for its own convenience in connecting the various stations with an electric light and power system, but its use may be extended eventually to the general public if sufficient demand for it should arise.

According to the present plan the wireless system will extend from Okuwa to the Lagano Prefecture on the Central Japan Railway Line, from which point communication will be established through Nagorya and through and as far as Osaka, a distance of about 150 miles.

Economy of High-Pressure Steam[*]

Pressures Up to 1,500 Lb. Are Commercially Obtainable—Present Materials Limit the Maximum Temperature to 750 Deg.—Greatest Immediate Economy Possible Is Found to Be Through Reduction of Existing Heat Losses

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It is well known that steel when heated to comparatively low temperatures, say 900 deg. or 1,000 deg., loses its strength and becomes unfit to sustain loads, and that heat strains from even a moderate heating of 300 deg. or 400 deg. may cause certain deformations of a highly undesirable character. Cast-steel valves have deformed at 750 deg. to such an extent as to render them useless, and the "growth" of ordinary cast iron at temperatures above 450 deg. is known to be destructive. Notwithstanding these facts, plants have been constructed for 250 lb. to 300 lb. pressure and 700 deg. maximum temperature, and some are under construction now designed for 400 lb. and 530 lb. respectively. The first cost is not excessive, repairs are moderate, and the life of the installation is all that can be desired.

What, then, are the commercial limits of pressure and superheat in the central station? It will be seen from Fig. 1 that the regenerative cycle for saturation follows very closely the efficiency of the Carnot cycle, while the Rankine cycle falls below the latter increasingly with rise of pressures. The superheat lines for both cycles are nearly parallel and maintain this characteristic over a wide range. The gain from regeneration increases with pressure and is constant for equal superheat. For any final temperature the gain from pressure increments decreases, but the gain from regeneration increases with pressure increments. Thus, at 750 deg. final temperature the Rankine efficiency increases from 33.5 per cent to 40.5 per cent with pressure rise from 200 lb. to 1,200 lb., while the regenerative efficiency increases from 37 per cent to 48.5 per cent with the same pressure increase.

TABLE I—SAVINGS EFFECTED THROUGH INCREASE IN STEAM PRESSURE

Case	Cycle	Pressure, Lb.	Maximum Temp., Deg. F.	Theoretical Efficiency per Cent	Station Efficiency, per Cent	Actual Efficiency, per Cent	B.t.u. per Kw.-Hr.
1	Rankine..	200	750	33.5	55	18.4	18,500
2	Rankine...	1,200	750	40.5	55	22.3	15,300
	Gain..			21			3,200
3	Regenerative.	200	750	37	55	20.35	16,800
4	Regenerative...	1,200	750	48.5	55	26.7	12,800
	Gain.			33.3			4,000

As shown by Fig. 2, not much benefit can be expected from increasing pressure with the ordinary methods of using steam. Increase of temperature helps to some extent, but not enough to be attractive, since the saving is nearly always offset by the additional fixed charges.

With the regenerative cycle the results are much better and useful savings are indicated, increasing considerably with pressure and slightly with temperature. It is evident that some such regenerative cycle must be used if increased economies are expected from higher pressures and temperatures, but the rewards from increasing temperature are not commensurate with the costs. Many regenerative cycles are possible, but the one used shows nearly the maximum economy. Such cycles need many heat interchangers and a number of separate feed pumps for the close approach to theoretical figures. So far four or five stages have been the ultimate practical application, and not more than three have stood the commercial test. It therefore appears that considerably better design must be incorporated in apparatus if many steps are proposed, and also that more consideration should be given to operating difficulties.

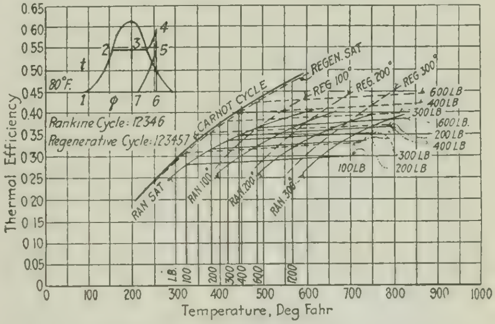

FIG. 1 — THEORETICAL THERMAL EFFICIENCY OF THE CARNOT, RANKINE AND REGENERATIVE CYCLES

Using both saturated and superheated steam for pressures up to 1,200 lb. and superheats of 750 deg. and above.

Grouping the station losses, which are not shown in Fig. 1 and which aggregate around 55 per cent, it may be said that the generator efficiency is 97 per cent, turbine efficiency 78 per cent, boiler efficiency 80 per cent, leaving 91 per cent for the efficiency of auxiliaries, piping and radiation. Using the foregoing figures, the saving by regeneration when using 200 lb. pressure (case 1, case 3, table I) is 1,700 B.t.u., and when using 1,200 lb. pressure (case 2, case 4) is 2,500 B.t.u. Considering the trend of the curves in Fig. 1, comparatively little is gained by further superheating. The flattening out of the curve is still more marked as the temperature increases above 800 deg.

Since the critical temperature of water is 704 deg. and the critical pressure is 3,200 lb., and since oil-still temperatures up to 1,100 deg. have been used, the foregoing temperatures and pressures may be considered usable so far as critical temperatures are concerned. Allotropic changes occur in steel at about 1,300 deg., and 1,100 deg. is well below this point. At this temperature, however, the physical properties of steel used in power-plant construction need serious consideration.

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[*] Based on a paper to be presented before the American Society of Mechanical Engineers in New York, Dec. 4 to 7.

Good boiler steels increase in tensile strength up to about 600 deg. to 700 deg. and lose much in ductility, but above 800 deg. the tensile strength rapidly falls off and ductility largely increases. Cast steel of proper carbon content and suitable for fittings, valves and turbine construction shows the same properties within rather narrow limits. Pipe steels have nearly the same characteristics, but the temperature at which the tensile strength starts to fall is around 550 deg. to 600 deg. This lack of ductility or increase of brittleness at the maximum temperature of use must be compensated for by a larger factor of safety—i.e., increased thickness and weight with higher cost—and a more careful selection of material. With increased thickness, however, it must not be forgotten that the safe stresses must be correspondingly lowered.

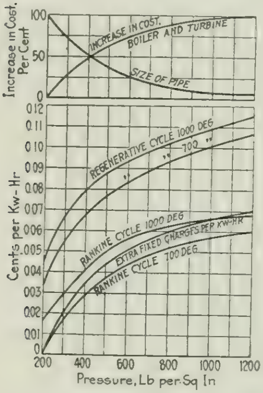


FIG. 2
COST OF INSTALLING AND ECONOMY IN USING PRESSURES ABOVE 200 LB.

The savings afforded in cents per kilowatt-hour, based on the Rankine cycle at 200 lb. and 700 deg. maximum temperature and coal at $6 per ton. The extra fixed charges per kilowatt-hour are plotted separately. At the top of the figure are two curves showing the increase in cost of boiler and turbine and the decrease in size of pipe required for a given quantity of steam. The extra fixed charges are always greater than the coal saving for the Rankine cycle (ordinary operation) at 700 deg. maximum temperature, and the additional gain for 1,000 deg. maximum temperature barely exceeds the additional fixed charges.

The variation of strength of materials with temperature may be considered from five points of view, depending on the conditions under which the materials are to be used:

Boiler Material—The maximum temperature cannot exceed 704 deg., the critical temperature of water, and the fire side of the tube or drum can only be a few degrees hotter. If 1,200 lb. to 1,800 lb. per square inch be the chosen pressure, the water temperature is 625 deg. at the maximum and the fire side will not exceed 725 deg. normally. This temperature is well within the maximum strength zone, and only care is needed to secure sufficient ductility.

Superheater Material—The maximum temperature of the inner surface of the tubes may be a little higher than the maximum superheat. The outer temperature depends on the position in the boiler. Radiant-heat superheaters are now commercial where the pressure parts are protected with a heat-absorbing and conducting covering of cast iron. The fire surfaces may be 1,400 deg. to 1,600 deg., while the inner-wall temperature is as low as 700 deg., but 1,100 deg. is comparably easy of attainment. Bare-tube superheaters would have a maximum outside temperature of around 1,200 deg., but their life at this temperature is unknown. The maximum safe point may be taken as 800 deg. superheat temperature and 950 deg. outside temperature.

Neither the tube manufacturers nor the superheater manufacturers are afraid of these conditions, and they are prepared to guarantee their product under them.

Piping Material—Under this category the condition is markedly different. The steam side of the pipe is below the maximum temperature of the steam. The outer surface is much lower and the thickness of the material can be increased to compensate for the lower elastic limit of the material. The ductility improves with temperature increase. Pipe joints are the only serious trouble, and the modified Van Stone joint with pipe edges welded for tightness is the apparent solution. Experience with this joint has been satisfactory.

Valves and Fittings—Valves and fittings must necessarily be made of castings. The low carbon, open-hearth steel used, while falling off in strength sooner than the worked material used in boiler and piping construction, has still a respectable elastic limit at 1,100 deg. As in the last category, the inside wall temperature is lower than the steam temperature and the outer wall has a still lower temperature. The shape of the casting is all important. Globe valves of the double-beat or Wanick type can be made with practically no flat surfaces and with two axes of symmetry. Internal pressures do not seriously deform this design, but external strains may cause minor troubles. Throttle valves and marine stop valves are usually of this type and can be kept tight at 750 deg. It is probable that a temperature of 1,100 deg. can be safely undertaken with these valves if special precautions be used in the design of the seat, disk and stem. Flexible-disk, double-beat valves are used in Europe at temperatures in excess of 750 deg.

Gate valves have only one axis of symmetry and have flat surfaces of considerable size. With these seat and disk troubles are encountered at temperatures above 700 deg., and it may be some time before manufacturers can guarantee a tight job at the higher temperatures. This type of valve is peculiarly sensitive to outside strains, which tend to deform the seats and disk.

Turbine High-Pressure Ends—Pressures can make little difference here as the high-pressure parts are comparatively small, and without doubt the pressure will be reduced 50 per cent in the first nozzle. There need be no high-pressure stuffing box, so that the highest pressure to be packed against will be about half the maximum. Temperature strains will be the only thing that need be considered; the expansion will reduce the superheat in the first-stage nozzle to a workable

TABLE II—SAVINGS IN COAL WHICH MAY BE EFFECTED WITH PRESSURES OF 200 LB. TO 1,200 LB. AND SUPERHEATS OF 700 DEG. TO 1,000 DEG., USING REGENERATIVE AND RANKINE CYCLES

Pressure, Lb. per Sq.In.	Superheat Temp., Deg. F.	Carnot Efficiency	Regenerative Efficiency	Rankine Efficiency	Regenerative × 0.55	Rankine × 50.5	Regenerative B.t.u.	Rankine B.t.u.	Saving Over Rankine 200 Lb. 700 Deg. B.t.u. per Kw.-Hr.		Saving in Lb. Coal per Kw.Hr. (13,800 B.t.u.)	
									Regenerative C.	Rankine C.	Regenerative C.	Rankine C.
200	700	53.5	37	33.4	20.3	18.35	16,820	18,620	1,800	....	0.13	.....
400	700	53.5	41.2	36.3	22.6	19.95	15,100	17,120	3,520	1,500	0.255	0.109
600	700	53.5	43.5	38	23.9	20.9	14,300	16,350	4,320	2,270	0.313	0.1645
1,200	700	53.5	47.5	40	26.1	22	13,100	15,500	5,520	3,120	0.40	0.226
200	1,000	63	38	35	20.9	19.25	16,350	17,750	2,270	870	0.165	0.065
400	1,000	63	42.8	37.6	23.5	20.7	14,500	16,500	4,120	2,120	0.299	0.1535
600	1,000	63	45	39.5	24.7	21.7	13,820	15,720	4,800	2,900	0.348	0.21
1,200	1,000	63	49	41.5	26.9	22.8	12,700	14,970	5,920	3,650	0.43	0.257

value, which is 750-850 deg. Where 400 lb. and 750 deg. superheat have been tried out, the only prominent troubles have been with the steam-chest or nozzle box. Proper design will obviate most of the troubles. Cast or forged steel must be the material used.

In general, the turbine designers say that 1,200 lb. to 1,500 lb. pressure has no terrors for them and can be used when desired. Temperatures are more troublesome, and no one apparently cares to go much above 700 deg. to 750 deg. at the present time. Superheater and valve materials at present seem to be the deciding factor in the use of high pressures and temperatures, and there is apparently very little which careful design and the selection of proper materials will not overcome.

Only a portion of the central-station installation is affected by high pressures and temperatures, especially where electric auxiliaries are used. The boiler and piping system and prime mover cover the whole list, and in the usual central station this has represented about 40 per cent of the entire installation cost. Lately, with the larger station, the percentage is around 30 and may be taken at 25 per cent for the newer and larger stations of which Hell Gate and Calumet are types. If unit station cost be taken at $100 per kilowatt as an average figure, the portion of the installation cost attributable to the boiler piping system and prime mover is $25. At 15 per cent the fixed charges are $3.75 per year, or 0.07 cent per kilowatt-hour, based on 5,000 hours' operation per year.

What, then, will be the extra cost of apparatus designed for higher pressures and temperatures? Standard boilers today can be bought up to 275 lb. pressure. Pressure of 300 lb. necessitates thicker plates and tubes, and prices advance accordingly. Boilers rated at 400 lb. have been purchased recently, and 500-lb. boilers have been built. Flash boilers of the Serpollet and De Laval types, using pressures in excess of 1,200 lb., and coil boilers of the Herreshoff type, using equally high pressures, have been built for automobile work or high-speed launches. Schmidt's water-tube boiler working at 900 lb. has been run 14,000 hours with marked success. Boilers for 400 lb. pressure have been offered at about 50 per cent increase in price, and 1,200-lb. boilers have been figured at a 100 per cent increase in price.

Turbine designers are at work on designs arranged to utilize higher pressures, but they are fighting shy of higher temperatures. No estimates are available, but it is safe to apply the same percentage increase of price to the turbine that obtains with the boiler. Steam piping decreases in size with increase in pressure, so much so that it is doubtful if a 1,200-lb. steam line would cost more than a 200-lb. line of the same capacity. The volume of high-pressure steam at 1,100 deg. maximum temperature is quite uncertain, but the chances are that the foregoing figures are not more than 10 per cent from correct.

In concluding it may be said that pressures up to 1,500 lb. are commercially obtainable without serious difficulty. Temperatures above 750 deg., which is now commercially obtainable, should not be exceeded until the material for valves and superheaters are improved. More extended experience is necessary before temperatures of 800 deg. and over are attempted.

With the completion of steam table research it will be possible to calculate accurately just where the possible limits of economy in pressure and temperature may be placed. At the present time the uncertainty of all values above 200 lb. pressure and 400 deg. F. render most calculations of only academic value.

Rather than attempt to obtain the greatest plant economy through use of higher pressures and extension of temperature ranges in heat cycles, it would be more effective and expedient to study carefully how existing heat losses in present installations may be reduced to the lowest limits.

Installing Pit-Shaft Cables

Advantages and Disadvantages of Various Methods—Cable Joints a Source of Trouble—Rules for Inspection

FROM A CORRESPONDENT

HAVING regard to the abnormal conditions to which a shaft cable is usually exposed, the protection both from mechanical damage and from that due to the corrosive nature of some pit water generally receives special consideration. The best practice is to provide double armoring in order to afford protection from falling materials. The armoring should also be well protected from the corrosive action of water by a double-jute serving, which should be periodically treated throughout the entire length of the cable with Stockholm tar or an equivalent, in order to preserve the jute. This should be done in two or perhaps three years, depending upon local conditions.

A factor which must always be taken into consideration when a cable has to be fixed to a shaft wall is that ample space must be allowed at all points between it and the cable, in order that falling objects may to some extent be prevented from crushing the cable against the wall and that the cable itself may be as resilient as possible.

Moreover, the cable cleats should be provided with shields at the top to prevent accumulation of dirt around the cable where it enters the cleats. This shield also serves to deflect falling material which might otherwise injure the cleats. Every care should be exercised to avoid damage to the jute covering as a result of rubbing against walls or girders while being lowered into its place. Further, discretion must be used in making temporary fastenings to the cable for the purpose of lowering it or in connection with any other method which may be necessary to get it into position.

EQUIPMENT AND DEPTH AFFECT INSTALLATION

The different equipments usually met with in pit shafts may be briefly summarized as follows:

1. Those in which rail guides are fastened to girders placed in either side of the shaft.
2. Those provided with rail guides fastened to girders placed down the center line of the shaft.
3. Those for which rope girders are provided.

Method 1.—Lowering Cable Down from the Drum of a Capstan Winding Engine.—This is perhaps the ideal method of getting a cable down, from the point of view of labor as well as of time. It consists in making the cable end fast to the cap of the winding engine or capstan rope and coiling it on the drum, after which the end of the cable is fed over a suitable pulley into the shaft and the end guided by the pitmen from a box lowered by some other means at the same speed as that of the cable. One important consideration, however, must never be overlooked; i.e., will the length and weight of cable to be lowered be such as to cause injury by its own weight being suspended by one fastening?

This will obviously depend on the size of the cable, its length and construction. For instance, a lead-covered and armored cable is much heavier than one of the bitumen-insulated type. To be on the safe side in this respect, it is always advisable to consult the makers before lowering a cable in this way, in order to ascertain their views after giving them full particulars of the method suggested. If the cable cannot be lowered in one length, the lower length or lengths necessary have to be suspended during the process of lowering, with the whole weight hanging and depending on a suitable clamp or capel, to which the winder or capstan rope is attached.

If possible the lower end of the capel should be tapered in order that it shall be less likely to catch on obstacles encountered in its passage through the shaft. Having secured a suitable capel to the cable end, the capstan rope, assuming that one is used for the purpose, should be attached and the cable carefully coiled on to the drum over a bedding of sacking or other material, which should serve the purpose both of protecting the cable from the hard surface of the capstan rope already coiled on the drum and of providing a more or less uniform surface on which to coil the cable. A suitable pulley must be erected at the pit top and so arranged that a line dropped from the groove overhanging the pit shaft will fall where the cable is to be fixed, but clear of shaft equipment against which the cable might rub and damage its jute covering. The pulley groove should be large enough for the cable to be in the bottom without being exposed to a crushing side pressure when the weight gets on. Further, a layer of soft hemp fastened in the groove is an additional protection. The brackets in the shaft should have all covers removed before any attempt is made to lower the cable, which should not be allowed to hang from its clamp longer than is absolutely necessary.

PITMEN GUIDE CABLE

When everything is in readiness the pitmen should be lowered at the same time as the cable, guiding the end past any obstacle in its path and also keeping it in the course intended. When a cable has to be lowered in two or more lengths, it is necessary that the lower ones should be let down with great caution, especially after the end of the cable which is fastened to the winding or capstan rope enters the shaft. No matter how ingenious the design of clamp employed for holding the cable may be, there is always a possibility of its catching, and should this occur, allowing the descending rope to lose the weight of the cable, a serious accident might result through the obstruction to the cap giving way and allowing the full weight of the cable to fall for some yards. This would be sufficient in many cases to strain the cable severely, if not to cause it to break away.

The method to follow is to ascertain roughly the distance the bottom end of the cable can be safely lowered unattended without going out of its course or being obstructed. Then the pitmen should be raised until they are level with the upper end of the cable and in a position to guide the cap where necessary. After lowering the cable the prearranged distance, the pitmen should again be lowered to the end of the cable and preparations made for a further lowering as soon as they have again been brought to the upper end. These operations must be continued until the cable is finally in the desired position.

It is always advisable to have the cable fastened into most of the brackets before slackening out the capstan rope, as by this means the weight is now more or less distributed over the whole length of the cable, which toward its upper end is naturally under a greater stress than are the lower portions. Although in most cases this is not a serious matter, yet in some instances, owing to special circumstances, it may be desirable to relieve the cable of all strain. To effect this a few of the lower brackets should be fastened and then made to take their share of weight by lowering the cable ever so slightly, in order that the weight then hanging will be that of the cable less the lower portion already fastened. This might be repeated two or three times in sections up through the shaft and so relieve the cable from all strain.

Method 2.—Pulling Cable Up from the Pit Bottom.—This method is a very convenient one, provided that the cable drum can be taken to the pit bottom. Once there it is placed on a strong bar resting between two substantial supports so that the drum can rotate. A capstan rope is then lowered and connected by a suitable fastening to the cable end, which is pulled up the shaft while it is watched by pitmen who should accompany the ascending cable on top of the cage in order to prevent its getting caught in obstacles.

MANUFACTURERS ADVOCATE LASHING

Method 3.—Lashing Cable to Capstan Rope.—This is the method usually advocated by cable manufacturers as, provided it is properly carried out, the operations are fairly safe and the cable is got into place without fear of straining due to hanging by its own weight. However, a great deal more skill is required, and incidentally much greater patience, while mishaps are more likely to occur than in some other methods of installing.

In this method a capstan rope is needed as before, but instead of fastening the cable end to the rope and suspending it by its end, both cable and rope are fed into the shaft at the same time. Rope lashings are made from the cable to the capstan rope every few yards and serve to support the cable. As mentioned above, considerable skill is required in making good fastenings to the cable and rope; without them the cable may slip down the rope and pull the cable drum and everything else with it.

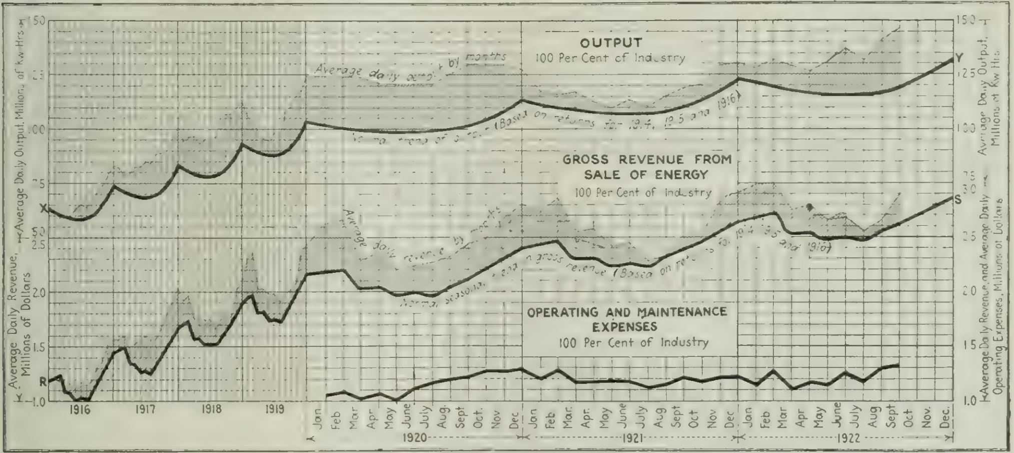
The chief objection to this method is the possibility of the numerous lashings becoming caught here and there in the shaft and thus caused to slide up both cable and rope until long lengths of cable remain unsupported. Further, the lashings do not readily slide along the rough cable jute, so that the jute becomes torn and perhaps stripped for long distances, thus exposing the cable to the effects of pit water. Moreover, one of the objections to this method is the enormous amount of time required to put down a cable. It would not be wide of the mark to say that from the commencement of operations methods 1 and 2 can be carried out in less than half the time required for the method that has just been described.

Method 4.—Cable Drum Slung on Cage.—The foregoing methods of installing shaft cables are obviously applicable to almost any kind of shaft, but in cases where it is not convenient to use a capstan, and where rope guides exist, a very successful way, and one which is quickly carried out, is to erect the cable drum between the bridles of the cage and slowly revolve the drum and pay off onto the shaft brackets as the cage is gently lowered. Where this is done it is usually necessary to use for the purpose extra long bridles or cage chains so as to allow room to erect the drum in the angle between the rope cap and the carriage.

Where a cable is too long to be put down in one length it is necessary to make joints, which should, if possible, be in headings rather than on the shaft wall. This is advisable in order to have a dry place for the making of the joint as well as for its permanent position, and in the second place, the joint is thus protected from falling material, while overheating or other troubles can more readily be attended to. However, where no heading is available it is necessary to fix the joint or joints on the shaft wall or other suitable position. In such a case a vertical type of box might be used, but joints of any kind are most objectionable in pit shafts and should be avoided. At all points below the surface where pit cables enter or leave the shaft adequate provision should be made to protect them from falling material which might cause injury. Suitable stout wooden coverings should be fixed to the shaft wall and project beyond and surround the cables, which should pass through the covering before bending to enter the heading or other opening.

Shaft cables should be examined by the electrician at least every three or six months, depending on circumstances. This inspection should be carried out from the top of the carriage by the aid of a good light in order that defects may be easily noticed. Broken jute covering and the avoidance of collections of dirt around cables entering brackets are the chief things that usually require attention, but more serious damage should be always anticipated and looked for.

Record Energy Sales During September



REPORTS received by the *Electrical World* for the month of September from central generating and distributing companies representing 83 per cent of the installed generator rating of the country indicate that two new records were hung up by the industry during September. So many records have been superseded during the year 1922 that it has become a matter for inquiry if a month passes without a new record being set in some phase of the electric light and power industry. The total sale of energy during September was 4,400,000,000 kw.-hr., which exceeded the former high monthly figure set during August by 14,000,000 kw.-hr., although September had one less day than August. The average daily output was 146,696,000 kw.-hr., which exceeded the previous record made during August by 5,071,000 kw.-hr. and the output reported for September, 1921, by 22.5 per cent. If this growth were continued, the industry would double its present operations by 1928.

Final government reports indicate that general manufacturing activity declined somewhat during the month of September. Out of fifty-two commodities reporting, eighteen showed increased production compared with August, thirty declined and four showed no change. Many of the declines reported in September were small, while others were purely seasonal reactions. It is probable that the consumption of electrical energy by manufacturing industries of the country was about on a par with that of August. The underlying cause, therefore, for the increase in sales of electrical energy during September was undoubtedly the advancing season, reflected in increased lighting energy requirements plus consumption of such new industrial power customers as were added to the lines during the month. The advancing season, however, also had a slight adverse effect on the activities of the electric light and power industry, especially in the West. The irrigation load plays a large part in the business of companies operating in the Mountain and Pacific States, and practically every generating and distributing company serving these sections reported slightly decreased operations during September. The effects of this seasonal decline in the irrigation load probably will be felt more keenly in the reports for October operations.

The gross revenue of the industry also showed a decided upward swing during September, probably a direct

TABLE I—CENTRAL STATION RETURNS FOR THREE MONTHS

Mos.	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1922 Thousands	1921 Thousands	Per Cent Increase	Mos.	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting) 1922 Thousands of Dollars	1921 Thousands of Dollars	Per Cent Increase	Operating Ratio: Steam Plants 1922	Steam Plants 1921	Hydro Plants 1922	Hydro Plants 1921	Combined Systems of Steam and Hydro 1922	Combined Systems of Steam and Hydro 1921
July...	83	3,401,789	2,823,231	20.4	76	$60,392	$54,442	10.9	July..	62	23,006	21,556	6.7	55.3	56.8	27.9	28.5	46.1	48.1
Aug.	83	3,644,111	2,985,881	22.0	76	62,869	55,487	13.3	Aug..	62	24,967	22,315	11.9	56.6	54.2	26.8	31.4	48.8	50.7
Sept..	83	3,652,773	2,981,396	22.5	76	66,371	57,938	14.6	Sept.	62	24,555	22,245	10.3	53.4	53.2	26.4	25.8	46.9	48.3

reflection of the increased high-revenue lighting load. An average daily revenue from the sale of energy of $2,906,000, while almost $300,000 above that reported for August, was about $100,000 under the peak revenue reported during last February. For the next four months new records in gross revenue from sale of energy may be expected in every section of the country.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to gross revenue from sale of energy, shows that financially the industry is very close to the same position it occupied this time last year. The operating ratio reported for September by companies having steam plants only, taken in the aggregate, was 53.4 per cent against 53.2 per cent for September of last year. Although in January the operating ratio for these same companies was only 45.7 per cent, such an increase in operating ratio between winter and summer months is to be expected on account of the relatively higher percentage of low-revenue industrial energy sold during the summer months. During the present year must also be added the higher price of coal in September as compared with January. A very favorable indication, however, is the fact that the operating ratio during September was 3.2 per cent below that reported for August. It is evident that the operating ratio reached its highest point during the present year in August. If the normal trend is followed, the operating ratio should continue to decrease as the large winter load approaches, and the lowest point should be reached in December or January, when the high revenue load is at its peak.

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Electricians on German Vessels

The electrical equipment on German vessels is extensive and of complicated character, concentrated in a small room. Ships equipped with electrical apparatus are often away from their home ports for several months. When a vessel is at sea the ship's electrician becomes a very important factor in the operation of the vessel and its movement and safety are often greatly dependent on his technical ability. There is a plan on foot in Germany, according to Harry J. Anslinger, United States Vice-Consul at Hamburg, to advance the ship's electrician to a position equivalent to his importance and to amend the seaman's law to give him the title of a ship's officer. It has also been suggested to provide an electrotechnical school for ship's electricians.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

Month	Percentage of Installed Ratings Represented	New England States 1922 Thousands	New England States 1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Atlantic States 1922 Thousands	Atlantic States 1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	North Central States 1922 Thousands	North Central States 1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	South Central States 1922 Thousands	South Central States 1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Pacific and Mountain States 1922 Thousands	Pacific and Mountain States 1921 Thousands	Per Cent Increase
KW.-HR. OUTPUT:																				
July.......	82	227,799	193,144	17.9	83	1,180,488	970,398	21.7	82	1,114,357	911,543	22.3	63	166,374	142,407	16.8	95	712,771	605,739	17.7
Aug.......	82	260,666	214,944	21.4	83	1,275,186	1,026,388	24.3	82	1,176,589	972,551	21.0	65	179,325	150,412	19.3	95	752,345	621,586	21.0
Sept.....	81	262,920	225,222	16.7	82	1,308,060	1,034,936	26.4	81	1,170,392	976,454	19.8	64	192,090	155,684	23.3	97	719,311	589,100	22.2
REVENUE:																				
July.......	82	$5,729	$5,301	8.1	76	$21,867	$19,903	9.8	68	$18,709	$16,411	13.9	63	$4,036	$3,716	8.6	95	$10,051	$9,111	10.3
Aug.......	82	5,968	5,415	10.2	76	22,586	19,991	13.0	69	19,702	16,760	17.6	65	4,201	3,881	8.2	95	10,412	9,440	10.3
Sept....	81	6,334	5,751	10.1	76	24,506	20,946	17.0	68	20,491	17,590	16.8	64	4,454	4,022	10.7	97	10,586	9,629	9.9
OPERATING EXPENSES:																				
July....	53	$1,783	$1,765	1.0	57	$7,769	$7,361	5.5	55	$7,923	$7,175	10.4	62	$1,961	$1,966	-0.2	94	$3,570	$3,289	8.5
Aug..	53	2,003	1,973	1.5	58	8,202	7,412	10.6	55	8,943	7,363	21.4	64	2,182	1,990	9.6	94	3,637	3,577	1.6
Sept..	53	2,030	2,100	3.3	56	7,624	7,322	4.1	55	8,945	7,289	22.7	63	2,280	2,017	13.0	96	3,676	3,517	4.5

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States 1922	1921	Average for Previous 12 Months 1922	1921	Atlantic States 1922	1921	Average for Previous 12 Months 1922	1921	North Central States 1922	1921	Average for Previous 12 Months 1922	1921	South Central States 1922	1921	Average for Previous 12 Months 1922	1921	Mountain and Pacific States 1922	1921	Average for Previous 12 Months 1922	1921
Steam Plants:																				
July	54.3	62.4	56.3	64.5	56.2	57.3	50.3	55.9	56.7	55.8	51.8	59.3	51.9	53.9	49.7	54.9	49.7	52.6	48.0	54.4
August	57.8	64.3	55.6	63.8	57.7	52.0	50.4	55.3	58.6	55.7	51.8	58.1	51.8	53.3	49.4	54.7	48.3	51.8	47.7	53.8
September	56.8	60.2	55.6	62.8	53.3	53.2	50.5	54.8	55.8	52.3	51.7	57.4	50.1	52.5	49.1	54.1	44.2	45.9	47.6	53.0
Hydro Plants:																				
July	40.6	49.9	34.4	43.8	24.5	22.1	20.5	23.4	20.5	26.0	22.6	22.9	50.2	47.8	42.1	39.6	28.2	28.1	27.3	26.9
August	35.1	39.8	34.5	43.6	23.6	22.7	21.2	23.6	26.0	25.9	23.2	23.2	37.1	33.8	42.2	39.9	27.5	31.3	27.6	27.5
September	36.3	31.6	34.8	44.2	19.8	21.4	21.4	23.6	30.0	30.4	23.9	24.0	45.2	27.6	42.6	40.1	27.5	27.1	27.8	27.8
Combined Systems of Steam and Hydro Plants:																				
July	53.2	56.7	51.6	52.1	51.3	52.0	46.7	50.0	54.8	56.3	48.9	54.6	41.2	48.4	42.9	46.1	30.5	33.6	35.3	39.0
August	58.9	64.4	51.6	52.0	53.3	59.8	47.5	51.3	58.1	56.6	50.3	54.5	43.8	45.2	42.8	45.7	31.1	35.3	34.6	38.2
September	55.8	65.6	49.9	52.1	47.8	50.9	47.4	51.3	56.2	54.4	51.0	54.1	51.0	42.3	43.5	45.6	31.8	34.7	34.1	37.1

Electric Steam Boilers for Using Surplus Water Power

High Efficiency, Negligible Attendance, Small Floor Space and Flexibility of Operation—Relative Merits with Essential Requirements

MUCH has been heard lately of the development and the rapid popularization of electrically heated steam boilers in Europe. Especially in countries lacking adequate national deposits of coal or fuel oils but having an abundance of water powers have these boilers gained ground rapidly. The most efficient utilization of an existing water power can be achieved only if the demand for power corresponds to the supply, which is very rarely the case. When ice and snow are melting in the spring—and during the night hours of every day—surplus energy is available for which there is seldom a use. Storage batteries, especially for alternating-current systems, are very inefficient, and hydraulic accumulation requires a high investment and is not always possible.

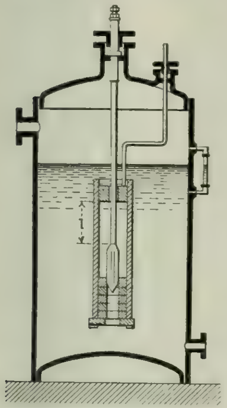


FIG. 1—SINGLE-PHASE SMALL ELECTRODE BOILER. HEAT INSULATION NOT SHOWN

The electrically heated steam boiler is an almost ideal solution of this problem, says a recent issue of the *Hackethal Nachrichten.* One kilowatt-hour gives theoretically 860 calories, or with an average practical efficiency 1.25 kg. (2.75 lb.) of steam. Assuming a five-fold evaporation, 1 kw.-hr. is equivalent to 0.25 kg. (0.55 lb.) of coal. If a plant has available a surplus energy of, say, 1,000 kw. for eight hours a day, an electrically heated boiler will save daily 1,000 × 8 × 0.25 or 2,000 kg. (4,410 lb.) of coal.

Among the many advantages of these boilers are their high economy, the negligible amount of necessary attendance, the small floor space occupied, the absence of a chimney, reduced possibility of explosion (as low water has no effect upon the operation of the boiler) and the instantaneous starting or stopping of the heating process. The simplicity and safety are such as to permit installing such a boiler in a remote part of any plant, thereby economizing on long and ineffective steam lines.

Storage of the generated steam will frequently be necessary, and for this purpose an existing coal-fired boiler may usually be adapted easily, in which case an average over-all efficiency of about 85 per cent may be reached. Based upon this figure, a definite relation exists between the cubic meters of storage water necessary for a certain number of kilowatt-hours at given charging and discharging pressures. For example, 1 cu.m. (35 cu.ft.) of water will store 56 kw.-hr. if charged with 12 atmospheres and discharged with 4 atmospheres.

Three different methods of heating the water are available—the indirect, the direct and the electrode system.

For small boilers and for direct current the indirect-resistance method is the only possible form, says the *Hackethal Nachrichten.* It consists of heating units sealed into tight metal containers, which are submerged into the water of the boiler. This type has the advantage that it can be used on either direct or alternating current. Even for the latter, for voltages under 500, it is much cheaper than the electrode system. As a rule the unit is divided into a number of sections, so as to give several steps of heating by group connections of the units, or by star-delta connections in case of three-phase supply.

DIRECT-RESISTANCE METHOD

The direct-resistance method is suitable for all sizes of boilers and for alternating currents of between 110 volts and 1,000 volts. The resistance wire is in direct contact with the water of the boiler. For medium size and large boilers the resistance required for the heaters within the given voltage limits is usually less than 1 ohm. If in such a case the electrode principle were to be used instead, the slightest amount of scale upon the electrodes would change the resistance very appreciably and an unreliable and irregular service would ensue. Direct current cannot be used for this type because the conducting water would form a shunt across the resistor, which would result in the generation of a highly explosive mixture of hydrogen and oxygen. The earlier constructions of boilers of this class consisted usually of a horizontal drum boiler, to which were attached on either side a number of vertical tubes with concentrically arranged heating units in which the actual boiling took place. In more modern designs the heating elements are mounted directly in the main boiler. The unit itself is made of a special non-rusting round alloy wire (chrome-nickel) wound non-inductively upon a core of ceramic material. The wire will stand safely and permanently temperatures as high as 1,200 deg. C. so that its operation is quite safe, even in the case of complete embedding into scale. For voltages above 500 a tube of ceramic material is slipped over the resistor to minimize the shunting action of the water.

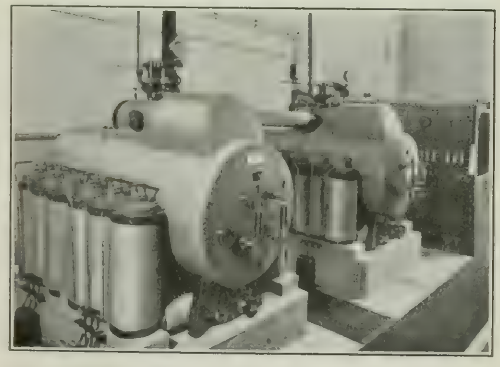


FIG. 2—DIRECT-RESISTANCE METHOD BOILER WITH FIVE BOILING UNITS ON EACH SIDE CONNECTED TO THE MAIN TANK. CAPACITY 1,000 KW.

A 1,000 kw. boiler of this type, with five heaters attached to each side, connected to a 532-volt, three-phase system, produced 1,475 kg. (3,250 lb.) of saturated steam per hour under 5.8 atmospheres pressure in actual service. This corresponds to a boiler efficiency of 97 per cent. (See Fig. 2.)

If high-voltage alternating current is available for boiler heating, the electrode heating method is the most advantageous, provided the voltage is not higher than about 15,000. The resistance method is impracticable for two reasons—the shunting action of the water is too great and the high resistance required for the high potential would necessitate the use of so small a wire as to be mechanically too weak. The water in the boiler being the resistance itself, it is of utmost importance to know its specific resistivity in order to provide a suitable electrode distance and electrode surface. Water from different localities shows greatly varying resistances. The limits may be between 3,000 ohms and 10,000 ohms per cubic centimeter (0.06 cu.in.). To this comes the very decided increase of resistance with increasing temperature. Wide possibility of regulation is therefore very essential for a boiler of the electrode type. It is also of importance to avoid too much scale formation on the electrodes in order to prevent overheating and possible arcing at the electrodes. Experience has shown that the maximum deposition of scale occurs at the points of the maximum evaporation, caused by the number of watt-seconds energy transformers in 1 cu.cm. of water. To avoid, therefore, scale formation on the electrodes it is essential to locate the energy transformation as much as possible away from the electrodes. Displacement pieces, made of insulating material, are therefore arranged along the path of current flow, providing passages of such length and cross-section as to enforce the maximum energy transformation in these places. (See Fig. 3.) This will leave the electrodes as mere entrance and exit points for the current. It is of greatest importance to observe this detail in the design of an electrode boiler, as the safety of its operation depends largely upon the proper arrangement of the electrodes.

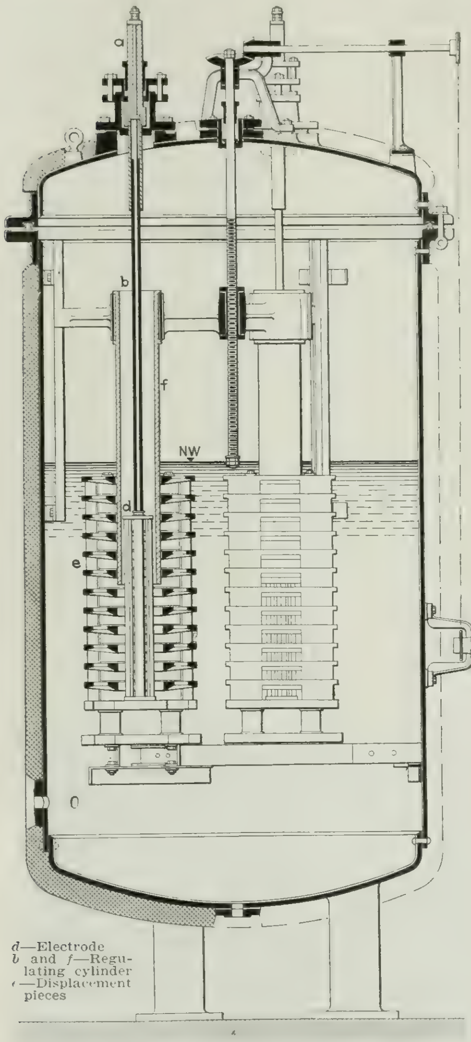


FIG. 3—THREE-PHASE LARGE ELECTRODE BOILER

Another vital point is the right dimensioning of the electrode surface. In a similar way, just as there is a maximum current for a certain metallic wire cross-section, exceeding which the wire will melt, there is also only a limited current density permissible for water as a conductor. If this maximum is exceeded, the current will no longer flow steadily through the water, but will be intermittently made and broken. Use of this fact is being actually made in the electrolytic interrupter for X-ray spark coils. If through a faulty design or an excessive overload this condition occurs in practical service, a total destruction of the boiler may result.

Calculating Current Density

The method of calculating the safe maximum permissible current density is based upon the determination of the voltage distribution in the water between the boiler electrodes. From the hyperbolic curve "volts per cm. distance" can be calculated the resistance capacity, which will be a further function of the diameter of each electrode. The calculation will be made somewhat unsafe by the complications introduced by layers of hot water of different degrees of heat and by the admixture of steam bubbles to the water, both of which affect the resistance of the water considerably.

The concentric arrangement of electrodes (rod within a cylinder) is difficult for voltages over 1,000. Individual electrodes placed parallel or, for three-phase boilers, at the points of an equilateral triangle give best results for high voltages. To regulate the input the electrodes may be arranged so as to dip them more or less deeply into the water, or, better, an insulating concentric cylinder may cover a smaller or greater part of the electrode. (See Figs. 1 and 3.)

It may be mentioned finally that a three-phase electrode boiler represents an ideal overvoltage protector, as the lines are grounded over a relatively small resistance. The theoretically required resistance for a damping grounding resistor is equal to $r = \sqrt{\frac{L}{C}}$, or about 30 ohms to 50 ohms for a cable. A 500-kw. to 1,000-kw. boiler connected to a 5,000-volt cable will give just the right amount of grounding resistance to take care of all switching overvoltages.

Commercial Aspects of "Change-Overs"

The Replacement of Direct-Current with Alternating-Current Equipment Should Be Thoroughly Planned and Carefully Executed to Minimize Cost and Avoid Misunderstandings with Customers

By F. S. ROOT
Power Engineer and Commercial Manager Fall River (Mass.) Electric Light Company

MANY small and medium-size central-station companies which are still supplying customers with direct-current service in limited districts would long ago have changed them over to alternating current had it not been for the uncertainty of the expense involved. There have been instances where "change-overs" have been entered into without making a complete survey of the situation and numerous unpleasant misunderstandings have resulted. The value of a complete preliminary survey, therefore, cannot be overestimated. In this article Mr. Root makes some pertinent suggestions which can be profitably followed in changing from direct to alternating current. He points out the stumbling blocks which can be largely avoided if the change-over is carefully planned and properly carried out.

WHEN a central-station company decides to change over a whole or a part of its direct-current system to alternating current — and it takes no little courage to arrive at this decision — there are still a good many problems to face. First of all, the company must decide upon what financial basis the exchange of customers' apparatus will be made. Several schemes have been tried out, ranging from an even exchange of equipment and changes in interior wiring at no expense to the customer to an arrangement whereby the customer is allowed only the market value of the goods replaced and is charged for any alterations in interior wiring made necessary by the change.

COMPANY SHALL STAND COST

From personal experience the writer is in favor of all expense of the "change-over," of whatever nature, being borne by the central-station company, principally because it is the fairest thing to do, and also because it causes less friction between the company and the customer. After all, the change-over is being made at the company's desire, not the customer's, who is probably very well satisfied as he is. Besides, no matter how carefully the change is planned, some interruption in service is unavoidable and some "muss and fuss" will have to be made in the customer's premises. This is especially true in stores and in doctors' and dentists' offices. In some cases, such as passenger elevators, printing presses and cash-carrier systems, direct current is actually preferable to alternating, and it is very difficult to give the customer as good and as quiet service with alternating current as he enjoyed with direct current.

It may seem rather hard on the central station to have to give a brand-new motor or fan for an old piece of "junk," apparently only fit for the scrap heap. Even so, many customers will be found who will claim in all sincerity that the new piece of apparatus is not nearly so good as the old one taken away and which had served so well year after year.

WIRING IMPORTANT ITEM

Changes in interior wiring are more serious than may at first appear. When direct-current motors are replaced by three-phase apparatus one new wire must be run, and since the old wiring was very often put in years ago, when requirements were not so strict as today, all wiring may have to be revamped.

Many mechanical difficulties may also have to be overcome. In the case of cash-carrier systems, for instance, very low-speed direct-connected motors are generally used, and it is impossible to get an alternating-current motor which will operate at anywhere near this low speed, so that some mechanical changes are necessary to allow for the use of belt drive. The belted alternating-current motor is always a good deal noisier than the direct-current, direct-connected machine was and as the motor is usually installed in the cashier's cage, the customer may insist on a sound-proof box over the motor before he is at all satisfied.

In changing over organ-blower motors it is almost always advisable to cover them with a properly ventilated sound-proof box to deaden the hum, which will be quite audible in the body of the church when the organ is playing softly unless some means of muffling the sound is used. Oftentimes the construction of this box costs as much as the new motor, since it is necessary to match the woodwork of the church wall paneling.

DIFFICULT CASES

Unfortunately for the central station, the most expensive changes of apparatus often come in places that pay the least revenue, such as the offices of medical specialists and dentists. If a dentist has an X-ray machine, a couple of dental engines, two or three lathes and desk fans, and so forth, it may cost several hundred dollars to change this equipment over, although he may use but $25 worth of energy in a year. Eye, ear and throat specialists are also costly customers to take care of, while passenger elevators and newspaper plants will cost one or two thousand dollars each before the change is completed. Photographers' and engravers' arc lamps are expensive things to exchange, and the customer is generally dissatisfied even after you have done your best for him.

The value of the direct-current equipment taken out is discouragingly low, and if a part of the direct-current system is changed over it is better to wreck all apparatus and sell it for junk. If this is not done, a great deal of it will somehow find its way back on your lines again and you will have to exchange the same piece of apparatus more than once no matter how careful you are. And this recalls another word of warning. Keep your intentions as to making the change-over quiet as long as possible. If you don't, unscrupulous dealers will conspire with equally unscrupulous customers to obtain new alternating-current equipment.

In one instance where the change-over was announced prior to commencing the actual work a dental supply company furnished a dentist's office a few weeks before the change with two old dental engines and three old direct-current dental lathes, over and above the dentist's regular equipment, and thus the dentist procured some brand-new alternating-current equipment for practically nothing. A few weeks after the exchange the new alternating-current equipment had disappeared from the dentist's office and presumably had gone to the dental supply house's stockroom.

Desk and ceiling fans are another thing that customers will stock up on before their turn comes to be cut over to alternating current, and old fans that had lain in the junk pile for years have been resurrected by unscrupulous jobbers and placed in various customers' offices to be exchanged for nice new fans.

Make Preliminary Survey

To prevent this as far as possible, it is well to make a preliminary survey of the territory to be changed over, checking up all equipment which will not operate on alternating current and have the customer then and there sign a form of inventory of his direct-current apparatus, stating that it includes all the equipment that he has in his possession which needs to be changed and that he will purchase no more direct-current equipment without first consulting the company. The company signs the same form, which is in duplicate, stating that it will, at no expense to the customer, exchange the old apparatus for new apparatus of similar description. One form which has been used reads as follows:

Agreement to Change Customer's Apparatus from Direct to Alternating Current

This agreement made in duplicate this   day of   , 1921, by and between the Blank Electric Light & Power Company, hereinafter called the company, and the Brown & Smith Dental Company, hereinafter called the customer, witnesseth as follows:

FIRST—The company proposes to change its direct-current system to alternating current, which will make it necessary to change some of the apparatus which its customers now have connected.

SECOND—The customer now has installed in premises at 83 South Main Street, South Warburton, Mass., the following direct-current apparatus which is to be changed.

One (1) stationary vacuum cleaner, belted to 1 hp., 1,720 r.p.m. motor pulley, 3 in. x 3 in.
One (1) "Electro" dental engine.
One (1) X-ray machine (dental size).

THIRD—The company will furnish and install the following alternating-current apparatus in exchange for the direct-current apparatus as listed above................at no cost to customer:

One (1) 1-hp., 220-volt, single-phase Wagner motor, 1,800 r.p.m., with 3 in x 3 in pulley, for vacuum cleaner.
One (1) "Electro" dental engine (engine head only to be changed).
One (1) Ritter dental lathe with chucks.
One (1) X-ray machine of same size and type now used.

FOURTH—The above is a full and complete list of all direct-current apparatus now in the possession of the customer which is to be changed, and it is understood and agreed that no additions or changes shall be made in this apparatus without first notifying the company, and such additions and changes shall be made entirely at the customer's expense.

FIFTH—The company will, upon the execution of this agreement by the customer, take immediate steps for the completion of this change and use all reasonable measures to give uninterrupted service during the change-over period and not to inconvenience the customer.

IN WITNESS THEREOF the parties have caused these presents to be signed the day and year first above written.

Blank Electric Light & Power Company,
(*Signed*) By H. E. Green, President.
Brown & Smith Dental Company,
(*Signed*) By R. S. Brown.

Story of a Doctor

There is one word of warning to append to this kind of agreement. In it appears the following sentence: "The company will furnish and *install* the alternating-current apparatus, etc." The word "install' nearly caused one company a lawsuit. A certain doctor had a direct current X-ray machine, and when the matter of the change of apparatus to alternating current was investigated he asked that a more powerful machine be put in, the difference in cost over that of a machine of the same size as his old one being very little. This the company agreed to do. However, when the new X-ray machine arrived and was put in place the current requirements were found to be so much greater than for the old one that heavier circuits from the basement to the fourth floor where the office was located were required.

The company felt that, as it had been good enough to provide the larger machine as requested, the least the customer could do was to stand the expense of the wiring change and also held that the word "install" in the agreement only meant to place the new machine where the old one had set and plug it in at the old receptacle. The customer held that the word "install" meant to put the machine in ready to run, including any increase in copper needed for satisfactory operation, and hired a lawyer to bring suit to compel the company to put in the heavier wire. The case was finally settled out of court, the company being the loser. Be careful, therefore, in filling in the body of your change-over agreement to cover any such possible cause for disagreement by positively stating, in any case where it seems necessary, just what the company will or will not do as regards wiring changes.

Converters Not Satisfactory

In the case of medical specialists it sometimes seems as though the cheapest way out for the company would be to buy a rectifier or motor-generator set and leave the apparatus unchanged, but don't do it unless it is absolutely impossible to get similar apparatus for alternating-current operation. Several companies have tried this plan, always with unsatisfactory results, and have finally installed the alternating-current equipment. Almost every kind of machine or appliance can be obtained wound for alternating current.

And another thing—don't buy any apparatus except the best. Remember that the customer will look to you for some time to come to see that the new alternating-current appliances give good service, and that he is naturally a little suspicious of the change and expects that somehow the company is trying to get the best of him in the exchange. So far as is possible, see to it that the new appliances are at least as good as, and preferably better than, the old direct-current equipment ever was.

Naturally, the actual shifting of apparatus and cutting over of services from one current to the other must be conducted with as little inconvenience and loss of working time to the customer as is possible.

Co-operation Needed in Rural Service

Organized Bodies of Farmers and Those Interested in Serving Them Must Solve the Problems Involved in Promoting Use of Electrical Energy in Rural Districts—Entire Subject Worthy of United Study

TWO phases of the rural electric service situation need careful attention now if trouble and confusion are to be avoided in the future. During the past few years the demand for electrical service that has come from the farmer has apparently been founded on sound economic grounds. Judged by the standards of older developed classes of service, the costs of energy have proved high because of its small use and the scattered locations of the consumers. This did not deter the farmer from seeking service until his financial situation forced a modification of his normal activities. Present indications are that the demand is being renewed as the farmer gets back on his feet financially. With the renewed demand inquiries are coming from farm sources concerning the costs of obtaining service facilities and the ensuing rates for electrical energy. The two questions that must be answered are: (1) What maximum use can the farmer make of electrical service, viewing the farm as an industrial establishment? and (2) How can the central-station company furnish its share of the service to the best advantage at a reasonable price?

HOW CAN THE FARMER USE ELECTRICAL ENERGY?

To reduce the cost of electrical energy on the farm requires the development of methods for increased use in the home and routine agricultural tasks. The uses in the farm home are probably fairly well developed, since this use is not different from that in the city home. Light is the first use. The washing machine, iron or ironing machine, heating appliances and other familiar items of equipment are as useful on the farm as in the city. The electric range is an important factor because it is the only method by which the farmer can escape the wood or coal range or the oil stove. That it is a practical home device can no longer be questioned. Its application to farm use should be actively studied. The churn, water-pumping equipment, milking machinery and the general utility motor are items of equipment that have been developed to some extent, though it is questionable if the limit has been reached. As an example, the water supply on a stock farm is a most important factor. It is asserted by some farm authorities that if ample water supplies are available at well temperatures during all the months of the year and coupled with proper feeding, the time of preparing stock for market can be materially shortened, resulting in a direct saving of expense. In the winter season in many parts of the country stock will drink only a fraction of the amount of water that should be consumed because of the low temperature of water taken from tanks or reservoirs. With present methods the supply is often irregular and stock suffers accordingly. Electrically driven pumps are susceptible of almost unlimited automatic control. Of what use can such control be in the handling of water supplies?

Much the same problem can be found in the question of using ground feed, and particularly in the mixing of various kinds of grain. It has been said that the grinding of feed on the farm is only an intermittent job at best. With the automatic possibilities of the electric motor it may be that a general-utility motor can be utilized and grain ground in greater quantities and over longer periods of time to give better control of feeding and consequent better results in the marketing of stock. In this connection the present situation in respect to farm machinery is interesting. The machines in use on the average farm are not highly developed from the standpoint of mechanical efficiency. This is not a reflection on the manufacturers of farm equipment. They have built equipment to fit such conditions as existed. That equipment has helped tremendously in promoting efficiency in farm work. However, until the past few years most of the equipment has been designed for either horse or man power. The mechanical efficiency requirement has been that the power needed shall not exceed the capacity of the driving power. In general, with horse-drawn equipment there has been a large surplus of power for emergencies. Mechanical inefficiency has not been revealed as a matter of dollars and cents in fuel costs, and so long as the horse was not overloaded mechanical inefficiency has not been reflected in the cost of his upkeep. With the advent of mechanical power devices the question of mechanical efficiency of equipment becomes an important one, since it has a direct bearing on the cost of operation. If mechanical power of any kind is to continue in use on the farm, it cannot be long until the refinements that have been necessary in other industrial equipment will be found necessary in farm equipment. The tendency is already in evidence in many directions. Along with such a development must come better care of farm equipment, which means less machinery abandoned in the fields to rust until the next season's work begins and still further improved service organizations on the part of the farm equipment people. The farmer, with his experience in the use of the automobile, the gasoline engine and other mechanical equipment, is in better position today to appreciate this than he has ever been before, and under the pressure of economic need the lesson will be more thoroughly learned. With the development of greater mechanical efficiency in farm equipment must come the consideration of electrical energy as an aid in development

HOW CAN THE CENTRAL STATION SUPPLY ELECTRICAL ENERGY?

It seems hardly necessary to review all the past discussion touching the question of how the central station can supply electrical energy. It is becoming increasingly evident that, so far as the central-station lines can reach, the handling of such a supply is a central-station job. Either the central station must bring to the problem its experience and help in finding the answer, or the farmer will be forced to find his own way at the expense of repeating the errors made in the past by central-station men, in the effort to enter what is legally and from a commission regulation viewpoint central-station business. This latter course is an illogical and uneconomical one and unworthy of central-station initiative. In the giving of such service from central-station systems there are certain costs involved that are susceptible of analysis. It is true that these cannot be set down at once and with complete confidence that all items have been adequately covered. Movements are now under way in which studies are being made of these costs. In the past two years particularly much progress has been made and there is a much clearer understanding of the problem than there was even a year ago. The studies of these costs must be prosecuted until figures on which practice can be based are made available to every one who cares to know them.

How Can the Problems Be Worked Out?

There are two distinct problems involved. The first covers farm methods and equipment. It cannot be worked out by central-station men. Only men who know the farm and its problems can do it. In the United States today there are more than half a hundred experiment stations devoted to the farmer and his interests. In their hands lie the means of carrying out a large part of the research work that is necessary. Men involved in the work of these stations have expressed themselves informally as eager to undertake such work, going even to the extent of putting competent technical men on electrically equipped farms to carry on investigations as to the ways in which electrical energy can be properly utilized and how more efficient methods and equipment can be developed. There are the manufacturers of farm equipment, most of whom have seen the problem and are engaged actively in the improvement of equipment for use on the farm. There is an agricultural press that has done efficient work in the education of the farmer to better methods of work and living. The farm bureau is another organization that is interested. And not the least of those interested are the men who have undertaken the development of the individual farm plant. Some central-station men have been short-sighted enough to resent the business obtained by these manufacturers. The term short-sighted is used advisedly because it is believed that the individual plant has a very definite part to play in the development of electric service on the farm and that the central station cannot afford to assume other than a friendly attitude toward this development as one of the means of giving the farm the benefits of electrical energy. All of these agencies have something to offer in the solution of the problem. With them will lie the determination of the extent to which the farmer can use electricity.

On the other hand, these agencies cannot work out the problem of the central station and electrical manufacturers. The solution of that problem lies in the hands of central-station men who are trained to think in terms of distribution of energy and efficient service, and in those of electrical manufacturers, who have been called on to face similar problems in the past. That this is so has already been recognized among central-station men in the appointment of the national rural lines committee of the National Electric Light Association, which has made a beginning in its work during the past year. Electrical manufacturers are busy on the problem in many directions. Along with its own peculiar problems the central station, because it is the first point of contact with the individual consumer, must carry a share of the burden of getting the results of the investigation work done by the various interested agencies to the individual farmer. To a greater extent than any other class of men the farmer is an individualist and must be reached individually. This condition may make a slightly more difficult problem than that involved in the early educational work done through central-station men in the industrial field, but the educational work in the farm service field is no different in type from that central-station men were called on to do in the industrial field. The lessons learned there will be of immense value in avoiding pitfalls in the newer line of endeavor.

Co-operation the Answer

There are two ways in which the development can be carried out. One would be to let each side in interest go its own way. Eventually the force of economic pressure would force a solution of the problem at the expense of much labor, controversy and many mistakes. The other would be that of co-operative work. Following this course mistakes would be made and serious disagreement might exist at times. In the end the question as to how the farmer can best use electrical energy in his operations would be answered promptly on a basis which would be thoroughly understood by all concerned, at the saving of much time and expense. The former method would be likely to end in the political arena with profit to none concerned. The latter would avoid such undesirable results. It is not possible to state now how such a co-operative movement could be handled. It might be found desirable to have a joint committee something after the fashion of the committee handling the inductive co-operation problem. Such an organization would act as a steering committee in co-ordinating the efforts of all the forces at work. At best it could handle only a small portion of the forces, but those would probably be the most important and controlling ones. Backing up this sort of work should be a close relation between the various local interests involved. As an example, the Iowa Agricultural College at Ames has already undertaken investigation of some of the phases of the problem in co-operation with the Iowa Section of the National Electric Light Association. This is only a start, but it has already brought into the work the type of men who can be of immense assistance in solving the problem. Every state association and every utility having such a problem ought to be in intimate touch with the agencies representing the farmer in their own localities. In this way real progress can be made and misunderstandings that may end in political mix-ups can be avoided. Back of the problem are facts that need to be set forth as a basis on which every one interested can build. This can be done best through co-operation.

◆

Electrification Plans in Holland

THE Dutch government has just appointed a commission for the purpose of closely studying and eventually improving an electrification plan which was submitted to the government some time ago. It is intended to erect five large central stations, able to take the place of the numerous smaller ones now existing. In connection with this project plans for the electrification of the Dutch railways are under way. The first line to be electrified will be that part of the Dutch Railway running from Amsterdam and The Hague to Rotterdam. All the other leading railway companies, as well as the Dutch State Railways, are at present examining the problem of electrifying their lines.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Expedients Should Be Adopted with Caution

To the Editors of the Electrical World:

In an article appearing in the *Electrical World* a short time ago there was an illustration of three 100-kva. transformers connected in a bank and a stream of water was shown being played on one side of the tank of each one of the three transformers. In this way, the author pointed out, the capacity was increased from 300 kva. to 450 kva. It immediately occurred to me that this might very well lead operating companies into trouble and cause excessive internal heating due to the higher current densities and possibility of local hot spots.

Before applying such expedients it would be advisable for plant operators to consult the manufacturers of the equipment to ascertain whether any operating hazard would thus be incurred.

L. F. WOOLSTON,
General Electric Company.
St. Louis, Mo.

[We agree most heartily with the idea expressed by Mr. Woolston.—EDITORS.]

Solving the Fuse-Plug Problem

To the Editors of the Electrical World:

I have read with interest the article by W. W. Merrill in the Nov. 4 issue of the *Electrical World* under the heading "Waste and Loss in the Fuse-Plug Situation," and it occurs to me that the way to handle the situation of which Mr. Merrill complains is for the interested manufacturers to combine and run an educational publicity campaign to educate the public to the necessity of always having on hand a supply of fuses.

The small cartons containing enough plugs to meet any ordinary emergency provide a convenient way for the average householder to stock them. I feel that there is a great opportunity to improve conditions by the education of the public, which so far as I am aware has never even been attempted.

ROBERT CHARLES COLE,
Sales Manager Electrical Division.
The Johns-Pratt Company,
Hartford, Conn.

Improving the Operation of Electric Ranges

To the Editors of the Electrical World:

I have noted with interest the letter in the *Electrical World* of Oct. 28 by George M. Hardy in reference to improving the operation of electric ranges. The writer has been interested in this matter for more than a year and has considered the two methods suggested, but has devised another method which should prove more satisfactory from the various points of view. The objection to using 220-volt elements in the units is that they are not long-lived. They compare with the 220-volt filament lamp as against the 110-volt lamp for ruggedness and durability. The objection to using an auto-transformer is the added cost of installation as well as the reduction in efficiency.

The most practical way which has been devised and tried by the writer is to have a switch for each individual plate or unit which will put the two halves of a unit in series across the 220-volt line for high heat, using the rugged and durable 110-volt element instead of the present method of putting them in multiple across 110 volts or one side of the three-wire line. The same switch would put one-half of the element across 110 volts for medium heat and the whole element in series across 110 volts for low heat as at present. By this method not only is the operating condition improved to the same extent as by the methods mentioned by Mr. Hardy, but the efficiency and speed are also improved.

This switch is now being offered to the manufacturers and will doubtless be accepted as standard, as its cost is very little more than the cost of those now in use.

G. R. BLAKESLEY,
Commercial Manager.
Janesville Electric Company,
Janesville, Wis.

Interconnection Log Sheets

To the Editors of the Electrical World:

Referring to the editorial in the *Electrical World* of Nov. 4, 1922, on interconnection log sheets, our dispatcher's log sheet covers incoming power at all points hourly. Our substation log sheets cover outgoing power on all feeders hourly. This is, of course, in addition to the special demand-measuring devices. We feel that the first record—that is, of all incoming power—is necessary in order to know the exact system production each hour. Any unusual variation in this figure can be checked by the outgoing meters at the various substations where we are delivering power to large customers who have plants of their own and consequently are apt to vary the amount which they take from us to a considerable degree.

W. R. BELL,
Operating Engineer.
New England Power Company,
Worcester, Mass.

The International Status of Superpower Systems

To the Editors of the Electrical World:

The writer has read with interest the article entitled "The International Status of Superpower Systems," printed in the *Electrical World* on page 814, Oct. 14, especially the section on high-tension cables. In this section various extra-high-tension cables in Europe are mentioned.

A great real of rather misleading information has appeared in the past on the subject of high-tension cable installations. For instance, articles have been written on a proposed high-tension cable system, which system might never materialize or else was actually operated at a lower pressure. The original article, however, has often been quoted as authority for the actual existence and operation of a "super-cable." In the above-mentioned section on high-tension cables there appear to be several errors or omissions, and in order to avoid perpetuating certain false impressions which might be gained from your article, we desire to make certain comments about some of the cable mentioned, these comments being based on a careful study of foreign high-tension cables both from the technical press and from private sources.

France.—The report mentioned 70,000-volt single-conductor cables and 50,000-volt three-conductor cables. It seems quite probable that the 70,000-volt cable referred to is the cable at Lyons, which has operated for many years on the Thury system of high-voltage direct current at 70 kv., which is of course a considerably different proposition from alternating current. It is understood that 60,000-volt single-conductor cables have recently been installed in Paris, and a 50,000-volt single-conductor cable line installed some years ago at Chalons-sur-Saone; also that there are several installations of commercial lengths of three-conductor cables for 33,000 volts. Mention was made in 1910 of a short length of 40,000-volt three-conductor cable. If a 50,000-volt three-conductor cable exists, the writer believes that it must be a very short or experimental length.

Sweden-Denmark.—Our information is that the submarine cable connecting Denmark and Sweden is a three-conductor 25,000-volt cable installed in the fall of 1916, rather than a 50,000-volt cable installed in 1913 as mentioned in the report. When first mentioned in the press the cable was called a 30,000-volt cable, but the actual working pressure used was 25,000 volts, as shown by numerous articles in the technical press and confirmed by private sources. It is of course possible that the voltage has been doubled comparatively recently, but this does not seem probable in view of the insulation thicknesses and the fact that no publicity has been given to this change.

Italy.—The report states that in Italy three-phase cables are used at 30,000 volts and single-conductor cables up to 80,000 volts. The figure seems to be correct for three-conductor cables, but our information is that the single-conductor cable for 80,000-volt three-phase operation was never delivered to the customer and that the project has been dropped. There were two 38,000-volt single-conductor installations in Italy, the working pressure of one of which was reduced to 22,000 volts a few years ago, the present status being unknown.

England.—The article seems to be correct in stating that the upper limit of voltage is about 33,000 volts, the cables being in three-conductor form.

Holland.—The report states that Holland uses cables up to 50,000 volts. A Dutch commission was formed to study the question of a suitable voltage for the country and has recently made a series of most excellent reports on the subject, 50,000 volts being recommended as the most suitable pressure. Two different lines of 50,000-volt underground cables were planned to connect to overhead lines of the same voltage, one line being three-conductor and the other single-conductor in form. We have been informed that the former developed considerable difficulties, and until recently was not in operation, while the latter has been operating at 10,000 volts pending the arrival of station apparatus.

Switzerland.—A 150-mile line of 30,000-volt single-conductor cable is mentioned. This statement is believed to be closely correct but somewhat misleading, since the line, which is undoubtedly the St. Gothard line of the Swiss Federal Railways, consists of four single-conductor cables, and apparently the 150 miles is the total cable length instead of the length of line. The cables are single-conductor cables for operation at 60,000 volts single-phase with the midpoint grounded, so that each cable has to withstand 30,000 volts only. However, the other single-conductor cables have been rated in terms of line pressure rather than of voltage between conductor and sheath, the previous cables all being for operation at the stated voltage three-phase, and it seems only fair that the Swiss cables should be called 60,000-volt cables, though the voltage per cable on this single-phase line is 30,000 volts, as compared with about 35,000 volts per cable on the Paris 60,000-volt three-phase line.

It is, of course, most difficult to obtain exactly correct information about all the foreign high-voltage cables since reports are sometimes conflicting. However, we feel sure that the figures given above are very close to the true values, since converging evidence has been obtained from various sources in all cases. Additional information in regard to three-conductor cables at least is offered in the Oct. 5, 1922, number of *Elettrotecnica*, which has just been received. On page 667 appears an article by Sacchetto, of Pirelli & Company, the well-known Italian cable makers, in which a positive statement is made as follows: "At the present time there are no three-conductor cables in service at voltages above 33,000 volts." The main purpose of this letter is to avoid the inference which naturally would be made from the article that various systems are in commercial use or are even standard practice, whereas, in actual fact, many of these are probably only experimental, projected, or even abandoned. DONALD M. SIMONS.

Standard Underground Cable Company,
Pittsburgh, Pa.

[The report published was an abstract of the translations of the papers presented at the congress.—EDITORS.]

An Opportunity for Exchange of Experience

To the Editors of the Electrical World:

As a small plant usually has only one man to furnish the brains for all the different classes of work carried on, this one man is often called upon to tackle work in which he has had no previous experience. Usually books cover only the theory of different operations and give nothing concerning actual methods used to accomplish results. Therefore detailed experience on the following subjects would be of interest to the writer and doubtless to many other power-plant managers in a similar position:

Methods of testing, adjusting and repairing switchboard instruments in detail.

Methods in which a meter manufactured for one number of phases or one voltage may be made to operate on a different number of phases or voltage, including detailed diagram of connections.

Proper methods of installing motors, generators, engines or cables, showing details of leveling and lining up.

Methods of locating faults and making repairs to the above apparatus, using simple instruments.

Proper and improper transformer connections, with reasons why some which appear good are not generally used.

Installation operation troubles and proper remedies for small water-power plants.

Buying, selling, handling customers and handling labor. CLARENCE N. BRIDGE,
Superintendent.

Electric Light & Water Works,
Charlevoix, Mich.

[Any practices or experiences on the above subjects which are contributed by the readers of the *Electrical World* and which would be of interest to the majority of its readers will be gladly published.—EDITORS.]

A Correction

In the letter entitled "The Fused Neutral," by L. H. B. Sandwell, in the issue of Nov. 18, an editorial error was made with respect to the directions of the arrows on the diagram. The cut on the right should have had all the arrows on the right-hand side of the branch circuit pointing to the right instead of to the left. The cut on the left has an arrow in the top middle wire reversed.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Individual Responsibility in Plant Inspection

SUCCESS in central-station operation depends in large measure upon faithful and intelligent inspection. In some quarters it is believed that this inspection cannot be rendered without elaborate records and forms, comprehensive books of instruction and a system of checks and balances that at least purports to show minutely at all times the inspection history of all station apparatus. In response to an inquiry by the editors of the *Electrical World* as to the inspection methods followed by the United Electric Light Company of Springfield, Mass., in relation to steam and hydraulic generating machinery and auxiliaries, the writer gives it as his firm opinion that men are far more important than too minute records in handling this class of work.

ALLOCATION OF INSPECTION

All of this company's electrical maintenance work, electrical inspection and new construction of an electrical nature in generating and substations is in charge of the company's electrical engineer, and the thorough inspection system employed on the electrical side of the property has been described in the *Electrical World* in an article published Nov. 6, 1920, on page 923. On the so-called steam and water ends the superintendent of the generating department has charge of the operation of all equipment, including electrical apparatus in stations, also supervision of all steam-plant maintenance, waterwheel inspection, repair work on boilers, piping, governors, buildings, etc. This division of plant work results in well-defined responsibilities, co-ordinates the operation of prime movers, auxiliaries and electrical equipment and insures thoroughness in maintenance.

On the steam side of the station the stokers and coal-handling machinery are under practically continuous inspection, and constant watchfulness is also given to operating turbines. One man is maintained on duty constantly in the space above the boiler coal bunkers to attend to lubrication of conveyor equipment and see to it that the fuel supply is at all times running smoothly. Particular attention is paid to all bearings concerned in the fuel supply, and no chances are taken of the piling up of coal in the wrong place through improper operation of conveyors, etc. Turbines are closely watched for vibration, and the larger units are shut down at least weekly for inspection. At such times the automatic stops are tested and lubricating oil is drained and filtered, including that serving auxiliaries.

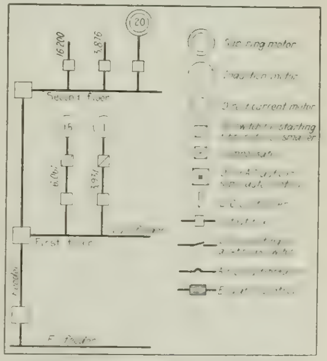
Boilers are thoroughly cleaned yearly both internally and externally and all fusible plugs renewed. At this time the boilers are inspected by a state or insurance inspector. In addition, all boilers that are in 24-hour service are taken out of service every four weeks and the first two rows, or more, of tubes are bored if conditions warrant. The brickwork is inspected, stoker equipment looked over thoroughly and combustion chamber cleaned at such times. This inspection period may appear short as to intervals between examinations, but it has resulted in practically 100 per cent service from all boilers during hours of operation, and I recall no instance where a boiler has been withdrawn from the line when needed for service. Fans for stoker air supply are inspected fortnightly and are thoroughly cleaned to prevent unbalancing and excessive wear of bearings. Air washers are inspected weekly and elevators at the same interval, a signed report of the latter being turned in. A complete overhauling of the turbo-generating units occurs yearly.

The operating staff in charge of steam and hydraulic equipment is from the nature of the work constantly inspecting such equipment. Waterwheels are inspected semi-annually at least, alignment of bearings receiving particular attention. In the absence of extended records of the routine gone through with in equipment inspection a list is posted in the turbine room at the State Street station showing exactly what units of apparatus on the steam side of the station are assigned to particular individuals for inspection responsibility. It is not believed necessary in the maintenance of such equipment to resort to elaborate forms recording minute details of inspection. The staff is composed of trained and responsible men to whom the company looks for results rather than methods, and considerable latitude in the ways of accomplishing the required service is freely permitted. The company does not lack records of its steam and hydraulic equipment troubles, but we have kept away from any temptation to maintain elaborate clerical reports of inspection, and the policy seems justified. **W. D. PACKARD,**

Superintendent Generating Department.
United Electric Light Company,
Springfield, Mass.

Symbolizing Industrial Motor Layouts

A DIAGRAMMATIC method of recording motor layouts shown in the accompanying illustration is used at the plant of the Fisk Rubber Company, Chicopee Falls, Mass., as illustrated. The diagram virtually represents an elevation of the



CONVENIENT SYMBOLS FOR INDUSTRIAL PLANT WIRING AND MOTOR LAYOUTS wiring, the feeder and junction-box arrangements at different floor levels being indicated symbolically as shown, and sub-feeders, taps and motors, with compensators and other information, are readily included. Motor ratings in horse power are indicated by figures in circles, and the number of any leased machine is indicated on the appropriate tap circuit. Quick understanding of the electrical layout is greatly facilitated by these schematic diagrams.

P. L. Butterfield,
Chief Electrician.
Fisk Rubber Company,
Chicopee Falls, Mass.

Cable in Flexible Tubing Allows for Expansion

The protection of splices and compensating for expansion and contraction in a 2,800-ft. lead-covered cable laid on the Interstate Bridge spanning the Columbia River at Vancouver, Wash., were ingeniously provided for by the engineers of the Portland (Ore.) Railway, Light & Power Company. The cable was installed in a 3½-in. conduit laid on the curbing as shown in Fig. 1. Owing to the 2,800-ft. run several splices were necessary. Where cables are installed in conduit splices are usually protected by steel cabinets, which are not only unsightly but expensive. The method of housing the splices shown in detail in the upper half of Fig. 1 made a job of neat appearance and provided a maximum of protection at a minimum of expense. The bushing, the reducer and a 4½-in. sleeve cost about $16 a splice. The labor of installing was approximately a dollar per splice, as against about $10 had a steel cabinet been used.

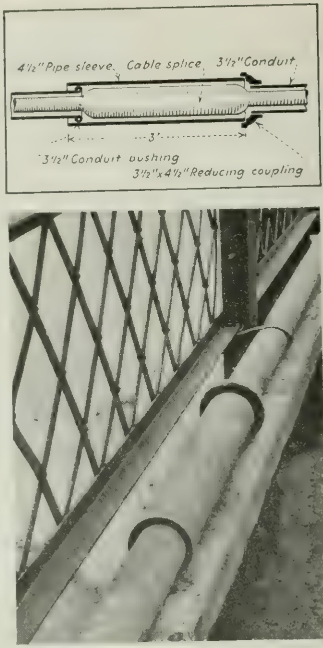


FIG. 1 — PROTECTION OF SPLICES IN LEAD CABLE ON STEEL BRIDGE IMPORTANT

Above — Splice protected by conduit sleeve. Below—Easily and cheaply constructed splice housing eliminates use of costly steel cabinet.

Some method of allowing for a total expansion and contraction of 2½ in. at the expansion joints in the bridge had to be devised. This was accomplished as shown in Fig. 2. The cable was passed through a 3-in. metal carburetor hose formed into a loop and the end of the hose sweated into brass collars. These collars form a bell mouth and bind the end of the flexible tubing inside the end of the conduit, as shown in cross-section in Fig. 2. One end of the conduit was offset to allow the loop in the cable to be easily made. The cable was pulled both ways through the expansion joint. In one direction it was pulled directly off the reel. A sufficient length for the pull in the other direction was then taken off the reel and cut. Before making this last pull the carburetor hose was slipped over the end of the cable. The total material cost was approximately $21, and the labor cost about $1.50 per expansion joint. A steel cabinet 10 ft. x 4 ft. x 2 ft., costing approximately $50, would have been required for each joint had the obvious method of providing for expansion and contraction in the cable been employed. Furthermore, where the cable is in view of the public as in this case, the use of the flexible metal tubing made a much more sightly installation.

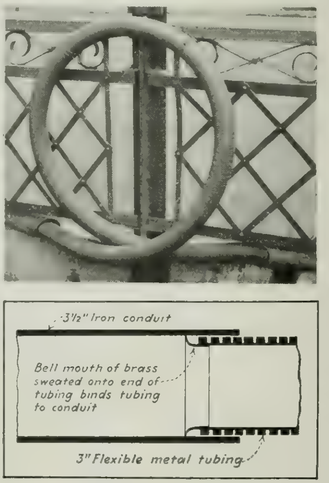

3½" Iron conduit
Bell mouth of brass sweated onto end of tubing binds tubing to conduit
3" Flexible metal tubing

FIG. 2—EXPANSION OF CABLE AND CONDUIT TAKEN CARE OF BY LOOP

Above—Flexible steel tube provides mechanical protection at expansion joint. Below—Longitudinal section showing method of fastening flexible hose in end of rigid conduit.

R. S. Carroll,
Superintendent Underground Distribution.
Portland Railway, Light & Power Company,
Portland, Ore.

Boiler-Room Experiences of Three Plants

Recommendations covering boiler-room control taken from actual operating experience in three steam plants were given recently by the sub-committee on boiler-room operation of the Empire State Gas and Electric Association at its annual convention at Lake Placid, N. Y. A. C. Jordan of the Elmira Water, Light & Railroad Company was chairman of this committee. The experiences were contributed by the Elmira (N. Y.) Water, Light & Railroad Company, the Rochester (N. Y.) Gas & Electric Corporation, and the Buffalo (N. Y.) General Electric Company.

Every boiler room should be equipped with one large steam gage, reading approximately 15 lb. per square inch each way of the ordinary operating steam pressure. This gage should be equipped with an illuminated dial with approximately 1 in. on the scale to 1 lb. pressure. The ordinary steam gages furnished with boilers are difficult to read and do not have fine enough scale markings. They require too much of a change in pressure to indicate. Such a steam gage has practically eliminated low steam pressure in these three plants.

Balance draft should be maintained either by hand or by automatic control, preferably by automatic control, as then one does not have to depend on the firemen to maintain the draft at all times, and there are certain times in the fire room when the human element comes short. Pressure in the furnace should be maintained as near zero as possible.

Boilers should be equipped with automatic feed-water regulators, preferably of the type that drops the water level slightly with increase of load. Each boiler should be equipped with a steam-flow meter with both recording and integrating mechanisms, since this very materially assists in load dispatching.

One of the most valuable accessories in the boiler room is a boiler meter. By this is meant a meter which indicates at all times the drop in pressure through the passes of the boiler or through the fuel bed, because once this instrument is properly installed, one can burn coal much more efficiently than with any other device known to the committee.

In at least one of these plants a stoker revolution counter has been found invaluable, owing to the fact that in burning one grade of coal of uniform quality it has been possible to insist that the firemen keep the speed of the stokers within very narrow limits. It also gives a valuable check on coal weights, because from a period of tests it is possible to arrive at the average amount of coal per retort per revolution of the stoker.

Mechanical control of air and coal fed to the boiler has been tried in some places, but the committee is not at present in a position to make a report on its advisability.

The above details cover most of the mechanical features of boiler control. There are other things that are as important in boiler control as the mechanical features, or even more so. These are load dispatching and the personnel of the fireroom. With boilers equipped for such operation, load should be dispatched so that they will carry from 150 per cent to 225 per cent of rating when they are on the load. Various indicating and recording thermometers should be used to check operation in the fireroom. A competent foreman in charge of each fire shift and a thorough education of new men who are broken in as firemen will tend largely to the increase of efficiency in the boiler room.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

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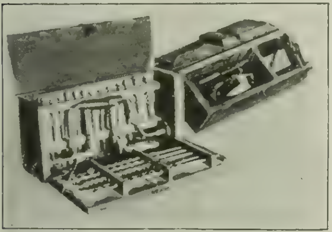
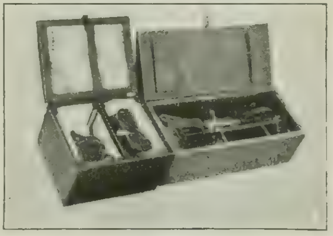
Saving Time in Handling Tool Equipment

THE difficulty of keeping and caring for tools in power company service work is well recognized. There is always a danger of tools or parts of tools being overlooked and forgotten when men are left in isolated places for a time to do a special job. This not only entails the expense of replacing the tools, but lessens the efficiency of the service wagon, the loss not being noticed until the tool is urgently needed for other work. Very little that is lost in this way is ever recovered.





SUITABLE BOXES FOR EQUIPMENT PREVENT LOSS AND FACILITATE HANDLING OF TOOLS

Each box is arranged to care for groups of tools generally used together. They are light enough to be easily portable by express or by an automobile such as is shown in D. A bit box containing wood bits with braces and a smaller box for drills from ½ in. down are illustrated in A. A canvas lined ammeter box and pipe threading equipment is shown in B, while C is an oil test set for making tests in the field. A case for carrying oil samples equipped with reversible cover is shown in E.

Three years' experience in the field has led to the development of boxing equipment for use on service wagons of the Pacific Gas & Electric Company which not only saves time but prevents loss and facilitates in every way the handling of tools and equipment. Each box is arranged to care for groups of tools generally used together, so that one box will usually cover the needs of a small job and can be left with one piece of work while other equipment is being transported elsewhere. Boxes were made one at a time, and each one was designed to meet its particular need. They are light enough to be easily portable and suitable for transportation by express or car as occasion may demand.

Among the boxes which have been worked out for particular equipment are the bit box, containing wood bits with braces and expansion bit; also a smaller box containing drills from ½ in. down, the hand grinder and a hand drill for working small drills by hand. An electric drill is used for larger sizes. For the ammeter with its current transformer a canvas-lined box is used, stuffed with excelsior, and there is a special box containing pipe-threading tools for cutting threads on ⅛-in. to 2-in. iron pipe and conduit. This box also includes the pipe vise with bolts, pipe cutter, reamer, oil can and waste. In the oil sample or shipping-case the removable reversible cover is made in two halves and is held together by a meter seal or wire, being made so that it cannot open while this wire is in place. On one side of the cover is the forwarding address and on the other the return address.

A special box cares for the set for testing the oil in the field. When the case is opened out flat the parts are connected together and in position for work by placing the gap cup in position and attaching it to the power source. This case also contains two quart measures, a drip pan, rags for wiping up the drip, a special drawing spout made from a short piece of ½-in. pipe and a complete set of reducing bushings from 2½ in. to ½ in. to fit all valves.

These cases fit neatly into the usual service car or can be carried individually or sent by express. With good tools properly cared for and kept in their proper places, a foundation is laid for better work and loss, wear and replacements are minimized.

F. F. LODER,
Foreman Substation and Maintenance.
Pacific Gas & Electric Company,
Corning, Cal.

Remote Control by Radio Possible

Description of a Relay Developed by the Bureau of Standards—Simplicity and Ruggedness Important Features—Delicate Adjustments and Light Spring Contacts Avoided

THE possibility of remote control of apparatus by radio has excited a great deal of comment among central-station engineers, particularly since the work of the navy in which war vessels have been so controlled and a number of civilian experiments in which automobiles and smaller vehicles have been so handled were announced in the news columns of the daily press. The Bureau of Standards has developed a relay[*] by means of which radio signals can be received and recorded or used to operate a remote-control mechanism. As an example it would be possible to send and receive a predetermined set of complicated signals arranged to operate a selective mechanism built on something of the same scheme as the automatic telephone selective devices in common use. The signals might be so arranged that accidental reproduction by an outside agency would be a virtual impossibility. The necessary devices to utilize the relay for remote-control purposes have not been developed, but the possibilities involved are apparently great enough to justify serious study on the part of central-station engineers.

The diagram of connections for the relay recorder for use with batteries is shown at the left of Fig. 1, while the principle of operation is illustrated at the right. Variations of the grid potential produced by the incoming signals cause a pulsating direct current in the plate circuit, which flowing through the condenser across the relay winding causes an increase in the plate current at the keying frequency. This change in current closes the relay contacts, thereby controlling any mechanism desired.

During the development of this relay it was found that the rectified audio-frequency current in the plate circuit caused the relay armature to chatter rapidly and make a poor contact with the fixed contact point through which the circuit is closed. This was overcome completely, however, by the addition of a 1-mfd. condenser across the relay coils. This serves the purpose of an audio-frequency bypath for the highly inductive winding of the relay, thus greatly decreasing the resistance of the circuit. The change of plate current due to this audio-frequency causes a second change which occurs at the keying frequency. This latter change passes readily through the relay coils and exerts a steady pull on the relay armature.

It was also found that the 0.0006-mfd. variable condenser (Fig. 1) across the secondary of the input audio transformer made possible audio tuning, which increased the selectivity considerably. By means of this tuning it was found that European stations could be made to operate the relay while a high-power station here in the United States would fail to operate it, although the high-power station was coming in on approximately the same wave length and slightly stronger. This was made possible by adjusting the heterodyne note of the European station to a frequency different from that of the local station and then tuning the secondary of the audio transformer to that frequency. The 0.0006-mfd. variable condenser may be replaced by a 0.0003-mfd. fixed condenser and the audio tuning accomplished by adjusting the heterodyne note to the resonant frequency. By means of this audio tuning one of three stations transmitting simultaneously has been selected and caused to operate the relay.

By using two relay recorders connected in series across the output terminals of a single radio receiving set two messages sent on practically the same wave length, but of different audio frequencies, have been accurately received simultaneously.

Tests showed that with a signal

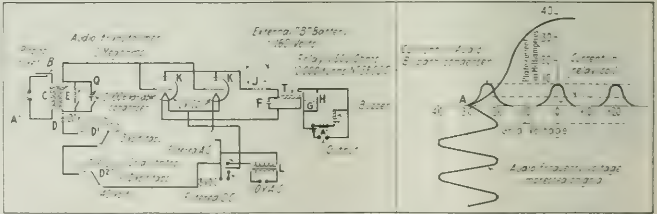


FIG. 1—RELAY RECORDER CONNECTIONS FOR USE WITH BATTERIES AND TUBE CHARACTERISTICS SHOWING PRINCIPLE OF OPERATION

In the wiring diagram at the left *A* is a telephone plug for connecting the relay device to the amplifier output. *B* is a telephone socket to permit operator to listen to the received signal. *C* is an audio transformer of the type used in audio amplifiers, the type used at present being a Signal Corps type C-21. *E* is a 2-megohm grid leak. *Q* is a 0.0006-mfd. variable condenser or a 0.0003-mfd. fixed condenser. *D* is a 20-volt "C" battery connected in series with D^1 a "C" battery variable in steps of approximately 3 volts, and D^2, which is variable in steps of 10 volts. *J* is a 160-volt dry "B" battery. *K* is a type UV-201 radiatron. *F* and *H* are 1-mfd. paper condensers. *A'* is the output to be connected to the apparatus to be controlled. *L* is a step-down transformer for operating the tube filaments from 110-volt alternating-current supply when such is available.

The principle of operation is illustrated at the right. By means of the variable "C" battery the grid voltage is adjusted to approximately 30 volts, at which value the plate current is zero, as shown at *A*. The incoming audio-frequency voltage impressed on the grid varies the grid potential, for example, between the values of —20 and —40 volts. The 10 volts decrease from —30 to —20 causes an increase, for example, from zero to 10 milliamperes, while the increase from —30 to —40 volts is not effective in causing a plate current to flow owing to the fact that —30 volts is already sufficient to reduce the plate current to zero. The result will be a pulsating direct current of 10 milliamperes, maximum amplitude, in the plate circuit. This current, flowing through the plate circuit and condenser *F*, causes an increase in the plate current at the keying frequency. This change, passing through the relay coil, will pull the relay armature over, making contact at *T*, which contact may control any mechanism desired. With the "C" battery grid voltage adjusted for maximum sensitivity it was found that static induction, etc., operated the relay. When these disturbances are not so strong as the signal their effect on the relay may be overcome. For example, if the "C" battery is increased to —35 volts, the critical value for maximum sensitivity being —30 volts, the disturbances due to strays, induction, etc., merely reduce the "C" battery voltage to —30, which is not sufficient to cause plate current to flow. However, the signal, being of greater intensity than the induction, reduces the voltage to —25, which causes a plate current of 5 milliamperes. It will be seen, therefore, that no disturbing effects, if of less intensity than the signal, affect the relay.

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[*] A complete description of this device was published as "A Relay Recorder for Remote Control by Radio," by F. W. Dunmore, *Journal A. I. E. E.*, April, 1922.

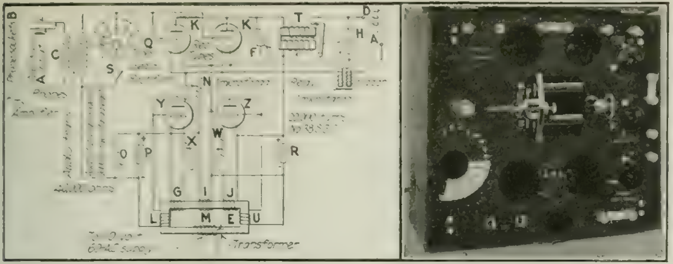

FIG. 2—RECORDER FOR 110-VOLT ALTERNATING-CURRENT SUPPLY

The method of operating the recorder from the alternating-current supply consists in the use of two receiving tubes as rectifiers. The tubes *Y* and *Z* are used as half-wave rectifiers, one supplying the plate voltage, and the other the grid voltage, thus eliminating the "B" and "C" batteries. When used as rectifiers, receiving tubes should have the grids and plates electrically connected together. A special transformer *M* with six windings is used. The windings *G* and *J* supply the filaments of the two rectifier tubes, *I* the filaments of the recorder tubes, *U* the high voltage for the plate; *L* supplies the grid voltage, and *E* is the 110-volt primary winding. The rectified alternating current is smoothed out by means of 4-mfd. condensers *P* and *R*, connected across the output terminals. As the currents in the grid and plate circuits are small, smoothing out inductance was unnecessary. It was found necessary to put 40,000 ohms *O* across the output circuit of the rectifier tube supplying the voltage to the grid, as the grid is otherwise insulated from the filament of tubes *K* by the rectifier tube. By means of the filament rheostats *X* and *W* the grid and plate voltages may be varied over any ranges desirable for the most efficient operation of the recorder. By the use of binding posts with straps (as shown at the right), the type *B* recorder may be operated from *A*, *B* and *C* batteries for supplying the filament, plate and grid voltages respectively in cases where alternating-current supply is not available.

strength sufficient to reproduce a plate current of 10 milliamperes the relay could be operated at a speed of forty-eight contacts per second, the contact being sufficient to operate a buzzer. With 3 milliamperes in the plate circuit a speed of twenty-seven contacts per second was obtained, and with 1 milliampere a speed of nineteen per second. In each case the relay armature spring tension was adjusted for the best operation.

Among the uses to which this apparatus may be applied are: (1) As an ordinary receiver. Here it has advantages over reception with telephone receivers, for one may receive by buzzer or sounder with all induction and interfering noises eliminated, if they are not louder than the signal. (2) A tape or drum-type recorder may be used and a copy made without a trained radio operator. (3) Time signals may be recorded. (4) A call system may be worked by a time switch connected to close the filament circuit for a given time at set calling intervals. (5) Any form of mechanism may be operated by an incoming signal. (6) A receiving station may be located remotely from the transmitting station and the radio signals relayed by wire to the operating room some miles distant. Seven page printers may be operated by radio, the received message appearing in typewritten form as on a typewriter.

For use on a 60-cycle, 110-volt supply the recorder is similar in construction to the one described above except that the plate and grid voltages (B and C battery) are supplied from the alternating-current source. As shown in Fig. 2, the current for operating the tube filaments is also obtained from this source so that the recorder is entirely independent of any form of batteries. It is only necessary, therefore, to connect to the 110-volt alternating-current line and the recorder is ready to operate.

In cases where very high-speed operation is desired the ordinary relay may be replaced by one that has been designed for high-speed operation.

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Radio Laboratory, Bureau of Standards,
Washington, D. C.

* * *

Park Cable Simplifies Street Lighting

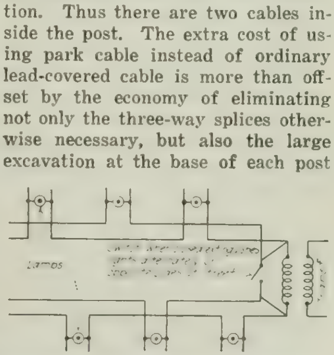
THE use of park cable for ornamental street lighting is now becoming such a frequent practice that some of the details of installation which have been developed may be of interest. In a good many instances it is desirable for reasons of economy to extinguish alternate lights on opposite sides of the street after a certain late hour in the evening. This is accomplished by using two two-conductor park cables and connecting them to the transformer through a switch, as shown in the accompanying illustration.

When it is necessary to connect the park cable to an open-wire series lighting line, the transformer would have a one-to-one ratio with one side connected in series with the open wire. This transformer serves to insulate the park cable circuit from the main line, and its capacity limits the voltage rise in the branch in case the tub transformer supplying the main circuit should send up the voltage because of a break.

Even if the operating voltage of the cable circuit is only 1,500, the latter would be insulated for 5,000 volts to provide a margin of safety on account of the possible action of the tub transformer. Where a circuit is to be supplied from a 2,300-volt commercial circuit, it is connected through a voltage regulator which is nothing more than a small outdoor tub transformer. The voltage for which the park cable should be insulated is then the open-circuit voltage of the regulator.

Single-conductor park cable is, of course, used where it is not necessary to extinguish alternate lights, but in such cases a separate cable is usually provided for each side of the street partly to avoid zigzagging from one side to the other and partly to obviate the possibility of total darkness in case of cable failure in any part of the system.

In some instances where single-conductor cable is used important economies have been effected by eliminating splices at the base of the lighting posts. This is accomplished by stripping the steel-tape armor off the cable and running it as a plain lead-covered cable up the inside of the lighting post from each direction. Thus there are two cables inside the post. The extra cost of using park cable instead of ordinary lead-covered cable is more than offset by the economy of eliminating not only the three-way splices otherwise necessary, but also the large excavation at the base of each post for a man to work in while making the joints. The net saving that was effected in one specific instance amounted to $2 per post.



PARK CABLE ENABLES THE EXTINGUISHING OF ALTERNATE LIGHTS AFTER A CERTAIN HOUR

F. A. WESTBROOK,

Field Engineer,
Habirshaw Electric Cable Company, Inc.,
New York, N. Y.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Central-Station Sales Policy and Methods

Outline of Standard Practice for Employees in New-Business Department—How to Receive Customers and How to Handle Complaints

WITH a view to standardizing and tying together the work of its sales department, the Public Service Electric Company of Newark, N. J., has issued a code of instructions for the exclusive use of employees in the new-business department. The company serves a widely diversified territory through several division offices, and this code was drawn up to define the company's sales policy and make for team work in the department. It sets up a high commercial standard, outlining the company's sales policy and methods as follows:

Keep in mind that the sales policy of the company is to sell only goods of the best quality, made by reliable manufacturers, and their guarantees, as well as that of the company, are an assurance to our customers of the most satisfactory service.

Sales Value of a Good Appearance.—All salespeople should remember that their appearance has much to do with the impression that they make upon the customers whom they are trying to influence and that the appearance of the salespeople as a whole affects the impression that a customer receives regarding the company. The impressions received have a direct effect upon the sales made and the commissions earned by the salespeople. Therefore all salespeople should dress neatly and in a businesslike manner. They should avoid extreme styles or conspicuous clothing and a display of jewelry.

Treat a Customer as You Would Treat a Guest in Your Home.—We all like best the people who are courteous and pleasant in their manner toward us, and we are most likely to ask for the salesperson who has previously sold us goods with a marked degree of courtesy and sympathetic willingness to help us obtain the type and quality of goods which best fulfill our needs.

The impression which you make upon a customer during the few moments' interview remains in the customer's mind for a long time and has a marked influence upon his or her future calls. If you have been sympathetic, courteous and polite and really tried to serve the customer, the impression received will be favorable and the customer will be inclined to call again and will want *you* to wait upon her. On the contrary, if you have been indifferent or discourteous, the impression will be unfavorable and the customer will not feel inclined to return.

You will find your efforts most successful if you will always treat a customer with the same kindliness and consideration with which you would treat a respected guest in your home, and you should always try to convey to the customer by your manner that to satisfactorily serve her is the most important matter on your mind at that time.

Most salespeople find it easy to be courteous and polite to well-dressed, well-bred people whose pleasant manner inspires courtesy, but it is not so easy for these same salespeople to be courteous and polite to the poorly dressed foreigner who speaks in broken English and who does not grasp readily what the salespeople mean. You should make a particular effort to be courteous and helpful to foreigners, because our methods and customs are new to them and they may not clearly understand our language.

Voice and Language Have the Power to Sway People.—Keep always in mind that salesmanship is largely the influence of one personality over another. It is very important that the impressions given by your personality be as favorable as possible. Perhaps no single quality of your personality has more effect upon others than your language.

You will find that you will have a stronger influence over people if you use the best language at your command and speak in a well-modulated voice and with an easy, positive manner. You should carefully avoid the use of words with which your customer may not be familiar. It is always well to remember that the most popular speakers use simple language that a child can understand.

Perhaps we are so accustomed to technical terms that we forget the customers may not understand them. So, for instance, when talking to a customer about type C-4 "Mazda" lamps, refer to them as "daylight lamps."

While you may be assigned to the sale of a particular class of goods, you should as rapidly as possible acquire a selling knowledge of all the goods carried in stock. If a customer asks to be shown a certain article about which you are not informed, you should not attempt to answer the question, but should ask the merchandise assistant or the agent to assist you or assign some one else to wait upon the customer.

You will increase the number of customers who will come in and ask for you, and you will make more money in commissions, if you follow the practice of mailing to the customer a week or two after you have sold an appliance a follow-up card provided for that purpose, and inquire if the appliance is giving entire satisfaction. The customer will then feel that your interest did not end when the sale was consummated and will be likely to call for you when additional appliances are needed.

Floor salespeople who are unable to close a sale should try to obtain the name and address of the inquirer and refer it to the merchandise assistant or the agent, who will have an outside representative call.

Avoid Mistakes on Sales Checks and Save Yourself Trouble.—After the sale has been made, thoughtfulness and care must be exercised in issuing the sales checks and completing the transaction. It is important that all writing on sales checks should be plain and distinct so that mistakes in reading will be avoided. All salespeople should be very careful to see that the name and address of the customer is correctly printed. Never use the customer's initials if it is possible to get the full name.

In selling goods to customers living in a territory served by one of our other offices, you should take the order, if it is a cash sale, in the same manner as though the customer lived in the district, and you should collect the money and turn it in just as you would ordinarily. The order should then be telephoned to the district in which the customer lives.

Promises of Delivery.—Goods should be delivered as soon as possible, but you should be careful in making a promise regarding the time of delivery. When customers insist upon goods being delivered at a certain time, you should ask the merchandise assistant or agent, and neither of these should promise delivery at such a time without first ascertaining that the promise can be fulfilled. If the promise is made, it must be fulfilled.

Promises in General.—We cannot emphasize too strongly that you should not make promises which you are not absolutely sure can be fulfilled. If a customer insists upon a definite agreement, you must not allow that fact to lead you into agreeing to do something which cannot be done. It is far better to lose a sale than to secure it on the basis of a promise which cannot be fulfilled.

Misrepresentation. — Misrepresentation to a customer is always a serious matter whether it be done intentionally or unintentionally. You will save yourself and others very embarrassing unpleasantness and you will help maintain the company's reputation for fair dealing if you will so completely inform yourself regarding the goods you are selling and the conditions surrounding the sale that unintentional misrepresentation will be unlikely to occur.

You should guard yourself against making statements which may be misleading or may be construed to mean something which you do not intend.

What Our Guarantee Means.—Before any type or make of electric apparatus in shown in our salesroom a sample is first tested in our laboratory to determine its safety, efficiency and durability. If the sample does not pass the test, none of that particular make and type of appliance is offered for sale. Every appliance shown and offered for sale is guaranteed to be as represented and to do the work for which it was designed.

All merchandise that proves defective in material or workmanship within one year from date of purchase will be replaced, free of charge, or the amount paid for the article will be refunded.

Receiving Complaints from Customers.—Remember, you must be courteous and polite. The customer making the complaint may be provoked and rather severe in criticising the company's methods. Perhaps some unusual condition has given the customer a just cause for complaint and for being provoked. But, no matter how disagreeable the customer may be, it is your duty to yourself, the customer and the company to keep your temper and be courteous and polite.

First get the facts. Do not guess or assume, but find out the facts by investigating. The actual facts underlying the complaint will show the proper way of adjusting the complaint.

If the facts show the company to be at fault, correct it at once and endeavor to show the customer that the fault was not due to any lack of desire on the part of the company or any employee to give satisfactory service.

If the customer is at fault, try pleasantly and tactfully to show him wherein he misunderstands the matter and then do everything you can to adjust it to his satisfaction.

The company spends a good deal of money to improve its service to its customers, and we believe that most of our employees do their work to the best of their ability. Therefore you will do the company and your fellow-employees an injustice if you criticise either the company or another employee when adjusting a complaint.

The Goal to Work For.—To induce a large number of buyers to come to a store repeatedly for their supplies and to build a favorable reputation and prestige for the store is a hard, complex task. It requires constantly the rendering of a sales service that is so satisfactory to customers that they will come again and make more purchases.

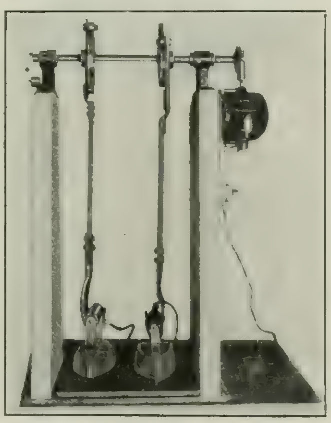
To maintain a satisfactory sales service the goods must be of the newest design and of the best quality for the money. The salespeople must know all about the goods they sell and must help—not force—customers to select the goods best suited to their needs. The salespeople must always be courteous, no matter how disagreeable customers may be, and everything about the store must express cheerfulness, alertness and progressive methods.

If we are to maintain our position as the largest distributors of electric appliances, we must render our customers such a sales service.

Tests of Electric Flatirons

Standard Methods Employed by the Electric Testing Laboratories to Determine Uniformity, Energy Consumption, Efficiency, Durability and Strength of Insulation

RESULTS of a series of very complete tests of electric flatirons have just been issued by R. S. Hale, chairman of the standardizing and testing division of the National Electric Light Association. The tests were conducted by the Electrical Testing Laboratories in New York and are of particular interest as they establish standard methods for testing these appliances. Although the names of the manufacturers will not be published the results show what kind of performance may fairly be expected from flatirons of several well-known makes.



APPARATUS FOR BUMP TESTS

Five brands were selected as representative of the irons being sold at the present time. All were 6-lb. irons of domestic manufacture. Six irons of each brand were purchased in the open market, and in no case was the dealer advised that the iron was to be used for other than domestic purposes. The schedule of tests was as follows:

I. *General, Weights, Dimension, Etc.*—With the exception of areas and weights of component parts, the observations were made on all irons. These special tests were made on one iron of each brand.

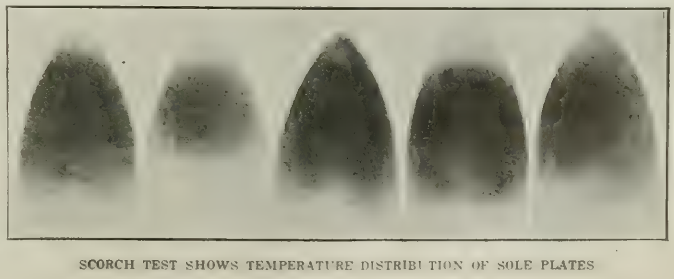
II. *Power Consumption.*—The power consumption of each iron of each brand was measured on alternating current (60 cycles) immediately after the application of the voltage and again after the iron had attained operating temperature. The power consumption was also measured on direct current with the iron at the higher temperature. All of the above tests were made at rated voltage or at the average voltage where a range of voltage was given on the name plate.

III. *Temperature Tests.* — Temperatures were in general measured with thermocouples and indicating millivoltmeters. In measuring the temperatures of wooden handles, spring wire guards, etc., the thermocouples were soldered to thin copper sheets which were wrapped around the part under test. To determine the temperature distribution of the sole plates the scorch test was employed. The procedure was to leave the iron on a continuous-flow calorimeter until normal temperature was reached. The iron was then set on a blotter for thirty seconds, at which time a satisfactory scorch was usually produced. The blotters had previously been dried in an oven at 105 deg. C.

IV. *Stability.*—In the stability tests the minimum force required to overturn one iron of each brand was measured. A flexible cord was attached to the handle of the iron and run over a frictionless pulley. Fine sand was poured into a scale pan attached to this cord until the iron overturned, after which the sand was weighed.

V. *Efficiency.*—To measure the efficiency a continuous-flow calorimeter was developed. It consisted of a hollow box of highly polished metal upon which the iron rested and through which cooling water circulated. Thermometers indicated the temperature of incoming and outgoing water. The difference between their indications multiplied by the rate of the flow of the cooling water was a measure of the heat passing from the sole plate of the iron into the water.

VI. *Heating and Cooling.*—One iron of each brand was left on its stand while connected to a circuit of rated voltage. The temperature in the sole



SCORCH TEST SHOWS TEMPERATURE DISTRIBUTION OF SOLE PLATES plate was measured with an embedded thermocouple, the thermo-junction being at a point about two inches from the rear of the iron along the center line and at a distance of approximately ⅛ in. from the outer surface. The current was left on until the iron had reached a maximum temperature, after which the current was turned off and the iron allowed to cool down. Temperature readings were taken from time to time throughout the test. The watt-hours required to bring the sole plate to a temperature of 300 deg. C. was also noted.

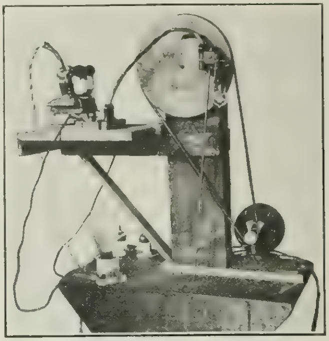
VII (A). *Durability Tests, Bumping.*—The bumping tests were made with the apparatus illustrated. The connecting rods were securely clamped to the irons so that their weight (2½ lb.) added to the severity of the test. The iron plate used as an anvil weighed 16 lb. and was supported on soft-rubber cushions. The irons dropped a distance of 1¼ in. forty-five times per minute. Throughout the tests rated voltage was applied to the irons. Pilot lamps (not shown) indicated grounds, open circuits or short circuits in the heater element. The stands were tested by substituting them for the iron plate.

VII. (B). *Durability Tests, Repeated Heating and Cooling.*—Air was blown upon the iron as a cooling medium. In this test current was applied for fifteen minutes, after which current was cut off and a blower applied for a like period.

VII (C). *Durability Tests, Continued Heating.* — The irons were suspended in the open air while connected to a circuit whose voltage was approximately 10 per cent higher than the rated value of the irons under test. Pilot lamps indicated electrical failures as they occurred.

VII (D). *Durability Tests, Contacts and Plugs.*—The contacts and plugs of one iron of each brand were tested with direct current at rated voltage. Contacts were made and broken by hand at approximately one-minute intervals. From time to time the force required to separate the plug from the iron was measured with a spring balance.

VII (E). *Durability Tests, Cords and Cord Protectors.*—The cord from one iron of each brand was tested with the apparatus shown. The speed of rotation of the large wheel, which carries one end of the cord, was approximately four revolutions per second.



APPARATUS FOR BENDING TEST OF CORDS

Pilot lamps indicated when failure occurred. In all tests, rated current (approximately 5 amp.) was passed through the cord.

VIII and IX. *Insulation Resistance and High-Voltage Tests.*—A voltage of 500 volts at 60 cycles, obtained from a transformer, was applied between the heater element and the shell of the iron. A rectifier, driven by a synchronous motor, and a direct-current galvanometer were connected in series with this circuit. By suitable adjustment of the phase of rectification the galvanometer read the in-phase component of the current flowing through the insulation. Insulation resistance was computed from the galvanometer readings used in conjunction with a constant obtained when the standard resistor was substituted for the iron under test. By applying direct current to the heater element the insulation resistance could be measured while the iron was heating.

In summarizing the outstanding features of the results of the tests Chairman Hale makes the following observations:

The first test, of course, was the judgment of the central-station man on the brands, placing them in the order A, B, C, D and E. It is important to note that this was not unanimous, that not everybody placed the iron which is noted above as A as the first, nor did every one place the iron noted as E as the last.

In the continued heating test only one iron of each brand was tested. This test was made at 10 volts higher than the rated voltage of the iron, or in case an iron was rated at 2 voltages, as 110 to 120, the test was made at 10 volts above the intermediate value of the two ratings. The results were as follows:

	Flatiron				
	A	B	C	D	E
Hours to 95 per cent initial watts..	700	660	670	450	300
Hours to 90 per cent initial watts.	930	*	*	*	*
Hours to failure......	†	800	†	†	400

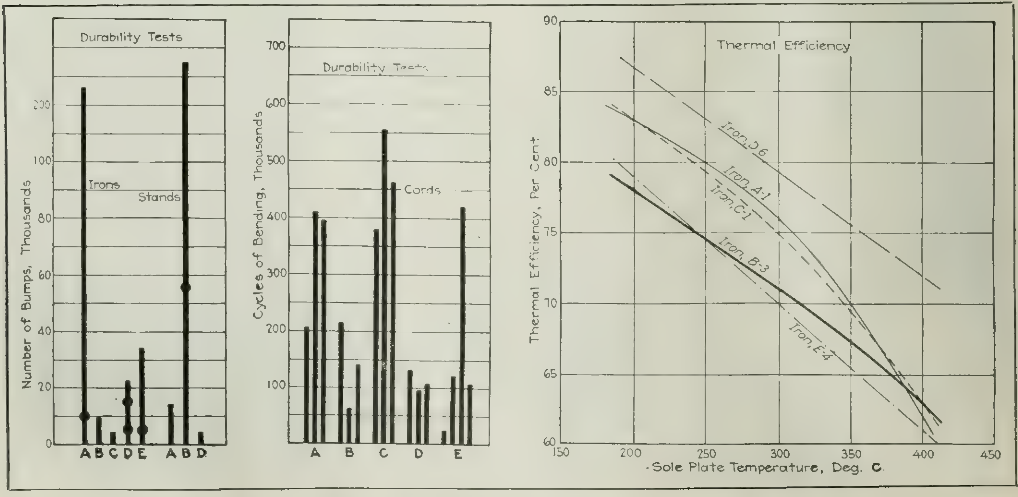
* Did not fall off 10 per cent.
† Had not failed at 1,000 hours.

Of these tests it is obvious that iron A might possibly be criticised for falling off in consumption below 10 per cent, indicating that when it got old it would not do so much work as when new, even though still operating. In view, however, of the test being made at 10 volts over rating, the results probably show entirely satisfactory life. B and E failed, while C and D stood up well. B and E might, of course, last as well as A, C and D if used only at rated voltage. C possibly gained its long life at the expense of efficiency as noted below, though D with a long life was even more efficient than A.

The test on the average thermal efficiency showed the following:

	Flatiron				
	A	B	C	D	E
Per cent efficient..........	79	76	75	80	70

A and D are evidently the best and E not at all good.



RESULTS OF DURABILITY TESTS, AND THERMAL EFFICIENCIES AT DIFFERENT TEMPERATURES

On the bumping test, the results were as follows:

	Flatiron				
	A	B	C	D	E
Bumps to first failure	10,000	...	....	6,000	5,000
Bumps to complete failure..	126,000	9,000	4,000	22,000	34,000

On these tests iron A evidently stood up very well indeed, the others not so well.

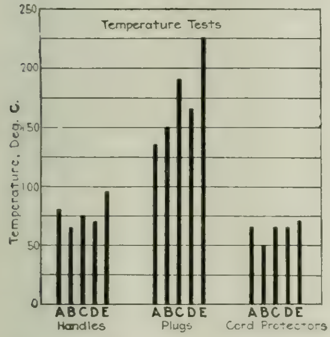
The test on plugs and connectors was performed by having a boy connect and disconnect the iron from the circuit under load. The force necessary was measured at intervals by a spring balance.

The results were as follows:

	Flatiron				
	A	B	C	D	E
Cycles to failure....	2,400	2,400	*	2,600†	2,600

* Had not failed at 2,600 cycles. † D during the test developed considerable friction, requiring undue force to connect and disconnect.

The next test was on the cords and protectors, a special machine being used to swing the cord through a circle as might be done in practice. The results were as follows:



TEMPERATURES OF HANDLES, PLUGS AND CORD PROTECTORS

	Flatiron				
	A	B	C	D	E
Average cycles to failure....	336,000	138,000	467,000	109,000	167,000

DIELECTRIC TESTS

All irons when cold stood the standard A. I. E. E. test of 500 volts alternating current. When hot, however, four irons broke down under this test, two from brand B and two from brand E. The insulation resistance when cold was satisfactory with the exception of one iron from brand E, which was very bad. When hot all the irons showed satisfactory insulation resistance with the exception of four, two from B and two from E, which broke down under the dielectric pressure.

The general result of the above tests is that until better tests are devised we recommend that the following be used:

1. Determination of thermal efficiency at the various temperatures of the sole plate, including power consumption, measurement, cold and hot.
2. Durability under continuous heating.
3. Mechanical durability—iron only (i. e., excluding stand)—when subjected to the standard bumping test.
4. Durability of the plug connection when subjected to repeated make-and-break tests.
5. Test of the dielectric strength according to the standard A. I. E. E. test made both hot and cold, and at the end of 1,000 hours run under the continued heating test and at the end of 5,000 bumps under the bumping tests.

All the tests are to be made by the standard methods as developed.

It is our opinion that when a new iron is brought out the use of tests as described above will serve to classify it as a good, medium or indifferently poor iron as compared with those on the market at present and that a classification by such tests will be of use to purchasers.

The further development of tests will depend on the desire of purchasers to know what irons, etc., will do under test and on the willingness of manufacturers to have their irons judged by tests as well as by inspection and reputation.

The use of tests depends largely on there being available tests of irons known to be good, medium or poor, with which tests of a new iron may be compared. The tests of flatirons here published cover these requirements to a certain extent.

It is planned to conduct tests of a few more irons, and an endeavor will be made to pick out the brands on which information is most desired. If companies will advise the chairman of the division, R. S. Hale, at 39 Boylston Street, Boston, as to the brands which they think it most desirable to have tested, the tests will be made on those brands for which there is the most demand.

Central Station Takes Part in Community Activities

THE Empire Gas & Electric Company of Auburn, N. Y., endeavors to co-operate in every possible manner with local community movements, and an interesting example of this policy is seen in the company's participation recently in a "Dollar Day" sale staged by the retail merchants' division of the Auburn Chamber of Commerce. This day was something of an event in the city, involving considerable planning and advance preparation to make it a success. Direct-by-mail advertising was sent out, and about a week in advance the merchants of the city arranged a motor trip which took in many of the outlying towns, villages and rural districts. At this time other advertising literature was distributed and the daily press got out two bargain editions on the eve of the sale. All of this publicity led to an unusual response from the public.

To help make the day one of uniform interest to buyers, the Empire Gas & Electric Company offered substantial reductions on its household appliances. The public was invited to visit the company's salesroom, where various appliances were put on special demonstration. It was found that many people availed themselves of this opportunity to obtain one or more of the standard appliances which were being offered.

While the company does not follow a policy of price cutting and while reductions of this kind eat up profits, its participation in the general sale helped to increase the merchandise turnover and was the means of making more friends.

What Other Companies Are Doing

Lineville, Iowa.—The municipal electric light plant here has been sold to the Lineville Light & Power Company, which will install additional generating equipment and rehabilitate and extend the distribution system. The company is also preparing to handle electrical appliances.

Providence, R. I.—A new record in the sale of electric washers was established recently by the Narragansett Electric Lighting Company, which sold 226 machines in thirty selling days. Of these, 130 were sold in the first fifteen days, and in one week orders were received for forty-two machines which could not at the time be filled owing to the unexpectedly large demand. An installment plan of $1.50 per week was adopted. Newspaper advertising, circularizing and personal solicitation were utilized, and this record was made in spite of a widespread textile strike in the territory. A. H. Allcott is manager of the company's electric shops.

Chicago, Ill.—The electrical energy output of all plants of the Standard Gas & Electric Company for the week ended Oct. 31 increased 11.4 per cent over the same period in 1921. The connected load gained 1,074 customers with 749 kw. of lighting. Applications were received for 2,346 new electric services, covering 1,177 kw. of lighting and 452 kw. in motors.

Louisville, Ky.—Gross earnings of the Louisville Gas & Electric Company in the twelve months ended Sept. 30, 1922, amounted to $5,339,267, an increase of $493,801 as compared with the previous twelve months; the net earnings were $2,507,803, an increase of $313,072, or 14.26 per cent.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Power Development of Georgia Railway & Power Company on Tallulah and Chattooga Rivers.—H. M. Atkinson.—A review of the water-power development program of the Georgia Railway & Power Company on these two rivers since the organization of the company in 1911 is given. The three undertakings in the carrying out of this program—namely, the Tallulah Falls generating station, the Mathis reservoir and the Burton reservoir—have been completed and are in operation. The total installed capacity of the Tallulah Falls plant is 102,000 hp. This plant now serves fifty-one municipalities in northern Georgia in addition to hundreds of large manufacturing industries. The Mathis reservoir is on the Tallulah River, about 6 miles from the intake dam of the generating station, which is about 1½ miles up the river from the Tallulah Falls generating station. This reservoir will store 1,369,000,000 cu. ft. of water. The Burton dam is about 14 miles from the Mathis dam and 21 miles from the power house. The greatest capacity of this dam is 5,280,000,000 cu. ft. of water. Ten photographs, showing the power station and the various dams and reservoirs, are included.—*Manufacturers' Record,* Nov. 2, 1922.

Fuel Economy in Steam Power Plants.—J. B. C. Kershaw.—The utilization of waste heat from steam boilers is the subject of the fourth article of this series. After showing by calculation the amount of heat likely to be recovered from exit gases, the principles and practical design of economizers for the purpose are considered, many test results and figures from actual practice being given. A further source of heat recovery lies in the preheating of the air supply to the boiler furnaces, and the author shows that this is deserving of more attention than is usually given. Several types of air-heaters and recuperators are discussed. —*Beama,* October, 1922.

Generation, Control and Switching

Efficiency of Overlapping Joints in Copper and Aluminum Busbar Conductors.—S. W. Melsom and H. C. Booth.—An investigation was carried out by the authors to determine the amount of contact resistance between the surfaces of an overlapping joint in rectangular straight-busbar conductors of copper and aluminum under various conditions of surface preparation and pressure, with the particular purpose of ascertaining the efficiency of such joints. Numerical results are deduced and tables and graphs given for the contact resistance per unit of surface area under various conditions of pressure and amount of overlap and after various modes of cleaning and preparing the surface, including the interposition of tinfoil and the soldering of the two bars together. A series of graphs is given which shows the efficiency of copper and aluminum joints in terms of a defined standard with a wide range of busbar sizes. The effect of modifying the numbers, size and position of the bolts used to hold busbar sections together was also investigated.—*Proceedings of (British) Institution of Electrical Engineers,* Vol. 60, No. 312.

Runaway Speed of Turbines.—P. Attlmayer.—Properly chosen regulators make the actual running away of water turbines an extremely rare occurrence. But if it should actually happen, serious danger may be avoided to any extent by providing a sufficient amount of flywheel mass in the driven generator. An example is cited of a 1,000-hp. generator operating at 500 r.p.m. with a Mr^2_g of 7,850 kg.-m.^{2}, which accelerates to a dangerous speed of 800 r.p.m. within eight seconds if its load is lost. If this same generator were provided with a Mr^2_g of 15,700 kg.-m.^{2}, twice the time would be required to reach that critical speed, giving the attendant more chance to cope with the situation. A curve diagram is given to determine the time within which a generator reaches a runaway speed.—*Elektrotechnik und Maschinenbau,* Oct. 15, 1922.

Transmission, Substations and Distribution

Application of Schwarz's Theorem to Problems of High-Tension Transformer Design.—L. Dreyfus.—An electric discharge under oil probably takes place when the line integral of field strength, taken over a certain finite length—i.e., across the "ionization zone"—exceeds a definite value, the "edge voltage." At the end point of the integration path there exists a certain critical field strength, which the author assumes to be identical with the dielectric strength of oil in a homogeneous field. By a skillful application of the theory of conform images (Schwarz's theorem) the author succeeds in reducing a great number of high-tension problems involving sharp edges into forms which permit of analytical treatment leading to expressions for the disruptive voltage in terms of the distance between the electrodes and a certain constant which experiments have proved to be dependent only on the properties of the oil and which involves the edge voltage and the dielectric strength of the oil. By use of a special transformation the author also investigates the effect of a rounding of the edges. The methods developed are applied to a great number of problems concerning transformer design.—*Teknisk Tidskrift,* June 10, Aug. 19 and Sept. 30, 1922.

Present Status of High-Voltage Transmission of Power—Part II.—W. W. Lewis.—This installment of the article concludes the subject of high-voltage transmission with a discussion of synchronous condensers, characteristics of long lines, transformers, oil circuit breakers and bushings. Part I, appearing in the October issue, treated of the present limit of transmission voltage, line insulations, corona, grounded neutral, protection and charging the line. It also included tabulated data on 160 transmission systems whose circuit voltages are 66,000 or above.—*General Electric Review,* November, 1922.

Failure of Disk Insulators on High-Tension Transmission Lines. — H. D. Panton. — Accurate information showing the actual operating performance of insulators during a period of years is included in this article, prepared for the Vancouver convention. A 300-word abstract will be found in the *Electrical World* convention report, Aug. 26, 1922, page 426.—*Journal of the A. I. E. E.,* November, 1922.

Units, Measurements and Instruments

A Million-Volt Testing Set.—A. B. Hendricks, Jr.—The new 1,000,000-volt, three-phase equipment described should be valuable, the author thinks, in magnifying the possible troubles which may arise in the 220,000-volt practical installation—that is to say, such troubles as may arise from the electric pressures now being pushed above the known field of operation. Moreover, the testing set will have its uses in the near future for various researches in insulation, ionization, spark discharges, lightning, high frequencies, designs of apparatus and so forth. The design and construction of the three 500-kw., 578,000-volt transformers and of the 500-kw. insulating transformer composing this set are described in this article, together with many illustrations of the apparatus and voltage discharges up to as high as 1,500,000 volts.—*Journal of the A. I. E. E.,* October-November, 1922.

Production and Measurement of High Vacua.—F. H. Newman.—The increasing importance of the complete exhaustion of gas in a thermionic valve is emphasized. The greater part of the gas is removed by mechanical oil-sealed pumps of which the piston and rotary types are described. The evacuation is then completed by mercury pumps and by the use of charcoal cooled by liquid air. Of the various measuring devices for high vacua, the author describes the McLeod, Kundsen, Langmuir and Buckley gages.—*Beama*, November, 1922.

Illumination

Theory of End-Loss Corrections and Its Application to Uniform, Electrically Heated Tungsten Filaments in Vacuo.—A. G. WORTHING.—A method for computing end-loss corrections and applications of it to the case of uniform, electrically heated tungsten filaments in vacuo are the main subjects considered. In the case of long filaments, several expressions are derived for the temperature, resistivity, emission intensity, brightness and thermionic emission distributions near a cooling junction. Those computed for tungsten were found to check observed distributions closely. For short filaments the relation of the distribution curves to those for long filaments is shown, and it is pointed out that there is a family of reduced distribution curves from which any one desired curve may be obtained. Equations and conclusions developed for cylindrical or wire filaments apply equally well to filaments with rectangular and other cross-sections when the ratio of twice the cross-section to the perimeter of the filament is substituted for the radius of the cylindrical filament.—*Journal of the Franklin Institute*, November, 1922.

Motors and Control

Universal Chart Method of Calculating Starting Rheostats for Direct-Current Motors.—A. T. DOVER.—The calculation of the resistance of the sections of a starting rheostat for a series motor requires a knowledge of the magnetization curve of the motor as well as a determination of two "grading" coefficients. A number of graphical and analytical methods of calculation have been proposed, but these give the solution only for a particular number of sections. The method presented by the author has the same order of accuracy as analytical methods, but it enables the grading coefficients corresponding to several numbers of sections to be obtained simultaneously from a single set of preliminary calculations. The basis of the method is the use of charts of grading coefficients that are calculated for various numbers of sections, definite values of the percentage pressure drop in the motor at full load, and given starting conditions. The complete calculation of the starter can be carried out in a few minutes. A number of worked examples are included, illustrating the application of the method.—*Proceedings of (British) Institution of Electrical Engineers*, Vol. 60, No. 312.

Heat Applications and Material Handling

Refractory Materials for Electric Furnaces.—A. B. SEARLE.—The limitations of the electric furnace, as every operator knows, are largely bound up in the range of refractory materials available for building and lining the furnaces. In this article the author describes and classifies the various types of refractory materials in use at the present time, pointing out their deficiencies and their advantages. Among the materials now used are silica brick, grog brick (composed of burned fireclay in a small proportion of raw fireclay), bauxite bricks, corundum, alundum bricks, magnesia bricks, carbon or graphite bricks, zirconia and zircon bricks and carborundum bricks.—*Beama*, October, 1922.

Electric Melting Furnaces for Metals and Alloys.—J. RITZ and G. KELLER.—On account of the scarcity of fuel and labor during the war the development of electric furnaces and their accessory apparatus was actively pursued, so that at the present time electric melting furnaces are more than able to hold their own against the older types of furnaces, which they are gradually displacing. The construction and advantages of several types of melting furnaces are set forth in the article.—*Brown-Boveri Review*, October, 1922.

Electrophysics, Electrochemistry and Batteries

Experiments in Electrical Prospecting.—Any mineral mass which possesses metallic electrical conductivity throughout a sufficient depth and which lies underground in such a fashion that part of it rises above the water table produces in the surrounding moist terrain electrical currents observable by the differences of potential which they produce. This principle is the basis on which experiments in electrical prospecting were carried out. The entire phenomenon is explained, as is the manner of utilizing these currents to determine the presence of minerals. The results of field work in various metal mines in the United States and Canada made by the author are presented. The most important application of this method is its value in the preliminary determination of advantageous locations for diamond drilling. Coal is also subject to satisfactory tests.—*Engineering and Mining Journal-Press*, Oct. 7 and 14, 1922.

Traction

Diesel-Electric Railroad Cars.—E. HUBENDICK.—While German designers of Diesel-driven railroad cars have reverted to earlier types with gear shift and friction clutch, Swedish engineers have continued to develop the Diesel-electric car, with electric transmission from Diesel motor to driving wheels. This type of automotive car has given very good results in service, and there are indications that by its aid the difficult problem will be solved of keeping up in an economical way frequent passenger accommodations on roads in outlying districts. Besides two earlier Diesel-electric cars of limited capacity, two new types have been developed, one weighing 37 tons, with a 160-hp. engine, the other a 50-ton car, with a twelve-cylinder, 250-hp. Diesel engine. Two cars of the 37-ton type which have been hauling 80-ton trains during six months of the year 1921 gave an average oil-fuel consumption of 0.45 kg. to 0.61 kg. per train-kilometer, the higher figure applying to a road with numerous heavy grades.—*Teknisk Tidskrift*, Sept. 2 and 9, 1922.

Telegraphy, Telephony, Radio and Signals

Quantitative Analysis of the Thermionic Tube Oscillation Generator.—In most practical cases a thermionic tube when used for the generation of electric oscillations is operating under conditions which invalidate the assumptions necessary for a simple mathematical discussion of the subject, i.e., the rectilinearity of the characteristics. To take account of the actual shape of the characteristics of the tube means to take the matter outside the scope of mathematical treatment. A method is outlined for the exact quantitative analysis of these characteristics. Two types of generators are considered—(1) a separately excited generator in which the generation of oscillations in a circuit inserted between the anode and filament is done by means of an alternating potential due to some external source applied to the grid; (2) a self-excited or back-coupled generator.—*Electrician*, Nov. 10, 1922.

Portable Short-Wave Radio Wavemeter.—The design of a portable short-wave wavemeter is a matter of importance to amateurs who are required by law not to use wave lengths exceeding 200 m. This circular points out the most important considerations in the design of such a wave meter and describes the construction of a meter suitable for the measurement of frequencies corresponding to wave lengths of from 100 m. to 570 m. As only a few mimeographed copies of this circular are on hand, its circulation is limited.—*Circular Letter No. 78 of the Bureau of Standards.*

Miscellaneous

Seventy-five Years of Electrical Development.—This year the German Siemens company celebrates its seventy-fifth anniversary and devotes the October issue of its publication to a commemoration of some of the larger achievements made during the last three-quarters of a century. The bibliographer and technical historian will find a host of material and valuable pictures of electric machinery from days long past in the 125 well illustrated pages. Some of the main subjects are "From Indicating Telegraph to the Modern Machine Telegraph (1846-1922)," "Development of the Fire Telegraph System (1851-1922)," "Measurement of Liquids and Gases Flowing Through Pipe Lines," "Development of the Alternating-Current Wattmeter," "Progress in Dynamo Design," "Fifty Years of Carbon Manufacture" (for arc lights, electrodes and brushes), "Development of Railway Signal Systems," "The Telephone from 1880 to 1922," and "The History of Electric Railways."—*Siemens Zeitschrift*, October, 1922.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

I. E. C. Meeting at Geneva

Two Ratings for Industrial Motors—Lamp Bases Standardized—New High-Voltage Ratings

By Special Radiogram from Geneva

THE committees of the International Electrotechnical Commission met at Geneva, Switzerland, on Nov. 20 to 25, with fifty-eight delegates present, representing twelve countries.

After three days of discussion, the advisory committee on rating adopted the British proposal recognizing for certain classes of industrial motors the rating standard of 40 deg. C. rise with 25 per cent overload for two hours without exceeding the I. E. C. maximum temperature,* the I. E. C. equivalent rating also to be indicated.†

The committee on graphical symbols after three days adopted many proposals.

Forty-five kilovolts and 120 kv. were added to the list of standard voltages. The committee rejected emphatically the British proposal standardizing 220-440 volts as a distribution standard.

The Edison base committee approved the American proposal adopting in principle the universal "mogul" and medium socket to take the place of all existing bases, details to be settled by a committee of manufacturing experts. Other bases, such as candelabra and miniature, were left for further investigation.

The German delegates participated in the work of all of the committees.

According to reports from England, the British Commission, whose proposals have thus apparently been adopted by the rating committee of the I. E. C., was instrumental in bringing about the present rating committee meetings in Geneva. British industry, according to these reports, found itself unable to conform to the old I. E. C. method of rating (that is, 50 deg. C. rise continuous maximum rating with no sustained overload) in the case of a considerable portion of the electrical machinery made in Great Britain. The British made the statement that in the case of motors and generators for ordinary industrial purposes the fact that 95 per cent of British business relates to machines for which the industry demands a sustained overload could not be ignored.

Five-Day Service Forced

Drought Compels Southern Power to Curtail Service Temporarily—Effect of Fuel Shortage

THE Southern Power Company has served the long-contemplated notice on its industrial patrons that because of drought it is compelled to suspend service for one day a week. The suspension began last Monday for plants in a certain specified district. The next day service in other territory was suspended for the day. This was continued for five days, until the five districts into which the territory served has been divided had each had one day's curtailment. The same program will probably be continued next week and indefinitely until the situation is relieved by copious rains on the headwaters of the Catawba and other streams on which the power plants of the Southern Power Company are erected. The suspension does not apply to municipalities and other users of power for public purposes.

The notices were sent out over the signature of Charles I. Burkholder, vice-president of the company. Commenting on the situation, Mr. Burkholder said that the action was taken now rather than to compel the company to face the prospect of a more serious situation later. The limited coal supply for several weeks in the summer compelled heavy drawing of the reserve supply of water, and the water heads have been pulled down so low that the generating capacity is reduced and there is danger of putting the water plants out of commission unless the greatest care is exercised now. The power company, in addition to the two immense water plants which are now in course of construction, has given orders for the construction of two additional steam plants.

Constitutional Change Fails

Wisconsin Defeats Overwhelmingly Proposal in the Interest of City Ownership

COMPLETE election returns given out by the Wisconsin Election Commission indicate that the proposed amendment to the state constitution to permit any municipality to increase from 5 per cent to 10 per cent that portion of its bonded indebtedness which may be incurred for the purpose of acquiring or building street-railway properties or buying properties for the production, transmission, delivery or furnishing of light, heat, water or power to the public was overwhelmingly defeated on Nov. 7, when a referendum vote on the proposed change was taken. Virtually all the communities in the state gave a majority against the amendment.

Stock Issues in New York Metropolitan District

Various issues of public utility stock in the metropolitan district embracing New York City and contiguous territory have been announced in the last week or two.

The Consolidated Gas Company has authorized an issue of 300,000 shares of 6 per cent cumulative participating preferred stock, of the par value of $50 each, and has offered the same for subscription to employees and consumers of the company or any subsidiary corporation, under such terms and for such consideration as may hereafter be decided upon.

Three subsidiary companies of the Consolidated Gas have obtained permission from the Public Service Commission to issue additional common capital stock. These companies and the amount of the issuances granted are: New York Edison Company, $14,000,000; Astoria Light, Heat & Power Company, $7,500,000, and New York & Queens Electric Light & Power Company, $7,100,000. The new stock of the New York Edison Company is to go to the Consolidated Gas in liquidation of loans, as is also the new stock of the Astoria company and $3,700,000 of that of the New York & Queens. The remaining $3,400,000 of the latter company's issue is to be exchanged, par for par, for ten-year 7 per cent debentures.

Two changes in the capitalization of the Public Service Corporation of New Jersey have been decided upon, described by President Thomas N. McCarter as follows:

"At present the authorized issue of preferred stock is $50,000,000 at par,

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* The I. E. C. maximum temperature rules are:
Highest Permissible Observable Temperatures

Class	Kind of Insulation	Temperature, Deg C
1	Cotton, paper and silk, non-impregnated	80
2	Cotton, paper and silk, impregnated	95
3	Cotton, paper and silk immersed in oil	95
4	Enameled wire	95
5	Mica, asbestos, glass, porcelain, micanite and similar compositions	115
6	Insulated windings, permanently short-circuited	100
7	Non-insulated windings, permanently short-circuited	110
8	Oil	
9	Commutators and slip rings	90
10	Bearings	80
11	Iron core immersed in oil	95
12	Iron core in contact with winding	To be same as winding

In the United States insulation is divided into two classes, A and B, class A being that principally under discussion in the rating of motors, and in America the highest permissible observable temperature is interpreted as being 90 deg. for this class, the highest internal temperature, with a 15-deg. conventional allowance, being 105 deg.—*Editors*

† By I. E. C. equivalent rating seems to be meant the rating of the motor on the basis of 50 deg. rise under continuous service with no provision or guarantee for sustained overload.—*Editors.*

carrying 8 per cent cumulative dividend, of which approximately $18,500,000 is outstanding. This stock is redeemable at 110 per cent of its par value, but as this tends to keep down the price of the issue to the redemption figure, the stockholders will be asked to waive this provision.

"The directors of the company also felt that there would be times hereafter when it would be practicable for the corporation to sell 7 per cent preferred stock and have therefore decided to recommend to the stockholders for approval the alteration of the company's charter so that the $50,000,000 of authorized preferred stock shall hereafter consist of $25,000,000 of 8 per cent preferred stock and $25,000,000 of 7 per cent preferred stock."

The directors of the Public Service Corporation of New Jersey have declared a quarterly dividend of $2 a share on the common stock, placing it on an annual basis of $8. The previous quarterly payments have been $1.50, or $6 annually, the disbursement having been increased from $1 quarterly in March, 1922.

Boston Edison Stock Issue

The judgment of the Edison Electric Illuminating Company of Boston that its immediate financing should be done by the issue of new capital stock instead of bonds was sustained in a decision of the Massachusetts Department of Public Utilities last week, which authorized the issuing of stock of the par value of $5,406,700 (yield value $8,110,050) to meet liabilities incurred prior to Oct. 31, 1922. A résumé of President Edgar's discussion of the policy of the company before the commission was published in the *Electrical World* for Nov. 25, page 1168.

Harrison Williams' Interest in Republic Company Sold

It is officially announced that R. P. Stevens and his associates in New York City and Youngstown, Ohio, have purchased from Harrison Williams and associates their interests in the Republic Railway & Light Company, which through its subsidiaries, the Pennsylvania-Ohio Electric, the Pennsylvania-Ohio Power & Light and the New Castle Electric companies, owns and controls virtually the entire electric light, power, local and interurban electric railway business in the industrial district between Pittsburgh and Cleveland. The territory served comprises about 600 square miles with a population of more than 300,000.

At a meeting of the board of directors, held on Nov. 21, John T. Harrington, John R. Rowland, Herbert L. Dillon, Henry L. Bogert, Jr., and Walter H. Nash were elected to succeed Harrison Williams, R. E. Breed, F. L. Dame, Edwin Gruhl and Robert Lindsay, resigned. These new members, together with R. P. Stevens, Anson W. Burchard, Clarence L. Harper and G. T. Seely, who remain, will constitute the board.

A. S. M. E. to Discuss Power, Fuels and Safety

Two sessions of especial interest to electrical engineers will be held by the American Society of Mechanical Engineers in the course of its annual convention at New York City on Monday to Thursday next week, Dec. 4 to 7.

On Wednesday morning there will be a joint session with the Stoker Manufacturers' Association on fuels, when these papers will be presented: "Chronological History of Stoker Development to the Present Day," A. H. Blackburn; "Overfeed Stokers of the Inclined Type," G. I. Bouton; "Design and Operation of Underfeed Stokers," H. F. Lawrence, and "Development and Use of the Modern Chain Grate," T. A. Marsh.

On Thursday morning there will be a power session with this program: "The Commercial Economy of High Pressure and High Superheats in the Central Station," G. A. Orrok; "Feed-Water Heating for High Thermal Efficiency," L. Helander; "Tests of Stirling Boiler of Detroit Edison Company's Connors Creek Station," P. W. Thompson; "Elasticity of Pipe Bends," D. Crocker and S. S. Sanford, and "Transmission of Superheated Steam," B. N. Broido (by title).

At a joint session on the same morning with the American Society of Safety Engineers M. C. Goodspeed will discuss "The Development of Safety Codes," M. G. Lloyd "Safety Codes," and A. D. Risteen "Safety Engineering in Connection with the Compression of Gases."

Birmingham Fighting Public Service Commission

A determined fight upon the power and authority of the Alabama Public Service Commission in its control of the rates, finances and service of public utilities is being conducted by the city of Birmingham through William L. Harrison, Commissioner of Public Utilities, who was formerly an organizer for the United Mine Workers of Alabama and is still a leader of labor in the state. The cities of Mobile, Cullman, Albany, Sheffield, Marion, Troy, Hartsells and Attalla have lined up with Birmingham, while Montgomery, Selma and a few others have declared against the plan for "home rule" of public utilities.

The present City Commission of Birmingham has been at loggerheads for some time with the Birmingham Railway, Light & Power Company over the question of franchises, street-car fares and the extension of lighting facilities. In a letter sent out last week to all members of the next Legislature Commissioner Harrison asks support of a bill giving cities the right to control their utilities. He asserts that he is making no fight on public utilities themselves, but for the control of rates and service. Complaint is made that persons with complaints have to employ attorneys to appear at Montgomery before the Public Service Commission.

A. G. Patterson, president of the Alabama Public Service Commission, has issued a statement opposing the "home rule" movement. He declares that the removal of hydro-electric plants from state jurisdiction might place them under the supervision of the Federal Power Commission, which is further removed from the citizens. Mr. Patterson also calls attention to the fact that the expert engineers in the employ of the commission are capable of ascertaining the real values of the utilities and verifying their reports of earnings. Cities, he points out, do not have these experts. Referring to the Birmingham situation, he points out that the Birmingham Railway, Light & Power Company operates in several incorporated towns and that it would be impossible for one city to control all its operations.

Reorganization of Union Electric Light & Power

As a step in the financial reorganization of the Union Electric Light & Power Company of St. Louis a charter has been granted to the Missouri Electric Light & Power Company, which will take over the franchises, physical property and other assets of the Union Electric Light & Power Company and will later take over the name of Union Electric Light & Power Company. The new company is to have an authorized capital stock of $25,000,000 in preferred and 650,000 shares of no-par common. Of the preferred stock, $6,000,000 will be issued in exchange for the $6,000,000 of outstanding preferred of the Union Electric Light & Power Company, and additional preferred shares will be issued as the expanding business of the company requires. This financial reorganization is a part of the plan of the company to expand its business and increase its facilities in St. Louis and the surrounding territory.

Portland Company Orders a 35,000-Hp. Turbine

An order for a 35,000-hp. hydraulic turbine has just been placed by the Portland (Ore.) Railway, Light & Power Company for its Oak Grove project. The turbine is of the Francis or reaction type and will operate at a speed of 514 r.p.m. under an effective head of 857 ft. The unit was purchased from the Pelton Water Wheel Company of San Francisco and will constitute a world's record both in capacity and operating head for a reaction-type turbine. It will be similar to the Francis turbines at the Kern River No. 3 plant of the Southern California Edison Company, which have a rating of 25,000 hp. operating under a head of 610 ft. and which have stood as a world's record for reaction turbines up to this time.

Utility Extension Rules

New Jersey Commission Invites Companies and Municipalities to Discuss Proposals

GENERAL rules and regulations proposed for the government of extensions by electric light and power companies will be the subject of a hearing called by the New Jersey Board of Public Utilities Commissioners for Dec. 7 at Trenton, N. J., to which public utilities, chambers of commerce, boards of trade and incorporated towns have been asked to send representatives. Among the rules and regulations which the board favors and which will be discussed at the hearing are the following affecting electric supply companies:

"Where applications for extensions into newly developed tracts of land are made by individuals, partnerships or corporations interested in the development and sale of land, but not as ultimate residents, the utility may require a deposit from the applicant covering the entire cost of installing the necessary main lines to serve the tract. These deposits are to be returned to the depositor when and as new houses are completed and occupied.

"Upon application for extension to reach a house not already served with electricity, gas or water, an estimate shall be made of the cost of making such extension to serve the applicant and an estimate shall also be made of the anticipated normal revenue from this extension.

"Where the cost to the utility for an electric extension does not exceed three times the estimated normal annual charge for service at regular rates, the utility shall make the necessary extension upon receiving from the applicant the properly signed standard form of application for service; such application, however, to be for an indefinite period.

"Where the cost of making an extension exceeds the amount which the utility, under one plan, must install without special guarantee, the excess cost of the extension shall be deposited with the utility and remain, without interest, in the possession of the utility until such time as the revenue from the particular extension is sufficient, when it shall be returned pro rata to the depositor."

Under another plan the applicant for the extension shall guarantee the utility a monthly revenue equivalent to one-thirty-sixth of the total cost of the extension if electric, one-twenty-fourth of the total cost of the extension if gas, or one-forty-eighth of the total cost of the extension if water; provided, however, that the utility shall not be required to accept a guaranty of more than 50 per cent above the normal charge for service to the particular applicant.

Jobbers, in Convention, Resolve to Help Dealers

Definite action was taken last week at the annual winter convention of the Electrical Supply Jobbers' Association in Cleveland to develop stronger practical co-operation with the dealer. This purpose was expressed throughout the sessions and in the corridors and received confirmation in the adoption of a resolution providing for a committee of three members to confer with the association counsel in the matter.

Declaring that the pay-as-you-use plan has been clearly demonstrated as the chosen policy of the American people, John H. Gilchrist, vice-president Commonwealth Edison Company, gave some interesting figures on the experience of his company in selling electrical appliances. He discussed at length the position of the dealer today and dwelt on the thought that if the central-station company of any community does not conduct its retail business on a basis that enables the small dealer to succeed in competition, appliance selling in that community will be choked and the interests of the central station will suffer.

W. R. Herstein, Memphis, in his paper on "Electrical Merchandise Distribution," challenged the general complacence over the increased sale of electrical appliances through non-electric stores and argued against the sale of appliances by central stations, in the light of experience.

W. R. Robertson, Buffalo, told the jobbers that the best insurance of prosperity for them is to render such a service that the manufacturer will select the jobber to distribute his goods in preference to any other method. Mr. Robertson announced that 1,100 communities have now been tabulated in the survey which is being made by the jobbers for the Joint Committee for Business Development.

A resolution was passed on the recommendation of the radio committee to petition the government to permit the increase of the wave lengths authorized for commercial broadcasting stations, on account of the interference existing at present. The committee on accounting and statistics was empowered and directed to proceed with a further six months' study of a limited number of the more important commodities for the purpose of developing still more detail on the cost of jobber distribution. A "code of ethics" was unanimously adopted.

Announcement was made that the next quarterly meeting will be held in the week of Feb. 14, the Central Division assembling in Chicago, the Atlantic Division in New York and the executive committee in Atlantic City, N. J.

New York Has a New Electric Taxicab Service

A new type of electric taxicab has just gone into service in New York City, where the Electrotaxi Corporation has placed a fleet of such cars in operation. These are the first electric taxicabs that New York has had since the old electric hansoms of more than twenty years ago. The new taxis are finished in two tones of gray and are in contrast with the color schemes usually employed by public vehicles. The distinctive feature of these new cabs is that they are built with the same stream-line design as gasoline taxicabs, including the hood, underneath which the battery is placed.

FLEET OF ELECTRIC TAXICABS PARKED ON NEW YORK CITY STREET

Alaskan and Other Projects

Power Commission Grants Permits in and Receives Applications from Widely Separated Regions

REVIVAL of interest in Alaskan water-power development was evidenced by the action of the Federal Power Commission at its last meeting in two cases affecting that territory. Two others are pending. For some months interest in this direction has lagged, owing principally to the low prices for wood pulp, the production of which is involved in the proposed developments. The Alaskan-American Paper Corporation of New York, which failed to begin work by Aug. 31, 1922, as required by its license, made satisfactory explanation and gave assurances of proper financial support and was granted two years' additional time by the commission. Approval also was given the application of Maurice D. Leehey of Seattle, Wash., for a preliminary permit to develop power on Beaver Falls and Lake Mahoney, in the Tongars national forest, near Ketchiken, Alaska. A permit was granted last January but not accepted because of the low market for pulp, but the applicant is now anxious to carry forward the development and has proper financial backing.

The commission approved the application of the Empire District Electric Company of Galena, Kan., for a preliminary permit to construct a power dam 175 ft. high in White River, southwestern Missouri. This dam would develop between 40,000 hp. and 80,000 hp. and would increase the capacity at the present Forsyth project and give a regulated flow in the river for 125 miles, with a fall of approximately 350 ft., almost to Batesville, Ark.

The commission approved the application for license of J. M. Freeman of Billings, Mont., for a 45-hp. project on Boulder Creek, in a national forest in Idaho; the application of the Idaho Power Company of Boise for a right-of-way for a transmission line between American Falls and Pocatello; the application of the Emery Consolidated Mining Company of Deer Lodge, Mont., for a license for a transmission line from Deer Lodge to Emery in a national forest in Montana, and the application of O. G. Peterson of Somerset, Ky., for the right to raise an existing dam in Pitman Creek, a tributary of the Cumberland River.

Pacific Coast Projects

Application of the Straits Power Company of New York for a preliminary permit to develop 100,000 hp. in northwest Washington was denied on the ground that the same interests are represented in the Sound Power Company, to which recently was granted a preliminary permit for a 90,000-hp. project on Sultan River, and that it is not desirable that further permits be issued until the interests have demonstrated their ability to carry out the Sultan project.

The commission also disapproved the application for a preliminary permit asked by the Northwestern Power & Manufacturing Company of Seattle for a 10,000-hp. project at the outlet of Lake Crescent, in northern Washington. The company has 5,000 hp. on the Elwha River, 25 miles east of the lake. The commission decided that as the Elwha has large power possibilities and Lake Crescent is a summer resort, more power should be developed from the river before turning to the lake.

The application of Harrison Albright and Susie Bemis Albright for water-power development on a number of small streams in southern California was denied as not feasible.

St. Paul and Louisville Cases

The commission deferred until Dec. 10 action on the conflicting applications of the Northern States Power Company, the city of St. Paul and Markham, Kelsey & Druan for development on the St. Croix River.

The Luce case was set for hearing Dec. 11, and the commission decided that early in January it will hear the issues between the city of Louisville and the Louisville Hydro-Electric Company involving the right to development at the falls of Louisville.

Refunding Activity Continues

DURING the month of November new issues of electric light and power public utility securities were moderate in volume. The total amount of offerings of this type of security equaled $50,328,000, as compared with $91,694,750 during October and $54,900,000 for November, 1921. As is shown in the accompanying table, the number of single issues was small, and the highest offering was the eighteen-million-dollar issue of gold bonds of the Louisville Gas & Electric Company. The most conspicuous feature of the month's financing was the exceedingly low average rate of return yielded the investor, 5.85. Not one 8 per cent issue was floated last month and only a few 7 per cent issues came out. A great proportion of the issues were for refunding outstanding securities, although a large amount of new capital has been obtained to finance plans for the development of properties in response to the increase in load. This condition has been stimulated by the generally prevalent increase in public utility net incomes.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN NOVEMBER

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Interest	Offered at	PerCent Yield
Janesville Electric Co. (Wis.)	$520,000	One-to-twenty-three-year*	First and refunding mortgage gold bonds of 1915	To reimburse for capital expenditures and for other purposes	5		5.80 to 6.00
Louisville Gas & Electric Co. (Ky.)	18,805,000	Thirty-year	First and refunding mortgage gold bonds, series A	Refunding and for construction, working capital, etc	5	91½	5.60
	3,500,000	Fifteen-year debenture	Sinking-fund gold bonds, series A	To retire notes and for extensions	6	96½	6.35
New York State Gas & Electric Corp	650,000	Forty-year	First mortgage gold bonds		5½	97½	5.65
East Penn Electric Co	1,110,000		First preferred stock	To provide funds for new plant and other extensions	7	92½	7.57
Tidewater Power Co. (N. C.)	3,000,000	Twenty-year	First lien and refunding mortgage sinking-fund gold bonds, series A	To retire bonds, acquire additional stock, to increase capital, etc	6	96	6.35
	1,500,000	Fifteen-year	Sinking-fund gold debenture bonds		7	97	7.30
Beloit Water, Gas & Electric Co. (Wis.)	500,000	Fifteen-year	First mortgage sinking-fund gold bonds	To reimburse for expenditures for additions, etc.	5	93½	5.65
Commonwealth Edison Co.	7,143,000	Twenty-one-year	First mortgage gold bonds of 1908	To redeem notes and to partly reimburse for improvements, etc	5	99	5.07
Niagara, Lockport & Ontario Power Co	2,000,000		Cumulative preferred stock	For acquisition of stock and new construction	7	103½	6.76
Sioux City Gas & Electric Co.	3,500,000	Twenty-five-year	First mortgage gold bonds, series A	To acquire property, refund debt and supply capital	6	99½	6.05
Nevada-California Electric Corp.	1,500,000	Twenty-eight-year	First lien gold bonds, series A	Refunding	6	98	6.15
Utilities Power Co. (N. H.)	600,000	Twenty-year	First mortgage gold bonds, series A		6	95¾	6.38
Dayton Power & Light Co.	6,000,000	Nineteen-year	First and refunding mortgage bonds	To retire bonds and for additions.	5	93¼	5.60
Total	$50,328,000						

*Due $4,000 annually July 1, 1923 to 1944, and $432,000, 1945

Water-Power Projects Under Way in Wisconsin

The hydraulic engineer of the Wisconsin Railroad Commission reports that at present there are four rather large water-power developments in progress in that state. The Wisconsin Public Service Company is building a dam and installing hydro-electric equipment at a plant built some years ago and operated by this company. The Big Falls Power Company is constructing a dam on the Flambeau River near Ladysmith, and hydro-electric equipment will be installed, the power being disposed of largely in the Ironwood-Bessemer district and in Ashland. The Wisconsin-Minnesota Light & Power Company is constructing a reservoir dam on the Chippewa River, where, although it is not intended to install hydro-electric equipment, a large quantity of water will be stored and released during times of low flow, materially benefiting the Cornell Wood Products Company at Cornell, the Wisconsin-Minnesota Light & Power Company at Wissota and the Dolls Paper & Pulp Company at Eau Claire. The Chippewa Power Company is completing a water-power development at Jim Falls, where the dam is already built. This plant, which also will benefit by the Wisconsin-Minnesota company's new dam, will probably market power in St. Paul and Minneapolis.

In addition to the above developments a number of hydro-electric plants are being extensively improved either by increasing the head or by the installation of more efficient machinery and in some cases the reconstruction of the dams. There are more water-power developments in progress in the state this year than during any former year for a considerable period, and it is authoritatively stated that the total amount of developed power in the state will be increased by approximately 10 per cent when the developments that are now under construction are completed.

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Patent Office Still Struggles Against Difficulties

Despite enactment by Congress last spring of a bill readjusting salaries upward in the Patent Office and authorizing twenty-nine additional examiners and twenty-two more clerks, the work of the office is no more advanced as regards overtaking the number of pending applications than it was a year ago. This condition is attributed to a steady increase in applications for patents and extensions as well as for the registration of trademarks. The office continues to have difficulty in holding experienced technical men as examiners against the inducements of private employment. While 362 examiners are authorized, approximately a dozen vacancies exist because of inability of the Civil Service Commission to supply qualified men at the salaries offered. It was stated at the Commissioner's office that within forty-nine working days twenty-two examiners submitted resignations.

Up to Nov. 1 32,582 first patents had been issued for the calendar year compared with 37,885 during the twelve months of 1921, which shows a higher rate of issuance this year. None the less, while on Jan. 3 there were 60,244 cases up for action, on Nov. 11 this had increased to 69,845. The greatest activity among applicants has been along chemical and electrical lines.

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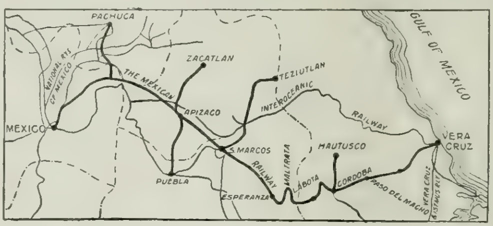
Mexican Railway Will Electrify 30 Miles of Track

The International General Electric Company has closed a contract for the electrification of 30 miles of track of the Mexican Railway Company, Ltd., between Orizaba and Esperanza, on the main line between Mexico City and Vera Cruz. The section contains many steep grades, and the electrification project calls for the expenditure of between $2,000,000 and $2,500,000. It is predicted that this undertaking will be the first step in the electrification of the whole main line of the railroad, which is the longest in Mexico. The project will be financed through London upon terms agreed upon by officers of the International General Electric and the railroad company.



LINES OF THE MEXICAN RAILWAY WHICH WILL BE PARTLY ELECTRIFIED AT THIS TIME

The compelling reasons for the electrification of this piece of roadway, according to the officers of the International General Electric, were the heavy grades and the increasing traffic. Indefinite postponement of the necessity of double-tracking the road and a saving which will pay for the entire cost of electrification in five or six years are indicated, according to those interested in the development. The system will be operated at 3,000-volt direct current, the power to be supplied at this voltage by the Pueblo Tramway, Light & Power Company, whose hydro-electric plant is about 5 miles from Orizaba.

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The Gospel of Publicity Is Preached in Texas

Speaking before a convention of telephone men at Fort Worth, a short time ago, George McQuaid of Dallas, director of the Texas Public Service Information Bureau, made a vigorous plea for publicity, saying:

"The public's welfare depends on the utility being able, through reasonable rates, to maintain unimpaired service and secure new capital to meet the requirements of constantly increasing demands for service. What people desire is most efficient service so long as it is supplied at a reasonable rate. The public stake in a public utility is greater than the general run of people have come to appreciate. There is now a compelling necessity that public utilities relieve regulatory bodies of some of the tremendous pressure falling on them through misapprehension on the part of some of the people of the economic situation. This the utilities may do, educating public opinion to the true condition of the utilities by taking the public fully into their confidence.

"Particularly, the customers of a utility should have every opportunity to understand that nothing is so expensive as poor and unreliable service and nothing so short-sighted on their part as a policy of utility starvation, either through inadequate rates or unjust burdens of irresponsible competition. Utilities should thoroughly understand that they are public servants; that good will and public relations are to be acquired, not alone by good service, but by frankness and an every-day policy of treating the smallest of their patrons with that consideration which is practiced by successful business in non-regulated fields."

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Scientific Study of Taxation of Utilities to Be Made

Financed by several of the largest public utility companies in the country, a scientific study of the system of taxation of public utilities in the United States will be made by Dr. Herbert Simpson, professor of economics and political science at the College of Wooster, Wooster, Ohio, working under the auspices of the research institute of the University of Wisconsin. The Milwaukee Light & Traction Company was the leader in this movement and recently appropriated $5,000 for the financing of an exhaustive investigation of the system of taxation as it affects public utility companies. Several other companies added to the fund, which now totals nearly $20,000. The Milwaukee company stipulated that the investigation be made under the auspices of the University of Wisconsin.

The University of Wisconsin is also, according to Prof. Edward Bennett, chairman of the department of electrical engineering, to undertake a detailed investigation of two electrical problems—rural service and inductive co-ordination, a fellowship for that purpose having been founded by gifts from the Wisconsin Utilities Association and the N. E. L. A.

Progress in Carolinas

Group of Power Companies Has Program Involving Expenditure of More than $6,000,000

A CONSTRUCTION and expansion program involving the outlay of more than $6,000,000 has been started by the Carolina Power Company, the Carolina Power & Light Company and affiliated companies, including the Yadkin River Power Company and the Palmetto Power & Light Company, according to officials of the Carolina group. This program includes work now under way, together with extensions to be started in the immediate future, in North and South Carolina, and it is believed that the new power facilities which will be provided will add impetus to the large industrial development taking place in the sections served, which embrace about forty communities in the two states.

Early in the year arrangements were made for the purchase of 27,500 hp. from the Tallassee Power Company at Badin, N. C. This necessitated the construction of a 65-mile transmission line from Badin to Sanford, where the line will tie in with the present transmission system of the Yadkin River Power Company. The new line will be of double-circuit, steel-tower type and will have a capacity of about 75,000 hp. The Carolina Power Company is also constructing a 30,000-kw. substation at Badin and is planning for the immediate construction of a 15,000-kw. steam plant, which it expects to have in service by Sept. 1, 1923. This plant will supplement the hydro-electric plants of the Carolina group during low-water periods. It will be of most modern and efficient design.

The Carolina Power & Light Company has recently purchased the municipally operated plant at Dunn, N. C., and has extended its transmission system to that point. A new 60,000-volt line has been built from Cumberland, N. C., to Hope Mills, N. C., and the company is serving cotton mills there. The construction program of this company also embraces enlargement of 60,000-volt substations at Goldsboro, and Selma, N. C., and other points.

COTTON-MILL DEMAND GROWS

The Yadkin River Power Company now has under way the construction of additions to a 22,000-volt substation at Blewett Falls and a new 22,000-volt transmission line from Blewett Falls into Rockingham, to care for increased power requirements of cotton mills. The company is increasing the capacity of the Laurinburg 100,000-kw. substation by the addition of 7,500 kw., and arrangements are being made for connection with the transmission line being built from Fayetteville to Laurinburg.

The Palmetto Power & Light Company has acquired municipal plants at Dillon and Latta, S. C., and is extending its transmission system from the North Carolina state line through these points to Marion, S. C. The new line will unite other transmission systems now reaching Maxton and Marion and will provide additional power connections for other Palmetto properties. The company is also constructing a 100,000-volt transmission line from De Kalb, S. C., to Camden, S. C., and will install a substation of 3,000 kw. rating at the latter point. Hydro-electric power for both lighting and power purposes will be furnished to the city and industries at Camden.

* * *

Consolidation Trend Persists in Indiana

Northern Indiana Power Company Takes Over Seven Properties—Plans of Interstate Public Service Company—Indiana Electric Corporation Ready to Build Seven-Million-Dollar Plant

ANNOUNCEMENT has been made that the properties of the Indiana Railways & Light Company of Kokomo, the Wabash Water & Light Company, the Public Service Company of Rochester, the Noblesville Heat, Light & Power Company, the Sheridan Water, Light & Heat Company, the Logansport Utility Company and the Roann Light & Power Company, all located in north central Indiana cities, have been purchased by the Northern Indiana Power Company. These properties all have been connected by transmission lines and the actual consolidation of the companies will be completed in a short time. The Kokomo company is one of the seven companies previously consolidated as the Indiana Electric Corporation. The commission's action in permitting this consolidation was fought by Kokomo and Indianapolis, and the case is pending in the Indiana Supreme Court.

The consolidation is held to mark a great step in the electrical and industrial development of northern Indiana. The joint operation of the plants will result in economies and efficiencies and will insure all the cities an adequate and dependable supply of electrical energy. In the event of a breakdown of any one of the plants, service may immediately be given from other plants. No change in policies or managements is contemplated, it is said.

The value of the properties which have been purchased is approximately $8,500,000, and the total stocks and bonds to be issued by the new company is approximately the total of the present outstanding stocks and bonds of all the companies. The purchase has been completely financed. It is the intention of the new owners to connect the plants as soon as possible with the superpower plant for which preparations are being made in the coal fields of the Wabash River. The plant is to be of the latest and most modern type and will generate electricity at less cost than any other plant in the state. It is expected that it will be completed about January, 1924. At present the plants located in several of the cities are limited in their growth owing to lack of an adequate supply of condensing water.

The Northern Indiana Power Company is controlled by the Brewer interests, according to L. G. Rothschild, one of the Indianapolis representatives of the interests concerned. A petition for ratification of the action will be presented soon to the Indiana Public Service Commission, which has still to pass upon the consolidation.

INTERSTATE TO ABSORB SUBSIDIARIES

Preparations are under way for the absorption by the Interstate Public Service Company of its seven subsidiary corporations, said to be worth nearly $6,000,000. The Interstate company will request authority of the Public Service Commission of Indiana for the issuance of $3,100,000 of securities and authority to assume the $2,075,000 of underlying obligations or bonded indebtedness of the subsidiaries. The subsidiary properties to be taken into the Interstate company are the Hydro-Electric Light & Power Company of Connersville, the Hawks Electric Company of Goshen, the Middlebury Electric Company, the Electric Transmission Company of Northern Indiana, the Winona Electric Light & Water Company, the Southern Indiana Power Company and the Indianapolis & Louisville Traction Railway. The Interstate has facilities for developing power from the Tippecanoe and St. Joseph Rivers.

The Middle West Utilities Company, which, with the Interstate company, is owned by the Insull interests of Chicago, now controls the Hawks, Winona, Middlebury, Southern and Electric Transmission companies. The Interstate now controls directly the Hydro-Electric and Indianapolis & Louisville companies. The Electric Transmission Company owns the line connecting the Hawks and Winona properties. The Southern company operates in Lawrence and Monroe Counties. The Indianapolis & Louisville operates the interurban line between Seymour and Sellersburg. No money is to change hands in the deal, but the new Interstate company securities will replace those of the old companies, with the exception of those to be assumed.

INDIANA ELECTRIC'S PLANS

Laying of ground plans for the construction of a seven-million-dollar unit of a superpower plant for the Indiana Electric Corporation has been begun on a sixty-three-acre tract on the west bank of the Wabash River, near Terre Haute. Organizers of this corporation are the Brewer interests of Grand Rapids, Mich., controlling the Northern Indiana Power Company, the Merchants' Heat & Light Company, Indianapolis; the Wabash Valley Electric

Company, serving Clinton, Sullivan and other western Indiana cities; the Cayuga Electric Company and the Putnam Electric Company of Greencastle.

Plans call for the installation of two 20,000-kw. units and the installation of three additional units of equal power at a later date, making the ultimate capacity of the plant 100,000 kw.

Adjoining the plant site on the south, west and north are 3,000 acres of coal land, the coal underneath being sufficient to operate the plant to a capacity for thirty years, officials estimate. More than one-half of the water of the Wabash River will be diverted to serve the plant condensers.

Brief News Notes

Lectures on Electric Vehicle Maintenance.—To meet the demand for information regarding electric motor-truck operation and care brought about by the rapidly increasing use of the storage-battery vehicle for city deliveries, the Electric Motor Truck Association of New York City is planning a course of instruction covering every phase of maintenance. These lectures will begin on Friday, Dec. 8, and will be given on the second and fourth Fridays of each month throughout the winter at the Electric Garage, Sixty-second Street and Central Park West.

North Missouri Companies Unite — The Excelsior Springs (Mo.) Water, Gas & Electric Company has completed negotiations whereby it absorbs the Brookfield Light & Power Company, and the new organization will be known as the North Missouri Power Company. Possession will be given as soon as the Missouri Public Service Commission approves the deal. The new properties acquired by the Excelsior company give service to twenty-two cities in north and northeast Missouri, and this added to the sixteen towns now served by the company makes a total population of 50,000 reached by it.

Government Issues a Novel Publication.—Apparently everything that a commercial traveler ought to know about the twenty republics and the many colonies to the south of the United States, to make a trip profitable as well as enjoyable, is contained within the 734 pages of the revised edition of the "Commercial Travelers' Guide to Latin America," edited by Ernst B. Filsinger and issued by the United States Department of Commerce. Information on steamship lines and railroads, timetables and connections, road routes, hotels and rates, taxes on travelers and restrictions, duties on samples and advertising matter, banks, postal service and postal rates, weights and measures, and all things that may obviate those vexatious delays which are especially troublesome to the uninformed and inexperienced traveler in Latin America, is included, and every city and market of importance in the Latin-American nations is listed, with information as to its characteristics, trade regulations, license fees, routes by which to reach it, etc. More than forty maps based upon the most recent authentic data were specially drawn for use in this publication. The guide may be obtained by applying to the Superintendent of Documents, Government Printing Office, Washington, D. C., or to any of the district or co-operative offices of the Bureau of Foreign and Domestic Commerce.

Progress on Norway (Ind.) Plant.—The new hydro-electric power station of the Hydro-Electric Light & Power Company on the Tippecanoe River at Norway, Ind., is nearing completion. Two complete generators have been received and parts of the four waterwheels are on hand. The transmission line to the site has been built. The plant will have four generating units with a combined capacity of 10,000 hp. All energy produced in this plant will be taken by the Interstate Public Service Company in Indiana and the Central Illinois Public Service Company in Illinois. The property will be operated by the former company.

Wisconsin Commission to Fix New System of Rates for "Loop" Cities.—Eau Claire, Chippewa Falls, Menomonie, La Crosse and thirty-eight other cities and towns receiving electric power from the big seven-million-dollar Wissota dam of the Wisconsin-Minnesota Light & Power Company have been assembling evidence on which a new system of rates will be determined by the Wisconsin Railroad Commission. Preliminary hearings by the commission will be held in Madison some time in December to collect the extensive mass of figures upon which it will base a new schedule of rates for the cities served by its "loop" line, in accordance with the recent finding of the Wisconsin Supreme Court. In this new schedule each community is to be regarded as a unit, and its distance from the source of supply will affect the rates prescribed for it.

Mexican Northern Expanding.—An important expansion of the electric power system of the Mexican Northern Power Company at Boquilla, Mexico, is to take place as rapidly as the construction work can be done, it is authoritatively announced. This is due to a contract which the company has just entered into with the state government of Chihuahua for the building of a power transmission line from its hydro-electric plant to the city of Chihuahua. It is stated that the same line will be extended to the mining camp of Santa Eulalia and that electric power will be furnished for operating the machinery of the mines, ore-reduction mills and various industries of that camp and the capital of the state. The Mexican Northern Power Company, which is a Canadian enterprise, finished its plant while the Mexican revolution was in progress and was in the fighting territory, but its construction was never interfered with.

Associations and Societies

Watt Hour Club.—The New York & Queens Electric Light & Power Company gave its annual dinner to the Watt Hour Club of Queens Borough, New York City, on Nov. 23. The Watt Hour Club, composed of electrical contractors, dealers and jobbers, together with commercial men of the Queens company, is conducted in the interests of co-operation. There were about eighty in attendance. Charles A. Barton, commercial manager of the company; Ray Palmer, its president, and Frank W. Smith, president of the N. E. L. A., spoke.

American Physical Society.—For the meeting of this society in Chicago at the Ryerson Physical Laboratory on Dec. 1 and 2 several papers of interest to electrical scientists were scheduled. Chief among these were the following: "The Torques and Forces Between Short Cylindrical Coils Carrying Undamped Alternating Currents of Radio Frequency," by W. A. Parlin, State University of Iowa; "The Low-Voltage Mercury Arc," by M. Scott, Cornell University; "The Electron Emission from Tungsten, Thorium, Molybdenum and Tantalum," by S. Dushman, H. N. Rowe and C. A. Kidner, General Electric Company; "Characteristics of a Short-Wave Oscillator," by L. L. Nettleton, University of Wisconsin; "The Volt-Ampere Characteristics of Electron Tubes with Thoriated Tungsten Filaments Containing Low-Pressure Inert Gas," by Albert W. Hull and W. F. Winter, General Electric Company, and "The Photoelectrical Properties of Heated Oxides," by H. Kahler, Yale University.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

American Society of Mechanical Engineers—New York, Dec. 4-8.

Electrical Supply Jobbers' Association—Pacific Coast Division, Coronado, Cal., Dec. 7-9; Central Division, Chicago, Feb. 13-14; Eastern Division, Atlantic City, N. J., Feb. 15-16.

New York Electrical Credit Association—New York, Dec. 14. W. J. Kreger, 47 W. 34th St., New York.

American Physical Society—Boston, Dec. 26-30. D. C. Miller, Case School of Applied Science, Cleveland.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf. Electrical League, Hotel Statler, Cleveland.

Western Association of Electrical Inspectors—Chicago, Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Wisconsin State Association of Electragists—Milwaukee, Jan. 24-26.

Assciation Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Recent Court Decisions

Lapsed Franchise Need Not Be Recognized by Commission When Owner Applies for Certificate of Convenience.—In Pirie vs. Colorado Public Utilities Commission the defendant sought to force the commission to issue to him a certificate of convenience and necessity permitting him to supply electric light and power at Idaho Springs because he had conducted such a business there before the war, at which time the transmission line to that place was sold and dismantled. The commission, finding the territory sufficiently served, refused to recognize any right of the defendant to operate there, and in this action the Supreme Court of Colorado acquiesces, finding that the commission had acted within its powers and upsetting various allegations made against the constitutionality of the act creating it. (209 Pac. 640.)*

A High-Voltage Wire Sagging Within 5 Ft. of Ground Constitutes Negligence as a Matter of Law.—A verdict for the plaintiff in Hale vs. Appalachian Power Company, in which suit damages were sought for the death of a farm laborer who either came in contact with a sagging high-voltage line or went so close to it that he received fatal burns, has been affirmed by the Supreme Court of Appeals of Virginia. In this case testimony was that an 88,000-volt transmission wire which had been broken by a sleet storm was temporarily repaired but left sagging at one place within 5 ft. of the ground. This condition, the court held, constituted negligence as a matter of law, and contributory negligence on the part of the victim was for the jury to determine. (113 So. 711.)

Right of Owner of Dam to Manipulate Water a Qualified One.—In Merkel vs. Consumers' Power Company damages awarded by the trial court because of injury to plaintiff's property caused by overflow from the defendant company's hydro-electric development on the Au Sable River have been affirmed by the Supreme Court of Michigan, which made the three decisions that follow: (1) If a release of damages from overflows by reason of a dam was executed in reliance on representations that the payment was made only for land washed away, and not for crop damages, it did not bar a subsequent action to recover for damages to the crops without restoring the money paid; (2) the right of the owner of a dam to manipulate the waters of a river for power purposes alone was not absolute, but qualified by the rights of other riparian owners, and the reasonableness of its acts was not measured alone by the demand for power from its customers; (3) in action for damages to crops from overflows where the evidence fairly tended to show that the work of producing and harvesting the crops had been performed, it could not be said as a matter of law that the expense of production and harvesting should be deducted, and an instruction as to damages was not erroneous for failing to require such deduction. (189 N. W. 997.)

Municipal Bonds to Construct Transmission Line Held Constitutional.—An issue of bonds by a city and the levy of taxes to pay them in order to construct a transmission line to connect with the municipal power plant of another city are for a strictly corporate purpose, according to the Supreme Court of Illinois, and an ordinance authorizing such an issue does not in any manner contravene the national constitution, as alleged by the plaintiff in the case at issue (Carr vs. City of Athens). An injunction was sought to prevent the municipality from issuing bonds for the purpose of constructing a transmission line to connect with the Springfield municipal plant and thus obtaining electric service. In its business relations, the court further decreed, a city is not confined, in purchasing needed supplies, to limits of the city. (136 N. E. 633.)

Apportionment Between Gas and Electric Departments.—In a report filed in the New York Supreme Court by a referee to whom had been referred the case of the Bronx Gas & Electric Company vs. the Public Service Commission, and who found the legal rate of $1 per 1,000 cu.ft. of gas confiscatory, this expression of opinion was contained: "Much testimony was taken in relation to the necessary allocation of certain expense items between the gas and electric departments of the plaintiff's business and the apportionment of the value of certain property used in both departments, but necessary for the plaintiff's gas business. The defendants claimed that the methods used by the plaintiff failed to charge to the electric operation its full proportionate share of the expense or of the value of the property used jointly. On all the evidence, I am convinced that the plaintiff's officers, in distributing these expenses and costs in the manner brought out by the testimony, were actuated by no other motive than an effort to be fair alike to the consumers of the gas department and of the electric department of its business, the latter being at all times subject to regulation by the Public Service Commission, and while doubtless an exact, or nearly exact, distribution could have been made by the introduction of an elaborate system for that purpose alone, its cost, I am certain, would have been more than the saving to either branch, and I doubt even then if the actual percentages would be far from those more or less arbitrarily fixed by the company. No one suggested bases of apportionment less open to criticism. If the case were closer, I would review this phase of it more fully, but I find no reason for disturbing here the actual allocations made."

Commission Rulings

Commission Must Not Substitute Its Judgment for That of Town Council on Question of Policy.—The Public Service Commission of West Virginia, granting a permit to the town of Franklin to construct a dam to produce hydro-electric power, although it was alleged that the town could purchase power more advantageously, declared that it had no right to substitute its own judgment for that of the Town Council on this question.

Rates and Density of Service—Uncollectible Bills—Free Service.—In prescribing rates for the Libby Water & Electric Company, the Montana Public Service Commission laid down these among other principles: (1) Patrons of a plant situated in a community where it is not possible to develop that degree of service saturation which insures a dependable and profitable demand may be required to bear higher rates than those in force in more profitable territory. (2) Charges for uncollectible accounts should not be allowed as an item of operating expense unless the accounts are in reason uncollectible, since a public utility must employ more than ordinary diligence to collect the sums due it. (3) The practice of furnishing free service or reduced rates to certain consumers is unlawful, and it makes no difference whether or not the recipient of such service is an employee of the company or the city or county.

Wisconsin Commission Settles Dispute Over Territory.—A settlement of the three-cornered dispute between the Eastern Wisconsin Electric Company, the Calumet Service Company, and the Badger Public Service Company over franchise rights to build light and power extensions to serve the town of Calumet has been effected, the Wisconsin Railroad Commission having granted the Eastern Wisconsin Electric Company, with headquarters in Fond du Lac, sole and exclusive electric service privileges in this township. The law provides an orderly procedure for determining territorial disputes between rival companies, and the commission gave no weight to construction, which it regards as an attempt to obtain advantage during litigation. On the legal points raised the commission found that the Badger Public Service Company had failed to exercise any right it may have had under a permit which it claims to hold, more than one year after its alleged passage by the town board, and that it had no legal right to extend service into the town of Calumet without first obtaining a certificate. On questions of fact the commission found that the town would be better served from the plant of the Eastern Wisconsin Electric Company, to which Calumet had granted a permit.

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

C. S. Laudis has resigned his position with the Federal Shipbuilding Company and is now associated with the Pennsylvania Power & Light Company at Hazleton, Pa.

H. C. Miller has severed his connection with the Utah Power & Light Company, Preston, Idaho, and is now associated with the Eastern Oregon Light & Power Company, Baker, Ore.

M. T. Crawford, superintendent of distribution of the Puget Sound Power & Light Company, has recently completed a month's tour of the larger Eastern cities, where he took the opportunity to investigate underground electric systems.

Stuart Wilder now fills the post of electrical engineer for the Bronx Gas & Electric Company of New York City. For some years Mr. Wilder was associated with the Westchester Lighting Company and its affiliated companies in various official capacities.

J. Henry Collins, president and general manager of the New England Electric & Supply Corporation of Lowell, Mass., has recently returned from a four months' trip to Europe, during which he visited France, Germany and Belgium.

J. R. Johnston, treasurer of the Western Electric Company, New York City, recently visited Salt Lake City and attended a luncheon meeting of the advisory committee of the Rocky Mountain Electrical Co-operative League.

L. E. Gettle, a member of the Wisconsin Railroad Commission, has been elected chairman of that body to succeed Carl D. Jackson. Mr. Gettle was appointed to the commission by Governor Blaine in February, 1921, to succeed John S. Allen.

H. C. Sterling became manager of the new organization which was recently formed when the Ohio Power Company of Canton, Ohio, took possession of the light and power properties of the Ohio Electric Railroad Company in Lima. James T. Loftus was made assistant manager.

J. H. McDonell, who was in charge of electrical construction work for the Capital District Engineering Company of Albany, N. Y., with headquarters in Utica, is now in charge of transmission, distribution and trolley system for the Monongahela Power & Railway Company, Fairmont, W. Va.

G. E. Emmons, vice-president of the General Electric Company, has been decorated with the Order of the Rising Sun by the Japanese government, in recognition of services in introducing electrical machinery into Japan and developing the electrical industry. Mr. Emmons recently made a trip to Japan in connection with engineering development work for one of the affiliated concerns of the International General Electric Company.

Dr. von Siemens Celebrates Anniversary

Carl Friedrich von Siemens, the present head of the Siemens & Halske Aktiengesellschaft and the Siemens-Schuckertwerke of Germany, celebrated the fiftieth anniversary of his birth on Sept. 5. Dr. von Siemens is the present head of the illustrious family of Siemens, whose connection with the electrical industry dates back to the work of Werner Siemens more than seventy-five years ago. He was educated at the Falk-Realgymnasium in Berlin and later at the technical high schools in Munich and Berlin. Extensive traveling added much to his mental development as well as to his experiences.

C. F. VON SIEMENS

His first practical experience was gained in laying a cable between England and Ireland in 1893, and in 1899 he was connected with the Berlin works of the company. From 1901 to 1908 Dr. von Siemens was stationed in London, where he took charge of the plants and business of Siemens Brothers, formerly headed by William Siemens. Returning to Berlin, he was placed in charge of the company's export business and in 1912 he became managing director of the Siemens-Schuckertwerke. From that time on Dr. von Siemens has been the active head of the whole concern, and it was largely due to his supervision and initiative that the business of the company weathered the storm of the after-war troubles and revolutions in Germany so successfully. Like a great many other leading men in industrial life in Germany, Dr. von Siemens has taken an active part in political and social work. He is a member of the Reichstag and of a great number of associations, societies and committees connected with economic and industrial affairs in Germany.

Martin J. Insull, vice-president of the Middle West Utilities Company, Chicago, and Harry Reid, president of the Interstate Public Service Company, Indianapolis, recently inspected the construction work of the Hydro-Electric Light & Power Company, a subsidiary at Connersville, Ind.

Harry G. Cisin, formerly engineering editor of the *Electrical Record* and author of "The Radio Telephone Handbook," has been placed in charge of the publicity and advertising of the Dictograph Products Corporation, New York City. Mr. Cisin was formerly instructor in electrical engineering at Cornell University, Johns Hopkins University, United States Navy Electrical School and the Stevens Institute of Technology.

Robert S. Hale of the Edison Electric Illuminating Company of Boston, chairman of the wiring committee of the National Electric Light Association, has just been elected president of the famous Atlantic Tuna Club. This is a deep-sea-fishing organization, whose headquarters are on Block Island, off the coast of Rhode Island, where the sport of catching the big fish is carried on in much the same way as at Catalina Island on the Pacific Coast.

Joseph B. McCall, president of the Philadelphia Electric Company, received an enthusiastic reception from his employees at a company section meeting of the National Electric Light Association which was held recenly at New Century Hall, Philadelphia. It was Mr. McCall's first appearance since he became ill in the early part of the year.

D. E. Callender, who for some years has been general manager of the Wisconsin Gas & Electric Company, operating the utilities in Racine and Kenosha, has been appointed Racine manager of the Milwaukee Electric Railway & Light Company and on Nov. 1 assumed this position in addition to being general manager and member of the board of directors of the Wisconsin Gas & Electric Company. Mr. Callender's new responsibilities include direction of the operation, distribution, commercial sales and accounting departments of the Racine division of the Milwaukee Electric Railway & Light Company. He entered the public utility business as an accountant with the old Racine Gas Light Company and became manager of that company in 1908. Four years later, when the Wisconsin Gas & Electric Company was organized and it purchased the Racine and Kenosha plants, he was appointed general manager of the corporation. Since that time the company has expanded until it operates electric utilities in fifty cities and villages in southeastern Wisconsin.

George O. Bason has resigned from the employ of the General Electric Company, New York City, and is now local manager of the Poughkeepsie district for the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y.

O. O. Rutledge has been appointed representative of the Puget Sound Power & Light Company at Puyallup and Sumner. Prior to this appointment Mr. Rutledge was in the train service of the Puget Sound Electric Railway for thirteen years.

E. L. Bennett has been appointed sales manager of the Berthold Electrical Manufacturing Company, Chicago. Mr. Bennett was formerly sales manager for the Crystal Washing Machine Company, Detroit, and later sales and advertising manager for the Airway Company, Toledo, Ohio.

Arthur Louis Thexton, who was recently made assistant editor of the *Edison Round Table*, the official publication of the Edison Club of the Commonwealth Edison Company, has been made editor, replacing Ernest S. Butt, who is now in the publicity department of the company. Mr. Thexton was formerly associated with the Chicago *Daily Journal* as reporter and special writer.

George V. W. Ingham has been appointed Eastern sales manager for the electrical division of the Johns-Pratt Company, Hartford, Conn., manufacturer of fuses, protective devices, packing and insulation, and will make his headquarters in the New York City office, 41 East Forty-second Street. Mr. Ingham is well known in the electrical wiring device field, having recently been eastern sales manager of the Bryant Electric Company, with which he was associated for eleven years. Prior to that Mr. Ingham was with Pass & Seymour, Inc., as Western sales agent. His wide acquaintanceship in the electrical industry and his intimate knowledge of the problems of distribution will be of great value in his new connection.

John B. Bassett, who was recently appointed assistant engineer of the New York district of the General Electric Company, has been a member of this company for the past eleven years, with the exception of a short period during the war. Mr. Bassett was graduated from the University of Illinois, where he completed the course in electrical engineering in 1911. From college he entered the testing department of the General Electric Company and was made assistant head of large-apparatus tests. From this post he was transferred to the direct-current engineering department, where he was employed in synchronous-converter design, production and field engineering. In 1918 Mr. Bassett was enrolled at the United States Submarine Base, New London, Conn., where he took the Naval Reserve training course, leading to his assignment as submarine engineer officer. Later he returned to the General Electric Company and joined the engineering department at the New York office to take part in the rapidly developing marine activity. When appointed to his present position he was in charge of Diesel engine electric drive engineering.

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F. H. Woodward Made General Sales Manager

Frank H. Woodward, who has been appointed general sales manager of the Great Western Power Company, as was announced in a recent issue of the *Electrical World*, brings to his new office knowledge gained through years of experience in the electrical industry in the West. Mr. Woodward, who is well known to old-time electrical men in San Francisco, served with the Edison Light & Power Company in the years 1894 to 1898 as salesman. After the consolidation of that company with the San Francisco Gas Company as the San Francisco Gas & Electric Company he served until 1902 as superintendent of the contract department. Later he and four others left the service of the company to become factors in the newly organized United Gas & Electric Company of San José, having Santa Clara and San Mateo Counties as their field and assuming the management of the Standard Electric Company of California, with offices in San José, as well. In 1906, following the consolidation of the United Gas & Electric Company with other properties in the Bay region, Mr. Woodward became associated with R. J. Davis and entered the jobbing business in San Francisco. In 1909 he took charge of the commercial department of the Great Western Power Company in San Francisco, and in 1911, when this company took over the City Electric Company of San Francisco, he was made manager of industrial sales. When the Great Western Power Company entered the Oakland field he succeeded to the management of the Alameda and Contra Costa County districts. The reputation he made for himself made him the logical man to succeed James B. Black as general sales manager of the company.

F. H. WOODWARD

P. T. Davis is now secretary and treasurer of the Juniata Public Service Company, Clearfield, Pa., replacing A. J. Musser.

Obituary

Edward A. Newlon, who until about six months ago was superintendent of the Fremont (Neb.) business of the Fremont Electric Light & Power Company, died recently at David City, Neb. Mr. Newlon was born and educated in Fremont and had become prominent among the younger business men of the city. He went to David City a few months ago to engage in the operation of a theater. He was thirty-five years of age.

Thomas M. Meston, president of the Emerson Electric Manufacturing Company, St. Louis, died suddenly on Nov. 23, of heart disease. Mr. Meston was born in Elgin, Scotland, emigrating at an early age to Canada, where he received his education. In 1886 he moved to St. Louis and entered the employ of the Simmons Hardware Company. He remained with this firm until 1897, when he resigned to become secretary of the Emerson Electric Manufacturing Company. He became second vice-president in 1905 and later succeeded to the presidency of the company.

Frederick Welles Prince, a member of the publicity department of the Western Electric Company, was killed under tragic circumstances while on a business trip in Detroit on Wednesday, Nov. 22. Mr. Prince was spending the evening with friends when a telephone message from a neighbor begged his host and hostess to come to her aid, stating that her husband, from whom she was seeking a divorce, was threatening her. The entire party responded, and soon after they had reached the apartment the husband, who had left it, returned and broke in the door, ordering them to depart. Mr. Prince left at once. He was followed by the husband and a few moments later was found lying unconscious at the foot of the steps leading to the apartment. He died without regaining consciousness. An autopsy was performed and showed that he had been killed by a cerebral hemorrhage, the result of a blow on the jaw. Mr. Prince was well known in the electrical industry. He had been sales manager of the Hartford Light & Power Company, lighting engineer with the Franklin Electric Manufacturing Company, advertising manager of the Westinghouse Lamp Company and had recently joined the organization of the Western Electric Company. He was a man of the highest character, and his genial personality had won a host of friends who held him in much esteem. Mr. Prince was a graduate of Trinity College, where he was a Phi Beta Kappa man. He was forty years old and leaves a widow and one son.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Electrical Apparatus in the Orient*

Opportunities for American Manufacturers—Reflections from a Recent Personal Study of the Market Situation in Japan and China—Labor Conditions in Japan

By S. Glen Vinson
The Ideal Electric & Manufacturing Company, Mansfield, Ohio

THE aftermath of the world war caused in the Orient, as in this country, a period of huge stocks, sudden deflation of values and sharp drops in credit and exchanges. Conditions now, however, are rapidly adjusting themselves to a more sound and economical basis. Business is being resumed, not with a rush or with a boom spirit, but slowly and surely toward a normal, staple, solid footing.

Within the past six months it has been my good fortune to be able to study some of the conditions in the Far East very intimately. Sailing from San Francisco on April 19, I first visited Yokohama, Tokio, Kioto, Kobe and Osaka in Japan and, like any American visiting Japan for the first time, was amazed at the extent of her industries. The city of Osaka particularly is a second Pittsburgh—a busy, hustling, thriving place. In fact, all of Japan appears very well developed from a manufacturing standpoint. There are several very large companies there manufacturing electrical products, for the most part operated and owned entirely by the Japanese. Japan, of course, deserves some credit also for the electrical development of China. There she finds a natural outlet for her products as well as a dependable source of raw materials. Several projects are now under way that will utilize the inland waterfalls for electrical purposes as well as for the electrification of several of her railroads. All in all, I would say that there is a real opportunity for the American manufacturer in Japan, but home competition must be reckoned with very seriously and carefully.

From Japan I crossed to China, where I spent nearly two months and where I truly believe exists a great potential field for American manufacturers of electrical equipment. At the present time only the surface has been scratched. In China the American has one outstanding advantage. All of the Chinese seem to favor both American goods and American methods. China's big drawback always has been politics—an ever-changing directorate that up to now has not had the support of any two sections of the nation. There is a day coming—not too far in the future either—when a big man will take hold and pull all their little parties and cliques together, and then you will see a tremendous era of industrial expansion in China. Right now, even in her unsettled state, China is far from being dead commercially. Shanghai is a hustling commercial city—it has one 40,000-kw. central station, thoroughly modern and efficiently equipped in every way. Iron, textile and flour mills abound and a multitude of smaller plants are to be found. There are iron and steel mills in Hankow, about 600 miles inland on the Yangste River.

English Firmly Intrenched

The English are firmly intrenched here as elsewhere throughout the East, and they are bitter in their commercial prejudices against American firms and American goods. They may accept your account, but it is extremely unlikely that they will sell your goods. There are, of course, many good importing houses and brokers, a number of whom are American, but the real and only successful way to market your product in China is to follow the lead of the Standard Oil Company and the American Tobacco Company and install your own selling organization. This takes money and it takes time, but it will pay big dividends in the end to the firm with courage enough to go into the field aggressively and persistently.

Another condition to be seriously considered in exporting to China is credit, for the Chinese are not good credit risks. Sight drafts with bills of lading attached are very risky. Moreover, Chinamen are accustomed to receive from both English and Germans what to us is almost unbelievable credit. One instance I ran across was of a fifteen-thousand dollar power plant sold by a German firm on nine years' credit, payable $5,000 every three years. But, as I mentioned before, even in the face of this American goods will get the preference if they are rightly introduced, because the Chinese prefer them and also the American way of doing business.

In my tour of China I visited Shanghai, Tientsin, Pekin, Nanking, Hongkong, Canton and many smaller cities. I saw a few American motors, some American fans and a great number of Japanese motors and fans, also a number of English, Italian and German makes.

China has unlimited natural resources virtually untouched. With the exception of the Kailan mining administration organized by Herbert Hoover in north China and since sold to the Belgians, no formidable attempts have been made to mine either coal or metal. The ridiculous part of this is apparent when it is pointed out that China has the greatest potential coal fields known today and yet she imports a large part of the coal she needs for her railroads, mills and steamboats. In the past the Chinese superstitious fear of devils in the ground has prevented them from digging, but in a very short time this will probably pass away under the influence of the white man.

In metal deposits China is rich in copper, lead and zinc and is said by competent authorities to hold the richest iron-ore deposits in the world. A country so vast and so naturally favored as this cannot long withstand the determined efforts that are being put forth and will be put forth to develop it to its fullest extent. The American manufacturer who today recognizes this market and who polishes up his sample kit and gets in there now is going to reap his reward a very few years hence.

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*From a talk at the Electric Power Club fall meeting, Asheville, N. C., Oct. 30-Nov. 2.

Labor and Commercial Facilities

Labor conditions in the Orient are interesting. In Japan there are no regulations to speak of concerning child or girl labor, except a government day of eleven hours, which is not at all observed. The average working day will run from fourteen to eighteen hours, and about 60 per cent of all the industrial work is being done by female labor, the other 40 per cent by male labor. These are some of the facts that were brought out at the disarmament conference in Washington, at which it was agreed that by the end of the year 1923 Japan must reach certain standards that were set by the labor committee at the conference.

So far as women and children workers are concerned, Japan is on a lower plane than any other nation represented in this conference. Sixty per cent of her female employees are in the industries, and 80 per cent of these are in the textile mills. There are no laws in Japan demanding inspection of factories and housing conditions. Forty per cent of the girls go home ill annually, and 20 per cent of this number soon die from various causes. These statistics were obtained largely through Mr. Kagawa, who, though a large capitalist, is the principal labor leader of Japan.

In China labor is practically unpaid. In the outlying or rural districts the worker receives hardly enough to buy food. Conditions are better, however, in the manufacturing centers, where laborers are paid what are very good wages for China, though only a small fraction of what we pay here.

The American manufacturer going into China or any part of the Orient, with the exception of Japan, must realize that he is going into a practically undeveloped commercial field without the facilities for distribution, advertising or sales prestige that he would enjoy in his own country. Advertising, of course, can be used, but it must be direct, in the shape of educational literature, as there are practically no mediums, with the exception of our American export papers, that can be used successfully to reach the buyer. Traveling is tedious, difficult and exceedingly slow, the mail service is not what it is here, and unless the company has a full understanding of these facts, it will probably in a very short time become discouraged and withdraw from this field.

I believe that there is a great market looming up for us in the Orient, and I am quite sure that if we tackle it in the thorough manner that has been characteristic of American methods throughout the history of the United States, it will not be many years before this country will have taken the leadership away from the English and our American boats will be carrying American goods in ever-increasing quantities to all the principal ports of the far East. I think, too, that the Shipping Board should extend its service to the Federated Malay States and to India. The present terminus is Hongkong.

The Marsh Patents and the Heating Line

Why the Expiration of the Licenses Will Not Unsettle the Field—Effect of the Entrance of New Manufacturers Into It—The Outlook for Winter Business

By George A. Hughes
President Edison Electric Appliance Company, Chicago

RUMORS have been in circulation that a severe disturbance in the general economics of the heating-appliance industry may follow the expiration of the Marsh patents next February. The chief reason why both manufacturers and jobbers have worried over this matter, it seems to me, is because of the amount of misunderstanding which has grown up around these patents. Back in every human mind there exists an inherent fear of the future and the changes in business and social conditions which may be impending. It is therefore but natural that men in the business of manufacturing, distributing or merchandising heating devices should view with some apprehension any change in an existing system of economic balance. This fear, however, can be dispelled by a study of the actual facts.

At the present time virtually all manufacturers of heating devices are operating under an open, free, competitive market. That is, restrictions affecting trade discounts and competition have been removed from the Hoskins license; and we, as well as other licensees, are using prices based on individual costs.

People think that the prices of electric heating devices have been supported artificially by the Marsh patents. Some think that a flatiron will come down in price $2 when the royalties are no longer paid. But, as a matter of fact, all of the licensed manufacturers pay a royalty of only 6 cents on irons and other socket devices and an average of $1 for every range. That is not enough to affect the price materially. Moreover, the difference in cost between the nickel-chromium heating elements which the "quality" manufacturers will continue to use and the cost of the inferior wire which inexperienced manufacturers may try to substitute will not be great enough to make any marked difference in production costs.

Most of the friction surrounding the early issuance of these patents has been removed, and the business is now one of long standing and so stabilized that the industry is operating along rigid laws of supply and demand. The fundamental problems of manufacturing and distributing are still with us, and so they are with all other manufacturers, and these will and can be solved only by companies with years of experience to their credit. The patent situation has little influence or bearing on these prime issues.

New Manufacturers Will Come

The electrical industry appeals to everybody just as the automobile tire business has been a loadstone to thousands, and there will be overproduction in various lines of electrical manufacture just as there has been overproduction in the tire business. But there is an abnormal element of risk when it comes to electric heating appliances because electricity in the form of heat is a hazard and there is no counting on quality in the product of an inexperienced, inexpert manufacturer. Yet people will innocently buy these goods if electrical retailers tell them to.

Undoubtedly a considerable number of new manufacturers will spring up when these patents expire, but unless these manufacturers are successful in producing appliances made with an accurate knowledge of cost, I do not see why we need to worry over expansion in this direction. At the present time, as we all know, there are many companies manufacturing a class of equipment that may be called unlicensed, and they are selling such products, but unless these concerns are keeping an accurate account of their costs, I fear that more than one jobber will be disillusioned after a short period of fairly active sales. For most of these houses will have a short life owing to poor cost accounting.

Manufacturers of "quality" products which are well distributed and sold at fair prices need have no qualms regarding the termination of the Marsh patents. Such products sold on a cost basis and a fair profit will always endure. Unless some drop in labor or raw material occurs this fall, I don't see how a reduction in the cost can be made. And the present day tendency is toward rising prices since steel and labor are now about on the level of 1919. There is nothing in the horizon to indicate any lowering of prices on standard goods. Raw-material prices are generally stiffening, and the recent action of the United States Steel Corporation in advancing wages 20 per cent is not without considerable significance.

Although both the railway and the coal strike have been settled, it will necessarily be some time before any saturation in the coal demand can be reached. Therefore, I feel that we shall find a very active sale of heating appliances this winter, especially of the open air heaters. For with a scanty supply of coal on hand people will be more appreciative of an applance which offers instantaneous heat without any dirt or ashes. The few new manufacturers who undoubtedly will spring up to meet this demand cannot create much of a disturbance, and business for the well established firms will be bright. The movement of goods, however, may prove embarrassing, for the demands of the shippers are going to prove more than the railroads can take care of unless the present indications are misleading.

Survey of Business Conditions

Better Industrial Buying Is Helping Control Apparatus

Better buying by the industries and improved business conditions are said by several manufacturers to be responsible for the improvement in control apparatus. A great increase in activity is expected for the next six months on the basis of orders now on hand and inquiries being received. Deliveries are fair.

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Commercial Fixtures Helped by Engineering Advice

A large increase in commercial lighting orders is shown by manufacturers' books for the three months just ended. Increased industrial activity and the heavy construction during the summer are given as the primary reasons for this added interest.

Prices are diversified and scattered and few of them seem to bear directly on the amount of demand or supply. One company reports that its lighting engineering department's expense has well paid for itself because of the large amount of orders gained through its advice and activities. Textile mills and the metal industry are showing added interest in proper lighting methods, and although there has been much replacement business, new installations are said to have made up the bulk of the orders. Foreign shipments are fair and increasing.

◆

Say Range Sales Were 85 per Cent Heavier

Range manufacturers are of the opinion that sales during the first ten months of the year have greatly surpassed those for the entire year of 1921, some saying that more than 85 per cent more business was done than last year.

It is stated by one maker that sales vary in different parts of the country. He points out that merchandising by central stations was most important in the work of promotion. Where a spirit of co-operation was not shown by the central stations sales, results were very poor. Another manufacturer again brings up the complaint that there are still a few utilities in the country which are not interested in appliances that cannot be attached to lamp sockets.

Stocks are said to be very much lowered, although manufacturers, jobbers and distributors began this year with quite large amounts.

Farm-Lighting Plants Show Way for Central Stations

Farm-lighting plant salesmen are selling the idea of electrical service for the central-station company by placing small plants in the rural districts, said a manufacturer last week when being interviewed on market conditions for these sets.

This manufacturer pointed out that the installation of these sets generally involves 110-volt wiring in rural homes and farm buildings, and that the standards of insulation adopted often enable service from the local utility to be provided with little additional cost.

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Bright Outlook for Storage Battery Sales in 1923

Sales of storage batteries continue brisk and the outlook is bright for the remaining months of 1922 and for the first months of 1923, according to several manufacturers in the Eastern territory. Orders during the last few months have been much higher than those for the corresponding period of 1921. The railroads are buying in greater amounts, and the rapid growth of the electric truck industry is another primary reason for this betterment. Rural sales are said to be in larger volume.

◆

Holiday Business to Be 100 to 175 per Cent of 1921

Holiday buying, according to a survey of leading jobbers, will be from 100 to 175 per cent of last year's business. One distributor states that he will be well satisfied if orders equal those of 1921, and another, voicing the opposite extreme of opinion, says that he is confident business will be almost doubled. However, none of the jobbers thinks sales will fall below the 100 per cent mark.

Vacuum cleaners and washers are the best sellers of the year, with electrical toys running a good second in the market. Sales of flatirons and waffleirons are showing good progress in the Christmas market and are reported by some large retailers and department stores to be from 115 to 125 per cent heavier than for the corresponding weeks of 1921. Percolators in the better makes are showing much activity. It is pointed out by one sales manager in a New York department store that heaters are being sold in large quantities to persons who intend to present them as holiday gifts.

Some congestion in the toy market has been evident, manufacturers claiming that jobbers, fearing a decided slump in novelties, at first failed to order as heavily as was necessary, and when demands from the retailers flowed in, contrary to expectations, placed late orders in a rushed market.

Prices generally are firm, although there has been some slight recession in order to offer attractions in the larger stores where stocks were bought in larger amounts. This is particularly true in the Eastern market in the selling of certain standard makes of toasters, ironers and vacuum cleaners.

In the Western territory the California Electrical Co-operative Campaign has prepared some excellent display material for the holidays. The tendency is not to rush business there this season, and good orders from dealers are reported. Improved appliances and combination devices are featured. San Francisco jobbers report that some fairly large stocks were carried over by retailers in that city.

Holiday business in Denver is reported rather slow, with some standard lines in demand. One type of toaster has been reduced materially, to $5.95.

Big Increase in Power Apparatus Sales

More than $3,500,000 in Contracts Received by the Westinghouse Company in Last Month—Trend Toward Business Revival Shown

Contracts for power apparatus aggregating more than $3,500,000 have been received during the past month by the power department of the Westinghouse Electric & Manufacturing Company. This total business shows a marked increase in the total sales of previous months and indicates a definite trend toward normal or a revival of business in the electrical industry.

Practically every type of power apparatus is included in the contracts received. Central-station companies have been large contributors to this volume of business. Plans formulated during the period of business depression are now receiving executive sanction as conditions throughout the country indicate a revival of business. New power stations are being erected by a number of public utilities, and extensions are being made by others to take on new loads, both lighting and industrial, that are sure to follow.

The generating capacities of many existing stations have been found inadequate to handle the industrial loads in surrounding communities in many sections of the country, and this condition also has necessitated the construction of new power plants.

The larger part of the record business done recently has been received from customers in this country, but at the same time the activity in the export field has not diminished. Business in Japan particularly continues brisk owing to the further purchase of equipment for a number of power stations that are being built there in connection with the prosposed super-power system in that country centering around Tokyo.

Among the customers from which contracts have been received recently by the Westinghouse company are the Brooklyn Edison Company, Middle West Utilities Company of Illinois, Pennsylvania Central Power Company, Union Electric Light & Power Company, Illinois Power Company, Takata & Company (of Japan), Oklahoma General Power Company, Kansas Electric Power Company, Public Service Company of Northern Illinois, Georgia Railway & Power Company, Idaho Power Company, city of Kansas City, Kansas; Tennessee Electric Power Company, government of the Netherlands, United Gas Improvement Contracting Company, Union Traction Company of Indiana, Phoenix Utility Company, Norfolk & Western Railway, Philadelphia Electric Company, West Penn Power Company, Ohio Public Service Company, Duquesne Light Company and the United Electric Railways Company.

Steady Stream of Instruments Going to Autos and Boards

Demand for electrical instruments continues at a steady rate and there is no indication of a let-up in the near future. The call for instruments for farm-lighting systems is said to be very good at the present time because of improved rural conditions. Moreover, there is much business going to the automobile manufacturers and the switchboard makers.

Schools are not buying very heavily at the present time, but better business is looked for in that direction after the first of the year. Radio manufacturers are said to be well supplied at the present, but there is indication of better opportunities in that market because of the ever-increasing interest in better radio sets by the large army of amateurs.

Says Better Application Is Bringing Motor Orders

In discussing the rapid improvement of the motor market a leading manufacturer of various sizes said recently that the increasing demand was due mostly to a better understanding of application, and that after a period of two years of constant teaching and warning, the average user is now giving better attention to his motor, increasing horsepower when the load is too heavy or decreasing it when the shaft is too light. The result, he pointed out, is the heavy percentages of increased orders on the sales sheets.

Although there is an increased demand for the smaller sizes for use in motor-driven appliances, the medium and larger horsepowers are getting their share of the business. Stocks generally are fair and deliveries improved throughout the United States.

One manufacturing company in Michigan reported in a recent advertisement that its sales have increased 300 per cent over October, 1921, in spite of its price reduction of nearly 40 per cent. According to this firm, more than half of its motor sales have been "repeat" orders to industrial concerns, railroads and manufacturers.

The Metal Market

Some Copper Producers Advance Prices to 14 Cents—Zinc Market Decidedly Softer

Most of the metals have been unusually quiet during the last week, though the prices have been firm with the exception of zinc.

Some copper producers have advanced their quotations from 13⅞ cents to 14 cents, delivered, but not a great deal of copper has been sold at the higher level. The firmer attitude has had the effect of bringing a fair volume of consumption into the market at the 13⅞-cent price, especially as the quoted price was generally 14 cents, and producers gave the impression that at the lower figure a special bargain was being offered. When delivery charges are high there seems to be no disposition to go under 14 cents.

Export demand has been steady, though the volume is not nearly so great as would be the fact if exchanges were more stable. The foreign business has in general netted producers slightly more than has been obtained for domestic deliveries.

Producers in general report November business better than for several months and feel that a 14-cent level will soon be definitely re-established.

The zinc market has become decidedly softer, mainly from lack of support by galvanizers and Europe. Common zinc has been sold even as low as 7.05 cents for November-December shipment. Whereas a week ago sales were chiefly made for forward delivery, which commanded a discount under the spot price, sales during the last week have been largely for prompt shipment. The let-up of European purchases indicates an easier position abroad. However, export trade in zinc was not expected to continue indefinitely, as the sale of zinc by American producers is ordinarily confined to the domestic market. The statistical position of zinc is still excellent, and relief from the fear of a runaway market rather than alarm is expressed by producers. New York prices continue at 35 cents per 100 lb. above those at St. Louis. The price of high-grade zinc remains at 8.25 cents with 30 cents per 100 lb. freight allowance. High-grade zinc business is splendid.

NEW YORK METAL MARKET PRICES

	Nov. 23, 1922	Nov. 29, 1922
	Cents per Pound	Cents per Pound
Copper		
Prime Lake	13.75	13.87½
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	7.00	7.00
Antimony	6.50	6.50
Nickel, ingot	36.00	36.00
Zinc, spot	7.25	8.25
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	21.50	21.50

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

IMPROVEMENT is seen in the majority of the districts, business having been helped by increased buying in the form of holiday orders. The better sellers are vacuum cleaners, flatirons and all kinds of hollow ware. Demand for radio parts has improved, and there is indication of more intelligent buying in that market. Central-station companies and those filling construction orders showed more interest during the past week, according to several leaders in the industry. Prices generally are firm.

New York

Volume of Business Larger — Radio Parts Moving Faster— Wire Active

Volume of business is somewhat larger than two weeks ago, according to several jobbers in the territory. Holiday buying and slightly increased purchasing by the central-station companies have helped the market. Radio parts are moving in greater volume, and some dealers are restocking better grades of apparatus.

Motors.—Increased buying is apparent, the smaller sizes selling best. Stocks are good and prices are shaded in some instances.

Appliances.—Vacuum cleaners and washers are selling in larger volume and are making up the bulk of the holiday business. Toasters are receiving much attention from the gift makers. Other hollow ware is moving on good orders from the dealers.

Wire.—Stocks are in good condition and there are fair amounts going to the building trades. Prices generally are firm.

Chicago

Wire Demand Still Brisk and Prices Advancing—Conduit Supply Low —Lamp Cord Active

Current demand for wiring materials is moving at a steady pace since pleasant fall weather has allowed building construction to keep up somewhat the rate maintained during the summer.

Prices on rubber-covered wire and conduit have risen slightly, but the supply of conduit is still low. Manufacturers of high-tension equipment report another brisk week. Statements of jobbers relative to the Christmas trade indicate that ample stocks have been provided for an active holiday buying season. Most dealers have good stocks of appliances on their shelves and expect that December sales will clean them out.

Conduit.—Local demand is excellent, but stocks are still low. Jobbers report that shipments arrive slowly owing to the freight car shortage.

Flexible Armored Conductor. — No change in call has been noticed, since conductor is selling steadily.

High-Tension Equipment.—Action is still good for all companies. One firm reports that the call for high-tension fuses is tending toward higher voltage and current ratings. Another company is receiving a good volume of 33,000-volt substation equipment. Two 33,000-volt outdoor substations and twelve 13,200-volt farm-line equipment units were sold by one firm.

Safety Switches.—The new type of switch required by a recently passed Chicago ordinance is available since jobbers have received a fair supply from manufacturers. The 30-amp. size is selling the best, although there is some call for the large power sizes.

Lamp Cord. — Most jobbers declare that lamp cord is starting to become active owing to increased holiday buying. Prices remain unchanged.

Atlanta

Holiday Trade Starting—Jobbers Report Farm-Lighting Outfits Active —Telephone Sales Slow

Business continues to improve with the advent of cooler weather, which is responsible for stimulated movement in nearly all lines of retail trade. Building permits continue to pour in with no let-up in sight, thus insuring steady employment throughout the winter if weather conditions will permit construction being carried on. A long-continued drought in the Southeastern States is causing some difficulty to the larger power companies, which have been forced to cut off secondary power consumers. Deliveries are improving and stocks in general are good. Holiday trade in the retail electrical lines is just getting started and dealers are anticipating a good month.

Farm-Lighting Outfits.—Jobbers report the movement as very satisfactory in North Carolina, Florida, and the southern part of Georgia, the boll weevil having upset conditions in north and middle Georgia. The movement gains in volume consistently and the outlook is bright. Stocks are satisfactory and shipments good.

Telephone Equipment. — Sales have slowed up a bit for this period of the year. Good stocks and satisfactory deliveries are reported by all jobbers.

Washing Machines. — This fall witnessed a slight pick-up in this line in the larger communities, though the smaller towns are still averse to the purchase of this specialty in any quantity. Excellent stocks are the rule.

Outlet Boxes. — Continued building activity is responsible for the brisk movement in this line. Good stocks of the standard sizes are on hand, with shipments on all sizes satisfactory. Prices remain steady.

Boston

Wire Prices Firm — Iron Sales Well Maintained—Radio Equipment Buying Increasing

Business improves steadily, but without spectacular features. Prices are firm and stocks appear to be meeting current requirements. Deliveries show some improvement over recent weeks. Appliance sales are rapidly expanding into pre-holiday volume. Building operations contracted for in New England totaled $6,918,900 for the week ended Nov. 21, the best week of this period since 1900. General manufacturing is gaining although the textile industry is a trifle dull. The final collapse of the long-continued strike at Manchester, N. H., was announced on Monday with a vote of strikers to return upon company terms. Central-station business and plant expansion are growing very fast.

Wire.—Prices are firm and sales active in rubber-covered and, to a less degree, in weatherproof. Small sales of bare copper for radio antenna work are under way. House wiring is very active in New England.

Flat Irons. — Sales are well maintained. Recent campaigns for a central-station iron load in territory considered well saturated are yielding more than the quota of business.

Lamps.—A fine volume of business in diversified types and sizes is reported. Portables are moving exceptionally well. Buying for central-station use is vigorous and no reports of shortages are heard.

Radio Equipment.—Popular buying of tube sets is increasing steadily, and in some retail stores stocks are running low on certain parts. The variety of equipment available, however, enables the purchaser to solve most of his problems as far as working apparatus is concerned. The outlook is good for a heavy holiday business in radio supplies.

Pole-Line Material. — More liberal policies as to central-station extensions, combined with a broader acceptance by the public of the principles of local financing of unusually expensive extensions, are bringing considerable new business to jobbers. Deliveries are reasonably good, the time lag between many orders and the required date of erection helping the distributor.

Motors.—Slow but positive improvement is apparent in the motor market. Industrial requirements resulting from persistent labor scarcity are beginning to affect the demand somewhat. Competition is very sharp for the volume of business available, and buyers are weighing all factors in credit, delivery, price and service before placing orders.

Heaters.—These devices are entering the staple field, and the policy of selling them with frank statements as to their economic limitations is making for sound business. Extreme economy in domestic coal burning is steadying the sale of heaters in New England. Stocks are at present in excellent shape and the outlook for a well-sustained business is good for weeks to come.

St. Louis

Storage-Battery Sales Much Improved —Conduit Demand Drops—Holiday Buying Not Started

The relatively high price of cotton and slightly better wheat values are exerting a favorable influence upon business conditions. Up to Oct. 28 Illinois, Missouri and Arkansas shipped 6,647 cars of apples, as against only 459 for the entire 1921 season. Cotton ginned in the Southern States to Nov. 14 is about 20 per cent more than at the same time last year. Additional moisture has recently improved the livestock situation. Retail business is stimulated by colder weather and holiday buying has barely started. Electrical jobbers report declines in business for the week with no apparent explanation. Demand is especially strong for large power equipment. Prices are a little softer.

Radio. — Steady increase in demand obtains, and it is felt that this is not connected with any increase that may result from holiday buying. The buyers' desires are tending toward better grades and more complete equipment. The improved demand is lowering stocks to about their proper level.

Storage Batteries.—Sales are much improved in both radio and automobile lines. Demand is steady in character and is met with ample yet conservative stocks.

Conduit.—Recent shipments temporarily alleviated short stocks, but entirely satisfactory shipments do not yet obtain. Demand dropped somewhat last week.

Holiday Goods.—Dealers' stocks of merchandise are moderate and holiday buying has not appreciably started. They plan on rapid turnovers. Jobbers' stocks are good, being larger than last year as better business is expected. Waffle irons are expected to be good sellers and good orders for all hollow-ware items are coming in. Most prices are firm.

Power Equipment.—Power-plant and transformer substation equipment was very active last week. Large orders were placed and several others are expected to be closed in the immediate future. Competition is keen, but prices are much firmer than six months ago. Deliveries are slow in high-tension switching equipment.

Denver

Nearly All Jobbers Report Gain in Business—Cleaner Sales Spotty —Wire Stocks Excellent

The agreement on the terms of the Colorado River pact, following a court decision upholding the constitutionality of the Moffat tunnel project, together with the recently announced program of unprecedented building activities and municipal improvements, has done much during the past week to give this section of Colorado optimism for a new era of prosperity. Local building permits have fallen off temporarily, but the new program will more than compensate, provided the winter does not prove too rigorous. Nearly all jobbing houses reflect this optimism and report business to be on the gain.

Radio. — Interest is returning and improved trade is reported, with a tendency to cut prices by some retailers because of overstocked condition.

Vacuum Cleaners.—Spotty sales are reported by organizations doing house-to-house selling, the central-station company leading in sales. There is a dearth of unsolicited buyers, according to dealers.

Schedule Material.—A slight drop in discounts from manufacturers is causing an increase to contractors. Ample stocks are reported.

Rubber-Covered Wire.—Advance of 5 per cent now in effect. Local stocks in excellent condition.

Portland–Seattle

Holiday Business Is Active—Rubber-Covered Wire and Flush Switches Advance 10 per Cent

Demand for lumber is again picking up rapidly. Shipments recently showed an appreciable decrease owing to shortage of cars. This condition, however, is being rapidly relieved, and cars for the movement of both lumber and fruit are being received in large numbers. Shipments of fruit by water from ports of the Northwest will far exceed those of a year ago. The foreign commerce of the ports of the Pacific Northwest for 1922 will exceed that of 1921 by at least 30 per cent in volume.

Electrical jobbers report that business conditions continue to give ground for optimism. The volume of business is good and holiday buying is becoming active. Orders of good size are being received, the demand being especially good on percolators, toasters, radiant heaters, lamps and radio equipment. An advance of about 5 per cent is reported on rubber-covered wire. Flush switches have advanced about 10 per cent. Conduit is very active at present. The stock situation is somewhat improved over its condition a month ago, but is still short in some sizes. Country trade generally is active, but the demand for farm-lighting plants is very poor at present. Collections seem to be improving a little, outstanding accounts for the Northwest for the month of October being forty-seven days. Some classes of accounts, however, are in a very precarious condition even at this time.

Appliances. — Ranges are moving very well. This is particularly true of the automatic and super-automatic types. Ironers are very slow, with irons to be had at from $4 to $6. Washers are in good demand.

San Francisco

Range Sales Slower—Improved Broadcasting Helps Radio Sales—Conduit Stocks Still Low

Helped by ideal weather conditions, California building continues to set a record year. Every available craftsman is working. Retail store trade is rather quiet, but many dealers report deposits paid on appliances to be held for Christmas gifts, so that excellent holiday business is predicted. Improved appliance and wiring business from districts badly affected by the 1921 building strike, such as the Mission district, is evidence of restored prosperity. Prospects for 1923 are even brighter.

Ranges.—Sales during the past week have slightly slackened. Never before have such well-trained and experienced selling crews been employed, and, incidentally, never before has such competition among manufacturers been noted, the number of makes now being marketed having nearly tripled.

Radio.—Southern California noted an immediate increase of sales following the installation of improved broadcasting facilities.

Vacuum Cleaners.—The bulk of sales is still being made by crews, but many neighborhood dealers report splendid results through what is termed cold canvassing.

Conduit.—Arrival of a few carloads relieved immediate tension, but jobbers' and dealers' racks are bare of smaller sizes. Architects have changed brands specified so as to obtain immediate service by substitution.

Salt Lake City

Not Much Change in Conditions—Demand for Expensive Radio Shows Falling Off

Not much change in market conditions from the report of a week ago, but many merchants have complained of a slight falling off in demand. It is generally believed that this is due to the fact that taxes must be met within the next few days. Better conditions will probably come with the beginning of the new year. Holiday advertising is already driving home the electrical gift idea.

Demand for expensive radio sets shows a big falling off. One manufacturer has decreased his price about 25 per cent on head sets. The cheaper equipment is found to be more satisfactory with the constant extension of broadcasting stations.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Phelps Electric Company Moves to Larger Quarters

By moving from 163 North Curtis Street to 227 West Randolph Street, Chicago, the Phelps Electric Company has obtained floor space of 5,000 sq.ft. This firm is now manufacturing electric flashers since the patents held by the Solar Electric Company are back again in the Phelps organization. No other changes in the organization were made.

Specialties Manufacturer to Build $200,000 Plant

Homer A. Woods, 19-29 West South Street, Indianapolis, Ind., manufacturer of electrical specialties for automotive service, has completed plans for the construction of a new four-story plant, at Ludlow Avenue and Nevada Street, of brick veneer, 60 ft. x 200 ft., estimated to cost approximately $200,000; of this amount close to $65,000 will be used for machinery.

Mercury Manufacturing Company Tractor Sales Were Doubled

Sales of electric tractors in 1922 by the Mercury Manufacturing Company, Chicago, have doubled those of 1921, according to a statement made by J. R. Beansley, general manager.

On Nov. 22 the total sales for the month more than doubled the sales for the entire month of November, 1921. Mr. Beansley also stated that this volume of business had a wide distribution since equipment was sold to about twenty-five various industries. The material-handling installation for the Southern Railroad Company at Pinners Point, Va., he declared, had increased the material conveyed from 2 tons per man-hour to 9 tons per man-hour.

Hoover Week to be Held Dec. 11 to 16

According to an announcement by the Hoover Suction Sweeper Company, North Canton, Ohio, Dec. 11 to 16 has been designated as the time for "Hoover Week." During the past "Hoover Week" has always had the active support of Hoover dealers, and it is expected that this year's event will bring forth even more enthusiasm and greater results.

A feature will be the window-display contest, which is always earnestly participated in by dealers. To make it even more attractive for the dealer to enter this year's contest the number of major cash prizes has been doubled. In addition there are thirty smaller prizes.

Electrical Engineers' Equipment Increases Production

The Electrical Engineers' Equipment Company, 710 West Madison Street, Chicago, has increased its number of employees 50 per cent by starting a night shift.

R. T. Calloway, sales manager of the company, has said that this move was required because of the excessive demands on its operating capacity for high-tension equipment. He also asserted that most of this material was going to central stations for construction during the winter. With the present freight-car shortage the main problem, according to Mr. Calloway, is one of timely shipments. He expresses optimism for future months.

Sellers of Slate to Meet in New York City, Jan. 25

Manufacturers, producers, distributors, dealers, roofing and other contractors using slate are planning to gather in New York at the Commodore Hotel, Jan. 25 and 26, for the slate industry meetings to be held under the auspices of the National Slate Association. Many of the leading concerns in the industry will hold their own sales meetings with their representatives immediately before or after the dates of the sessions devoted to the problems of the industry. Roofing contractors and other users of slate all over the country have responded well to the need for a co-operative promotion of the use of slate and the betterment of the conditions and relations within the industry which Secretary Hoover urged the progressive concerns of the industry to undertake at the first meetings last year. The results of the first nine months are satisfactory.

Westinghouse Merchandising Department Holds Meeting

THE recently organized merchandising department of the Westinghouse Electric & Manufacturing Company held a meeting recently at French Lick Springs, Ind. The meeting was called by J. S. Tritle, manager of the department, and was attended by the merchandising division managers from all district offices, all the division managers from the factories and the headquarters staff from New York.

The meeting was opened with an address by W. S. Rugg, general sales manager of the company, and continued throughout the entire week, sessions being held every morning and evening, with the afternoons devoted to recreation.

The new Golf Club House was given over to the exclusive use of the visitors for the week and was used for both living quarters and a meeting place.

Back row, left to right: F. L. Nason, H. T. Pritchard, George W. Brown, L. C. Steffan, J. A. Clark, F. D. Koelbel, S. A. Chase, J. S. Tritle, manager; L. L. Gerstenberger, Fuller & Smith; W. S. Rugg, general sales manager; E. W. Knight, B. Lester, George Leake, R. C. Cosgrove, E. L. Andrew. Third row, left to right: B. F. Fuller, R. H. Cook, H. M. Wible, Dr. D. S. Wilson, French Lick Springs Hotel; H. C. Thomas, W. L. Southwell, G. T. Dunklin, W. H. Rolinson, M. C. Turpin. Second row, left to right: W. P. Cochran, George Roosa, J. P. Sprunt, Jr., F. H. Nealis, H. L. Garbutt, J. W. Busch, F. C. Albrecht, E. V. Peterson. First row, left to right: W. G. Balph, F. R. Kohnstamm, H. A. Grace, J. H. Jamison, M. C. Morrow, E. D. Story, J. J. Dorney.

Elliott Company's Thirteenth District Sales Office Opened

The Elliott Company, Pittsburgh, with general sales offices and factory at Jeannette, Pa., manufacturer of power accessories, announces the opening of a new district sales and service office in Baltimore, at 1514 Lexington Building, in charge of J. R. Lemmon, who has been connected with the firm's Philadelphia office.

This makes the thirteenth district sales office for the Elliot company. The products of the associate companies, the Liberty Manufacturing Company, Pittsburgh, and the Lagonda Manufacturing Company, Springfield, Ohio, will also be handled by the Baltimore office.

Western Electric Creates New Installation Department

On account of the rapid growth in the number of telephone switchboards installed the Western Electric Company has delegated this work to a newly created installation department and has placed at its head James L. Kilpatrick, formerly assistant general manager of the Bell Telephone Company of Pennsylvania. Mr. Kilpatrick's headquarters will be in New York City, and he will direct the activities of many thousand men in every part of the United States.

Roller-Smith Company Appoints Electrical Material Firm Agent

The Roller-Smith Company, 233 Broadway, New York City, announces the appointment of the Electric Material Company as its agent in the State of Washington and parts of Oregon and Idaho. The Electric Material Company has recently opened an office in the Hinckley Building, Seattle, and will handle the Roller-Smith Company's lines of electrical instruments, circuit breakers and radio apparatus in that territory. The Seattle office is in charge of R. F. Robinson.

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The Wheeler Green Company, Rochester, N. Y., has been appointed a distributor in the Rochester district for Landers, Frary & Clark, New Britain, Conn.

The Electric Storage Battery Company, Philadelphia, has awarded a contract for the initial unit of its proposed Kansas City plant, at Belmont Boulevard and Anderson Street. It will be one-story and basement, to cost about $120,000. It will be ready for the machinery installation at an early date.

The Norwalk Iron Works Company. South Norwalk, Conn., builder of air and gas compressors and refrigerating machinery, announces the opening of a Chicago office at 627 West Washington Boulevard. L. R. Bremser, who for thirteen years was associated with the Gardner Governor Company, will be in charge.

The Mid-City Wire Frame Company, Inc., 1622 Fulton Street, Chicago, recently incorporated with $25,000 capital stock, will manufacture wire lamp shade frames and wire goods to order.

The National Electric Humidifier Company, 4311 East Ravenswood Avenue, Chicago, recently incorporated with $50,000 capital stock, expects to build a plant for complete manufacturing purposes in the near future.

The Gloucester Electric Company, Gloucester, Mass., will issue additional capital stock amounting to $102,620, a portion of the proceeds to be used for extensions and improvements.

The Dominion Insulator & Manufacturing Company, a branch of the Ohio Brass Company, Mansfield, Ohio, has started work on the erection of a plant at Niagara Falls, Ontario, which is expected to be completed by the first of the year. The company will manufacture high-tension porcelain insulators, trolley material, electric car equipment, etc.

The Connecticut Brass Company, Waterbury, Conn., has plans prepared for a new castings factory on Watertown Avenue.

The R. Hardesty Manufacturing Company, Denver, Col., manufacturer of power equipment, has plans for the erection of a new works, estimated to cost $200,000, including machinery. The company recently disposed of a stock issue of $250,000.

The Phoenix Light Company, 525 Market Street, Milwaukee, Wis., manufacturer of electric light fixtures, portable lamps, etc., contemplates enlargement of its works and has issued $125,000 in preferred stock to finance the program, which will be undertaken shortly after Jan. 1. Joseph Sable is president.

The American Lamp-O-Phone Corporation, 442 East One Hundred and Forty-eighth Street, New York City, has been incorporated with a capital stock of $50,000 to manufacture machines and parts. It has taken over a business already established, but is planning to expand into larger quarters immediately. The incorporators are F. Riera, H. H. Stevens and M. H. Elvidge.

The Coppus Engineering & Equipment Company and the New England Brass Foundry Company, Worcester, Mass., are to consolidate under the name of the Coppus Engineering Corporation, capitalized at $500,000. The foundry will be operated as a department of the new company. The board of directors will consist of Frans H. C. Coppus, J. Verner Critchley, Frank A. Drury, Linwood M. Erskine, George A. Gaskill, Jerome R. George and William D. Luey.

The Pyrene Manufacturing Company, 520 Belmont Avenue, Newark, N. J., has moved to this address from its previous location, 17 East Forty-ninth Street, New York City. Its new property provides 100,000 sq.ft. of floor space.

The Cole Storage Battery Company, 2437 Indiana Avenue, Chicago, is taking bids for a one-story addition to its plant, 45 ft. x 100 ft.

The General Refractories Company, Ableman, Wis., has been incorporated in Wisconsin with a capital stock of $120,000 to quarry and mine materials and manufacture firebrick, etc. A large tract of refractory clay and silica has been developed in the heart of the extensive granite and rock deposits surrounding the village of Ableman. The incorporators are W. L. Spraul, B. E. Sloan and J. A. Spraul.

The Allied Belting Company, Greenville, Ohio, will shortly commence the erection of an addition to double its capacity. Considerable new equipment will be installed. The company is considering the installation of looms and other machinery for the weaving of duck which goes into its belts from raw cotton.

The Lexington Battery Company, Lexington, Ky., is planning to rebuild the portion of its factory recently destroyed by fire with loss estimated at $75,000, including equipment.

Dad's Factories, 238 South Meridian Street, Indianapolis, manufacturer of electric lanterns, automobile equipment, etc., has awarded a contract for a four-story-and-basement addition, 60 ft. x 200 ft., to cost $200,000, including equipment. Homer A. Woods is general manager of the firm.

The Gill Battery Company of California, Oakland, Cal., is planning the construction of a new two-story factory, estimated to cost $250,000 with equipment. M. R. Standish is president of the company.

The Trumbull-Vanderpoel Electric Manufacturing Company of Bantam, Conn., maker of electric switchboards, etc., has recently added $50,000 in shares to its capital stock, making a total issue of $300,000.

The Phillips Insulated Wire Company, Pawtucket, R. I., will build a new one-story power house estimated to cost $30,000.

The Walker Vehicle Company, Chicago, manufacturer of electric motor trucks, announces the removal of its New York City office from room 3709, Grand Central Terminal Building, to room 5002 in the same building.

The American Insulation Company, Roberts and Stokley Streets, Philadelphia, manufacturer of electrical asbestos products, has awarded a contract for a new building to cost $25,000.

The Frank H. Stewart Electric Company, Philadelphia jobber, has work under way on a four-story-and-basement addition to its six-story building.

The Hart & Hegeman Manufacturing Company, Hartford, Conn., manufacturer of wiring devices, has purchased a plant at Russ and Lawrence Streets, which has been occupied by the Hartford Auto Parts Corporation, manufacturer of universal joints. Hart & Hegeman bought this property in order to provide quarters for future expansion.

Foreign Trade Notes

PROPOSED UNIFICATION OF LUXEMBURG ELECTRIC SYSTEM.—In a bill now pending before the Chamber of Deputies, according to *Commerce Reports*, the unification of the central-station service of the whole of the Grand Duchy of Luxemburg is being considered. The plan involves the idea of supplying electricity for light and power purposes from one or more central stations, the management to be centralized in a single concern. Four propositions are now being considered by the Luxemburg government, one of which will probably be adopted. The two principal proposals are from steel-manufacturing interests in the Grand Duchy which wish to use waste gas produced from the manufacture of steel for generating electricity. The third proposition is from a Belgian company, which offers to build a steam power plant using coal, and the fourth proposal contemplates utilizing water power from the highlands of the Ardennes. The various cities and towns of the Grand Duchy at the present time are supplied with electricity by independent plants.

FARM-LIGHTING SETS OPERATED BY ELECTRICITY IN CUBA.—American self-contained generating sets which can be operated with alcohol, *Commerce Reports* states, should find an expanding market in Cuba. A group of distillers who are campaigning for the increased use of alcohol as fuel are seeking a wide assortment of American apparatus which can be operated on alcohol and have opened a salesroom for demonstrating and distributing such equipment. The use of alcohol enables a generator set to be operated in localities where current and gasoline are unobtainable.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Cuba (No. 4,427) for wire cables, steel products, etc.

An agency is desired in Australia (No. 4,432) for electric labor-saving devices, fractional-horsepower electric motors, electric lamp shades and fittings, wireless sets and appliances, etc.

An agency from manufacturers is desired in Peru (No. 4,439) by a representative in the United States for electrical supplies, such as lamp cord, fixtures, glassware, electric globes, motor appliances, heater appliances, insulators, dry and wet batteries and specialties.

An agency is desired in Norway (No. 4,496) for all kinds of electrical supplies for power stations.

ELECTRIC EQUIPMENT FOR WAIRARAPA (NEW ZEALAND) POWER PROJECT.—Bids will be received by the Wairarapa Power Board, New Zealand, until Dec. 20, for a 3,000-volt switchboard, lightning arresters, disconnecting switches and choke coils for 11,000-volt and 3,000-volt three-phase circuits.

New Apparatus and Publications

INSULATING VARNISHES AND COMPOUNDS.—The Sterling Varnish Company, Pittsburgh, Pa., is distributing a forty-eight-page catalog covering the "Sterling" insulating varnishes and compounds.

SWITCHES.—Harvey Hubbell, Inc., Bridgeport Conn., is distributing a leaflet (superseding pages 74-75, catalog No. 17), covering the change in the design of the Hubbell "De Luxe" toggle flush switches.

PRECISION INSTRUMENT.—The Olsson Corporation, 7-9 Hanover Street, New York City, has developed a new type CO_2 indicator, known as the "Olsson Gas Balance."

RADIO-TELEPHONE RECEIVERS.—The Roller-Smith Company, 233 Broadway, New York City, is distributing bulletin No. 20, covering its "Universal" radio-telephone receivers and loud speakers.

TABLE-TAP.—Bulletin No. 17-19, distributed by Harvey Hubbell, Inc., Bridgeport, Conn., describes the Hubbell "Triplex" table tap.

AIR COMPRESSORS.—The Ingersoll-Rand Company, 11 Broadway, New York City, has recently developed a new line of small vertical belt-driven air compressors, known as type 15.

ELECTRIC SIGN.—The Shelton Electric Company, 16 East Forty-second Street, New York City, has recently developed a new electric sign, known as "Shelton Script," which can be used on direct current and alternating current without changes.

ELECTRIC MOTORS.—The Fuerst-Friedman Company, electrical power engineers, 1,251 West Third Street, Cleveland, has issued bulletin No. 25, containing description and price list of new and rebuilt motors, generators, etc., carried by the company.

OIL BURNER.—The Hauck Manufacturing Company, 129 Tenth Street, Brooklyn, N. Y., has recently developed a new "Hauck" Venturi type of oil burner.

PORTABLE ELECTRIC TOOLS.—Catalog No. 5 issued by the Black & Decker Manufacturing Company, Towson Heights, Baltimore, covers its portable electric tools and shop equipment.

New Incorporations

THE BRIGHT LIGHT & POWER COMPANY, Sanford, Fla., has been incorporated with a capital stock of $100,000 by K. McIver, I. E. McIver and L. P. Campbell.

THE FISHING CREEK POWER COMPANY, Newark, N. J., has been chartered by L. J. Relyea, S. W. Myatt and J. E. Ammann, Newark. The company is capitalized at $3,500,000 and proposes to deal in electricity.

THE CITIZENS' LIGHT & POWER COMPANY, El Dorado, Ark., has been incorporated with a capital stock of $100,000 by E. L. Pye, N. C. Marsh, T. H. Norris and others. The company proposes to distribute electricity and water in El Dorado.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MADISON, ME.—The Great Northern Paper Company has started work on the construction of a new hydro-electric plant in Madison to develop 4,000 hp.

WINDHAM, ME.—The power rights of the Windham Manufacturing Company on the Presumpscot River have been leased by the Mallison Falls Power Company. The latter company proposes to erect a new power plant of 1,000 kw. capacity, to cost about $100,000. Electricity generated at the plant will be disposed of in Windham, Gorham and Westbrook.

MEREDITH, N. H.—The Utilities Power Company has issued $600,000 in bonds, the proceeds to be used for the construction of the first unit of a hydro-electric power plant at Ayer's Island, Bristol, with capacity of 7,500 hp., transmission lines and substations. The plans provide for an ultimate capacity of 35,000 hp. Jackson & Moreland, 387 Washington Street, Boston, are engineers.

BOSTON, MASS.—Preliminary plans have been prepared by the Boston Elevated Railway Company for the construction of an underground station in the Cambridge-Dorchester tunnel at Cambridge and Charles Streets, to cost about $600,000.

CAMBRIDGE, MASS.—The Ford Motor Company, Detroit, will build a power house in connection with its proposed local assembling plant, to cost about $300,000.

SPRINGFIELD, MASS. — Preliminary plans are under way for a new technical high school, with vocational departments, adjoining a present school on State Street, to cost about $800,000. E. C. and G. C. Gardner, 33 Lyman Street, are architects.

VINEYARD HAVEN, MASS.—Extensions and improvements are being made to the local plant of the Cape & Falmouth Electric Company, including an addition to power station, installation of a 425-hp. engine with generator, new condensers and pumps. The distribution lines are also to be changed from single-phase to three-phase.

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Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 12, for seventy-five pressure switches for the South Navy Yard (Schedule 316).

BUFFALO, N. Y.—Electric power equipment will be installed in the proposed new flour mill to be erected by the Island Warehouse Company, Ganson Street, to cost about $500,000.

DUNKIRK, N. Y.—Electric power equipment will be installed by the Atlas Crucible Steel Corporation in connection with extensions to its local plant, and also branch works at Charleroi, Pa., to cost about $250,000.

ITHACA, N. Y.—The New York Gas & Electric Corporation is considering an issue of $650,000 in bonds, the proceeds to be used for extensions and improvements.

NEW YORK, N. Y.—The New York Edison Company will make extensions and improvements to its substation at 33-43 Gold Street, to cost $100,000.

NEW YORK, N. Y.—Electric power equipment will be installed in the proposed ice-manufacturing plant to be erected by the Huntoon Ice Company, 631 Hudson Street, on West Nineteenth Street, near Tenth Avenue.

NORTH TONAWANDA, N. Y. — The Tonawanda Power Company is planning to build a power plant on Webster Street, to cost about $150,000.

PERTH AMBOY, N. J.—The Public Service Electric Company is reported to be negotiating for the purchase of the local municipal electric plant, to be merged with its system in the Raritan River district.

TRENTON, N. J.—The Public Service Electric Company plans to erect a transmission line from Burlington to Trenton. When completed the Chauncey Street power plant will be discontinued and service supplied from the Burlington plant which will be enlarged.

WEST BERLIN, N. J. — Baccellieri Brothers, 924-26 South Eleventh Street, Philadelphia, will construct a power house in connection with their proposed local furniture manufacturing plant.

ALLENTOWN, PA.—The Masonic Temple Association, 21 North Seventh Street, will build a power house in connection with its proposed masonic temple at Linden and Fulton Streets, to cost about $500,000. R. G. Schmidt Company, 154 West Randolph Street, Chicago, is engineer.

BANGOR, PA. — A new street-lighting system will be installed on Broadway. The Pennsylvania Utilities Company will furnish the service.

BRISTOL, PA.—The Megargee Paper Mills, Modena, will build a power house in connection with their proposed new local plant, to cost about $250,000.

CORAOPOLIS, PA.—Plans for the proposed manufacturing plant to be erected by the Russell, Burdsall & Ward Bolt & Nut Company, Port Chester, N. Y., in Coraopolis include a power plant. The cost is estimated at $1,000,000. George Mertz Port Chester, is engineer.

LANCASTER, PA.—The Berkshire Electric Company, which operates substations at Sinking Springs, Wernersville and Womelsdorf, has issued $59,000 in bonds for extensions and improvements.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 5, for 450 storage batteries for aircraft service at the local aircraft factory. (Schedule 312.)

PHILADELPHIA, PA.—A power house will be built in connection with the seventeen-story addition to the Jefferson Hospital to be erected at Clifton and Sansom Streets, at a cost of about $1,400,000.

PHILADELPHIA, PA. — The Baldwin Locomotive Works, North Broad Street, will replace the present steam-operated machinery with electrically-driven machinery. Installations will also be made at its proposed new plant at Eddystone, to cost about $2,000,000.

SHARON, PA.—The Shenango Valley Electric Light Company contemplates extending its transmission lines from Sharon to Orangeville, Ohio, a distance of 6 miles, to furnish electrical service in the latter town.

SMETHPORT, PA.—The Keystone Power Company will operate a local electric light and power service.

HAGERSTOWN, MD.—The Board of Commissioners has rejected the proposal of the Potomac Public Service Company for local service and has authorized plans prepared at once for the proposed municipal electric plant, for which $300,000 is available.

NORFOLK, VA.—The Nansemond Public Utilities Corporation, recently organized, plans for the construction of a transmission and distributing system in a section of Nansemond County. E. L. Myers is president.

WASHINGTON, D. C.—The Commissioners of the District of Columbia have decided to adopt new system of street lighting. The first installations will probably be made within a few months.

WASHINGTON, D. C.—Bids will be received by the Purchasing Agent, Government Printing Office, until Dec. 6, for electric and gas neutralizer equipment for department use.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Dec. 8, for miscellaneous telephone equipment, as per schedule (PR 1D1566—6CP).

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Dec. 12, for one armature coil winder for Hampton Roads, Va., and two armature coil winders for San Diego, Cal.; also for one motor-driven taping machine for Hampton Roads and two motor-driven taping machines for San Diego (Schedule 310); also for twenty portable electric drills and nine electric grinders for the Mare Island Navy Yard (Schedule 295).

North Central States

DETROIT, MICH.—The Detroit Edison Company will build a two-story substation on Visger Street, to cost about $125,000.

DETROIT, MICH.—The Detroit Lubricator Company, Trumbull Street, will build a power house at its plant, to cost $26,000.

EVART, MICH.—The Board of Education will build a one-story power house at the new local grade school, to cost about $135,000.

MONROE, MICH.—Bids will be received by F. M. Kressbach, city clerk, until Dec. 11, for furnishing and installing equipment in the city waterworks as follows: One 3,000,000-gal. (daily) steam pumping engine; one steam turbine-driven electric generator; two 150-hp. water-tube boilers, two boiler-feed pumps, one feed-water heater; two 1,000,000-gal. (daily) motor-driven centrifugal pumps, one 2,000,000-gal. (daily) centrifugal pump; one sump pump, two coal trucks, switchboard, etc. Hoad, Decker, Shoecraft & Drury, Ann Arbor, are consulting engineers.

PETOSKEY, MICH.—Preliminary plans are being prepared by the Petoskey Portland Cement Company for extensions to power house, factory and stock house, to cost about $500,000. J. C. Buckley, First National Bank Building, Chicago, is engineer.

CINCINNATI, OHIO—The Cincinnati, Newport & Covington Railway Company has issued $4,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

CLEVELAND, OHIO.—Plans are under consideration by the City Council for the installation of ornamental lighting systems on St. Clair Avenue, to cost $50,000; East 150th Street, $23,000; Superior Avenue, $48,600; East 105th Street, $51,000; Euclid Avenue, and East 105th Street, $44,000, and Lorain Avenue, $89,600. G. Beck with, City Hall, is engineer.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, Cleveland, until Dec. 8 for distribution transformers for the division of light and power. Bids will also be received on the same date for power limiting reactors.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Dec. 6 for furnishing, lighting, extinguishing, repairing, maintaining and furnishing energy for electric clamps in the city of Cleveland.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, Cleveland, until Dec. 8 for an electric traveling crane, switchboard and switchboard wiring and electric valve controls for the Fairmount pumping station, division of water.

MARION, OHIO.—A service company has been organized by farmers of Marion, Morrow, Crawford, Union and Wyandot Counties to erect a high-tension transmission line to supply electricity to farms in that section. Energy will be supplied by the Columbus, Delaware & Marion Electric Company.

LOUISVILLE, KY.—The Mengel Body Company, recently organized by officials of the Mengel Box Company, will build a power house in connection with its proposed new automobile body plant, to cost about $500,000.

ANDERSON, IND.—The Union Traction Company will build an addition to its local power plant to cost about $200,000, including equipment.

GARY, IND.—The Calumet Electric Company has acquired the property of the Wanatah-Lacrosse Electric Company. Extensions and improvements will be made and the plant merged with the Calumet system.

KOKOMO, IND.—The Northern Indiana Power Company, recently organized with a capital of $3,500,000, has made application for permission to purchase the following properties: Indiana Railways & Light Company, Kokomo; Noblesville Heat, Light & Power Company; United Public Service Company, Rochester; Wabash Water & Light Company; Roan Light & Power Company; Logansport Utilities Company, and the Sheridan Water, Light & Heat Company. The systems will be connected, new transmission lines erected and extensions and improvements made.

SHELBYVILLE, ILL.—Bonds to the amount of $100,000 have been voted for a new municipal electric light plant and distribution system.

MENASHA, WIS.—The City Council will install automatic electrically driven sewage-pumping equipment. Two 20-hp. motors, an automatic-control panel, air compressors and connections will be required. J. H. Kuester is superintendent of the municipal electric light and water department.

SHOREWOOD, WIS.—Bonds to the amount of $75,000 have been voted for changing the street-lighting system from gas to electricity. Shorewood has not a post office.

HANNIBAL, MO.—The Hannibal Railway & Electric Company is planning to issue $150,000 in bonds, part of the proceeds to be used for extensions and improvements.

MAYSVILLE, MO.—The De Kalb County Electric Company contemplate building a new power plant, to cost about $80,000.

ST. LOUIS, MO.—The Ford Motor Company, Detroit, will build a power house in connection with its proposed new assembling plant in this section, to cost about $2,500,000.

Southern States

MURPHY, N. C.—The Carolina-Tennessee Power Company has preliminary plans under way for a hydro-electric generating plant, with capacity of 60,000 hp., and transmission system, estimated to cost about $5,000,000.

STATESVILLE, N. C.—The Southern Power Company, Charlotte, plans to extend its transmission lines from Lookout Shoals to Winston-Salem, Greensboro and High Point, and also to erect a switching station near Greensboro, to cost about $1,000,000. W. S. Lee, 433 East Morehead Street, Charlotte, is engineer.

RIDGEWAY, S. C.—Bids will be received by the city of Ridgeway for the construction of an electrical distribution system, 13,200-volt transmission line from Ridgeway to Winnsboro with substations; water distribution system and sanitary sewer system, to cost from $50,000 to $60,000. The Ryan Engineering Company, Arcade Building, Columbia, is engineer.

OCALA, FLA.—The installation of new equipment, including a generator, engine, etc., is under consideration by the Marion County Ice Company.

CHATTANOOGA, TENN.—The Tennessee Power Company is planning to build a 15,000-hp. steam auxiliary plant in 1923 to supplement its hydro-electric units, to cost about $1,500,000. Plans are also under consideration to construct another power dam on the Oconee River, which would add another 20,000 hp. to the system, and also to raise the present dam at Rock Island, increasing its output by 12,000 hp. Arrangements are also being made to connect its system with that of the Georgia Railway & Power Company, Atlanta, Ga.

HAZLEHURST, MISS.—Preliminary plans are under way for the installation of an ornamental lighting system on West Railroad and Estelle Avenues.

WASHINGTON, ARK.—The local electric light plant has been acquired by the City Council to be operated by the municipality. Extensions and improvements will be made, including new distributing lines.

LAFAYETTE, LA.—Bids will be received by the city of Lafayette at the office of the Trustee of Finances until Dec. 4 for improvements to the electric and water plant. The equipment will include generators, water tube boilers, engines, switchboard, condenser, pumps, etc. The J. B. McCrary Company, Atlanta, Ga., and Lafayette, is engineer.

ATOKA, OKLA. — The Public Service Company plans to extend its transmission system from Wapanucka to Bromide and vicinity.

OKLAHOMA CITY, OKLA.—The Kenyon Brick & Tile Company, 2,700 West Tenth Street, will install electric power equipment in connection with proposed extensions to its plant.

AUSTIN, TEX.—A power plant will be installed in the eleven-story hotel to be erected in Austin by the Baker Hotel Corporation, San Antonio, to cost about $900,000.

CHILDRESS, TEX—The Texas Central Power Company contemplates erecting a transmission line from here to Clarendon, to cost about $100,000.

DALLAS, TEX.—Plans are under consideration for the installation of an ornamental lighting system in Oak Cliff, to cost about $25,000. G. D. Fairtrace is city engineer.

MARBLE FALLS, TEX.—G. L. Jones, owner of the local electric plant contemplates extensions and improvements, including the installation of additional equipment. New distributing lines will be built.

ROBY, TEX.—The Abilene (Tex.) Light & Power Company has acquired the properties of the Roby (Tex.) Light Company, and the Rotan (Tex.) Light Company. New substations will be erected and extensions made to the systems.

TERRELL, TEX.—Additions will be made to the municipal electric power plant, including the installation of new equipment.

Pacific and Mountain States

SPOKANE, WASH.—The Veneer Products Company, Seventeenth and Dock Streets, contemplates extensions to its power plant and mill increasing the output of the mill from 50 to 250 tons. The cost is estimated at about $250,000.

TACOMA, WASH.—Permission has been granted by the state for the construction of a municipal hydro-electric power plant on the Skokomish River, with storage reservoir of 190,000 acre-ft. capacity The plant will have an output of 75,000 hp. and will cost about $5,000,000 complete.

OREGON CITY, Ore.—The Hawley Pulp & Paper Company plans an addition to its power house in connection with plant extensions, to cost about $1,500,000.

TILLAMOOK, ORE.—The Coast Power Company is preparing plans for a new power plant, to cost about $1,000,000.

LIVERMORE, CAL.—Bids will be received by C. R. Forbes, director of the United States Veterans' Bureau, Arlington Building, Washington, D. C., until Dec. 18, for electrical work in connection with the construction of twenty-nine buildings at the United States Veterans' Hospital at Livermore, also for refrigerating machinery and laundry equipment. Drawings and specifications may be obtained upon application to the office of Matthew O'Brien, architect, 68 Post Street, San Francisco.

LOS ANGELES, CAL.—The Union Pacific Railroad Company, Chicago, will build a substation in connection with its proposed new shops here, to cost about $1,500,000.

LOS ANGELES, CAL.—The Council has adopted ordinances for the installation of ornamental lighting systems on Eighth Street and Western Avenue.

MANTECA, CAL.—The South San Joaquin Irrigation District has applied to the State Water Commission for permission to construct a hydro-electric plant on the

Stanislaus River, with capacity of 7,550 hp., to cost about $300,000.

SAN FRANCISCO, CAL. — Plans are being perfected for additional street lamps on Geary Street, Twenty-first to Twenty-eighth Avenue.

CASA GRANDE, ARIZ.—Plans are being prepared by the Casa Grande Valley Electrical District for the erection of 25 miles of 45,000-volt transmission line, 90 miles of 11,000-volt transmission line and about 100 miles of laterals, and a substation, to cost about $200,000. S. J. Norman, Casa Grande, is engineer.

Canada

VANCOUVER, B. C.—In addition to improvements to its power plant on the Stave River the British Columbia Electric Railway Company is planning to build a new power plant further down the river, to develop 100,000 hp. The cost is estimated at $10,000,000.

PORT BURWELL, ONT.—The erection of a 13,000-volt transmission line from Tilsonburg to Port Burwell and the installation of a local distribution system, to cost about $60,000, is under consideration by the Council.

PORT COLBORNE, ONT.—The Port Colborne Hydro-Electric Commission has requested the Town Council to pass a by-law authorizing an appropriation of $14,000 for improvements to the local electric service.

QUEENSVILLE, ONT. — The Village Council is negotiating with the Council of Newmarket to furnish electricity in Queensville.

ST. CATHARINES, ONT.—The Niagara, St. Catharines & Toronto Electric Railway Company contemplates extending its railway to Bridgeburg, a distance of 18 miles.

DRUMMONDVILLE, QUE.—Preliminary plans are being prepared by the Southern Canada Power Company, 330 Coristine Building, Montreal, for the construction of a dam and power house, to cost about $700,000. J. H. Trimingham is chief engineer.

RICHMOND, QUE.—Plans are under consideration for the erection of a transmission line from Drummondville to Richmond, to cost about $75,000, next summer, in connection with the franchise of the Southern Canada Power Company to furnish electricity for lighting here.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 7, 1922)

1,434,363. System of Electrical Distribution; W. L. Bliss, Niagara Falls, N. Y. App. filed Nov. 15, 1915. Chattering of automatic cut-out avoided on variable-speed generators.

1,434,365. Generator Regulator; A. F. Brotz, Kohler, Wis. App. filed April 21, 1921. For variable-speed generator.

1,434,374. Electric Resistance Welding Mechanism; M. De Lemon and A. Malec, Chicago, Ill. App. filed Jan. 20, 1920. Welding overlapping surfaces of sheet metal at several points simultaneously.

1,434,395. Electric Furnace; W. Meinersmann, Elizabeth, N. J. App. filed Jan. 30, 1920. Electrodes formed from scrap metal.

1,434,451. Process for the Manufacture of Carbide; A. E. Reid, Readsboro, Vt. App. filed Oct. 23, 1920. Within an electric furnace.

1,434,469. Depolarizer for Dry Cells; A. V. Wilker, Berea, Ohio. App. filed Dec. 28, 1918. Activating agent of yellow mercuric oxide.

1,434,472. Heater for Bottles and the Like; C. Anselm, New York, N. Y. App. filed Oct. 4, 1919. Electric element inserted into receptacle.

1,434,518. Telephone-Exchange System; R. S. Bailey, Montclair, N. J. App. filed March 22, 1921. Interconnection between manual and automatic exchanges.

1,434,548. Electrolytic Gas Generator; I. H. Levin, New York, N. Y. App. filed May 22, 1917. Produces hydrogen and oxygen.

1,434,555. Wave Filter; W. H. Martin, New York, N. Y. App. filed April 26, 1920. Transmits frequencies between preassigned limits only.

1,434,565. Supporting Mechanism for Insulators; E. O. Sessions, Chicago, Ill. App. filed Feb. 25, 1918. Prongs on base clamp porcelain securely.

1,434,588. Reinforced Primary for Starting or Ignition Systems; C. P. Brockway, Toledo, Ohio. App. filed Dec. 6, 1920.

1,434,633. Thermostat and Thermostatic Control Device; E. J. Rohne, Minneapolis, Minn. App. filed June 10, 1920. For electric irons.

1,434,640. Device for Cleaning Motors; G. Wencker, St. Louis, Mo. App. filed July 19, 1920. Clean air constantly forced through motor by fan.

1,434,671. System of Electric Ship Propulsion; W. J. Belsey, Helensburgh, England. App. filed July 29, 1920. Some of auxiliaries driven by current from main generator.

1,434,685. Ignition Mechanism for Gas Engines; W. L. Diffendorf, San Diego, Calif. App. filed July 14, 1920.

1,434,689. Motor Control; J. Eaton, Schenectady, N. Y. App. filed Dec. 26, 1919. For motors driving planers, etc.

1,434,693. Treatment of Zinciferous Ores or Concentrates; J. H. Gillies, East Camberwell, Victoria, and P. McP. Gillies, Electrona, Northwest Bay, Tasmania, Australia. App. filed Jan. 28, 1919. Zinc recovered by electrolysis.

1,434,707. Radio Receiving System; E. W. Kellogg, Schenectady, N. Y. App. filed April 21, 1921. Widely separated receiving antennas connected by lines to central receiving station.

1,434,727. System of Electric Lighting; J. H. Allen, Chicago, Ill. App. filed April 12, 1921. Ornamental street-lighting units with two sizes of bulbs.

1,434,728. Protecting Means for Electrical Systems; M. Arendt, C. W. Burrows and H. Rosenmeyer, New York, N. Y. App. filed July 31, 1920. Automobile generator and storage-battery system.

1,434,755. Alternating-Current Commutator Motor; C. W. Shaifer, Schenectady, N. Y. App. filed May 24, 1920. Control of pilot motors operating rheostat, valves, etc.

1,434,758. System and Apparatus for Motor Control; J. F. Tritle, Schenectady, N. Y. App. filed Jan. 24, 1921. Pilot motor gradually varies resistance in circuit.

1,434,767. Telegraph System; J. H. Bell, South Orange, N. J. App. filed Dec. 4, 1918. Transmission of impulses in form of block signals for ocean cable.

1,434,773. Telegraph; J. N. Correia, New York, N. Y. App. filed Oct. 23, 1918. System of cable telegraphy.

1,434,780. Portable Lamp; W. D. Kahn, Cedarhurst, N. Y. App. filed Feb. 27, 1919. Battery flashlight.

1,434,790. Two-Way Transmission with Repeaters; J. Mills, Wyoming, N. J. App. filed Sept. 6, 1919. For telephone lines.

1,434,795. Signaling Device; H. W. Ryder, Cicero, Ill. App. filed Nov. 8, 1918. Combined with electric switch.

1,434,869. Electric Regulator; P. I. Wold and O. E. Buckley, East Orange, N. J. App. filed Aug. 21, 1918. Voltage regulator of thermionic type for generator.

1,434,884. Tube-Welding Machine; F. G. Gale, Waterville, Quebec, Canada. App. filed March 2, 1921. Machine for welding tubes which have been previously rolled into shape.

1,434,885. Tube-Welding Machine; F. G. Gale, Waterville, Quebec, Canada, and P. W. Shaw, Lynn, Mass. App. filed Aug. 20, 1921. Method of supporting and feeding tube.

1,434,894. Holder for Dental X-Ray Films; L. A. J. Hawkins, Jerome, Arizona. App. filed May 10, 1921.

1,434,918. Tube-Welding Machine; P. W. Shaw, Lynn, Mass., and F. G. Gale, Waterville, Quebec, Canada. App. filed May 5, 1922. Guiding means holds tube firmly in correct position.

1,434,925. Tube-Welding Machine; F. S. Stearns and C. W. Greene, Lynn, Mass. App. filed Jan. 24, 1917. Improved contact rolls.

1,434,968. Call-Distributing Telephone System; F. M. Slough, Forest Lawn, N. Y. App. filed July 1, 1918. Outlying lines automatically extended to operators' positions.

1,434,974. Dynamo-Electric Machine; W. A. Turbayne, Niagara Falls, N. Y. App. filed March 31, 1916. Combined automobile starting motor and battery-charging generator.

1,434,975. Telephony; H. S. Turner, Washington, D. C. App. filed Dec. 4, 1915. Relates to link connector circuits.

1,434,984. Radio Receiving System; H. H. Beverage, Riverhead, N. Y. App. filed May 3, 1921. Permits simultaneous reception of signals coming from more than one direction.

1,434,985. Radio Receiving System; H. H. Beverage, Riverhead, N. Y. App. filed May 3, 1921. Permits of the simultaneous reception of several signals.

1,434,986. Radio Receiving System; H. H. Beverage, Riverhead, N. Y. App. filed May 25, 1921. Enables very close tuning.

1,434,988. Electric Generating System; C. P. Brockway, Toledo, Ohio. App. field April 8, 1919. Engine-driven storage-battery generator.

1,435,009. Radio Receiving System; E. W. Kellogg and C. W. Rice, Schenectady, N. Y. App. filed April 27, 1921. Permits the simultaneous reception of several signals.

1,435,050. Burglar Lock for Revolving Doors; D. H. Close, Keyport, N. J. App. filed Dec. 14, 1920. Electrically locked doors.

1,435,055. Electrotherapeutic Apparatus; J. H. Eastman, Detroit, Mich. App. filed Dec. 8, 1921. Special arrangement of vibrator and adjusting screw on X-ray machine.

1,435,096. Thermostatically Controlled Sadiron; J. A. Amelianovich, Chicago, Ill. App. filed June 29, 1922. Thermostat placed at point of greatest heat.

1,435,116. Automobile Signal; H. Getcheli, Detroit, Mich. App. filed Feb. 15, 1921. Rear stop signal.

(Issued Nov. 14, 1922)

1,435,195. Regulating Transformer; A. L. Atherton, Pittsburgh, Pa. App. filed June 18, 1919. Constant-current transformers.

1,435,203. Regulator System and Apparatus; C. A. Boddie, Pittsburgh, Pa. App. filed Aug. 10, 1918. Maintains constant voltage on lines.

1,435,206. Impulse-Correcting Repeater; H. B. Brown, Chicago, Ill. App. filed Dec. 13, 1917. For automatic telephone lines.

1,435,207. System of Control; A. H. Candee, Pittsburgh, Pa. App. filed Dec. 22, 1919. Multiple-unit control of electric vehicles or trains.

1,435,209. Brush Holder; J. L. Chantemerle, Turtle Creek, Pa. App. filed March 14, 1918.

1,435,210. High-Voltage-Producing Means; L. W. Chubb, Edgewood Park, Pa. App. filed Jan. 25, 1919. Electrostatic machine placed in evacuated chamber.

1,435,211. Electric Furnace; O. A. Colby, Irwin, Pa. App. filed May 4, 1920. Melting furnace of electric-resistance type.

1,435,213. Protector; W. I. Cook. App. filed May 8, 1919. Lightning arrester for communication lines.

1,435,215. Electric Regulation; J. L. Creveling, Tucson, Ariz. App. filed Sept. 27, 1920. Voltage regulator for generator.

1,435,225. Insulator; G. I. Gilchrest, Wilkinsburg, Pa. App. filed Oct. 8, 1918. Pin protected from damage due to corona or flashover.

1,435,229. Electrical System; F. C. Hanker, Wilkinsburg, Pa. App. filed Sept. 27, 1918. Automatic rotary-converter apparatus.

1,435,230. Control System; A. L. Harvey, Wilkinsburg, Pa. App. filed Jan. 25, 1919. Automatic restart for isolated motors.

1,435,238. System of Motor Control; H. D. James, Wilkinsburg, Pa. App. filed April 4, 1916. Apparatus for automatically charging blast furnaces.

1,435,240. Signaling System; K. S. Johnson, Jersey City, N. J. App. filed Dec. 29, 1916. Means for establishing communication between anchored balloon and ground.

1,435,241. System of Control; H. H. Johnson, Edgewood Park, Pa. App. filed Jan. 14, 1921. Emergency means for interrupting circuit and actuating air brakes.

1,435,243. Automatic Hand Telephone; Le R. W. Kelsay, New York, N. Y. App. filed Sept. 24, 1920. Hand telephones provided with impulse transmitters.

1,435,249. Automatic Telephone System; T. G. Martin, Chicago, Ill. App. filed Feb. 4, 1918. Method of extending connections from one exchange to another.

1,435,253. Calling Device for an Automatic Telephone System; W. W. Owen, Oak Park, Ill. App. filed May 26, 1919.

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Where the Contractor Stands

FOR many years the contractor has been one of the popular topics of general conversation in the electrical industry. Almost any kind of an "electrical man" will ask—or freely tell you—what's the matter with the contractor. But this comment almost always circles around his weaknesses and failures. It seldom estimates potential values.

Let us consider for a moment just what the electrical contractor does and where he stands in the electrical industry.

NO ONE can question the absolutely fundamental importance of the wiring in a building. Without the wiring installation there can be no electric service in any factory, office, store or dwelling. No electric labor-saving or comfort appliance has any worth there, because it cannot be used. Electric light, heat and power cease to exist for any one. Therefore the electrical contractor, whose function it is to install this wiring and make the benefits of electricity available, plays a vital part.

But the contractor, like the plumber, follows a trade in which the apprentice becomes a journeyman and the journeyman becomes a competitor just as soon as he elects to cut loose from a payroll and take contracts for himself. This "basket contractor," unburdened with overhead and ignorant of costs, can and will ever find small jobs that will be given him at prices lower than established contractors with resources and responsibility can meet, and so he lives. And always there are too many contractors in every city, competing on a minimum quality and profit standard that by squeezing price restricts installations and discourages the use of electric service.

Whose fault is it? Whose problem is it that this process in the work of electrical development has become demoralized?

The electrical industry itself—meaning all classes of electrical men—has simply failed to do for these small wiring contractors what the plumbing industry has so well done for the small plumbing contractor. They have not together spent the time and effort and money necessary to sell to him a full, enthusiastic belief in the principle of creative, constructive competition for higher standards, bigger jobs and better profits. Yet if plumbing could be raised to the present plane of porcelain tubs and brass piping, who can deny that the electrical contractor and the public can be converted to the same idea, expressed in adequate wiring, convenience outlets and complete appliance equipment permanently installed?

THE contractors' association has adopted the word "electragist" to denote an electrical contractor who does "quality" work. This may well have a good influence. But meanwhile the industry depends upon this man to do this vital wiring and to maintain a very close personal contact with the people in each town, the interpreter and representative of *all* electrical men. Can the matter wait?

Waldo Arnold Layman

An engineer executive equipped by many years of manufacturing experience and sound business judgment.

THE acid test of business judgment is consistent accomplishment under favorable and adverse conditions. Just as death is no respecter of persons, so also is leadership in business no respecter of fear, and the mark of the leader is the ability to adjust courses of action to apparent difficulties in such a way as to marshal the courage of others in surmounting them.

For more than twenty years W. A. Layman, as the executive head of the Wagner Electric Manufacturing Company, has stood the test in the demand for initiative, creative engineering thinking and business administration in the development of an organization which has grown steadily through recognition of the quality of its products and because of the service it has furnished to the electrical industry. It was he who made the original drawings of the first Wagner line transformers and direct-current motors thirty years ago, and he played a vital part in the development of the well-known Wagner single-phase motor. In 1894 he became assistant superintendent of the company and in 1898 attained the position of assistant general manager. In 1900 he became treasurer and two years later was made general manager in addition. This twofold position he filled until 1908, when he was made first vice-president and general manager. For about ten years previous to that time his engineering work for the company consisted chiefly in passing executive judgment on its engineering policies and designs and in investigating new lines of engineering activity. Since 1902 he has had full charge of the financial, engineering and manufacturing interests of the business of the Wagner company. In 1912, when the late S. M. Dodd was chosen chairman of the board, Mr. Layman was elected president and general manager to succeed him, and on the death of Mr. Dodd in 1913 he became also chairman of the board.

Like all manufacturing companies, the Wagner company has undergone vicissitudes in developing a well-rounded organization and a substantial line of products. Mr. Layman has not only played an active part in correcting the troubles of production and manufacturing, but it was he who led the company through the financial stress brought about by conditions following the war that were entirely outside of his own making. His dominating confidence in the character of the products his company has produced and the service which they render has stood as a bulwark for a business judgment which has won for him leadership as a chief executive.

Mr. Layman was born at Smithton Mo., in 1869, and was graduated from the Rose Polytechnic Institute in 1892 with the degree of B. S. In the fall of 1892 he entered the employ of the Wagner Electric Manufacturing Company as a utility man in testing and drafting work, and step by step he rose through the company's organization to be its executive head in 1902. From that time he has been the dominating figure in all of its affairs.

Mr. Layman is a fellow of the American Institute of Electrical Engineers, an associate member of the British Institution of Electrical Engineers, past-president of the Engineers' Club of St. Louis, past-president of the National Metal Trades Association, past-president of the Contemporary Club of St. Louis, member of the board of trustees of Washington University, member of the advisory board of the David Ranken, Jr., School of Mechanical Trades, member of the advisory board of the National Society for Vocational Education, member of the executive committee of the National Electric Light Association, member of the Engineers' Club of New York, the St. Louis Club, Noonday Club, St. Louis Commercial Club, City Club, Bellerive and St. Louis country clubs and the Round Table and Town and Gown clubs, the last named being a club of leading professional and business men.

Editorial Comment

Electrical World, December 9, 1922

Volume 80 Number 24

Special Fund for Highway Lighting

IN THE preparation of budgets for county and district highway expenditures for 1923, now under consideration in many sections of the country, men interested in better highway illumination should see to it that a special fund be set aside for this purpose. This should be done whether highway lighting be paid for directly by the counties or by districts such as are permitted by the laws of some of the states. Recent experiences have called attention to the difficulties that arise when appropriations are made from the general funds of the district. There is always a tendency in that case to spend the funds for something else, and in at least one case on record the treasury was so depleted two months before the end of the fiscal year that for the remaining period it was necessary to cut down highway lighting until the road was almost in darkness. No amount of arguing would convince the commissioners who had overspent their appropriations that this was a false economy.

The better method is to arrange at the time of the original contract that highway illumination shall be paid for out of a special fund set aside for that purpose and not to be used for anything else. Not only does this prevent use of the money for pet schemes of another character, but it also makes it possible to extend the lighting system at a later time without arraying against this plan all who have other ideas for the expenditure of the county or district funds.

This is not only a matter for the electric company in every community, but it also calls for action from the Commercial Section of the National Electric Light Association or local divisions of that organization. If these would go on record as favoring special provision for the payment for highway lighting, the action would have considerable weight both with some of the smaller companies, which are far from uniform in their practices, and with the county officials, who generally settle such matters on the basis of precedent.

Rebuilding Systems with Intelligence

BECAUSE of the nature of the growth of a district power supply nearly every system encounters the problem of consolidation and rebuilding at some stage of its development and is faced with the financial and engineering questions involved in insuring a unified system, cheap production and a secure future.

The article in this issue by William W. Handy outlines the method followed in an analysis of this problem as applied to conditions in the Pittsburgh district. It is a worth-while study and shows how accurately such problems can be solved if attacked with foresight fortified with field data. The very elaborate financial study involved in a study of the alternative solutions seems to have been warranted because the company wished to start on a basis of absolute knowledge that it was following the logical path of progress.

A great deal of interest should be aroused by the study of by-product plants in connection with the scheme. It would be valuable to get the exact reasons for deciding against this much-discussed type of development when it admittedly offered opportunity for cheapening power production. There is more to the matter than the disadvantages of a central station's attempting to operate several businesses. England has made many studies along this line and has produced some wonderful paper schemes, but no practical application of the ideas has resulted. More data are needed before a central station will embark on this new type of system. It almost seems worthy of government experimentation and research, because a successful by-product system would result in national fuel economies on a mammoth scale.

South Dakota Defeats Mobridge Project

JUST what the poll in South Dakota on the proposed hydro-electric development on the Missouri River at Mobridge means is rather hard to determine from an inspection of the vote. The proposal was defeated by 105,620 to 54,907, according to figures given out from Pierre on Nov. 21. However, it went down in a landslide of negative votes that overwhelmed five initiated laws and four constitutional amendments, none other of which had anything to do with such developments. Apparently the voters of that state made up their minds that an opposition vote was a safe one on any question. The friends of the project attribute the defeat to the state of the voter's mind, which was not favorable to the launching of any new enterprise. They declare that their plan will not be allowed to lapse because of this defeat and that "the best power site in any state in the Union will not be left unused for very long in the period of superpower and hydro-electric development that is now at hand."

Viewing the project against the sober background of the engineers' report, it will be apparent to the unprejudiced observer that the voters of the state are wise in their decision, regardless of the motive which may have inspired it. Though the project is not an impossible one, it is apparent that the cost of developing the site to a paying basis is one that would not afford a good commercial chance for private capital to take at the present time. It is equally apparent that in the hands of the politicians the development would be an expensive plaything for which the people of the state would pay a pretty price. The defeat of the initiated law will give every citizen further time to think over the proposition of handing such a plaything to the politicians. Regardless of the merits of the engineering features of the project, the people of South

Dakota should remember that there are many such projects that are desirable from a technical standpoint but as yet wholly impracticable commercially. The state can afford to engage in them only when the health and comfort of its people are at stake.

An Unusual Case in Industrial Power Design

THE tendency in recent years toward the use of alternating-current motors for practically all purposes has been so strong that the direct-current installation described in R. B. Stevens' paper in the current issue on the equipment of a sugar-refining plant affords a rather startling exception to the general rule of practice. The plant described is the refinery of the American Sugar Refining Company in Baltimore, one of the biggest and certainly the most modern of plants for treating cane sugar. Now, the fundamental of design as regards the layout of the entire system of machinery was to refine sugar cheaply while insuring the maximum continuity of operation and the greatest possible efficiency in the details of the process and at the same time depending on a low grade of labor.

In a sugar refinery the process from start to finish must be continuous and carried out at an even pace through all the departments if wastage is to be avoided and the final product obtained at a minimum price. In this particular instance, all things considered, it was found desirable to make the entire motor scheme of the plant a direct-current system, not on account of any particular fondness for direct-current machinery as such, but for certain very practical reasons connected with the chain of mechanisms which must be operated. About five hundred motors went into this great plant, aggregating nearly 8,000 hp. Most of the units are of rather low speed, and the driving shafts are often carried by silent chain or gear reducers.

The reason for so wholesale an application of direct-current motor units lies in the short distances of transmission, only a few hundred feet at most, and particularly in the frequent heavy starting loads and the great desirability, often a stern necessity, of speed variation at will. Sugar-refining machinery, carrying the material in process at a fairly high temperature, stiffens quickly after even a brief shutdown, so that the power required to start the machine may be ten times that required for operation when running in full use. The processes, moreover, being continuous and interdependent, must, if everything is to run smoothly from raw material to finished product, have their several elements capable of close adjustment in speed, unless there is to be large and expensive storage space between processes. Speed adjustment is definitely required or conspicuously advantageous in at least 80 per cent of the entire motor equipment.

Nothing can exceed the convenience and general effectiveness of a well-designed three-phase motor, but it is essentially a nearly constant-speed machine unless provided with slip rings and resistance, in which case it becomes the exact equivalent of a series-wound direct-current machine; but where facile change of speed is a prime necessity nothing has yet been devised quite so convenient as some of the adaptations of direct-current motor control. Here we have a case where the added complication and the higher first cost of the direct-current motor system showed itself decidedly worth while.

More Service Data Needed

A WEAK spot in the commercial routine of many central-station companies and manufacturing sales offices is the neglect of those closest in touch with new installation work to compile adequate performance data after such layouts become thoroughly "shaken down" into service. The industry is growing so fast that it is often most difficult to find time to put down these results before new demands absorb the attention of the sales engineer and the installation staffs. Yet, in the interest of escaping from rule-of-thumb imputations, something more must be done to reap this neglected harvest from the fresh fields of experience. The industry advances by leaps and bounds, and even the judgment of able engineers in close touch with commercial developments needs the reinforcement that significant service results offer.

Cost accounting has made great strides in factories during the past decade, and the rewards of a consistent policy of assembling and analyzing service data would be of the same magnitude if electrical men in touch with the economic performance of industrial heating, power and lighting installations would make a more concerted effort to pin down such information while it is fresh in mind or easily obtainable.

Plenty of descriptive information exists, but there is a serious lack of analytical data in the files of many central-station power engineering departments and of the sales offices of not a few manufacturers. If this statement is challenged, our columns are open to such material as contrary proof. We venture the assertion that in too many cases a search of the files will show bad gaps in economic information bearing upon service applications. Younger engineers in particular will do well to make a point of building up service data before these escape recording and analysis, and it is to be hoped that more and more information of the real "proof-of-the-pudding" type will be forthcoming for the benefit of the industry.

What Is the Source of Pin-Type Insulator Troubles?

WHAT is the trouble with high-tension pin-type insulators? The question is one that is agitating a great many central-station operators at the present time. There are no widespread troubles of an extremely serious nature that would lead any one to condemn present manufacturers or manufacturing methods, but there is a steady trickle of trouble that is a source of worry to both the manufacturer and the user. The trouble is typified by a tendency of insulators that have been in service for ten to twelve years to split, the top unit usually being the one to break. In some cases the petticoats break off. Although a large portion of the insulators that have given trouble seem to have been in service ten years or more, there are not lacking cases in which the insulators have been in service for only a short time.

In the discussion of the subject among operating engineers there is a decided tendency at the present time to blame the trouble on the cement used in the joints between members. Ordinary Portland cements in commercial use have a tendency to "grow" or increase in volume under the influence of repeated wetting and drying. Moreover, if not properly treated in preparing, even the most thorough mixing cannot clear out some small particles that on examination will be found to contain dry cement in their interior. It is to be presumed that the insulator manufacturers have used the best practical methods of cement preparation they know. That this is the case is evidenced by the fact that the development of trouble is generally slow. There is good ground for believing that in the case of suspension insulators the manufacturer has been able materially to mitigate, if not entirely obviate, such troubles. There are methods of cement treating and setting that, it is claimed, remove entirely any chance of cement difficulties. Although such methods as are now known are likely to increase the difficulties of manufacture and also the price, it is not beyond the bounds of possibility that cheaper and better methods can be found.

Back of all the discussion is a real doubt as to just how far cement troubles play a part in the difficulties experienced. There may be other and bigger things involved.

No Place for "Complaints" and "Applications"

MUCH progress has been made in educating central-station employees away from the old "public be damned" attitude and the idea that a representative of a monopoly can be independent and indifferent in his relationships with the other people of the world. There still remain, however, several words in common use among utility men that have no proper place in the vocabulary of a public servant. One is "application" and the other is "complaint."

It is a bad thing for men to feel that the public has to come to them applying for something. The inference is that they by graciously granting these applications acquire merit, but as a matter of fact the utility man is not doing favors in responding to these "applications," for he is compelled by law to serve the public without discrimination. As a matter of fact, he is engaged in a business to make money like any other merchant, and these so-called "applications" are just orders from new customers whose business he is seeking. It would be well therefore to stop talking about "applications" and call them "orders," so that these new customers would be known by their right name and get the welcome they deserve.

As to "complaints," we question whether this word is not equally harmful and misleading to ourselves. "Complaint" has an ugly sound, for no one likes people who complain, and if a utility is treating its customers in the fair and friendly way that it should there ought to be no cause for complaints from any one. Things may go wrong, of course, and customers will report trouble, or short-sighted employees may be careless and unjust and the customer will and should appeal for help and redress. But no one need "complain" of anything that he knows will be made right as soon as it is reported. And if the service policy of any central station is as it should be there is no place for complaints. Let us banish the "complaint" window, therefore, and let the troubled customer come to the "information" desk and be referred to the proper executive.

It is all a matter of attitude. Therefore, for the influence it will have on both the public and the employee, let us put these cold-sounding words out of the official lexicon.

Higher Pressures and Temperatures in Central Stations

THE recent proposed increase of pressures in several power plants under construction brings to the front again the question of present economical limits and possible future developments as regards both higher pressures and temperatures. George Orrok, in a paper presented this week before the American Society of Mechanical Engineers, entitled "The Commercial Economy of High Pressures and High Superheats in the Central Station," points out that the limitations to temperature are set at about 750 deg. by available materials, but that manufacturers are prepared to deal with considerably higher pressures than any in use today in power-plant work. He shows, however, that the extra fixed charges largely offset the expected savings in fuel.

In considering higher pressures we must not lose sight of the fact that a large increase of pressure will result in a considerable increase of the loss by gas escaping from the boiler surfaces, making necessary the increased use of economizers or some other means of reclaiming heat from the flue gases after they leave the boiler. Economizers are barred if the multistage regenerating cycle is used in the steam and water circuit, and since this is the most efficient applicable steam cycle, our attention is at once directed to a plant utilizing some form of this cycle and having flue air preheaters installed to reduce the otherwise rather large losses from escaping gas.

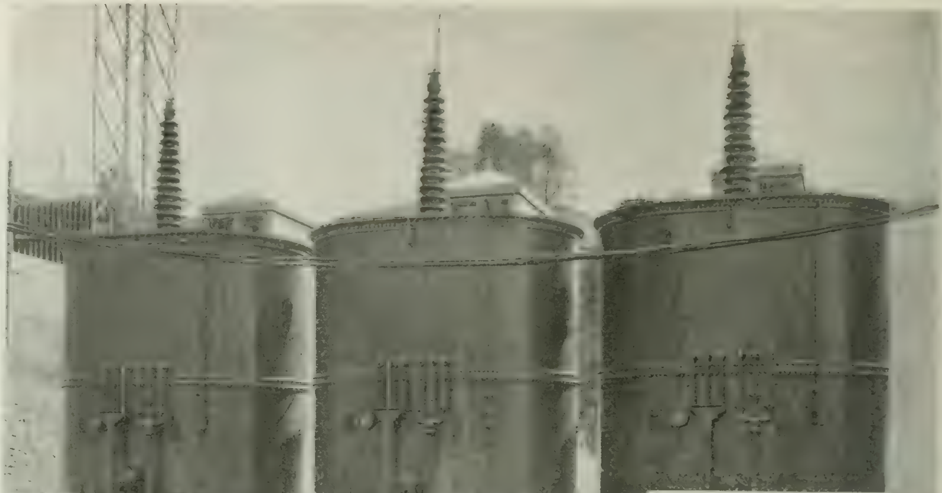
Flue air preheaters require large surfaces because the rate of heat transmission is low unless excessive draft losses are employed. Furthermore, they are not yet proved equipment, but in view of some recent installations, notably that of the Gennevilliers station of Paris, more information concerning their value may soon be available.

Should air preheaters prove impracticable, then it appears that it will still be advantageous to use some form of the regenerative cycle in which the feed water at fairly high temperatures, say between 300 deg. and 400 deg., enters an economizer. In short, there is probably some arrangement in which the modified regenerative cycle is combined with boilers having high-temperature economizers attached which will lead to the highest efficiency.

There is no question about the considerable gain in efficiency by the use of such arrangements at high pressures. At 1,200 lb. pressure it should be possible to save at least 25 per cent in the fuel bill. At such pressures the regenerative plant even without air preheaters or economizers should result in a fuel saving of 20 per cent as compared with heat-balanced plants.

The fixed charges appear as the economic obstacle to this development at the present time, but before coming to definite conclusions sight must not be lost of the facts that as more high-pressure equipment is developed its first cost, and hence the fixed charges, will probably decrease, that in the long run the price of fuel will probably increase, that as between two ways of generating power requiring equal effort and equal total expenditure that one is best which conserves the most fuel, and finally that high-pressure steam properly applied appears, even in the present undeveloped state of the high-pressure art, very nearly to hold its own.

The considerable saving in fuel which may be expected should encourage manufacturers to develop high-pressure equipment at a lower cost.

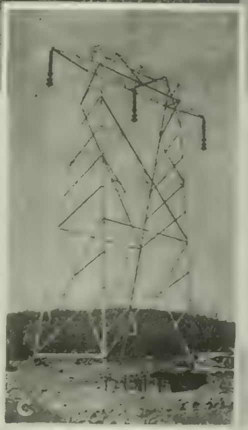


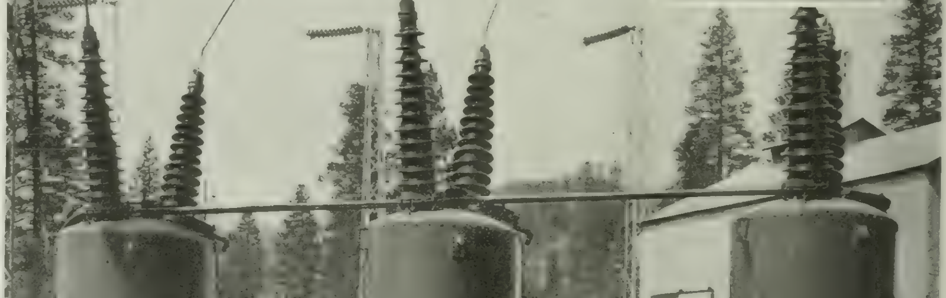
Glimpses of 220,000-Volt Equipment for Pit River No. 1 Line

A—Fifty-thousand kilovolt-ampere transformer bank at the Pit River No. 1 plant of the Pacific Gas & Electric Company, consisting of three 16,667-kva. units designed for 220,000-volt grounded-star operation. One terminal of each is grounded, thus necessitating only one high-tension terminal.

B—Oil circuit breakers for 220,000-volt line. Owing to the great weight of the moving parts they are inherently slow acting. A quick break is accomplished by means of an auxiliary contact.

C—Typical snow tower on 200-mile 220,000-volt line equipped with insulator strings consisting of nine standard disks and four special high duty units The special units are 10 and 14 in. in diameter, alternated at the line end of the string to break up the rain and thus increase the wet-flashover voltage. A 16-in. hollow copper disk below the lowest unit serves as a corona shield.





Voltage Limits in Impregnated Paper Cable

A Summary of the Technical Problems in the Manufacture of Cable and an Outline of the Present Methods for Obtaining Improvements

By WILLIAM A. DEL MAR
Chief Engineer Habirshaw Electric Cable Company

MAKERS of transformers, insulators and switching apparatus have successfully solved the problem of transmitting energy at more than 200,000 volts, but the cable makers have made no substantial advance since the 25,000-volt underground cables were installed at St. Paul in 1900. The entire industry is looking impatiently at the cable makers and asking why they are holding back the progress of underground transmission by their inability to keep pace with the makers of other devices. It is therefore a matter of prime interest to the electrical industry to examine the cause of this situation and to see whether any steps can be taken to help the cable makers out of their difficulties.

The designer of a high-voltage cable is limited at the outset by the maximum permissible diameter, which is usually 3 in. owing to the fact that the principal cities have large numbers of 3½-in. ducts installed. Even if larger ducts were used—and some cities are using 4-in. or 4½-in. ducts—the diameter of the cable could not be much over 3½ in. without making it too clumsy to install.

The limited diameter and the poor heat-dissipating quality of ducts make an installed cable a poor dissipator of heat. The heat that a 3-in. triplex cable can dissipate under these conditions is between 0.15 watt and 0.25 watt per foot per degree centigrade temperature rise.

Considering the problem of heat dissipation in greater detail, we find that the heat resistance from conductor to ground of a 25-kv. or 30-kv. triplex cable is made up, approximately, as follows, in percentages: Insulation, 82; sheath emission, 8; sheath to duct wall, 3; duct wall to ground, 7.

The heat resistivity of the insulation, which is the element in which the greatest room for improvement exists, is as follows, in degrees centigrade per watt-inch: Impregnated paper, 400 to 800; varnished cambric, 250 to 350; rubber compound, 250 to 350.

The big variations observed in each of these materials have been the subject of study by the National Physical Laboratory of Great Britain and numerous other agencies, but no notable progress has yet been recorded in increasing the heat conductivity of impregnated paper.

The emission of heat from sheaths varies from 150 deg. to 180 deg. C. per watt dissipated from each square inch of surface, depending upon the condition of the surface. No systematic attempt has been made to utilize this fact because of the practical difficulty of preserving any special surface on the lead during the act of drawing in the cable and while it is in service. The problem of the cable designer is therefore to transmit through the cable perhaps 20,000 kw. with a loss not exceeding the limited heat-dissipating ability described above.

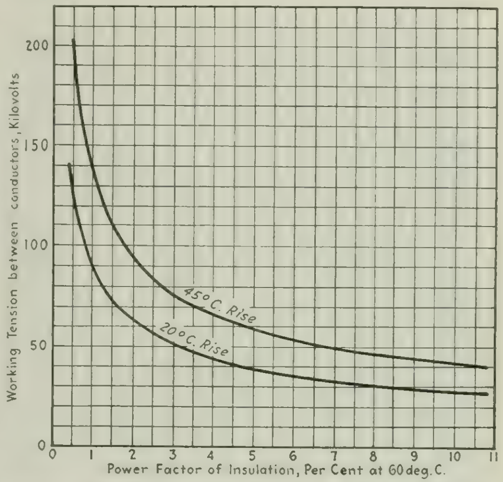


FIG. 1—VOLTAGE AT WHICH MAXIMUM CARRYING CAPACITY IS ATTAINED WITH VARIOUS POWER FACTORS

The energy loss is partly in the conductor and partly in the insulation. Commercial copper has a conductivity of about 100 per cent of the annealed-copper standard. There is no better metal available at any price. Any improvement that may occur along this line must be due either to some lucky discovery or to research work of a fundamental character.

The insulation loss, on the other hand, has been the subject of considerable study. During the past few years the power factor of impregnated paper insulation has been reduced from more than 20 per cent to about 2 per cent at 85 deg. C. or 1.2 per cent at 60 deg. C. There is room for further improvement, and there is a prospect that the power factor will be lowered to well below 1 per cent at 60 deg. C. The dielectric loss, however, depends upon both the power factor and the specific capacity of the insulation, and no progress has been made toward lowering the latter.

The very highest temperature at which an impregnated paper cable could operate would be limited to about 135 deg. C. by the fact that insulation chars slightly above that temperature, but unfortunately other limitations come into play at much lower temperatures. One of the most serious of these is the permanent expansion of the paper and lead at temperatures above 60 deg. C., which results in the formation of voids in which vapor ionizes. Furthermore, the longitudinal expansion and contraction of cables in ducts leads to abrasion of the sheath.

This entire matter of temperature limits for cables is the subject of an exhaustive research now under way at the Massachusetts Institute of Technology. This research is being supported by the National Electric Light Association and is under the direction of the cable research committee of that society.

It is interesting to study in greater detail the effect of power factor upon carrying capacity. Let us assume a triplex cable 3 in. in diameter, of a commonly used conductor size, for use on a three-phase system with grounded neutral. Such a size would be 350,000 circ.-mil, sector shaped, and about the most effective insulation that could be applied within the diameter limitation would be 19 64 in. on each conductor and 7/64 in. over all.

There is given on page 2021 of Pender's "Handbook for Electrical Engineers" (edition of 1922) a formula for calculating the effect of dielectric losses upon the carrying capacity of a cable. If the symbol for dielectric loss in this formula be replaced by its equivalent in terms of tension, capacity and power factor, and if the symbol for current be replaced by its equivalent in terms of kilowatts, capacity and tension, a formula will be obtained expressing the carrying capacity in kilowatts in terms of the power factor and tension. This formula is as follows:

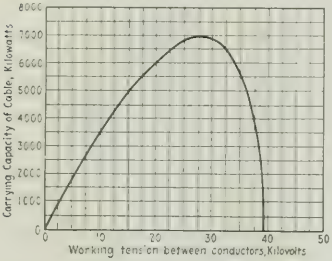


FIG. 2—CARRYING CAPACITIES BASED ON 10 PER CENT POWER FACTOR AT 60 DEG. C.

$$W = \frac{191}{\sqrt{r}} E \sqrt{\frac{T}{R} - 0.0159 E^2 CP} \qquad (1)$$

where

W = power carried by cable, kw.
r = electrical resistance per 1,000 ft. of conductor.
R = heat resistance, deg. C. per watt-inch.
E = tension between conductors, kv.
C = capacity between any two conductors, the third being insulated, mfd. per mile if the specific capacity were unity.
P = power factor of insulation as a fraction.
T = temperature rise, deg. C.

It will be noted that E occurs in two places in the formula, first so that an increase in it will increase W and then so that it will decrease W. There is, therefore, a certain value of E which makes W a maximum, and this occurs when

$$E = \sqrt{\frac{T}{0.0318\ CPR.}} \qquad (2)$$

Let us take the following values for our cable, assuming the specific capacity to be 4:

T = 20 deg. C. (= 60 deg. final — 40 deg. ambient).
C = 0.05.
R = 163.
r = 0.035 at 60 deg. C.
P = 0.1.

Then a graph of equation (1) will be as shown in Fig. 2, which clearly shows the maximum point referred to above. This maximum point occurs at about 28 kv. for the power factor assumed. For lower power factors the voltage corresponding to the maximum carrying capacity will increase, and for higher power factors it will decrease, as shown in Fig. 1.

Most of the old resin oil cables had power factors as high as 25 per cent at 60 deg., and in this case the maximum carrying caapcity in kilowatts would be attained at less than 18 kv. per conductor. At 40 per cent power factor, which was not at all unusual in the cables of twenty years ago, the maximum carrying capacity occurs at 14 kv. It is therefore very doubtful whether the early high-voltage installations could be justified.

When all problems relating to temperature have been solved, there remains the problem of dielectric strength. In other words, power factors being below 2 per cent at 60 deg. C., there is no reason, as far as average heating is concerned, why tensions as high as 60 kv. cannot be used. The problem resolves itself, therefore, into eliminating the local heating which causes electrical breakdowns. This problem is being attacked with great vigor by K. W. Wagner, H. J. Ryan, C. P. Steinmetz, J. L. R. Hayden and some of the cable manufacturers.

The dielectric strength of insulation is a subject that is complicated by the almost unavoidable presence of air or vapor spaces in every solid or liquid insulation. In cables this complication is unusually serious owing to the necessity of a high degree of flexibility in all cables.

At the present time the breakdown voltage of solid or semi-solid insulation in relation to its thickness and the electric field distribution within it is not clearly understood. This problem has been solved for air and oil, but not for the materials used as cable insulation. Until it is solved the voltage which a cable will stand cannot be accurately predetermined from the dielectric strength of its insulation. This subject was discussed at some length at a symposium held at the June, 1922, convention of the A. I. E. E., but the problem was by no means solved.

One of the problems that requires careful consideration is whether the European practice of using round conductors and thin insulation is as good as the American practice of using sector conductors and thick insulation. The arguments in favor of the European practice are that there results less cracking of paper with round than with sector conductors, better impregnation due to the smaller amount of paper, and less liability to hot spots.

A general view of the situation as outlined above is afforded by the following table:

	Limitation	To be Raised or Lowered	Agencies at Work Other than Cable Manufacturers
1.	Diameter	R	. . . . .
2	Heat resistivity of insulation	L	Nat Phys. Lab. & N E L A.
3.	Heat emissivity of sheath	R	. .
4	Heat resistance of ducts	L	. .
5	Electrical resistivity of conductor	L	. . .
6	Power factor of insulation	L	. . . . .
7	Specific capacity of insulation	L	. . . . . .
8	Temperature limits of cables	R	N.E L.A.
9	Dielectric strength of insulation	R	Several noted physicists
10	Dielectric strength of splices	R	. . . .
11	Dielectric stresses in insulation	L	. . . .

In addition to the above agencies of research, an important committee has been organized under the auspices of the engineering division of the National Research Council to deal with insulation problems in a general way. This committee is under the chairmanship of Prof. J. B. Whitehead of Johns Hopkins University and is now seeking the co-operation of all those who are interested in insulation problems. Suggestions as to phases of the problem and directions of approach or any hints of a helpful nature will be greatly appreciated by this committee. Furthermore, those who are carrying on research work on insulation will find this committee a splendid clearing house through which to exchange information and prevent duplication of effort.

Factors in Industrial Plant Distribution

Operation at Minimum Cost and with the Greatest Continuity of Service Obtainable with a Small and Inexpensive Force Was the Major Consideration in Designing American Sugar Refining Company's New Plant

By ROGER B. STEVENS*
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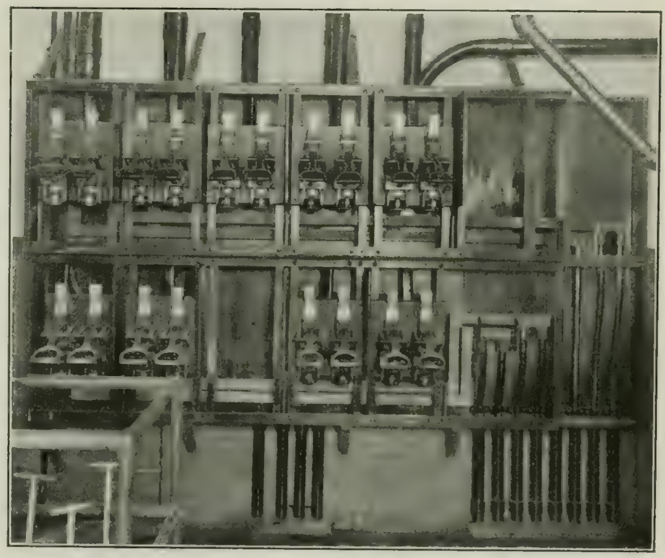

MOUNTING AND ARRANGEMENT ADOPTED FOR PANHOUSE BRANCH LINE CIRCUIT BREAKERS AND THEIR CONNECTIONS WITH RISER CABLES

MINIMUM operating expense and the highest dependability of operation obtainable with a small and inexpensive operating force were the major requirements in selecting and laying out the electrical equipment of the recently completed Baltimore plant of the American Sugar Refining Company. The operating and maintenance conditions particularly were kept closely before the designers, and in cases of conflict between standard power practice and process requirements there was no hesitation in departing from precedent in order to improve the operation and make feasible the object for which the refinery was built—namely, to refine sugar cheaply. Of particular influence were the low grade of labor to be utilized, the likelihood of damage to product from stoppage of any machine in the process chain, the possibility of having to change machine speed, and the necessity of providing for 25 per cent increase in power facilities. Aside from being the most modern cane-sugar refining plant in the world, this installation is interesting because direct current is used throughout, because of the very complete protection of live parts by conduits and steel cabinets, and because of the extensive use of individual motors and motor circuit breakers in place of fuses. Approximately 500 motors are installed aggregating 7,900 hp., the largest being rated at 300 horsepower.

CONDITIONS DICTATED USE OF DIRECT CURRENT

In view of the very general tendency in industrial-plant design toward alternating-current application, the adoption of direct current for such a large and extensive plant may seem reactionary. It was, however, made only after a thorough and exhaustive analysis of the problems to be met and of the relative advantages to be obtained from the two systems of transmission and application. The reasons underlying the decision can best be explained by briefly outlining the problems to be encountered:

The sugar refinery consists of a number of connected or closely grouped buildings, the transmitting distances are short and the loads closely concentrated. In nearly all cases the refining equipment offers a very high resistance to starting, as the material in process has a tendency to harden and stiffen after a brief shutdown. The power required to start a given machine may thus be from five to ten times that required for operation after the running condition has been reached. Nearly all of the refining processes are interdependent and continuous. Hence, if excessive interprocess storage space is to be eliminated, it is necessary that the speeds of the various conveying units be capable of close adjustment. Furthermore, in the case of more than 80 per cent of the total horsepower required, either a speed adjustment was absolutely necessary or a very distinct advantage was to be gained by providing such adjustment.

RELATIVE MERITS OF DIRECT AND ALTERNATING CURRENT

In comparing the application of alternating current with direct current the following important characteristics stand out: the extreme simplicity of the squirrel-cage motor, with its complete freedom from moving electrical contacts and light breakable metal parts; its low first cost; greater efficiency of electrical transmission at distances where direct-current transmission is out of the question; the fact that the voltage applied to motors may be raised to a point which would be dangerous in an installation where the motors have open commutators and brush rigs accessible to the class of labor used. Against the use of alternating current are the following considerations: The squirrel-cage motor is inherently a constant-speed device; its starting torque is low; its power factor is greatly reduced at less than full load. The slip-ring motor partially overcomes the first two of these difficulties, but in an unsatisfactory way because it introduces the disadvantages of moving contacts and vulnerable brush rigs.

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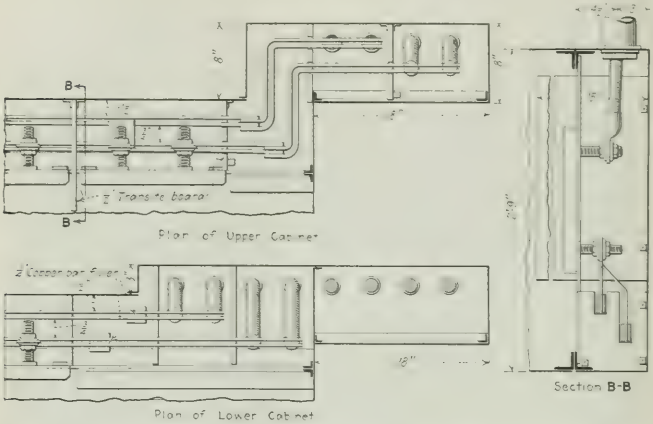
In favor of the direct-current system we have the following facts: Practically any desired range of speed adjustment or torque characteristic is possible; whatever the load, the power plant and system obviously operate at unity power factor and without the great drop in efficiency experienced with underloaded alternating-current equipment. Opposed to the direct-current system are the added complication and slightly higher first cost (horsepower for horsepower) and the less efficient transmission at great distances.



PLAN OF BUSBAR CONNECTIONS TO RISER CABLES (SEE ELEVATION ON PAGE 1259)

When applied to refinery conditions a decision between the relative advantages of direct current and alternating current must therefore be almost overwhelmingly in favor of direct-current operation. Compared with the higher starting torque and adjustable speed of the direct-current motor, the slightly higher first cost is negligible. When the necessity for greatly overmotoring the alternating-current drives in order to provide sufficient starting torque is taken into account, the first cost of the equipment is lower, if anything, for the direct-current than for the alternating-current system. In this particular case transmission is well within the economical range of direct current at 240 volts, the average weighted transmitting distance being 232 ft.; 1,050 kw. was transmitted 325 ft. to the pan and finishing buildings with a voltage drop of only 2.1 per cent, and 150 kw. was transmitted to the cooperage, or a distance of 800 ft., with a voltage drop of only 2.8 per cent.

While the voltage (230) used in the direct-current system is lower than would have been used in an alternating-current system and heavier individual cables were used, the total cost of the distributing system is lower. This is principally because of the advantage which is taken of the closely concentrated loads in grouping a large number of motors on single feeders to take advantage of the low diversity factor thus obtainable. With an alternating-current system the three wires of a three-phase system must be run together, and physical limitations preclude the use of feeders of as large capacity as may be used where the direct-current cables are run in separate ducts. Running the positive and negative conductors in single cables and separate ducts and grouping the conductors in multiple to form single-feeder circuits of large capacity allowed full advantage to be taken of the motor-grouping possibilities in cutting down the total copper installed.

To enable segregation of the bus in case of trouble and to facilitate repair work the main bus serving the refinery is provided with removable sections. Each power-feeder breaker is equipped with overload and direct-acting inverse-time-limit features, and permanently attached operating handles are provided for use in the very remote contingency of interruption in the control circuits. No locking devices are used on the disconnecting switches because it was not believed that the stresses under short-circuit conditions would be sufficient to open them. This has been proved true in the case of two practically dead short circuits on the heaviest feeders since the plant was completed.

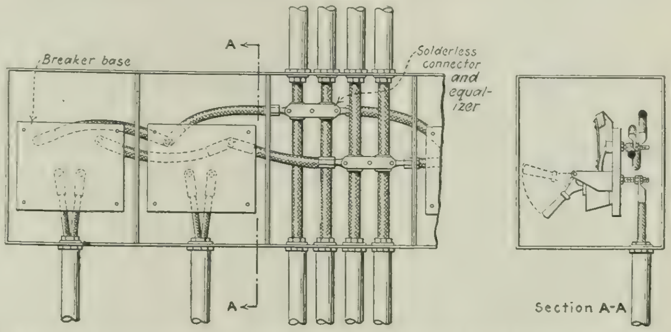
All of the feeders run to the various centers of distribution through underground conduits. Special precautions had to be taken in designing this part of the system because the ground consists almost entirely of a fill covered with a concrete pavement, which in many places must withstand the weight of railroad tracks and the company's heavy trucks. Furthermore, the heat absorbed by a pavement exposed to a Baltimore July sun is intense. The construction adopted consisted of 3½-in. fiber conduits laid in two layers on 6-in. centers and inclosed in a reinforced-concrete envelope. Under the building these ducts lie directly on a 3-ft. mat which supports the buildings. Between buildings a self-supporting bridge structure was built of reinforced concrete strong enough to allow the ducts to be led through it and at the same time to support the weight of the shallow earth fill, the concrete pavement and the superposed live load of trucks and railroad equipment. Opportunity was afforded the ducts to slide over the top of the mats to compensate for expansion and contraction due to temperature changes.

The signal circuits are also run in the concrete envelope with the light and power feeders, but are inclosed in iron conduit and segregated in one corner. At terminal points and cable pits the light and power ducts are either carried to separate cable pits or separated from the signal circuits by a substantial concrete wall. All cables are protected with a double wrapping of asbestos fireproofing tape impregnated with sodium silicate.

PAPER-INSULATED CABLE USED UNDERGROUND

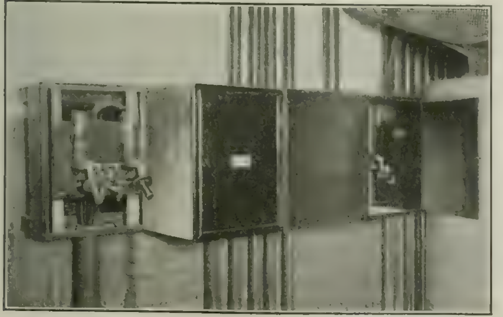
All underground cables except the small multi-conductor control and signal cables are paper-insulated. For interior work cable insulated with varnished cambric and covered with two flame-proof braids was used. Paper was chosen instead of varnished cambric for the underground cables because of its ability to stand up under severe temperature conditions and because of its lower first cost. Because of the conditions outlined previously and the fact that practically the entire space between the buildings is filled with duct lines separated from the pavement by only a shallow earth fill, all underground cables have been very conservatively rated. In all cases that part of a feeder which lies underground has been given a greater cross-section than the part in the interior conduits; in some cases the difference is nearly 100 per cent.

In several cases two cables were used in multiple to form a single heavy feeder. This was made necessary for several reasons. First, owing to the difficulty of using larger sizes, cables of 1,500,000 circ.mills cross-section were established as the largest size to be used. Aside from the weight and rigidity of the larger sizes, the fact that a paper and lead cable cannot safely be bent to a radius of less than twelve diameters, and that interference with water, steam and sewer lines made very long radius bends almost impossible, prevented the use of heavier single conductors. Second, a definite advantage was to be gained from better diversity factor by serving as many motors as possible from a single feeder. Both of these considerations pointed to the desirability of combining the carrying capacity of two cables in one feeder. Care was taken to have the cables of equal length within pairs, and at every point where a tap was taken off a full-size equalizer connection was made, so that unequal division of load and consequent overload and heating are not expected.



METHOD OF CONNECTING MULTIPLE RISERS WITH BRANCH LINE CIRCUIT BREAKERS

While the refinery, as constructed, is designed for two-thirds of its ultimate capacity, provision has been made for the 50 per cent expansion. Enough preliminary data were obtainable to make it possible to proportion the feeders, ducts and layout with this in view. Duct lines have been installed throughout in sufficient number to take care of the ultimate cable requirements and to leave at least 25 per cent spares in all cases after the last cables have been installed. No spare cables will be pulled into the ducts at present, as in case of trouble it will require only a couple of hours' work to pull into service a new feeder into any building. A length of No. 10 iron wire has been pulled into each vacant duct to facilitate the pulling in of future cables. When expansion is finally made it will only be necessary to install one additional circuit breaker in the space provided and on supports already installed, and to pull in one additional feeder to each building affected. The additional feeder and breaker in each case will be the same size as those already installed.



CABINET ADOPTED TO HOUSE ALL CIRCUIT BREAKERS

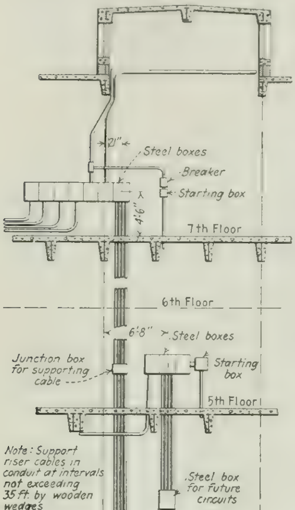
SPECIAL DISTRIBUTION BOXES USED

Each feeder is carried full size straight through to the last floor that it feeds. The installation and connection of feeder taps and branch circuit protective devices have been greatly facilitated by the use of shallow steel wiring chambers bolted to the wall on each floor so that the riser conduits enter at the bottom and leave at the top. These boxes leave the cables easily accessible and allow them to be wedged for support at each floor. Similar boxes are installed alongside the riser boxes for each branch floor-feeder circuit. All boxes are drilled on the sides where they abut and clamped together with short nipples. In all except the riser boxes steel frames are placed to support the slate panels upon which the branch circuit breakers are mounted. Solderless clamp connectors fasten the cable taps to the risers and provide equalizer connections in the case of multiple feeders. Taps are led off to boxes in both directions wherever more than one branch-feeder circuit is installed.

All branch-feeder circuit breakers are purchased mounted on slate panels of uniform size, and the steel frames which support them in the boxes are likewise drilled uniformly. Where a large number of breakers are installed together the abutting sides of the boxes are entirely cut away, transite board barriers with slots substituted, and all connections between risers and breakers made with bar copper instead of with cable jumpers. Connections are made to all of the breakers, which are back-connected before they are installed.

The riser boxes are provided with plain screwed covers, while the breaker boxes have the hinged front, thus making them easily accessible for operation, repair or extensive adjustment. The deep-front sections of the riser boxes serve no purpose except to bring all the work into symmetry, give a uniform appearance and form a convenient receptacle for the protection of instruments when extensive test readings are to be made.

A departure was made in caring for the branch circuit serving the centrifugal-machine floor of the panhouse. Here there are forty-eight centrifugal syrup extractors, each driven by a motor which is nominally rated at 20 hp., but which is started by being thrown directly on the line with only a small limiting resistance in series so that the momentary starting current is approximately 250 amp. These machines are served in groups of six to eight with a branch feeder and circuit breaker for each group. Wall space is limited so that it was necessary to place the breakers in two horizontal rows, one above the other. To take care of this condition the cabinet shown on pages 1259 and 1260 was designed. The two feeders which serve this floor enter the shallow part of the cabinet from below at the righthand side where they are attached to the distributing bus by lugs. One feeder serves the upper row of breakers, and the other feeder the lower row. All breaker connections are made with bar copper and the breakers are easily removable or interchangeable. The fact that a riser for the floors above had to pass at the point where the cabinet was installed made the design of the cabinet slightly more difficult, as it was necessary to allow space behind it for the passage of the four conduits carrying this riser. While apparently a rather expensive piece of equipment, this cabinet was built at somewhat less cost than the number of standard individual breaker cabinets which it supplants. It was constructed by a contractor who did a great deal of sheet-metal work in the plant. The copper-bar work was all done by the electrical force in the plant. From the branch circuit breaker boxes the floor feeders usually leave through the bottom and pass down through the floor to a point under each motor. As many motors as convenient are connected to each branch feeder, the largest feeder capacity being 600 amperes.



TYPICAL RISER SECTION, SHOWING BOXES THAT FACILITATE TAKING OFF BRANCH CIRCUITS

To avoid running the taps to the motors and breakers the same size as the floor feeders, as would be required under the code unless a cut-out of some kind were installed immediately at the point of tap-off, special permission was obtained from the local inspection bureau to use taps of motor-size cable not longer than 15 ft. without the installation of cut-outs, provided no wire smaller than No. 4 were used in the taps. This permission was obtainable in view of the high class of construction employed and the safeguards applied to the equipment.

Every motor has been equipped with some form of conduit terminal box which allows the cable to enter the motor frame without breaking the continuous chain of conduit protection. The rigid conduit from the branch circuit feeder, terminating at the motor base, is equipped with an end bushing and clamp, and the final run of 18 in. to 3 ft. is made in flexible metal conduit which enters the cast-iron and steel terminal box on the motor frame directly.

All manual starters and field rheostats of the face-plate type are equipped with safety covers which entirely obviate the possibility of accidental contact with live metal parts, only the insulated operating handles projecting through the covers. Automatic and remote-control equipment, where used, is installed in steel cabinets with provision for locking should operating conditions warrant the necessity.

The factors influencing the selection and installation of motors and control equipment will be discussed in a later issue.

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Present-Day Electrification

Although no power census is available in Great Britain, data are gradually being accumulated concerning some of the larger spheres in which power is produced. In this connection the summary concerning the electricity stations in Great Britain which was prepared recently is welcome. The return covers 421 generating stations belonging to authorized undertakings as well as eighty others that send in voluntary returns. Of these, 463, consuming coal or coke, generated nearly 5,000,000,000 kw.-hr., with a consumption of 7,356,757 tons of coal or coke, or an average figure of 3.32 lb. per kilowatt-hour. The lowest coal consumption recorded is 1.70 lb. per kilowatt-hour at works in the southwest counties that generated under 3,000,000 kw.-hr. The best thermal efficiency reported is approximately 17.75 per cent, obtained by a large station in Northumberland.

Waste-heat stations produced over 161,000,000 kw.-hr., oil engines nearly 24,000,000 kw.-hr., refuse destructors nearly 18,000,000 kw.-hr., water power less than 5,000,000 kw.-hr., and gas engines approximately 4,000,000 kw.-hr. for the year ended March 31, 1921. The thermal efficiencies of the stations using oil cannot be stated because they did not specify the quantity of fuel used.

In general these figures cannot be held to be very creditable, at least from a thermal point of view. If coal conservation is to be a live issue, they should be improved considerably. On the other hand, doubtless any drastic reduction in the coal used would compel an outlay of more capital than the financial savings to be effected would recoup. The figures support the contention that the larger power stations are more economical, as was to be expected, but the average figure of 2.71 lb. of coal per kilowatt-hour generated in the twenty stations with outputs over 50,000,000 kw.-hr. is still capable of great improvement. In fact, many small private plants using gas engines can easily beat that figure. Moreover, it is obvious that a supply from a station using coal at that rate could not possibly compete with a private plant where heating is also required.

Superpower Study in Pittsburgh District

Selection of Type and Location of Generating Stations — Economics of Bulk-Power Production and Distribution — Comparative Data and Solutions of the Problems Encountered in the Course of Investigation

By **WILLIAM W. HANDY**
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ABOUT ten years ago, prior to the beginning of the great war, some studies were made by the writer of this paper and other engineers, under the general supervision of Charles F. Uebelacker of the engineering firm of Ford, Bacon & Davis, to determine the most economical plan for the generation and distribution of electric power in that part of western Pennsylvania known as the Pittsburgh district. The work was undertaken originally for the Pittsburgh Railways Company and the Allegheny County Light Company, which at the time furnished street-railway and electric light and power service in Pittsburgh and Allegheny County, both companies being controlled by the Philadelphia Company, which, in addition to the street-railway and electric light and power systems, controlled certain natural and artificial gas supplies of the district as well.

While the final development of the system as it now exists, with certain modifications determined from more recent studies, was made under the supervision of engineers other than those making the original studies outlined in this paper, the plans ultimately carried into effect agree very closely with those proposed in the original investigation, indicating careful analyses and sound conclusions on the part of both bodies of men engaged on the work.

Existing Conditions in the Pittsburgh District

As a whole the situation affecting the generation and distribution of power which confronted the original investigators did not differ very materially from that which existed in other large centers of population, owing to the fact that the existing system was composed of a number of consolidated street-railway and electric light and power properties, with the consequent undesirable duplication of certain parts of the systems, such as generating stations, and the further complication, which invariably arises, that under certain of the mortgages applying to the original bond issues property could not be abandoned or sold without legal steps to protect the bondholders' interests.

All of the details requiring investigation cannot, of course, be presented in this paper, but the major factors will be brought out as far as possible. Chief among these were:

1. The railways company was generating its own power and distributing it to its substations or to the 600-volt feeder system direct, mostly from small and inefficient generating stations located haphazardly as regards the system development.
2. The light and power company, while it had two fairly efficient generating stations, had others that were as inefficient as the railway stations.
3. There was no general plan in effect whereby the generation and distribution of power for both railway and light and power purposes was from one central source or sources under the management of an organization whose sole business it was to generate and distribute power at the lowest possible cost.

Street-Railway Power

The most advanced modern practice at the time was for street-railway companies to obtain power where possible at the high-tension buses of their own substations or at the low-tension buses of light and power substations under contracts below the costs at which they could manufacture their own power, thus leaving the railway companies free to devote all their efforts to the business of transporting passengers. Studies were made of existing systems in other cities as well as in Pittsburgh of the several contracts for the purchase of power by street-railway companies, and after a thorough analysis of these data it was apparent that a contract could be entered into between the Pittsburgh Railways Company and the Allegheny County Light Company whereby power could be bought for all street-railway purposes by the former from the latter company at terms satisfactory to each, which would result in a sufficient saving in power cost to the former company and a sufficient profit to the latter to warrant fully putting the plan into effect. A contract carrying out this plan was drawn up and executed, one of the provisions of which was the taking over of the railway generating stations and their operation by the light and power company at certain purchase prices based on actual costs less depreciation, the purpose of the light and power company being to continue to operate certain of the more efficient railway generating stations and to discontinue operation of the others.

Industrial Power

During the time that the above study was being made of the railway power situation another study or survey was under way covering the requirements for industrial power in the Pittsburgh district with a view to ascertaining the quantities and location of the industrial power demand both at the time of the survey and as estimated for future years. An organization was built up for this study, and men were sent into the field to visit all industrial plants which used or might use central-station power and to ascertain in addition to the quantity of power required for each establishment the characteristics of the load, including present costs of power to the industries, amount and time of peak load, number of hours' use and the load factor. Power surveys such as these have been made in practically all industrial centers by the light and power companies, but while there was nothing new about the one made in Pittsburgh, it was of especial importance in view of the fact that a very small amount of central-station power was sold at the time in comparison with the enormous volume of industrial work carried on in the district and the apparently very large revenue to be derived from this source if the industrial establishments could be persuaded to buy central-station power. To sell this power it was necessary, of course, to insure absolute continuity of service and a cost considerably below that at which the industries were generating their own power. The result of these industrial power survey studies indicated that an enormous demand for electric power existed in the Pittsburgh district and that in order to secure it in large quantities it was absolutely essential that the cost of generating and distribution by the power company be at as low a figure as the most advanced development of the art would permit. This meant that old inefficient generating stations must be replaced by modern ones and that the more efficient of the existing stations must be enlarged and improved so as to produce power at the lowest possible cost.

Formation of Power Company

Based on the studies made of the immediate and estimated future requirements for street-railway and industrial power, the peak demands and the location of certain large blocks of power required for industrial purposes, it became evident that under the existing charter of the Allegheny County Light Company power could not be furnished to certain sections of territory outside of Allegheny County. In view of this fact charter modifications became necessary. It was found that a small independent light and power company, known as the Duquesne Light Company, operating a natural-gas engine station in the East End of Pittsburgh, was not only a competitor in the power market to a sufficient extent, considering possibilities of future extensions of operations then under consideration, to warrant the purchase of its plant and charter and franchise rights, but that the charter of the company included certain privileges as to enlargement of territory served outside of Allegheny County which were lacking in the charter of the Allegheny County Light Company and which embraced all the additional rights that the latter company required in order to enable it to furnish certain large blocks of power in sections outside of the boundaries of Allegheny County indicated by the power survey. Negotiations were therefore started for the purchase of the Duquesne Light Company and were consummated soon afterward, and since the date of purchase operations have been carried on under the name and charter of the Duquesne Light Company. The new company is primarily a power company, and while it does retail power wherever necessary in the territory covered by its charter, its fundamental purpose is to generate power at the lowest possible cost and sell it on a wholesale basis.

Careful analyses were made to determine whether or not the existing generating stations should be continued in service or their operation discontinued, these analyses comprising two comparisons briefly described as follows: First, a comparison for each station of the total annual cost of carrying its present load and the estimated cost if the station were discontinued and the load carried by a substation operated with high-tension power; second, a comparison for each station of the total annual cost for peak-load service alone, as compared with the total annual cost of carrying this same peak on a substation operated by high-tension power.

Under the first comparison the cost of operation and maintenance of the old station, together with fixed charges including interest at 10 per cent on the existing salvage value, made up the total cost of production, while the cost with substation power was made up of the operation and maintenance of substations, transmission lines and new generating-station equipment, together with the fixed charges on the investment for these items, including interest figured at 10 per cent. Interest in both cases was taken at 10 per cent on the assumption that it would not pay to replace the present stations unless at least 10 per cent could be earned on the new investment required. The result of these comparisons for the existing total loads indicated that out of a total of nine generating stations all should be discontinued with the exception of three known as Brunot's Island, Rankin and Twentieth Street, the two former being alternating-current and the latter a 600-volt direct-current railway station.

Similarly, under the second comparison for peak-load service only, the analyses included the same comparison of power costs—including operation and maintenance costs of the old station, together with fixed charges, including interest at 10 per cent on the existing salvage value—and costs with substation power, made up of operation and maintenance of substations, transmission lines and new generating-station equipment, together with fixed charges on the investment for these items, including interest figured at 10 per cent. In addition, for peak-load service, the second comparison included the preparation of two curves for each station by years up to and including 1918, one curve giving the costs of power for peak-load service by years with the old station, taking into consideration the estimated growth in peak demand, and the other curve giving the cost of power for the same peak-load service by years for substation power. In those cases where the curve for the old station was entirely above the curve for substation power the old station should be discontinued, but where the curve was below that for substation power or crossed it the old station should be continued in service to the date indicated by the point where the curves crossed, and at that date operation of the old station for peak-load service should be discontinued.

The result of these two comparisons indicated that for the period considered from 1913 up to and including 1918, out of the total of nine generating stations, the three stations known as Brunot's Island, Rankin and Twentieth Street should be in operation in the year 1918; that two stations known as Thirteenth Street and Glenwood should operate until about April, 1916; that one station known as the Duquesne gas station should operate until April, 1914, and that three stations known as Manchester, Thirtieth Street and Suburban should operate not later than the end of the year 1913, or, in other words, be discontinued immediately when substation power could be substituted.

Selection of Type of Prime Movers

Estimates were prepared covering investment and production costs, comprising operation and maintenance expenses and fixed charges on the investment involved for typical sizes of certain types of stations without reference to location, except that they should be in Pittsburgh, and exclusive of the cost of land and the cost of substructure below the basement floor. Of such stations built in Pittsburgh there were three kinds possible—(1) steam stations using coal for fuel with the coal purchased and exclusive of ownership of coal mines; (2) steam stations using natural gas for fuel with the gas purchased from the existing natural-gas system supplying Pittsburgh, and (3) internal-combustion-engine stations using natural gas purchased from the existing natural-gas system. The typical sizes of stations selected for analysis were rated at 40,000 kw., 75,000 kw. and 140,000 kw. for steam stations using coal for fuel, at the same figures for steam stations using natural gas for fuel, and at 15,000 kw. and 30,000 kw. for internal-combustion-engine stations using natural gas. It will be noted that the internal-combustion-engine stations using natural gas were of smaller size in the above comparison than the two other types of station. This was because a larger size than 30,000 kw. was considered impracticable owing to the comparatively small size of the internal-combustion engines then on the market, and because it would be better and more conservative, in view of existing practice in stations of this type, to have four or five of these stations at various locations than a single large one at one location.

From the comparison it was evident that the steam station using coal for fuel had a decided advantage over the two other types, the production costs per kilowatt-hour being on the average for the three load factors considered about 48 per cent higher for the steam station using natural gas for fuel than for the steam station using coal for fuel, and the production costs for the internal-combustion engine stations using natural gas about 23 per cent higher than the costs for the coal-fuel steam station. In view of these production costs for the types of station selected for comparison, both the steam and internal-combustion-engine stations using natural gas purchased from the existing natural-gas system were eliminated from further consideration.

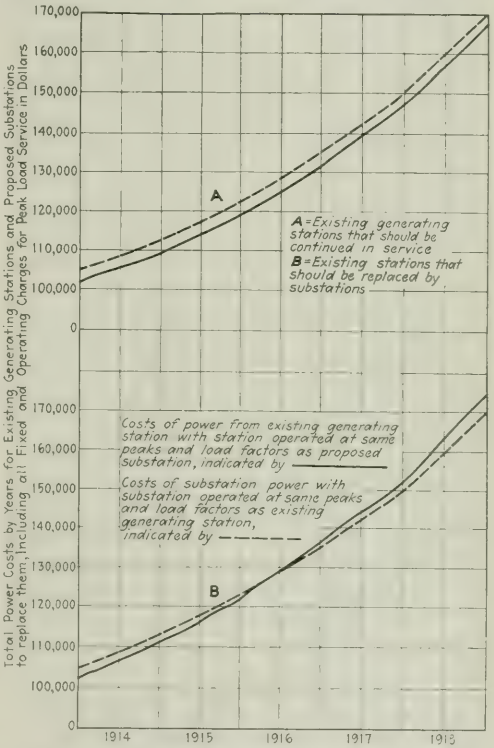
Stations at existing locations and new ones at certain selected sites, including hydro-electric stations, together with steam stations using coal for fuel where there was ownership and operation of coal mines, byproduct coke-oven gas stations, etc., were omitted in this analysis, owing to the fact that the costs of producing and delivering power could be estimated for them only at fixed locations.

Selection of Type and Location of Stations

After the elimination from further consideration of steam stations and internal-combustion-engine stations using natural gas purchased from the existing system and located in Pittsburgh, the next step was to determine the costs of production and delivery of power from existing stations which it had been determined should remain in service and the costs of production and delivery of power from all types of new stations at various sites selected as feasible. For these purposes an organization was perfected and men were assigned to make the investigations to be described.

Steam Stations Using Coal for Fuel at Existing Locations.—Costs were determined for production and delivery of power from the two largest and most economical of the existing coal-fuel steam stations of the company, which it had been determined should be continued in operation—the station on Brunot's Island in the Ohio River, about a mile down the river from the business district of Pittsburgh, and the station at Rankin, on the Monongahela River, about two miles up the river from the business district. The major factors considered at these locations comprised the price of the necessary additional land required for each station to provide an increase in capacity to take care of the future load in the district when operated in conjunction with the then existing station and existing capacity at the other location; the volume and quality of condensing water available; quality of the water for boiler feed; prices of coal both present and estimated for future years, and means and cost of ash disposal.

At Brunot's Island and at Rankin there were sufficient areas for large stations, and at both of these sites there was ample condensing water available for stations of any required size, but the quality was bad for both the use of surface condensers and for boiler feed, that at Rankin being the worse. At both sites there were ample transportation facilities for the delivery of coal to the stations by both water and rail.



GRAPHICAL ANALYSES HELPED SOLVE THE PROBLEM

Estimates of production costs indicated that for the two smaller sizes of station considered—40,000 kw. and 75,000 kw.—Brunot's Island would produce power at the lower cost, while for the largest size, or 140,000 kw., the production costs were the same at both sites. Although the cost of delivered power from Rankin was somewhat lower, the water was of better quality at Brunot's Island, in view of which, together with the large probable increase in power demand down the Ohio River and northwest of Pittsburgh, it was decided that Brunot's Island should be selected as the only existing station where additional equipment should be installed.

Steam Stations Using Coal for Fuel at New Sites Selected as Feasible.—Under the foregoing analyses, the disposition of existing generating stations and the selection of those which could be increased in capacity to produce power at the lowest cost having been determined, the next step was to ascertain feasible sites for new stations of all the types selected as possible, the first type to be considered being steam stations using coal for fuel.

In this study it became evident from the starting of the investigations that if the profit accruing to the coal companies from the mining of coal could be eliminated from the fuel costs to the power company a saving would result in the net cost of power production. In view of this it was determined that any new steam station using coal for fuel should be located in the coal-mining district and on the rivers where sufficient water was available for condensing purposes, and further that the power company should purchase and operate coal property of sufficient acreage to take care of future requirements of the system for at least a fifty-year period. The rivers having sufficient water for condensing purposes to meet the requirements of large generating stations were the Ohio, the Monongahela and the Allegheny. No coal properties were available on the Ohio, while many were available on the two other rivers. From the survey made of the coal fields on these two rivers it was found that to secure sufficient acreage of good coal at a reasonable price and not too far back from the river frontage it was necessary to go up the Monongahela as far as Riverview, about 16 miles from Pittsburgh by air line, and up the Allegheny about 12 miles to Harmarville. It was further found that Morgantown, West Va., on the Monongahela, was the farthest point upstream on this river from Pittsburgh where there was sufficient condensing water at 50 per cent load factor for the smallest size of generating station considered, which was 40,000 kw. At this point ample acreage of good-quality coal was available at a comparatively low price, while on the Allegheny River it was found that the thinness and distance underground of the coal veins and the quality of the coal would not permit mining in sufficient quantity and at a low enough cost to warrant the location of a station farther upstream than at a point in the vicinity of Harmarville. Therefore the sites selected as feasible outside of Pittsburgh for the location of steam stations using coal for fuel narrowed down by a process of elimination to Riverview and Morgantown on the Monongahela River and to Harmarville or vicinity on the Allegheny. Estimates were then prepared for the various sizes of stations selected for comparison, giving the cost of power delivered in Pittsburgh from the selected sites, including fixed charges on the investment required for generating stations, coal lands, mines, transmission and substations, together with the operation and maintenance charges on all of these items. Thus the estimated net costs of power delivered in Pittsburgh from each site were ascertained.

SITE INFLUENCED BY CIRCULATING WATER

From these estimates it was evident that for a new station outside of Pittsburgh using coal for fuel Harmarville would give the lowest cost of power delivered in Pittsburgh, and therefore that site was selected as the best for this type of station. An especially important factor in selecting the Harmarville site, and one which has not been previously mentioned, was the fact that the quality of condensing water was better than at the other locations, the site being on the west side of the river, where the water was not greatly affected by acid from coal mines on the Kiskiminetas and Conemaugh Rivers. While the coal was not of such good quality as that on the Monongahela River, the acreage available was ample, the cost moderate and the minable veins were at a sufficiently shallow depth and of sufficient thickness to make the fuel cost to the power company somewhat lower than at the other locations.

BYPRODUCT STATIONS CONSIDERED

Other Studies of Steam Stations and Internal-Combustion-Engine Stations at New Sites Selected as Feasible.—Space in this paper will not permit of setting forth in detail all of the studies made of the costs of production and delivery of power for all types of steam and explosion-engine stations from sites outside of Pittsburgh considered as feasible. A brief outline of the studies made and the net results are given in order to explain the conclusions reached with sufficient clearness for the purposes of this paper. These studies included the following:

1. Steam stations using byproduct coke-oven gas for fuel, including fixed and operating charges on coal acreage and mines and byproduct coke ovens, together with the revenue to be derived from the sale of the coke-oven byproducts.

The sites included Morgantown, West Va., where it was proposed to purchase the necessary coal acreage and to own and operate both mines and coke ovens. Estimates of the cost of producing power and of delivering it to Pittsburgh with all the generation at the Morgantown site were made, together with estimates of generating and transmitting the same quantity of power from Morgantown combined with the shipment of the power company's coal by river and rail to Brunot's Island and the generation and delivery of the power required from Brunot's Island with Morgantown coal. It was found that under these conditions, while the costs of power were very low, the actual investment required was enormous and the problem of financing uncertain. Moreover, the necessity of the power company's going into the byproduct coke-oven business was held to be an undesirable complication. Taking all these factors into consideration, it was evident that a mine owned and operated by the power company and combined with a byproduct coke-oven-gas generating station at Morgantown was impracticable.

2. The same analyses as above were made for mines supposedly owned and operated by the power company at Morgantown, and for the shipment of coking coal to a byproduct coke-oven gas-fuel generating station supposedly owned and operated by the power company at Rankin, together with the shipment of the power company's coal from Morgantown to Brunot's Island. It was found under these conditions that the cost of delivered power was higher than under the first plan with the generating station at Morgantown, and owing to this and the enormous investment and the difficulty of financing the plan it was eliminated.

3. Byproduct coke-oven internal-combustion-engine stations, including fixed and operating charges on coal acreage and mines and byproduct coke ovens, together with the shipment of power-company coal from Morgantown to Rankin and Brunot's Island, gave extremely low power costs, but the same undesirable features as to excessive investment, difficulty of financing, etc., were inherent in the plan, and it was therefore abandoned as impracticable.

4. Studies as to the cost of producing and delivering in Pittsburgh power from natural-gas internal-combustion-engine stations in the West Virginia gas fields, with gas purchased in the fields and without investment in

gas wells or delivery lines to the generating stations, resulted in arriving at a comparatively high net cost of power delivered, and this method was therefore eliminated from further consideration.

5. Additional studies were made as to the cost of producing and delivering power from internal-combustion-engine stations in Pittsburgh, with byproduct coke-oven gas purchased in Connellsville district and pumped to Pittsburgh in duplicate power-company pipe lines, and with natural gas purchased in the West Virginia gas fields and pumped to Pittsburgh through duplicate power-company pipe lines also, the compressing stations in both instances being owned by the power company and the gas compressed for transmission to 350 lb. in each case, two compressions being estimated as required for coke-oven gas and one for natural gas. The results of the analyses indicated a net cost of power delivered in Pittsburgh too high for further consideration, and in view of this, together with the experimental nature of the project, high investment, difficulty of financing, etc., the plan was eliminated.

While it was believed from the start, owing to all the uncertain factors involved in the production of power from coke-oven gas and from natural gas, that any plan using gas as a source of power would be eliminated in the final analysis, it was considered that a survey of the problem of the generation and distribution of power in the Pittsburgh district would not be complete unless such analyses were made.

Hydro-Electric Power from Developments Selected as Feasible.—So far, the studies made having disposed of the questions of continuing in operation certain existing generating stations, of discontinuing the operation of certain other existing generating stations and on what dates, of the selection of one existing generating station for the installation of additional equipment, and of the determination of a site for a new station to be of the steam-coal-fuel type, including ownership and operation of mines, there still remained one question to settle and that which it was expected from the beginning would be the all-important one. This question was whether or not hydro-electric power could be developed and delivered in Pittsburgh at a sufficiently low cost to warrant the necessary investment. The investigation made of this subject was especially comprehensive and thorough, involving careful studies of all United States Geological Survey and state survey data on topography, rainfall and stream flow for the sections surveyed to date, together with field inspections of all the hydro-electric developments indicated by these surveys as possible and field inspections and surveys of sections of territory not covered by either the federal government or state surveys and including the territory within a radius of about 150 miles from Pittsburgh as a center. After several months of this investigation conducted in the office and in the field the possible projects narrowed down to a total of ten developments, which by a further process of elimination were reduced to two developments considered as entirely feasible from all viewpoints. For the purposes of this paper these are designated as Sites No. 1 and No. 2.

From a consideration of power alone, both as to quantity and as to cost, the development at Site No. 1 was the best, but the investment was large and the distance of transmission excessive as compared with a smaller investment for the development at Site No. 2 and a much shorter transmission. Owing to the above considerations and the fact that the financing of the No. 2 site could be more readily effected, the latter was selected as the most feasible.

With the No. 2 site selected, further comparisons were made to determine whether it would be more economical to generate power from steam stations alone or to combine hydro-electric power from the No. 2 site with steam generation at Brunot's Island, Rankin and Harmarville. Estimates covering this involved much detail, but the results indicated that all steam generation for the immediate future would be slightly more economical than part hydro-electric and part steam. This is not readily apparent in view of the fact that the cost of hydro-electric power at 50 per cent load factor delivered in Pittsburgh from the No. 2 site was less than the cost of power from steam stations using coal as fuel and operated at the same load factor. The apparent contradiction is brought about, however, by the reduction in load factor and the increase in kilowatt-hour costs made necessary for the steam stations in order to utilize the hydro-electric power, and the consequent increase in the net cost of power per kilowatt-hour from the hydro-electric and steam combination as compared with all-steam generation.

FINAL RESULT OF STUDY

While it was considered that the advantage of water power would become more apparent in the future, owing to the inevitable increase in the cost of coal, it was apparent also that improvements in the art of steam-station design and operation due primarily to the increase in the sizes and higher efficiencies of steam turbines and boiler units might readily offset the increase in fuel costs.

In view of all these uncertainties, with the enormous investment required for hydro-electric stations of comparatively small size, as well as the equally large investments required for steam stations using gas for fuel, it was evident that for the immediate and future requirements in the western part of the district both down the Ohio River and up the Monongahela the more conservative policy would be to increase the capacity of the coal-fuel steam station at Brunot's Island; that to provide for the immediate and future requirements of the eastern part of the district, together with the very large additional industrial power demand throughout the district as a whole, the construction of a coal-fuel steam station should be started in the near future at or near Harmarville on the Allegheny River, and that all of the stations should be interconnected by adequate high-tension bus lines to permit of the most economical operation of the entire system.

The Harmarville site was later abandoned largely because of the cost of necessary dredging required for deepening the channel for condensing water, and the location of the present large station at Colfax, or Cheswick as it was known in the original investigations, and the acquisition of the coal-mining property appertaining to it were finally determined upon, in accordance with recommendations made jointly by Ford, Bacon & Davis and the chief engineer of the Duquesne Light Company. The present Colfax station is, however, within a few miles of the originally selected Harmarville site on the Allegheny River, and the assumption is warranted that the analyses made and the conclusions reached in both the original and the final investigations were, generally speaking, correct as to the solution of the broad problem of power production and distribution for the Pittsburgh district.

Comparing Direct and Indirect Lighting[*]

Experiments Put the Average Intensities for Ordinary Reading at 2.8 Foot-Candles for Direct Lighting and 4 Foot-Candles for Indirect

By William Kunerth
Associate Professor of Physics, Iowa State College

THE contradictions in existing data have opened anew the question of the relative intensities required under direct and under indirect lighting systems, and it was the hope of the writer to ascertain why a person needs more natural light than artificial light for a certain kind of work. Accordingly it was planned to make an experiment on a great number of individuals and under conditions such that the illumination would be decidedly diffused in one case and exclusively direct in the other case. The room used for this experiment was 30 ft. long, 18½ ft. wide and 13 ft. high. The ceiling and the upper half of the walls were painted white; the lower half of the walls and the floor were drab.

For the direct lighting the lamps were hung 7 ft. above the floor, and opaque white-enameled reflectors were used. As this work was done at night (actually between 7 p.m. and 8 p.m.), the window shades were raised so that no light was reflected from them but so that the light passed out through the windows. Every precaution possible was taken to have all the light on the book come directly from the fixtures.

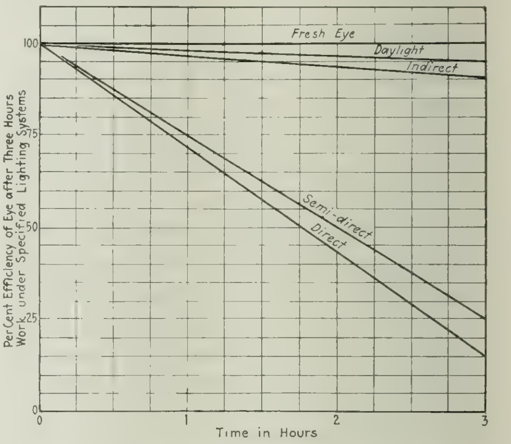
For the indirect system silvered reflectors of the opaque-bowl type were used, and thus no light passed directly from the light sources to the printed page. They were hung about 2 ft. below the ceiling. In this case the yellow window shades were pulled down so as to augment the reflected light. Gas-filled lamps were used in both cases. The value of the current which it was necessary to put through the lamps in order to get the illumination approximately the same in the two cases was ascertained by a preliminary test. At the same time, the current was so adjusted as to produce a variation in lighting intensity from one which was too low for comfortable reading to one which was too high.

After the twenty-six individuals had been under any one condition of illumination for upward of five minutes they were asked to put down their opinion of the lighting on the basis of the instructions given them. Then the current through the lamps was changed and observations again made. In this way five different values of current were used, changes in intensity being made by irregular stages and not always in the same direction, and the individuals did not know but that any value of current might be duplicated. Then the other system was installed and the five conditions repeated, except that the current values differed from the first set because of the difference in the efficiency of installation already noted. During the few minutes while the change was being effected from one system to the other the students were free to move about in the room. The arm of the chair on which the book was placed was 28 in. above the floor and sloped at an angle of 2½ deg. from the horizontal.

After the individuals had recorded their estimates of the illumination on their books under these conditions, the same conditions were repeated and the intensity in foot-candles which each individual had had on his book was measured by means of a Macbeth illuminometer. The number of foot-candles which each one considered as "just right" by the two systems is given in the table herewith. It will be seen that a few estimates are very high, while a few others are very low.

Even though some of the students required much less illumination intensity than is ordinarily considered satisfactory, it may be noted that they required less of both indirect and direct lighting and hence the ratio between the two, the determination of which was the chief object of this experiment, is left practically unaltered.

When we drop out the abnormal intensities we get an average of 2.77 foot-candles for the direct and 4.13 foot-candles for the indirect. It may be seen, therefore, that by the indirect system we need an intensity almost 50 per cent greater than that required by the direct system for the same kind of work.



COMPARISON OF DIFFERENT FORMS OF ILLUMINATION

Since under the indirect lighting system everything in the field of vision is about equally illuminated, the pupil contracts much more than it does under the direct system, where much of the field is dark. In the latter case the pupil will enlarge to allow more light to enter and will soon come to a state where a person can read print comfortably even though the actual intensity is small. It seems then that the illumination intensity required depends quite largely upon the brightness of the objects in the field of vision. If they are as bright as the objects on which we wish to focus our attention, then a high intensity is required; if, on the other hand, they are dark, the pupil will enlarge to take in a big flood of light and a smaller intensity will suffice.

The question which was at the bottom of this undertaking and which really prompted it was why a greater intensity of natural light is required for the same kind of work than is required of artificial light. Since natural lighting is only an extreme case of indirect lighting, it will be evident that our question is answered by the above data. It seems reasonable that this should be the case, for with indirect or natural lighting the objects in the range of vision are illuminated and the light reflected into the eye causes a contraction of the

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[*] Abstract of a paper presented before the Iowa Academy of Science.

INTENSITIES IN FOOT-CANDLES REQUIRED FOR READING ORDINARY TEXTBOOK PRINT BY TWO SYSTEMS OF LIGHTING

	Direct	Indirect		Direct	Indirect
1	2.0	2.5	14	3.0	3.5
2	7.0	5.7	15	3.0	[illegible]
3	3.0	2.0	16	2.3	5.0
4	2.3	2.3	17	3.0	6.5
5	1.1	1.9	18	4.0	6.7
6	1.8	4.9	19	3.0	3.0
7	2.0	6.0	20	3.0	3.0
8	5.0	6.5	21	1.0	3.7
9	5.0	3.0	22	1.5	6.0
10	3.0	5.0	23	2.0	6.0
11	2.5	4.3	24	2.3	2.3
12	3.0	2.3	25	2.3	2.5
13	3.0	4.5	26	1.7	3.0
Average				2.8	4.0

pupil, and hence a greater intensity is required for clear vision. For the direct artificial lighting most of the light which enters the eye comes from the printed page, and hence the pupil is larger and clear vision is obtained with a lower intensity.

In the direct lighting system the path of the beam of light from the source to the book is short—much shorter than for the indirect system. It follows, therefore, that the flux of light on the floor near the individual for the direct system is much less than on his book, but such is not the case for the indirect system where the path of the beam of light from the source to the book is almost the same as from the source to the floor. Thus if we had 3 foot-candles on the book by each system and 2 foot-candles on the floor by the direct system, we should probably have 2.8 foot-candles on surrounding objects by the indirect system. This would cause pupillary contraction, and hence a greater intensity would be required for clear vision.

Color Does Not Affect Results

It may be argued that in this experiment the change of current through the lamps caused a change in color which served to affect the results, but whenever the color was abnormal, owing to the small current, the intensity was too low for comfortable reading and hence did not affect the conclusion here arrived at.

Again, it may be urged that five minutes was too short a time in which to form a final opinion on a lighting system, but inasmuch as the persons concerned had been studying illumination for three months, and since an equal period was allowed for each condition or illumination, it is felt that the conclusions here arrived at can be considered reliable.

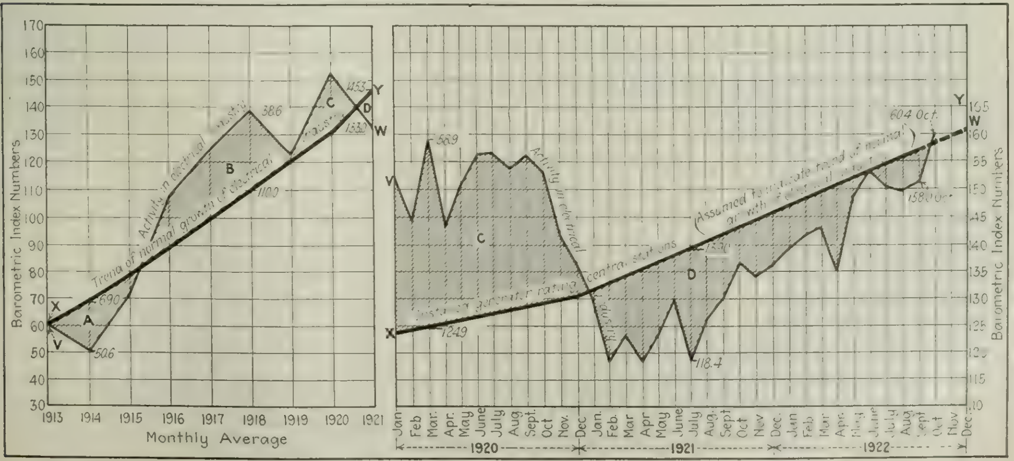
Industrial Activity Back to 1920 Levels

INDEX figures upon which the "Electrical World Barometer of Business Conditions in the Electrical Industry" is based indicate that October activity within the industry was in excess of even the peak month of 1920. The end of the tie-up in the bituminous-coal industry enabled the primary industries of the country to expand operations to meet the accumulation of unfilled orders and the natural growth of demands for commodities. Iron and steel mills, textile mills, coal mining, copper production, automobile production and cement and brick production all reported largely increased operations over September.

The "Electrical World Barometer" indicates that during the month of October business conditions in the electrical industry, taken as a whole, were, for the first time since December, 1920, above what would have been the point of seasonal demand if growth in the industry had been normal. The basic data indicate an increase of 9.0 points in the barometer scale as compared with September. The electrical industry as a whole was operating at 2.4 points above what would have been the point of seasonal demand if growth in the industry had been normal. In September it was operating at 5.9 points below the point of normal demand.

It would appear that the electrical industry is headed for a long season of unusual activity and that the area "D" of the "Electrical World Barometer" has at last been closed. Central-station operations for October were approximately 6 per cent above those of September and about 25 per cent above those of October last year. October witnessed only the beginning of the increased winter activities of the electric light and power division of the industry, and the returns in that month point unmistakably to a season of record-breaking operations in every branch of electrical business.

ELECTRICAL WORLD BAROMETER of ELECTRICAL BUSINESS CONDITIONS

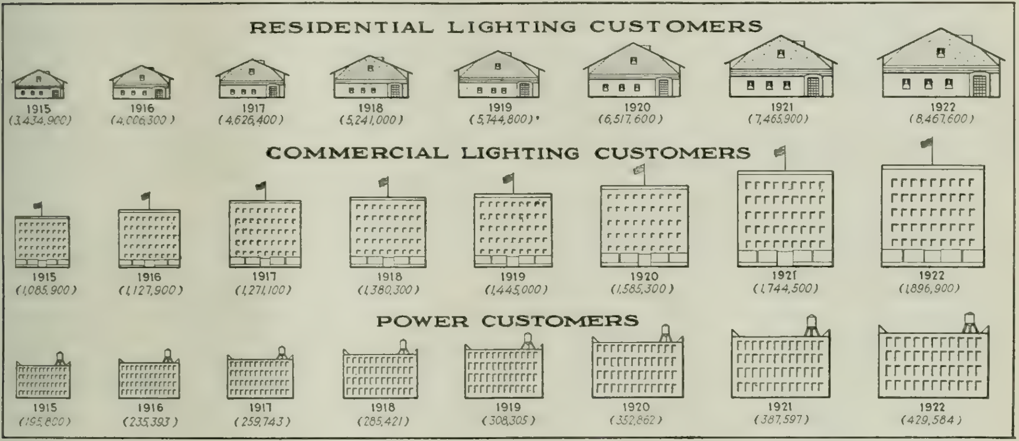


Commercial Lighting Customers Served by Electric Light and Power Companies

State and Sections	Jan. 1, 1916			Jan. 1, 1917			Jan. 1, 1918			Jan. 1, 1919			Jan. 1, 1920			Jan. 1, 1921			Jan. 1, 1922		
	Total Number (Thousands)	New Customers During 1915 (Thousands)	Per Cent Gain During 1915	Total Number (Thousands)	New Customers During 1916 (Thousands)	Per Cent Gain During 1916	Total Number (Thousands)	New Customers During 1917 (Thousands)	Per Cent Gain During 1917	Total Number (Thousands)	New Customers During 1918 (Thousands)	Per Cent Gain During 1918	Total Number (Thousands)	New Customers During 1919 (Thousands)	Per Cent Gain During 1919	Total Number (Thousands)	New Customers During 1920 (Thousands)	Per Cent Gain During 1920	Total Number (Thousands)	New Customers During 1921 (Thousands)	Per Cent Gain During 1921
United States	1,127.9	110.8	10.8	1,271.1	143.2	12.7	1,380.3	109.2	8.4	1,445.0	64.7	4.8	1,585.3	140.3	9.7	1,744.5	159.2	10.1	1,896.9	152.4	8.7
SECTIONS																					
New England	95.1	8.9	10.2	102.4	7.3	7.7	110.9	8.5	8.3	115.2	4.3	4.0	126.5	11.3	9.7	144.8	18.3	14.5	158.2	13.4	9.2
Middle Atlantic	270.0	32.3	13.6	303.8	33.8	12.3	328.2	24.4	8.2	343.7	15.5	4.6	386.1	42.4	13.2	425.5	39.4	10.3	460.7	35.2	8.2
South Atlantic	76.1	5.0	7.1	82.7	6.6	8.6	88.7	6.0	7.2	94.5	5.8	6.4	105.4	10.9	11.5	120.1	14.7	14.0	132.9	12.8	10.6
East North Central	273.5	14.7	5.6	323.4	49.9	18.2	350.2	26.8	8.3	362.1	11.9	3.4	399.9	37.8	10.3	425.6	25.7	6.4	464.1	38.5	8.9
West North Central	148.2	22.1	17.5	169.7	21.5	14.4	187.6	17.9	10.6	196.1	8.5	4.5	209.1	13.0	6.6	229.9	20.8	10.0	243.3	13.4	5.8
East South Central	41.8	3.5	9.2	44.4	2.6	6.2	47.1	2.7	6.0	49.4	2.3	5.0	50.6	1.2	2.5	55.3	4.7	9.4	58.8	3.5	6.3
West South Central	39.4	4.0	11.4	46.5	7.1	18.0	54.6	8.1	17.4	60.1	5.5	10.0	67.3	7.2	12.0	75.3	8.0	11.8	81.6	6.3	8.4
Mountain	41.3	2.9	7.7	46.5	5.2	12.4	50.8	4.3	9.4	51.2	0.4	0.7	52.7	1.5	2.9	54.9	2.2	4.2	55.7	0.8	1.3
Pacific	142.5	17.4	11.4	151.7	9.2	6.4	162.2	10.5	7.0	172.7	10.5	6.4	187.7	15.0	8.6	213.1	25.4	13.5	241.6	28.5	13.3
NEW ENGLAND:																					
Maine	15.2	1.4	10.2	16.1	0.9	5.9	17.7	1.6	10.0	18.3	0.6	3.4	20.3	2.0	10.9	23.3	3.0	14.8	24.8	1.5	6.4
New Hampshire	1.6	0.2	14.2	1.8	0.2	12.4	1.9	0.1	5.5	2.1	0.2	10.5	2.5	0.4	19.1	3.0	0.5	20.0	3.1	0.1	3.2
Vermont	7.5	1.1	17.1	7.8	0.3	3.9	8.1	0.3	3.8	8.3	0.2	2.5	9.2	0.9	10.8	10.6	1.4	15.2	11.5	0.9	8.4
Massachusetts	39.4	2.1	5.5	42.8	3.4	8.6	46.4	3.6	8.2	48.0	1.6	3.4	52.0	4.0	8.3	61.4	9.4	18.1	67.5	6.1	10.0
Rhode Island	14.4	2.8	24.2	15.6	1.2	8.3	16.9	1.3	8.3	17.5	0.6	3.5	19.0	1.5	8.5	21.9	2.9	15.2	25.1	3.2	14.6
Connecticut	17.0	1.3	8.2	18.3	1.3	7.6	19.9	1.6	8.8	21.0	1.1	5.5	23.5	2.5	11.8	24.6	1.1	4.6	26.2	1.6	6.5
MIDDLE ATLANTIC:																					
New York	144.3	18.3	14.5	162.2	17.9	12.3	173.5	11.3	7.0	183.4	9.9	5.7	209.5	26.1	14.2	232.5	23.0	11.0	252.0	19.5	8.4
New Jersey	35.9	4.2	13.2	41.1	5.2	14.3	46.5	5.4	13.2	48.8	2.3	5.0	55.3	6.5	13.3	61.0	5.7	10.3	66.0	5.0	8.2
Pennsylvania	89.8	9.8	12.4	100.5	10.7	12.0	108.2	7.7	7.5	111.5	3.3	3.1	121.3	9.8	8.8	132.0	10.7	8.8	142.7	10.7	8.2
SOUTH ATLANTIC:																					
Delaware	1.3	0.2	18.2	1.4	0.1	7.6	2.3	0.9	64.2	2.4	0.1	4.3	2.7	0.3	12.4	3.1	0.4	14.8	3.4	0.3	9.6
Maryland	10.4	1.1	11.8	11.9	1.5	14.3	14.0	2.1	17.6	14.3	0.3	2.1	15.6	1.3	9.1	16.2	0.6	3.8	18.5	2.3	14.2
District of Columbia	7.0	0.7	11.1	7.9	0.9	12.8	8.3	0.4	5.0	9.7	1.4	16.8	10.5	0.8	8.1	11.1	0.6	5.7	12.5	1.4	12.5
Virginia	9.9	0.3	3.0	10.7	0.8	8.1	11.2	0.5	4.6	11.2	0.0	0.0	12.2	1.0	8.9	12.8	0.6	4.9	13.0	0.2	1.5
West Virginia	3.4	0.5	17.2	4.0	0.6	17.6	4.2	0.2	5.0	5.1	0.9	21.4	5.8	0.7	13.6	7.8	2.0	34.5	9.2	1.4	17.9
North Carolina	11.8	0.7	6.3	12.7	0.9	7.6	13.2	0.5	3.9	14.8	1.6	12.2	16.7	1.9	12.8	19.0	2.3	13.8	20.8	1.8	9.3
South Carolina	6.5	0.2	3.2	7.0	0.5	7.6	7.1	0.1	1.3	8.1	1.0	14.0	9.3	1.2	14.7	10.6	1.3	13.9	13.1	2.5	23.6
Georgia	16.2	1.3	8.6	17.5	1.3	8.0	17.8	0.3	1.7	17.5	-0.3	—1.7	21.0	3.5	20.0	27.0	6.0	28.6	28.4	1.4	5.2
Florida	9.6	0.0	0.0	9.6	0.0	0.0	10.6	1.0	10.3	11.4	0.8	7.6	11.6	0.2	1.7	12.5	0.9	7.8	14.0	1.5	12.0
EAST NORTH CENTRAL:																					
Ohio	61.4	6.0	10.7	68.2	6.8	11.1	75.2	7.0	10.3	76.4	1.2	1.5	86.9	10.5	13.8	91.4	4.5	5.2	96.6	5.2	5.6
Indiana	20.7	1.5	7.8	22.6	1.9	9.1	26.6	4.0	17.7	27.4	0.8	3.0	31.5	4.1	14.9	37.7	6.2	19.6	42.0	4.3	11.3
Illinois	97.0	4.7	5.0	120.3	23.3	24.0	126.8	6.5	5.4	133.5	6.7	5.2	147.5	14.0	10.4	153.8	6.3	4.3	170.3	16.5	10.8
Michigan	66.7	0.7	1.0	82.2	15.5	23.2	90.4	8.2	10.0	91.5	1.1	1.2	96.0	4.5	4.8	102.2	6.2	6.5	111.2	9.0	8.8
Wisconsin	27.7	1.8	6.9	30.1	2.4	8.6	31.2	1.1	3.6	33.3	2.1	6.7	38.0	4.7	14.1	40.5	2.5	6.6	44.0	3.5	8.6
WEST NORTH CENTRAL:																					
Minnesota	35.9	11.4	46.5	43.2	7.3	20.3	45.2	2.0	4.6	45.9	0.7	1.6	48.8	2.9	6.3	53.2	4.4	8.8	56.1	2.9	5.4
Iowa	21.3	0.7	3.4	21.7	0.4	1.8	22.2	0.5	2.3	22.7	0.5	2.3	22.8	0.1	0.4	25.1	2.3	10.0	27.6	2.5	10.0
Missouri	37.6	4.6	14.0	44.0	6.4	17.0	53.0	9.0	20.5	58.2	5.2	9.7	63.5	5.3	9.1	70.2	6.7	10.5	74.4	4.2	6.1
North Dakota	8.1	1.6	24.5	9.4	1.3	16.0	11.0	1.6	17.0	11.1	0.1	0.9	11.5	0.4	3.6	12.6	1.1	8.7	13.3	0.7	5.5
South Dakota	8.3	0.0	0.0	8.9	0.6	7.2	9.6	0.7	7.8	9.7	0.1	1.0	10.7	1.0	10.3	11.8	1.1	10.3	12.5	0.7	6.0
Nebraska	23.8	2.4	11.2	24.8	1.0	4.1	25.9	1.1	4.5	25.9	0.0	0.0	27.5	1.6	6.3	30.0	2.5	9.1	31.0	1.0	3.3
Kansas	13.2	1.4	11.8	17.7	4.5	34.2	20.7	3.0	17.0	22.6	1.9	9.2	24.3	1.7	7.5	27.0	2.7	11.1	28.4	1.4	5.2
EAST SOUTH CENTRAL:																					
Kentucky	17.1	1.3	8.2	17.9	0.8	4.7	19.2	1.3	7.3	19.6	0.4	2.1	20.7	1.1	5.6	22.3	1.6	7.8	24.2	1.9	8.5
Tennessee	10.7	1.9	21.5	11.5	0.8	7.4	11.8	0.3	2.5	12.5	0.7	5.8	11.6	—0.9	—7.2	12.9	1.3	11.2	13.5	0.6	4.6
Alabama	5.3	0.3	6.0	6.3	1.0	18.8	6.6	0.3	4.8	7.1	0.5	7.5	7.9	0.8	11.2	8.6	0.7	8.8	9.1	0.5	5.8
Mississippi	8.7	0.0	0.0	8.7	0.0	0.0	9.5	0.8	9.2	10.2	0.7	7.3	10.4	0.2	2.0	11.5	1.1	10.5	12.0	0.5	4.2
WEST SOUTH CENTRAL:																					
Arkansas	6.9	0.9	15.0	8.1	1.2	17.4	9.1	1.0	12.2	9.9	0.8	8.7	11.2	1.3	13.1	12.4	1.2	10.6	12.8	0.4	3.2
Louisiana	5.7	0.7	14.0	6.7	1.0	17.5	7.5	0.8	11.9	8.2	0.7	9.3	9.3	1.1	13.3	11.8	2.5	26.7	12.6	0.8	6.8
Oklahoma	7.6	0.5	7.0	8.3	0.7	9.2	9.1	0.8	9.6	9.9	0.8	8.7	11.2	1.3	13.1	12.1	0.9	8.0	13.6	1.5	12.4
Texas	19.2	1.9	11.0	23.4	4.2	21.8	28.9	5.5	23.5	32.1	3.2	11.1	35.6	3.5	10.8	39.0	3.4	9.5	42.6	3.6	9.2
MOUNTAIN:																					
Montana	6.1	0.8	15.1	6.5	0.5	8.2	7.8	1.2	18.0	8.8	1.0	12.8	8.5	—0.3	—3.4	8.7	0.2	2.3	8.6	—0.1	—1.1
Idaho	10.1	1.0	10.9	10.6	0.5	4.9	11.0	0.4	3.8	11.1	0.1	0.8	11.8	0.7	6.3	12.3	0.5	4.2	12.1	—0.2	—1.6
Wyoming	3.6	0.4	12.5	3.7	0.1	2.6	3.9	0.2	5.4	3.9	0.0	0.0	4.2	0.3	7.7	4.4	0.2	4.8	4.9	0.5	11.3
Colorado	11.3	0.0	0.0	12.5	1.2	10.5	13.6	1.1	8.7	13.5	—0.1	—0.7	13.6	0.1	0.7	14.2	0.6	4.4	14.6	0.4	2.8
New Mexico	1.7	0.0	0.0	1.8	0.1	5.9	2.0	0.2	11.1	1.7	—0.3	—15.0	2.1	0.4	23.5	2.2	0.1	4.7	2.3	0.1	4.5
Arizona	1.2	0.2	20.0	1.5	0.3	25.0	1.6	0.1	6.7	1.7	0.1	—0.6	1.9	0.2	11.7	2.0	0.1	5.2	2.0	0.0	0.0
Utah	5.4	0.6	12.5	8.0	2.6	48.0	9.1	1.1	13.6	9.1	0.0	0.0	9.1	0.0	0.0	9.5	0.4	4.4	9.5	0.0	0.0
Nevada	1.9	—0.1	—0.5	1.8	—0.1	—5.3	1.8	0.0	0.0	1.4	—0.4	—22.2	1.5	0.1	7.1	1.6	0.1	6.6	1.7	0.1	1.4
PACIFIC:																					
Washington	35.1	5.5	18.5	34.4	—0.7	—2.0	35.7	1.3	3.7	38.2	2.5	7.0	38.9	0.7	1.9	40.9	2.0	5.2	40.3	—0.6	—1.5
Oregon	12.0	1.1	10.2	13.1	1.1	0.9	13.7	0.6	4.5	13.1	—0.6	—4.4	14.2	1.1	8.3	14.9	0.7	4.9	16.0	1.1	7.3
California	95.4	10.8	12.8	104.2	8.8	9.2	112.8	8.6	8.2	121.4	8.6	7.7	134.6	13.2	10.7	157.3	22.7	17.0	185.3	28.0	17.8

Central-Station Customers Total 10,800,000

More Than 78 per Cent of This Number Are Domestic Lighting Customers — The Commercial Lighting Customers Total 1,896,900—Six Million Patrons Added in Seven Years



THE GROWTH IN CENTRAL-STATION CUSTOMERS HAS BEEN WITHOUT A BREAK

IF THE success and prosperity of any undertaking can be measured by the extent to which its product is consumed by the field it is striving to serve, then the electric light and power industry must be classed as successful and prosperous. The fact that this growth has continued through a period of record financial and business depression, during which practically all other primary industries were forced to make extensive curtailments in operations, is an added proof of the extent to which the electric light and power industry has intertwined itself with the framework of America's industrial, domestic and commercial being.

More than six million new customers of all classes have been added to the service lines of the central generating and distributing companies during the past seven years, according to a country-wide survey, recently completed by the *Electrical World.* On Jan. 1, 1922, there were 10,794,084 central-station customers. Of these 8,467,600, or 78.4 per cent, were domestic lighting customers; 429,584, or 4.0 per cent, were industrial power customers, and 1,896,900, or 17.6 per cent, were commercial lighting customers. Details of the growth in number of domestic lighting customers will be found in the *Electrical World* for Jan. 14, 1922, and the industrial power customers were covered in the issue of Sept. 23, 1922.

The accompanying tabulations and diagrams indicate the annual growth in the number of central-station commercial lighting customers. Under this classification are included stores, hotels, theaters, schools, hospitals, public buildings, etc. It appears from returns received from about 70 per cent of the electric light and power industry that during the period of extreme industrial and business inactivity last year 152,400 new customers of this class were added to the lines, which is only slightly less than the number added during 1920, the peak year in American business.

It is but natural that the sections of the country having the largest population should report the greatest number of commercial lighting customers. The East North Central and the Middle Atlantic States have almost the same number of customers of this class, 464,100 and 460,700 respectively. The West North Central States follow with 243,300, and the three Pacific States taken as a whole are fourth with 241,600 customers.

New York, with 252,000, easily leads the states of the Union in the number of commercial lighting customers. This is due primarily not only to the fact that the metropolis of the nation is in this state but also to the circumstance that 82.7 per cent of the people of New York State live in towns and cities of more than 2,500 population.

California reports the second largest number of commercial lighting customers, with 185,300. The reason, however, for this relatively large number of customers is quite different from that given for New York State. Almost one-third of the people of California live in rural districts, but the transmission and distribution systems of the central-station companies of that state cover virtually every rural section, and it is a very rare exception when rural hotels and stores are not electrically lighted. Moreover, California's commercial growth is recent and rapid as compared with that of the older states of the East, California's population having quadrupled during the last forty years.

Getting Closer to the People*

Utility Official Should Represent Company in Giving News to the Press and the Public

Use of Advertising

By Joseph B. Groce
Director New England Bureau of Public Service Information, Boston

GRADUALLY the public is going to know more about its public utilities than it ever did before. The destructive force of silence is no longer at work in the public utility industry. By the "public" we do not mean politicians. What kind of a man is a politician? Some one has said:

"If he is successful, if he is a man who can win elections, he is a man who takes public opinion as he finds it. He wastes little or no time in attempting to mold public opinion. He spends most of his time finding out what the public wants and trying to get it. At least he does this for his constituents. If he does not, he will be unable to get their votes. As public opinion changes he changes or he loses his power as a politician. His tenure of office depends upon the people. If the people are all against a public utility and he makes it as unpleasant as he can for that utility, he gets votes. On the other hand, if that utility turns around and educates the people and wins their favorable opinion, he must keep his hands off or lose votes."

The first point to bear in mind, therefore, is this question of public opinion. If a public utility allows false impressions to linger and grow until they seem to the public at large like actual facts, how can that public utility expect the public at large to feel favorable toward it? On the other hand, if the public utility is well managed, if it is giving efficient service, if it is a company the community may well be proud of, and the management takes steps to give the public the real facts, it stands to reason that a lot of trouble is going to be avoided.

J. F. Hull, president of the Missouri Press Association, in a recent address before the Missouri Association of Public Utilities stressed these three points:

1. Managers of public service companies should keep in close personal touch with their customers.

2. Employees of public service companies should not spare any pains to explain the methods of operation, cost, rates, etc., to customers. Explain the cause of any failure to render good service and point out ways in which the service may be made better.

3. Public utilities should fully explain facts of operation and seek to obtain and retain the good will and confidence of the people. The local press offers the best means of accomplishing this essential condition.

That last sentence is the second point to bear in mind—use of the local press in order to educate the public and for the purpose of establishing and fostering a good public opinion.

It seems to me that every well-managed public utility should have one man in its organization, and preferably one of its chief executives, with whom the local newspapers could consult at all times, freely and frankly, in regard to the public policy of the utility.

If a newspaper man is sent to a public utility office for a piece of news, he should not be turned over to anybody and everybody to get his information. He should always have an opportunity to get a plain statement of facts from a reliable source. The cub reporter is the future editor, and the editors of our newspapers are a large factor, even today, in shaping public opinion. There is in my judgment, therefore, no safer, saner way to establish and foster a good public opinion for a company—always dependent of course on the fact that it is giving good service at fair rates—than to have an *entente cordiale*, as the French say, with local newspapers.

One other factor must be added to this. There must be a courteous, obliging, considerate corps of officials—managers, superintendents and employees. Some one has said: "With these two factors, good service at fair rates and courteous officials, no utility is likely to experience any great amount of unfavorable public sentiment. Without these the case is absolutely hopeless."

Finally, there should be intelligent, persistent and consistent publicity on the part of every public utility.

In a general way, our *News Bulletin* is supplying each week to every newspaper in New England, both daily and weekly, something educational and, we feel, something worth reprinting.

But newspapers are particularly anxious at all times to get information and news with local color. Would it not be a good practice, therefore, to cultivate this field and make a regular business of supplying each week some piece of information, some local news, in regard to what is happening or going to happen in the company? Through the publication in the newspapers of this material public confidence is going to grow, for the public will soon realize that the utilities are being frank with them, that there is no mystery in the public utility industry, and the newspaper editor, if he has been unfavorable, will soon realize that frank statement of conditions, a willingness always to tell the facts, an appreciation of the real public ownership of the public utilities by the public, is not to be ignored.

Having prepared the way for better public relations through local executives and their department heads, there should be a series of advertisements prepared in harmony with the work of the men who have contact with the public.

A recent editorial in a large metropolitan daily reads as follows:

> THE PUBLIC'S THE BOSS
>
> Do you know that, under our laws, the people now practically run the public utilities?
>
> That these utilities cannot expand through profits and must make additions with new money only?
>
> That they cannot make more than a reasonable profit on their investment—the amount of the investment being determined by the people as per the showing of physical property—stocks and bonds not being taken into consideration?
>
> That all this is so, not necessarily because any public utility company wants it so, but because the people's laws make it so?
>
> The great public will not readily accept these statements as accurate, and such statements are most unpopular. But they mighty near represent the exact situation—the people are mighty near being the practical owners of the public utilities these days, under the people's laws.

I firmly believe this is a pretty true statement of fact. And if this is so, I hope what I have briefly stated in this paper may suggest some of the many methods of convincing the public, our unconscious owners, first of the absolute necessity for their property in the community where they live, and then that that property is being fairly, honestly managed for the best interests of all. If this attitude toward the public is persistently pursued by the public utility companies, most of the public relations problems will eventually be solved.

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*Abstract of address presented before the New England division of the N. E. L. A. at its New London convention, Sept. 5-8, 1922.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Paying Rental for Wire Crossings Over Railroads

To the Editors of the Electrical World:

We note in the Nov. 11 issue of the *Electrical World* an editorial headed "Why Pay Rental for Wire Crossings Over Railroads?" in which you cite the decision handed down by the New York Supreme Court, Appellate Division, on July 6, 1920, in an action brought by the New York Central Railway Company against the Middleport Gas & Electric Light Company. This case was also taken to the United States Supreme Court and the application for a writ of certiorari was denied—a fact which lends additional interest to the legal finding which you quote.

F. S. TRACEY,
Manager.
Middleport Gas & Electric Light Company,
Middleport, N. Y.

The Fused Neutral

To the Editors of the Electrical World:

Several letters that have appeared in the *Electrical World* recently seem to me to mix two separate and distinct problems, viz., (1) the distortion of voltage in a three-wire, 110-120-volt building wiring scheme due to the blowing of a neutral fuse, and (2) the relative security of a system of inside wiring having both legs of all two-wire, 110-volt lines "fused," compared with one having only one fuse per leg. These problems should be dealt with separately.

At the outset it may be stated that any three-wire system of the above class that is operating today with fused neutrals—and wherever I use the term "neutral" in this letter I mean the middle wire of the three wherever it exists, and that wire only—should be considered a back number. Surely there is no diversity of opinion as to the desirability of the solid neutral or the lawfulness of it; but its adoption is most fortunately coupled with one primary condition in all codes of any standing, and that is that the neutrals must be grounded in a thoroughly efficient manner, not by haphazard, makeshift methods but by dependable grounds made at known locations.

The permission to ground neutrals was first given in the National Electrical Code of 1901. In the 1909 edition, by Rule 13A, this practice in regard to alternating-current systems was advised as being preferable to running without grounds, while the 1913 edition makes grounding compulsory in both alternating-current and direct-current systems. I further note that the code as far back as 1907 allows the omission of the neutral fuse, provided that the system is properly grounded. I would also draw attention to the National Safety Code, which covers both these points in an admirable and lucid manner and calls for grounding and omission of fuses in the neutrals when grounded.

I would therefore suggest that it is in order for those who are concerned about fused as against unfused neutrals to get busy and see that their neutrals are properly grounded and thus conform to well-established rules. They will then not only be able to enjoy the added security afforded by the solid neutral, but perhaps will avoid the burden of fighting legal claims, such, for instance, as the one that ended so disastrously for certain central-station interests in the Province of Quebec. Editorial reference to this case was made in your issue of May 15, 1920, coupled with a salutary warning which I am afraid has not been as yet sufficiently taken to heart by central-station interests. Perhaps a few more expensive lessons are required to drive the obvious truth home.

I may trespass on your space at a later date to bring forward some views on the question of the value of fusing both sides of a two-wire system, but beg to suggest that future discussion would be more helpful if it followed the two-wire line and avoided befogging the issue with a point as to which there should be no difference of opinion in informed minds.

F. A. CAMBRIDGE,
City Electrician.
Winnipeg, Manitoba, Canada.

Theories of Insulation Failure

To the Editors of the Electrical World:

The heat generated in a filament of insulation owing to dielectric loss lowers its resistivity and so increases the dielectric loss. This in turn leads to the further generation of heat, and if this heat cannot be dissipated as fast as it is created, the temperature will rise until the filament burns. This theory was advanced by K. W. Wagner as the cause of failure of solid dielectrics.

The same idea was contained in a recent A. I. E. E. paper by C. F. Hanson and the writer in which the same phenomenon was explained in terms of the ionic theory. Conductivity of insulation is explained as due to the average mobility of the ions it contains. In this paper dielectric failure was also explained as due to ion mobility, but in this case it is the maximum and not the average ion mobility that is concerned. Hence there is no obvious connection between dielectric strength and resistivity, although both depend on ion mobility.

The paper by Messrs. Hayden and Steinmetz in the *Electrical World* of Oct. 21 advances the same theory from another standpoint, namely, that of progressive failure spreading from an original hot spot. This idea was also advanced by G. B. Shanklin at the Niagara Falls convention of the A. I. E. E., but he ascribed the initiation of the hot spots to local surges occurring at ionized vapor pockets.

The authors claim that solid insulation has not a definite dielectric strength. This is not in agreement with the findings of Dr. Wagner, who, in his paper, found that the dielectric strength of a plate is proportional to its thickness provided that electrodes are used which insure a uniform distribution of current.

The curves of Fig. 4 in the Hayden-Steinmetz article were made on sheets of unimpregnated linen paper, and the authors derived some of their conclusions from these results on the assumption that unimpregnated linen paper is a solid dielectric. As a matter of fact, such material is principally air, and it would not be safe to assume that real solids would possess similar characteristics.

The subject is a broad one, and it is interesting to see how different experimenters are closing in on a "pyro-electric" theory which, in turn, ties in with the ionic theory.

The article by Messrs. Hayden and Steinmetz is timely and suggestive. It is to be hoped that they will elaborate it and present it for discussion to the A. I. E. E.

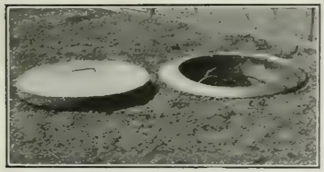
W. A. DEL MAR.
Chief Engineer.
Habirshaw Electric Cable Company
Yonkers, N. Y.

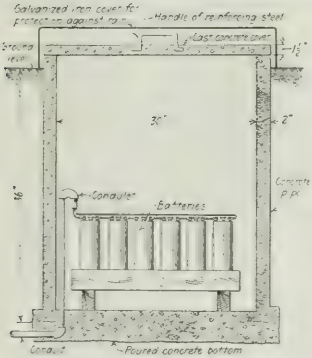
Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of
Economically Utilizing Electrical Energy

Keeping Batteries Cool by Installing in Ground

AT SEVERAL of the substations of the Southern California Edison Company in the San Joaquin Valley where the summer temperature is often very high the storage batteries used for oil-switch tripping and emergency lighting have been installed in the ground to keep them cool. Type B-4H Edison batteries of six and twelve cells are required for this service. The substation buildings are completely sided with glass, and although this is an advantage from the standpoint of lighting and fireproof construction, the temperature in the buildings in the summer is often considerably higher than the outside air.





CONCRETE PIPE PROVIDES UNDERGROUND CHAMBER FOR STORAGE BATTERIES

As a result of this condition the storage batteries are installed in sections of concrete pipe placed just below the surface of the ground as shown in the illustration, where the temperature is considerably lower than in the substation buildings. These sections of pipe are placed on end in the ground in holes dug for them. After the necessary conduit for the wiring has been installed, a concrete slab is poured in the bottom of the pipe for the batteries to rest on. A cover made of cast concrete is used. An additional galvanized cover is provided to prevent collection of water in rainy weather. The cost of each installation was approximately $50, 15 per cent of which was for labor. This method of installing small storage batteries has been in use for the past two years and has proved quite satisfactory.

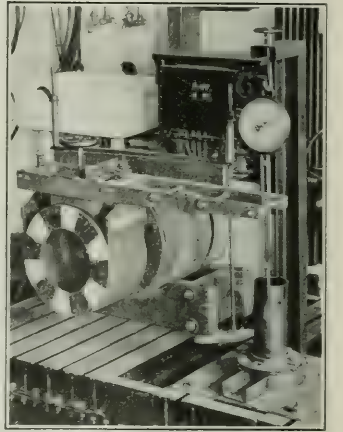
E. R. STAUFFACHER,
Protection Engineer.
Southern California Edison Company,
Los Angeles, Calif.

◆

Compact Brake for Motor Testing

FOR testing motors of various types and sizes up to 50 hp. and over with minimum loss of time and maximum convenience the laboratory of the Hartford (Conn.) Electric Light Company has built the brake set illustrated herewith. It consists of a friction drum, automobile brake lining, lever, spring balance and shock-absorber equipment mounted on steel I-beams and channels, the whole outfit occupying a floor space only 6 ft. long by 3 ft. wide. The motor horsepower is determined for the transmitting lever shown by multiplying the net force in pounds indicated on the dial of the spring gage by the speed of the motor in revolutions per minute and the product by the constant 0.000381. The effective length of the brake arm is 24 in.

Attachment of different motors to the base of the test set is facilitated by the use of 4-in. angles and channels with openings between their edges as shown, these being bolted to 6-in. longitudinal I-beams, which raise the lateral members sufficiently above the floor for convenient handling of motor pedestals, supporting blocks, bolts or clamps. The base rests upon the floor of the laboratory by gravity only, no bolting being needed. The scale is mounted on an adjustable hook carried by a right-angled column built of a 3-in. channel and terminating at the bottom in a circular base piece bolted to a steel plate in turn fastened to the base of the test equipment. An oil cylinder, 3¼ in. in diameter and 7½ in. high, immediately under the end of the brake lever provides space for the upward and downward travel of a plunger disk, 3 in. in diameter, which is attached to the end of the brake arm and serves to cut down vibration and yield a steadier reading at the scale. The end of the arm is connected with the scale and plunger by a U-shaped piece fitted with a fastening block and pin holes by which different attachment heights may be utilized to conform to differently sized motors and thus to maintain the balance arm in a horizontal position. Above the friction pulley an adjustable block with springs also contributes to the maintenance of steady running conditions through the helical springs shown near the left-hand end of the brake beam.

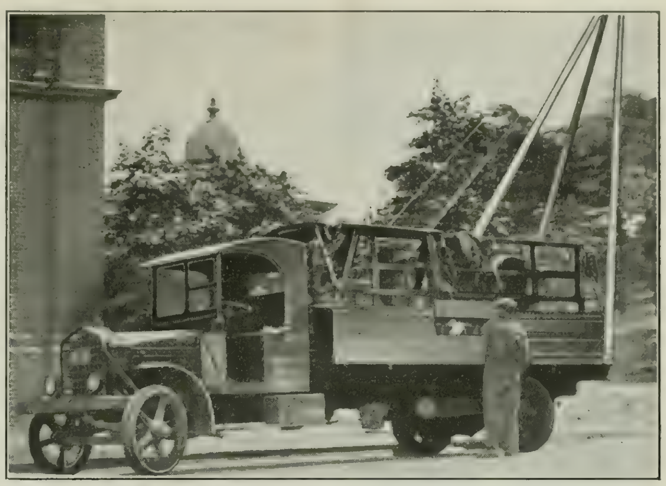


HOME-MADE TEST BRAKE HAS WIDE RANGE

The brake arm itself is of oak, tapering in section from 1 in. x 1¼ in. at the right-hand end to 1 in. x 2 in. at the left. The friction pulley, 12 in. in diameter and 6 in. wide, is provided with an opening at the end 7 in. in diameter through which water may be supplied to dissipate heat through evaporation. The pulley is designed to fit a split conical arbor which facilitates mounting on motor shafts of different size. Three pieces of automobile brake lining, each 2 in. wide, are used on the outside of the friction pulley and are controlled as to tightness against the pulley by a handwheel at the left, as shown. A small level taped in position on the brake arm facilitates keeping the latter horizontal when in use. The brake arm is cross-stiffened by ½-in. bolts spaced 6 in. apart. E. Y. RICE,

Chief of Laboratory Staff.
Hartford Electric Light Company,
Hartford, Conn.

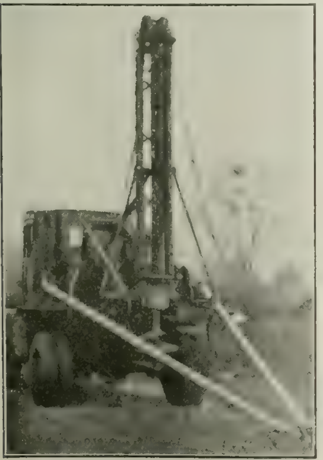
Trucks for Setting Poles Reduce Labor Costs



SETTING OR REMOVING POLES GREATLY FACILITATED BY USING A TRUCK OF THIS TYPE

VERY satisfactory service has been obtained from the two types of pole-setting trucks illustrated herewith. For more than a year the Brooklyn Edison Company has used one of these, mounted on a Pierce-Arrow chassis of 3½ tons capacity, which is equipped with solid tires on all its wheels, those on the rear being dual.

As will be noticed, the lower portions of the truck sides are taken up with lockers for tools, while above them are open frames from which can be hung coils of rope, etc. A winch, driven by the truck motor, is set up on the floor of the body just behind the driver's cab. Across the rear of the body there is bolted a heavy I-beam, and to this are bolted the two rear legs of a gin pole. This gin pole is made of 3-in. galvanized pipe, the legs being flattened at the ends and carrying a sheave at the top of the pole. The center leg is adjustable, the 3-in. pipe telescoping on one of a smaller section when necessary and being held at the proper height by means of a bolt and cotter pin. This allows sufficient extension to permit extending the gin pole straight out behind the truck, thus insuring its passing under any low bridge or other elevated structure that the truck itself can go beneath. With this truck the work of setting or removing a pole is but a matter of a few minutes after the hole has been dug.



POLE DIGGING AND SETTING TRUCK

The other truck is used by the Public Service Electric Company of New Jersey. The gin pole used with this truck has only two legs, the place of the third leg being taken by a wire rope which also raises or lowers the pole. This truck, which was made by the Winther Company, weighs 15,700 lb. without its load and has a loading capacity of 3,500 lb., making a total weight on the wheels of 19,200 lb., or almost 10 tons. Instead of the solid-rubber tires which are used on the Brooklyn truck, it is equipped with extra-large pneumatic cord tires, the rear wheels having dual tires similar to the Brooklyn Edison Company's truck.

Another point in which this truck differs from the one first described, as well as from most of the other pole trucks used, is that it is not only equipped for raising the pole after the hole has been dug but is designed to dig the hole. On the rear of the truck will be seen the large auger, driven from the truck motor, which bores the hole for the pole in the earth. By the use of trucks such as this the size of the gang of men needed to set a line of poles can be greatly reduced as compared with the older and more familiar ways of digging the holes and setting the poles. G. H. MCKELWAY.

Westfield, N. J.

Electric Heat Suitable for Drying Film Emulsions

FOR drying the emulsion on rotogravure films during their transfer to the printing rolls the Detroit *News* has recently installed an electric oven heated by twenty-four helical-core, sheath-wire air-heating units.

Very satisfactory results have been obtained with this installation due to the inherent characteristics of electric heat. The clear film on which the success of the picture depends is insured by the evenness of the heat distribution, the absence of contaminating gases from fuel and the freedom of the drying chamber from soot and dirt. A further advantage is the simplicity of the operation.

Air is heated by passing it through an insulated chamber containing the heating units and then circulated through the drying racks by a pressure blower. The heating units are a recent development of the General Electric Company, each consisting of a helical coil of resistance wire firmly held in a steel sheath by a packing of powdered magnesium oxide. The terminals for connection with the power circuit project from each end of the tube. This tube is fitted with flat radiation vanes welded together and provided with screw holes for mounting in any position desired. Rheostats regulating the heat are shown at the top and the method of air circulation is also illustrated.

RHEOSTATS REGULATING AMOUNT OF HEAT SHOWN ON TOP

The particular units comprising this installation are rated at 500 watts, 110/220 volts, and have a heating surface 20 in. long by 2 in. wide. The twenty-four units are so connected that by means of a rheostat from 12 kw. to 1.5 kw. may be obtained in steps of 1.5 kw. as desired. It is very easy to replace any unit or units, since by simply loosening the leads any section may be slipped out bodily without interference with the others.

W. S. Booth,
Assistant Business Manager,
Detroit *News*.
Detroit, Mich.

Causes and Prevention of Harmonics

The circuits in which the harmonics appear and their amplitude with respect to other components of current and voltage may be controlled within certain limits. In general lower magnetic densities will decrease the harmonics produced but cause other difficulties of greater importance, among which are high cost and extreme weight of apparatus and also a change in the efficiency curves which will alter the operating losses and may or may not be detrimental, depending upon conditions.

The connection of the transformers has a very definite effect upon the place where the harmonics appear. Four common types of connections (delta-delta, delta-star, star-delta and star-star) are given in the accompanying table. It is assumed that the first-mentioned connection of the transformer is the primary and that the power flows from the first to the second connection.

Delta-Delta.—In this connection the harmonics in the magnetizing current produce an impedance drop in the primary winding. The generated voltage, and hence the flux, thus differ slightly from a sine wave. Therefore the voltage generated in the secondary will also differ slightly from a sine wave. The third harmonic and all odd multiples of three will appear as a circulating current in the secondary and will furnish part of the missing magnetizing current owing to the primary impedance drop and will tend to bring the flux nearer to a sine wave. With this connection these results are more theoretical than practical, as the harmonics appearing in the secondary voltage are so extremely small that they are difficult to detect even with sensitive instruments.

Delta-Star.—In the delta-star connection slight harmonics are introduced into the flux in the same way as described above. As the secondary is star, no circulating current can flow and there will be a slight third harmonic component in the voltage from line to neutral on the secondary side. This is still so small as to be practically negligible.

Star-Delta.—No third harmonic current can flow in the star-delta connection in the primary line if the neutral is isolated. The flux will then have missing a very large part of the magnetizing current required for sinusoidal form. This will appear as a third harmonic voltage in the secondary and will cause circulating current on that winding. This circulating current will be of the same magnitude as the third harmonic component of the primary magnetizing current for the delta-delta connection, when corrected by the ratio of turns. The third harmonic impressed upon the lines will be the impedance drop of this circulating current through one of the transformer secondaries.

Star-Star.—With transformers in star-star and primary neutral isolated, the worst conditions are encountered. The third harmonic magnetizing current is suppressed, as in the case of star-delta, and no circulating current can flow in the secondary to correct for this. Therefore very large third harmonic voltages will appear between line and neutral in the secondary but do not appear from line to line.

As mentioned, the magnetic den-

ANALYSIS OF HARMONICS APPEARING IN TRANSFORMERS

	Third Harmonic Magnetizing Current	Third Harmonic Voltage		Third Harmonic Current in Transmission Line	Inductive interference
		Amplitude	Location		
Case A (delta-delta)	Appears as circulating current in both windings, dividing inversely proportionally to the winding impedance	Equal to third harmonic impedance drop in windings	Occurs within both primary and secondary windings, but cannot be detected externally as it is absorbed in impedance	None	None
Case B (delta-star)	Appears as circulating current in primary winding only	Equal to third harmonic impedance drop in primary. Usually very small	Between lines and neutral in secondary and same as case A in primary	Flows from lines to ground if neutral is grounded. Proportional to admittance	Usually negligible
Case C (star-delta)	Appears as circulating current in secondary winding only	Equal to third harmonic impedance drop in secondary. Magnitude similar to last case B	Same as Case A in secondary; between lines and neutral in primary	None	None
Case D (star-star	Absent	Depends upon characteristics of iron and magnetic density. May be large	Between lines and neutral both primary and secondary	Flows from lines to ground if neutral is grounded. Same as case B	May be quite large
Case E (star-star with tertiary delta)	Appears as circulating current in tertiary delta	Equal to third harmonic impedance in tertiary delta. May be fairly large, but usually less than D	Between lines and neutral both primary and secondary	Flows from lines to ground if neutral is grounded. Same as case D	May be large, but it is always less than case D, provided the characteristics of network are otherwise identical

sity of transformers can be reduced but is not desirable. Delta-delta and star-delta can be used, but both have objections from the operating standpoint. Delta-star connections with the delta on the primary side cause practically no trouble and are probably the best to use with transformers having two windings. Star-star connections are the worst if the primary neutral is isolated, but if the primary neutral can be connected to the generator neutral, the third harmonic magnetizing current is furnished through this connection.

Where this cannot be done, a transformer with three windings may be used, the third winding being known as a tertiary delta. The main windings are connected in star and the third winding in delta as implied. The third harmonic magnetizing component is furnished by the circulating current in this third winding. The third winding may be of any equivalent voltage, but must be of fairly large capacity for two reasons: First, if a large unbalance occurs upon the line, the third winding will have to carry a large amount of circulating current of fundamental frequency and will burn out if not of sufficient capacity; second, the third harmonic appearing in the secondary voltage will depend upon the impedance drop in the third winding caused by the triple-frequency circulating current, and it therefore must be of low impedance. The magnitude of the third harmonic appearing in the secondary may be estimated in a similar manner to that described under the delta-star connection where the impedance of the tertiary delta is taken instead of that of the primary winding.

There is a tendency to use transformers of high impedance owing to the current-limiting features. The effect of this high impedance upon the third harmonic produced in the secondary will depend upon the connections used and upon which winding has the larger impedance. Thus in the delta-star case the impedance of the secondary is immaterial and the impedance of the primary determines the third harmonic present.

The third harmonics appear chiefly between the transmission wires and ground and therefore depend upon the admittance of line to ground and will vary with the length of the connected transmission line. The same exposure with a short line would not give the same amount of interference from this cause as with a long line, the transformer connections being identical, and the interference on a long line would be greater with the exposure at the generator end than at the other end. Local conditions might vary these facts, so that they must be considered as guides rather than exact rules.

The above information was taken from a paper by the author that was included in the 1922 report of the N. E. L. A. inductive interference committee.

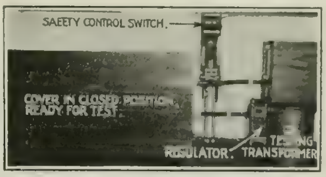
F. S. Dellenbaugh, Jr.,
Secretary Research Division,
Electrical Department.
Massachusetts Institute of Technology,
Cambridge, Mass.

* * *

Testing Rubber Gloves with Safety and Ease

A SAFE and convenient equipment for the testing of rubber gloves has been developed by the Houghton County Electric Light Company. This apparatus, which has given very satisfactory results for more than a year, is shown in the accompanying illustrations. Its safety features obviate the necessity of a special laboratory and a skilled operator. Six gloves may be tested at a time with this equipment.

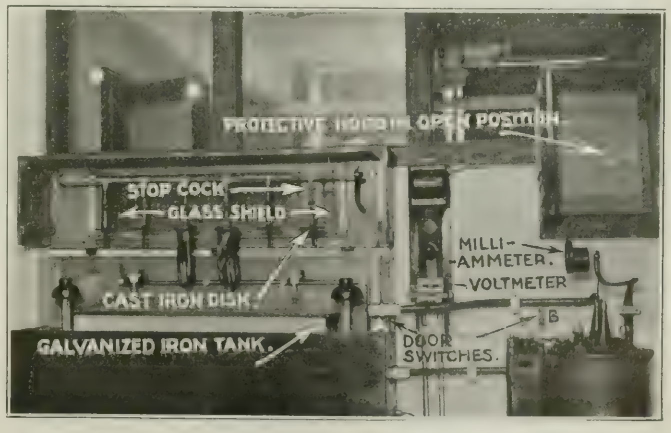
A 3-kva., zero-to-30,000-volt oil-testing transformer is used to supply the necessary test potential of 10,000 volts. This transformer is equipped with a regulator having a calibrated voltage dial making it possible to vary the voltage from zero to 30,000. A circuit breaker is mounted on the regulator and is set to give proper protection to the milliammeter. The transformer contains a grounded voltage coil with taps brought out, to which is attached a direct-reading voltmeter which measures the drop in potential across the gloves being tested. All high-tension terminals are covered with a protective hood.



GLOVE-TESTING EQUIPMENT READY FOR MAKING TESTS

The glove-testing equipment consists of a galvanized-iron water tank supported on insulators and an insulated galvanized-iron water pipe which is provided with six detachable glove-holding taps. This is all inclosed in a wooden box, and when the cover is closed it is impossible to come into contact with any live parts. The water pipe is provided with a detachable funnel, which is attached only when the gloves are being filled with water. Each of the six taps is equipped with a stopcock, a union connection and a cast-iron disk upon which the glove is supported. High-tension insulated leads are brought in through porcelain bushings at the right end of the box, one lead being attached to the tank and the other lead to the water pipe.

The top of the wooden box is provided with a glass shield protected, when not in use, by a hinged cover. This feature, together with the lamps which illuminate the interior, facilitates observation of the gloves under test. The tank is filled with water to



FROM SERVICE AND INVESTMENT STANDPOINT THIS GLOVE-TESTING APPARATUS IS WELL SUITED TO THE AVERAGE COMPANY a level 1½ in. from the top of the gloves.

When the gloves are mounted and ready for testing the cover is lowered, closing door switch *A*. The protective hood is then lowered, closing door switch *B*. Next, the circuit breaker on the transformer regulator is closed, and finally the safety control switch is closed. All switches, as shown in the wiring diagram, are in the primary low-tension circuit, and the circuit cannot be made alive until all switches have been properly closed by the operator.

The potential between the inner and the outer surface of the gloves is measured by a voltmeter which is furnished with the transformer. A milliammeter connected in the high-tension lead measures the leakage current. In making the test all gloves are subjected to breakdown and leakage tests at the same time. Any faulty glove can be removed readily from the circuit when it is found to be bad.

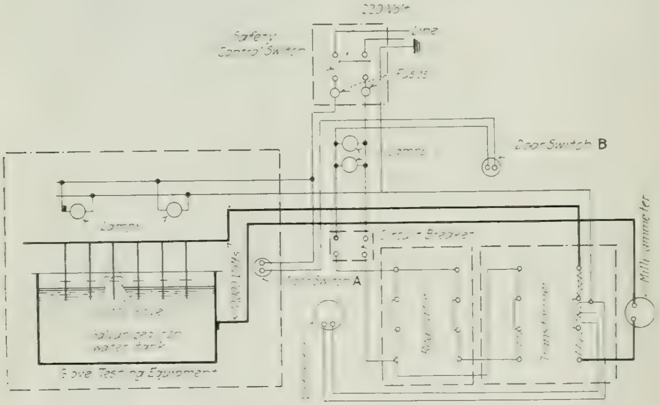


DIAGRAM OF GLOVE-TESTING EQUIPMENT GIVING POSITIVE RESULTS THAT IS SAFE AND EASY TO OPERATE

A test of from three to five minutes at 5,000 volts is made, and readings of voltage, leakage current in milliamperes and duration of test are recorded. Then a test is made at 10,000 volts for a period of one minute. If at no time during the test the leakage current exceeds 8 milliamperes per glove, the gloves are "O. K." It has been found by test that faulty gloves usually puncture. If this is not the case, the unusual disturbance in the water in the immediate vicinity of the glove indicates excessive leakage current.

P. W. WILDER,

Distribution Superintendent.
Houghton County Electric Light Company.
Houghton, Mich.

Systematically Sampling Delivered Coal

IN SAMPLING delivered coal the Bureau of Mines follows a definite procedure. A sample weighing not less than 1,000 lb. is systematically collected by taking equal increments at regular intervals throughout the delivery, while the coal is being loaded or unloaded, and then crushing and reducing this sample by successive stages to laboratory size before making any tests.

In using analyses of samples of delivered coal it must be recognized that the coal is not always of uniform size and that the impurities are not uniformly distributed throughout the mass. Some variation in the results obtained are consequently to be expected. Even if the same mass of coal were sampled a number of times the analyses would not agree absolutely except by chance. It is only when a considerable number of such analyses are available, representing a considerable tonnage mined over a period of time, that the average value and range of variation of a particular coal become known with assurance. With reasonable tolerances, however, for these variations, delivered coal can be sampled accurately enough for all practical purposes.

Deliveries from any one mine may vary in quality from time to time because of changes in mining or preparing the coal, and an analysis of deliveries for any one date should not be considered as establishing a permanent standard, for the output may be greatly improved by new methods of mining and preparation, or it may deteriorate through the carelessness of the miner and the operator.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Cost Data Again Available for Eastern Utility

THE following significant cost data for substation equipment were recently prepared by an Eastern utility in connection with a summary of plant additions since 1915. In each case except where noted the figures represent the cost of the equipment plus the installation cost. Cents have been omitted, and in general the costs include the complete provision and installation of the listed apparatus:

Replacement of three 200-kw. transformers with one 1,500-kw. three-phase transformer, including necessary changes in instrument equipment, knife switches for lightning arresters and cartridge fuses for 13,200-volt potential transformers	$7,383
Installation of one 1,500-kva., three-phase air-blast transformer with control equipment	8,298
Same without control equipment	7,085
Installation (only) of three 5,000-kva. outdoor transformers, 22,000/69,000 volts, three-phase, complete with switching equipment for two transmission lines	678
Installation of one 2,250-kva. rotary converter with complete alternating-current and direct-current control equipment, and equipment for five new direct-current feeders	39,122
Installation of one 1,000-kw. rotary converter to replace 500-kw. motor-generator set	19,203
Installation of switching, instrument and wiring equipment for new No. 4/0 split-conductor, 15,000-volt power distribution circuit	3,406
Installation of switching, control and wiring equipment for two new No. 4/0 split-conductor 15,000-volt transmission lines	6,776
Installation of one 30-gal. electric hot-water heater in place of steam-heated tank	460
Installation of a 2,000-kva. rotary condenser, 600 volts, three-phase, 60 cycles, with switching and instrument equipment	11,259
Installation of one 75-light mercury-arc rectifier, 6,600 volts alternating current to 6.6 amp. direct current, complete with four-tube equipment, lightning arrester and bus connections, installed	2,760
Installation of one 75-light mercury-arc rectifier, 13,200 volts alternating current to 6.6 amp. direct current, complete with four-tube equipment and lightning arrester	2,924
Installation of one 40-kw. "T" regulator in a circuit on line side of potential transformer	1,511
Installation of two 23-kw. I.R.S. automatic regulators, in two circuits with wiring	1,838
Installation of 35-kw. I.R.T regulator with complete equipment in on circuit	2,004
Installation of a 7.5-kw. pole-type transformer, 2,400 1,200 240 120 volts, connecting primary coil into secondary side of tube, carrying two circuits throughout, and connection of transformer inside of the short-circuit plugs so that it can be used in place of either circuit, the secondary ends of the transformer were left open and taped, primary connected for 1 200 volts	139
Installation of a synchroscope with lamps on swinging arm or bracket on a 13,800-volt switchboard, connecting the synchroscope with the upper and lower bus potential transformers through fuses and double-pole knife switches	112

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Should Distance from Plant Fix Rates?

Rate Committee of Utility Commissioners Opposes This Principle and Shows the Difficulty that an Attempt to Enforce It Would Cause and the Disadvantages that Would Follow

STRONG opposition to the principle laid down recently by the Supreme Court of Wisconsin that communities adjacent to a source of power are entitled to lower utility rates than those at a distance was voiced at the convention of the National Association of Public Utility Commissioners held in Detroit recently by its committee on utility rates, of which Lewis E. Gettle of the Wisconsin Railroad Commission is chairman.

The committee asserted that if cities near a source of power are to have this advantage the results will be discrimination against other communities and the retarded development of water-power resources. The cities favored will have an unfair commercial advantage over other cities in their efforts to obtain factories, and rates in cities farther removed from power sources will tend to be too high. It was also asserted that commissions would not be able to administer such a law properly.

"The Wisconsin Supreme Court has recently held in a case of this kind that communities adjacent to the source of power are entitled to more favorable rates than those at a distance," said Chairman Gettle, speaking for the committee. "While the decision of the court does not so state, it seems to be a fair inference that this means that the cost of getting the energy to outlying communities must be assigned in its entirety to those places. It overlooks the fact that if this means that the rate is unreasonably high in those communities—and that must be judged not only by the cost of serving them from the hydro-electric plant, but by the value of the service to the localities—the market will be restricted and cities close to the sources of power will have to carry more of the cost.

"This committee takes the position that proximity of a city or village to a water-power development should not give it a priority of interest in that development. The present-day electrical business is a business of transmission as well as of local distribution, and the benefits of water-power development should be made available within economical transmission distances to all who can be served. This means that the local community cannot be the unit for the assignment of costs upon which rates are based, and we submit that there is no logical reason why a city or village should be the unit in preference to an entire section of the state or of the country.

Grouping Communities

"Its treatment as a unit is merely a survival from the days when the theory and the practice coincided and when the utility supplying each city was separate and distinct from those supplying other cities. There are considerations of public policy as related to the development of the natural resources represented by our water powers which not only justify the grouping of communities into a single unit for rate-making purposes but make such grouping of foremost importance.

"We do not mean by this that there are not elements which will justify the differences in rates in the communities served from a hydro-electric plant, but we believe that distance is not the controlling element nor even one of the important ones, provided the distance is not so great that the cost of reaching the city throws a burden upon other cities supplied. Unless hydro-electric properties can develop their natural market in public utility service within economical transmission distance they must either throw a burden upon the communities near the source of power, carry the loss themselves, or market large blocks of their power at any price available, assuming that even that market can be had.

"It is not unusual in the development of water-power projects to have the surplus of power over that required in the utility service marketed wherever it can be sold and at whatever price is available. Normally this is a price so low that a better market would be obtained if all the energy could be sold to the regular customers of the company in the villages and the cities which it supplies. Rates should be so adjusted among the cities supplied that the uneconomical marketing of energy through the sale of amounts not required in the utility service will be as small as possible. The more completely the available power can be marketed in the general service of the utility, the more widely is the cost of supplying the utility service distributed and the smaller is the cost on each unit of product sold.

"While we take the position, therefore, that the development of water powers in the interest of the public precludes the acceptance of any idea of priority of right to the energy developed based on geographical location, we do not take the position that rates in all cities and villages served should be the same. Such a position would ignore many elements which have a bearing upon the reasonableness of the rates to be charged. The size of the city to be served, the economy with which it could be served by other sources of power, the character of the distribution system made necessary to meet local requirements—all these and other elements may make rates proper in one community different from those in another, but these are differences based upon local conditions and not upon advantages or disadvantages in the way of proximity to the source of power.

Conclusions of the Committee

"The suggestion of the committee amounts then to this:

"That the transmission lines which make possible the delivery of the energy generated by water power plants to the communities in which it is to be used should be treated to all intents and purposes as if they were part of the power plants. The power system could not exist without the market and the facilities which make it possible to reach the market, assuming that good business judgment has been exercised in their construction, must in practice be regarded as part of the power system and the costs incident to transmission be regarded as part of the power costs, or else there will be many instances in which the development of hydro-electric plants will be delayed awaiting the growth of a nearby market, if not prevented altogether.

Proper Basis of Rate Fixing

"Although the committee is more concerned at this time with presenting the general problem which has been discussed than it is with the practical difficulties of apportionment of expenses, we as members of state commissions which have to deal with this matter cannot overlook the great practical problem of how we are to determine the cost in each community if the city or village must be the unit. Often several hydro-electric plants are connected to the same transmission system so that it is impossible to tell where the energy supplying any particular city has been generated. Furthermore, in the construction of transmission systems, what may be called the loop type of construction, where the lines form a complete circle, is very often employed. Energy supplying a particular city may be delivered from either one side or the other of the loop. No one can determine how much of it comes from one direction and how much from the other. No one can determine how much demand is made for energy from one direction and how much from the other. Under these conditions anything approaching an accurate assignment of transmission costs on a basis which recognizes the distance element is utterly impossible, and if the law requires that the difference in cost resulting from difference in distance from source of supply must be the basis for differences in rates among communities, that law cannot be administered properly.

"There is also a commercial element to be considered in such cases. Industries within the territory supplied from a large water-power plant are often in competition with one another. Cities are in competition with each other to obtain factories. There are, of course, certain local types of industries which cannot move from city to city and in the original location of which in a given city the cost of energy has not been an important consideration, but there are other industries, particularly the larger ones, not dependent on local market, which, if other things are equal, will locate where energy can be obtained most cheaply. It seems to us that rates which will not give a material competitive advantage to an industry in one city over a similar industry in another city supplied from the same source of power are proper rates if the only criticism which can be made of them is that the distance factor has been left out of consideration. Also, we believe that the development of water powers is intended to be for the general good of the people who can reasonably be served from those powers, and that the market for the energy should be such that no one community will be given a great competitive advantage over others in securing industries because of its proximity to the powers.

"The interest of the state or of the entire geographical section which can be served from a hydro-electric plant ought to be paramount to the interests of any particular community in that section. Rate regulation which is based upon this principle will be unpopular in the communities which are situated near the source of power. Conversely, it may be assumed that it should be popular in other communities, but aside from the matter of popularity it will permit the broadest possible service to the greatest possible portion of the public, and this, we think, is one of the most important things to be taken into consideration in fixing public utility rates."

Industrial Electric Trucks in New England

Contrary to the opinion held by a number of central-station men and sales representatives of industrial electric tractor and truck manufacturers, a fair number of these equipments are now in service in New England and are supplied with central-station energy. From confidential sources a representative of the *Electrical World* was informed recently that from 100 to 150 industrial electric trucks and tractors are now being charged daily by central-station energy in these six states, and that from about 33,000 kw.-hr. to 45,000 kw.-hr. a day is absorbed in this service.

Ten representative industrial truck users have fleets aggregating about fifty machines, and this embraces a wide variety of applications, including steamship pier transportation and material handling in paper, fertilizer, rubber-goods and metal-working plants and in railroad yards. Though it is true that many more industrial trucks and tractors are in service in mills operated by isolated plants of considerable size, the number of trucks in central-station service is increasing and the beginning of a more active co-operation between the power engineering departments of the central stations and of the various truck and accessory manufacturers appears to indicate better business in the coming year.

Tact in Requesting Deposits from Customers

By Henry Bostwick
San Francisco Division Manager, Pacific Gas & Electric Company

Usually the central station company's first contact with a new consumer is through the credit department, where the customer must make credit arrangements for service. In many cases it is necessary to ask the new consumer for a deposit to guarantee payment of bills, and here is where many friends are made or lost for the company. From the credit man's standpoint it is hard to see why any one who has not used the company's service before and who has no credit rating and who cannot get a responsible person to sign the contract as guarantor should feel offended when asked to make a small deposit, on which the company pays a fair rate of interest, to guarantee payment of the account. Nevertheless, no matter how tactful the credit man may be or how carefully he may explain the reasons for requiring a deposit, the customer feels that his or her honesty has been questioned and immediately assumes a hostile attitude. If finally forced to make a deposit, the citizen goes away with a feeling of ill will toward all utility corporations.

Instead of refusing to supply service until satisfactory credit has been established, the Pacific Gas & Electric Company of San Francisco gladly accepts the customer's application and installs service on the date requested. Then, if a deposit is required, a few days after connection has been made the following carefully worded letter is sent out:

> In relation to the gas and electric service now being rendered at the above address:
>
> Please be advised that, pursuant to the rules and regulations governing our service, it will be necessary for you to deposit with the company not later than [date is here given], in order to insure the prompt payment of bills monthly, the sum of $5, $2.50 to be applied as a deposit on your gas service and $2.50 to be applied as a deposit on your electric service; or in lieu thereof the company will accept a guarantee signed by a responsible party, preferably a property owner. Deposits are returned after the expiration of one year with interest at the rate of 6 per cent, provided all bills during the interim are paid promptly.
>
> Kindly give this your attention, favoring us with the deposit requested or furnishing a proper guarantee as suggested on or before the expiration date mentioned herein, thereby avoiding our service to you being disconnected.
>
> Division Manager.

Of course, where the customer has no objection to making the deposit it is collected at the time application is made for service. In most cases, however, the company shows that it is willing to trust to the customer's honesty for fifteen days or until a time when it is perhaps more convenient for him to make the deposit.

New England Women Start Public Information Work

WITH 100 per cent attendance, the first meeting of the recently organized New England division of the Women's Public Information Committee was held recently at the headquarters of the New England Division, N. E. L. A., in Boston. Miss O. A. Bursiel, national chairman women's public information committee, and H. T. Sands, chairman national public relations committee, were present, the latter giving an informal address upon public relations. Miss G. M. Thibodeau of the Malden (Mass.) Electric Company is chairman of the New England committee, the other members being Miss A. M. Baker, Hartford Electric Light Company; Miss Marie Clement, Blackstone Valley Gas & Electric Company, Woonsocket, R. I.; Miss G. R. Colby, Bangor (Me.) Railway & Electric Company; Miss M. Goggin, Twin State Gas & Electric Company, Boston, and Mrs. E. M. Everett, Edison Electric Illuminating Company of Boston.

Central Station Manager Practices What He Preaches

HERE is a case where a central station manager believes so thoroughly in the electrical home idea that he owns one himself. This is the new home of A. Emory Wishon, general manager of the San Joaquin Light & Power Corporation, in Fresno, Cal. In addition to 263 outlets, it contains almost every kind of electrical appliance known to the industry. The example set by the central station men showing that they believe in the electrical home has resulted in building up a residential section in Fresno where nothing but homes that are fully equipped with adequate convenience outlets and modern wiring are built by the general contractor.

Utility Executive Lectures at School of Journalism

INCLUDING public utility problems as part of the course of study has become the practice of many colleges and universities, and a practical application of this policy is seen in the recent lecture on the fundamental principles of the public utility industry by George A. Davis, assistant to the vice-president of the Oklahoma Gas & Electric Company, before the University of Oklahoma's School of Journalism. Mr. Davis explained how many of the prejudices against public utilities have been inherited from the days before commission regulation, when the investment risk was considered much greater than under the present system. Naturally this made it necessary to charge rates high enough to cover such an element of uncertainty. With state regulation the investment of the utility has been stabilized and protected, while the public also is protected against unreasonable rates and profiteering.

"While the business man turns over his entire capital from three to five times a year," said Mr. Davis, "the average public utility company must carry on its business at least five years before its gross revenue for that period equals the amount it has invested.

"Some people believe that there is an underground connection of some kind between the public utilities and Wall Street. This is far from true. The largest stockholders of public utility securities are the insurance companies. Many public utilities secure much of their capital by selling their stocks and bonds to their customers and employees.

VIEWS OF A. EMORY WISHON'S ELECTRICAL HOME

"Regarding the popular fallacy of watered stock, I do not believe that there is a nickel's worth of watered stock among the public utilities in Oklahoma. Further, public utility rates are not based on capitalization of the company, but upon valuation of the physical property which is used and useful in serving its patrons. The corporation commission or some other regulatory body makes an appraisal of the property of the utility and then, besides allowing the company to earn only a fair rate of interest on its investment, also makes allowance to cover depreciation of the property and taxes."

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Utility Aids Contractors to Trim Windows

ALONG with its policy of assisting electrical contractor-dealers, the Commonwealth Edison Company is maintaining a window-trimming service, which consists of sending a trained window trimmer to contractor-dealers to teach them how best to construct window displays. Much interest has been aroused on the part of the dealers, who are eager to obtain pointers whereby they can improve their windows.

WINDOW TRIMMED AS MODEL FOR CONTRACTORS

At one of the recent weekly dinner meetings which the company is holding for these contractor-dealers Mr. Johnson, head window trimmer for the Edison company, demonstrated the effectiveness of properly trimming a window, erected in the dining hall, with material costing only $25. This material consisted solely of 15 yd. of red satin cloth, one Christmas wreath, a cotton-covered sheet to represent snow, and several small cartons or boxes. Special attention was directed toward the fact that all this equipment could be obtained with but little expense from material in the dealer's store room. With this material three trims were obtained which would provide a new window every two weeks until Christmas time.

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What Other Companies Are Doing

Salem, Mass.—Within the past six weeks the Salem Electric Lighting Company has closed 121 contracts for house wiring on existing lines, including 2,300 outlets and 157 meters. Special attention has been given to the wiring of old residences. The work is being done on the basis of $5 down and two years to complete payments, the central-station company financing the project. Direct-by-mail solicitation has been effective in this campaign, which is vigorously continuing.

Milwaukee, Wis. — The Utility Securities Company of Chicago has opened a branch office in Milwaukee under the management of John E. Miles. This company is the outgrowth of the investment department of the Commonwealth Edison Company, the Public Service Company of Northern Illinois and the Middle West Utilities Company, all having executive offices in Chicago. Securities of these three companies, as well as of their subsidiaries, will be offered in small amounts, particularly to the customers they serve.

Chicago, Ill.—Remarkable expansion in properties and substantial growth in business are shown in statistics of the Middle West Utilities Company and its twenty-six subsidiaries, just compiled. The report shows that on Oct. 1 the number of customers served totaled 387,354, a gain of 55,233, or 16.6 per cent as compared with Oct. 1, 1921. Connected electric load was 526,715 kw., an increase of 102,201 kw., or a 24.1 per cent gain for the twelve-months period ended Oct. 1. Sales of appliances for the nine months of 1922 ended Oct. 1 totaled $1,034,110, a gain of 17.6 per cent over the corresponding period in 1921. The subsidiaries of the Middle West Utilities Company serve directly, by means of their own distribution systems, 633 cities and towns. In addition they serve indirectly 174 other communities under wholesale contracts. This makes a total of 907 communities served in fifteen states.

Cleveland, Ohio.—The Electrical League of Cleveland has issued an eight-page pamphlet, entitled "Home Wiring Suggestions," which contains floor plans for every room of a modern house, showing the proper disposition of an adequate number of convenience outlets. Persons who contemplate building new homes have been invited to submit their plans to the league office for free advice on wiring, lighting equipment and appliances.

Boston—Plans are rapidly maturing for the establishment of a series of electric homes at Boston under the co-operative activities of local jobbers, contractor-dealers and central stations. Arrangements have been made with the Bonelli-Adams Company, a prominent real estate organization, to equip three residences now under construction for electric service and to demonstrate these applications until the houses are sold, fully furnished from the electrical standpoint. Lectures will be given upon domestic applications of electricity at these homes. Suburban central-station companies are interested in the development with the Edison Electric Illuminating Company of Boston. The preliminary committee is composed of H. B. Gilmore, Western Electric Company, Inc., Boston, chairman; F. S. Price, Pettingell-Andrews Company, Boston, and H. M. Savage, Wetmore-Savage Company, Boston. W. H. Atkins, general superintendent Boston Edison Company, is co-operating in the movement on behalf of this organization. It is expected that the first electric home will be opened in March, 1923. Other homes in different sections of the city will be operated later.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Hydro-Electric Station at Herlandsfossen, Norway.—A. Traber. — This 14,000-hp. station serves as an auxiliary to the main power supply of the city of Bergen. The plant contains four totally inclosed, horizontal-shaft generating sets of 3,500 hp. each. Two lakes with a drainage area of 24 square miles furnish the water supply under a head of 460 ft. A unique feature is the high-pressure line from the water-collecting tower to the turbines, which is drilled into the solid rock and used without any additional lining. Francis-Type turbines of 600 r.p.m. drive 3,200-kva., three-phase, 10,500-volt, 50-cycle generators. Large air impellers, mounted on each side of the rotor, provide excellent air cooling for the machine. The combined friction and windage losses of each generator amount to 30 kw. at full speed. At rated load and unity power factor the machines have an efficiency of 96 per cent. After a ten-hour full-load run the following temperatures were observed: Armature winding, 97 deg. F.; field winding, 59 deg. F.; air, 38 deg. F. The machines are designed to withstand safely an excess speed of 80 per cent.—*Bulletin Oerlikon*, September, 1922.

New Generating Plant at Nelson, England.—A description of the extension plant consisting of two 3,000-kw. standard Brush-Ljungstrom sets, each designed to operate at a pressure of 200 lb. per square inch superheated to 620 deg. F. and exhausting into a vacuum of 28½ in. of mercury. Each set runs at a speed of 3,000 r.p.m. and is capable of an overload of 25 per cent for two hours.—*Electrical Times*, Oct. 19, 1922.

Stack Height to Supply Draft Power.—H. Misostow.—The latest boiler developments have greatly increased resistance to draft in the fuel-bed and air passages. The stack in addition to conveying gases must act as a generator of power for operating the boiler. The connected load and mechanical efficiency are among the subjects discussed.—*Power*, Oct. 24, 1922.

Generation, Control and Switching

Eddy-Current Losses in Conductors of Electric Machines.—H. Rikli.—To avoid large eddy losses in heavy copper or aluminum conductors of machines and transformers, it is customary to subdivide each conductor into a number of small conductors insulated from each other and used in parallel. A simple formula is developed which, in conjunction with two curve sheets, gives the designer of machines a very exact means by which to choose the cross-section of a winding of a machine with a minimum of eddy losses. The method of using this formula is illustrated by several examples, both for machines and for transformers.—*Bulletin Oerlikon*, August, 1922.

Turbine Development.—G. Molinder.—The author gives a résumé of the hydraulic researches of Dr. Kaplan, which led to a departure from standard turbine design for the purpose of increasing efficiency at high specific speeds. The result of these investigations was a new turbine, usually called the Kaplan turbine (in America sometimes the Nagler turbine). The Kaplan turbine has a minimum of wet surface. There are only four, and sometimes only two, narrow blades and no external ring. This feature makes for low losses even at high speeds. Furthermore, the turbine can easily be built with adjustable blades, and thus the losses due to rotation in the draft tube can be cut down practically to zero. A third feature is the peculiar draft tube, which so efficiently converts velocity into pressure that the Kaplan turbine may be said to work with more than the actual head, the excess being paid back by the draft tube. The article includes a description of some large Kaplan sets for the power plant at Lilla Edet, Sweden. These turbines each consist of one single, adjustable, four-blade propeller, measuring 5.80 m. in diameter, and will develop 10,000 hp. each, at 62.5 r.p.m. at a net head of 6.5 m.—*Teknisk Tidskrift*, Sept. 16, 1922.

Units, Measurements and Instruments

Laboratory Apparatus for Technical Schools and Colleges.—F. S. Wheeler.—Laboratory apparatus should consist of standard equipment as far as possible, and where it is necessary to provide special pieces standard mechanical parts should be used wherever practical. Since the small synchronous motors and generators of the revolving-field type are not typical of the larger machines in construction, a 15-kva. maximum-rated, 220-volt, three-phase, 60-cycle, 1,200-r.p.m. revolving-field synchronous machine has been developed to meet the general requirements for laboratory work. This machine may be provided with either of two windings. One is a 220-volt, three-phase, 60-cycle winding which may be connected for one, two, three, six or twelve-phase operation, and the other is a 110-volt or 220-volt series-parallel, three-phase, 60-cycle winding, which is connected for one, three or six-phase operation. A complete description of this machine is given. A phase advancer, a generator panel and a laboratory generator-motor set suitable for technical schools are also described.—*Electric Journal*, November, 1922.

Transmission, Substations and Distribution

• *Current-Carrying Capacity of Cables When Intermittently Loaded.*—The size of cable should be chosen on the basis of time-constant and not of the root-mean-square current. The time constants for standard rubber-insulated cables have been obtained mathematically and curves prepared for determining the short-time overload factor. The pressure drop, however, must not be overlooked. A set of curves is included that has been made for finding the maximum allowable length of the line.—*Brown-Boveri Review*, October, 1922.

Transmission-Line Relay Protection.—A fourteen-page article describing the transmission relay protection outlined by the protective devices committee of the A. I. E. E. at the Niagara Falls convention. A three-page abstract of this article may be found in the *Electrical World* for July 8, 1922, beginning on page 66.—*Journal of the A. I. E. E.*, November, 1922.

Illumination

A Survey of Residence Lighting.—Two papers, by M. Luckiesh and N. D. Macdonald respectively, that were presented before the Swampscott convention, surveying the status of residence lighting and outlining the opportunities for development. Mr. Luckiesh collected information by questionnaire and Mr. Macdonald by means of surveyors. Abstracts of these two papers and some of the discussion upon them may be found in the convention report printed in the *Electrical World* for Oct. 7, page 758.—*Transactions of the I. E. S.*, October, 1922.

Lighting in Woodworking Plants.—A. D. Bell.—The use of general and localized-general systems of illumination in woodworking plans is discussed, attention being paid to the intensity required for the various operations and the manner in which lighting units should be placed. Concrete data are given, taking up each process through which the wood goes from the tree to the finished article.—*Industrial Engineer*, November, 1922.

Motors and Control

Properties of the Distribution Factor of Armature Windings.—B. Hague and S. Neville.—The principal mathematical properties of the distribution factor are discussed, and a complete series of curves exhibiting these properties in a form suitable for practical application is given.—*Institution of (British) Electrical Engineers*, Vol. 60, No. 312.

Factors Affecting the Selection of Electric Motors for Steel-Mill Auxiliary Drives—Part II.—L. A. Umansky.—By means of specific examples the author explains the method of calculating the performance of a motor-driven reversing mill table, including friction, acceleration, duty cycle, plugging and the influence of gear ratios.

It is intended in these articles to show how the calculations required to make the application of the electric motors in the steel mill are a matter of engineering and not of guesswork.—*General Electric Review*, November, 1922.

Operation and Maintenance of Electrical Equipment.—L. C. Ilsley.—A permissible schedule of the Bureau of Mines establishes certain minimum standards for safety and gives details of test methods adopted to determine whether these standards have been met. A list of charges for such tests is also given. Recommendations that apply to the operation and maintenance of nearly all makes and classes of apparatus are outlined.—*Technical Paper No.* 306, *Bureau of Mines.*

Gasoline-Electric War Tank.—M. Duthil.—The author gives a very interesting and unusual description of the equipment and the characteristics of a French war tank with gas-electric drive. During the war four hundred of these tanks were used by the French armies.—*Bulletin de la Société Française des Electriciens*, Vol. 2 (fourth series), No. 17.

Heat Applications and Material Handling

Electric Coal-Conveying System.—M. Druey.—To fill automatically the main coal bunkers of the power house of a large steel mill, an unusual electric conveying system has been installed. It is described in this paper. The buckets each hold 900 lb. of coal, and run underslung along an elevated rail system. The two running wheels are driven by a small, direct-current motor, which collects the current with a short trolley pole from a 110-volt overhead wire. The average speed of the bucket is 300 ft. per minute, and there are curves with as small as 6-ft. radius to be passed. The total traveling distance of the buckets is 1,320 yd., arranged in the form of a closed loop. As there are six buckets traveling, a total of about 11 tons of coal can be conveyed hourly. An interesting automatic blocking system is in use to prevent collisions between the buckets. The overhead trolley wire is divided into a number of sections, which are energized or opened by the passing of a bucket along the sections of the conveyor system.—*Bulletin Oerlikon*, October, 1922.

Electrophysics, Electrochemistry and Batteries

Properties of Cold-Worked Metals.—Zay Jeffries and R. S. Archer.—The properties of cold-worked metals are explained by a series of postulates regarding conditions at slip planes. The general theory is checked by experiments on copper, nickel, iron, molybdenum and tungsten.—*Chemical and Metallurgical Engineering*, Nov. 1, 1922.

Electrolytic Copper Extraction Process.—W. E. Greenawalt.—Details of a proposed process in which the major part of the reduction of ferric salts is accomplished with sulphur dioxide, the remaining reduction being effected with copper sulphide obtained by precipitating the lean and foul solutions with hydrogen sulphide. The various advantages of the process are discussed. —*Engineering and Mining Journal-Press*, Oct. 21, 1922.

Traction

The Trackless Trolley.—M. Iglesis and M. Duthil.—A very elaborate sixty-eight-page study of the development of the railless type of electric street cars of all countries of the world. This paper represents one of the most complete accounts written of the many types of trackless cars known and used the world over. Besides a very detailed description of the cars, the author gives exact comparative cost figures of the different systems, according to the density of the traffic, the cost of electrical energy and the radius of operation. On account of its completeness, this article will no doubt be of great value to the designer of this type of street cars.—*Bulletin de la Société Française des Electriciens*, Vol. 2 (fourth series), No. 17.

Electrification of Austrian Railroads Planned.—R. Mossman.—The serious need for coal, which must be purchased at high prices from other countries, has been the controlling factor in the determination to change from steam to electricity on Austrian railroads. The most important problem is to utilize the many existing watersheds in suitable hydro-electric stations. The plan contemplates the electrification of the main line from Innsbruck and Bregenz to the border, including all of its branches. This will be completed by June, 1925, according to the proposed program.—*Electric Railway Journal*, Nov. 4, 1922.

Telegraphy, Telephony, Radio and Signals

Triode Oscillator Theory.—Edy Velander.—A general formula, the so-called oscillator equation, is developed which enables the frequency and the oscillating condition of any one-tube triode oscillator be easily determined without the use of differential equations. By the use of this formula any oscillator problem may be resolved into an elementary determination of the network constants. This equation splits into two parts, one real, giving the frequency of the oscillator, and one purely imaginary, leading to the condition for stable oscillations of small amplitude. The same equation approximately holds for larger amplitude, provided the effective values of the tube constants are considered as functions of oscillating current amplitude. As examples of the use of the method, the article shows how the oscillator equation may be applied to a number of simple triode oscillator problems.—*Teknisk Tidskrift*, July 8 and Sept. 9, 1922.

Relay Automatic Telephone System. —This automatic system does away with all electromechanical switching devices, and even successive group selection is only utilized to a limited extent. It is built up entirely with relays. All operations in the exchange, inclusive of circuit hunting, connecting and ringing, are executed by means of relays without the intervention of any mechanical gear. The article deals chiefly with the main principles of the system and method of assembly, with particular reference to private automatic exchanges suitable for offices, factories, ships, railways, etc. Some information relative to larger exchanges designed for public service is, however, added in conclusion. The system embraces facilities for accommodating private branch exchanges and working over junctions to other exchanges in addition to caring for numerous special services, each of which is outlined in the article.—*Engineering*, Sept. 29, Oct. 6 and Oct. 13, 1922.

Commercial Radio Telephone and Telegraph Transmitting Equipment—Part II.—W. R. G. Baker and B. R. Cummings.—In Part I, appearing in the previous issue, the authors explained why the continuous waves or interrupted continuous waves given out by a vacuum-tube transmitter are superior for radio telegraphy. A preliminary description was given of a 200-watt and a 1,000-watt vacuum-tube transmitter for commercial radio telephony and telegraphy. Part II furnishes a detailed description of several component parts of these equipments, the complete assembled unit and similar information for a somewhat similar transmitter, to have an output of 2,000 watts.—*General Electric Review*, November, 1922.

Miscellaneous

Patent Laws of the World.—A convenient compilation of four pages which includes the names of the countries where patent protection is commercially available, the time for which such protection is granted in this country, the persons who may properly apply for patents, the time when such application can be made, renewal fees or taxes, if any, and the requirements for active or nominal working of the patent in order to retain exclusive rights.—*Bulletin No.* 106 *of Mida's Trade Mark and Patent Bureau.*

Departmental Organization.—Lee H. Mandeville.—The author holds that the organization diagram is to the department force what the wiring diagram is to an engineer. It is the graphic representation of the manner in which the various parts of the organization are connected and how they should function with relation to one another. Every department head should draw up the diagram of his organization, and it should be posted where every member of the department may have an opportunity to see it whenever desired. Nothing will so clearly show whether or not a well-formed organization exists, where improvement could be made, what division of authority is made and how it is delegated.—*Paper before Association of Iron and Steel Electrical Engineers*, October, 1922.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

Railway Signaling

By Everett Edgar King. New York: McGraw-Hill Book Company, Inc. 363 pages, illustrated.

A collection from various sources of common practice in the field of railway signaling presented in form suitable for the beginner. The sources from which the material has been drawn are of the best. No attempt is made in the book to compare the relative merits of different devices which are available for signaling and interlocking operations, but by careful selection and by citation of examples of applications the author furnishes to the reader a perspective of the subject.

To the electrical engineer interested in signaling only in a general way the book will furnish many interesting examples of electric circuit problem solutions. They show that the flexibility of electrical distribution and the reliability of such distribution and of the electrical devices required in this field have made modern railway signaling possible. The electrical engineer generally, as well as the budding signal engineer, ought to find the book useful and stimulating. H. H. NORRIS.

Direct-Current Machinery

By Harold Pender. New York: John Wiley & Sons. 314 pages, illustrated.

Dr. Pender has written this textbook for students with the object of teaching the principles and performance of direct-current machinery without going into details of design. Many other attempts have been made to do this work, but the contribution of Dr. Pender has many meritorious features sometimes lacking. The outstanding feature of the book is the admirable treatment of commutation and armature reaction. In addition, the graphical construction used in depicting motor and generator characteristics is new and ingenious. Another departure is the incorporation in the text of an excellent chapter on the testing of machines. A good selection of problems and illustrations adds to the completeness of the text.

An objection to the book is the incorporation of the fundamental electrical and magnetic principles in tabloid form in the first chapter. In many ways this form is objectionable—it involves the swallowing of dry technical material by the student and shakes his interest in what follows. Moreover, since these fundamental principles underlie all that is to come, it would seem better to introduce them as they are needed and to elaborate them by applying them to the machines. In addition, one who reads the book feels that several machines have been treated in detail without correlating them in such a way as to leave outstanding the fundamental fact that a few principles only are introduced which upon proper application explain each and every machine phenomenon.

Despite these criticisms, the book should find favor as a text and should be useful to many electrical engineers whose work is connected with direct-current machinery.

L. W. W. MORROW.

Electric Transients

By C. E. Magnusson, A. Kalin and J. R. Tolmie. New York: McGraw-Hill Book Company, Inc. 190 pages, illustrated.

Transients have become practical in the electrical art, and the newer developments in transmission and design are accomplished by means of a more detailed knowledge of them. This textbook was written as an introductory treatise for undergraduate students in electrical engineering and is an admirable condensed presentation of the theory of transients. It presents very little new material and does not fully detail the derivation of formulas, but it does compile in condensed form the fundamental principles.

It discusses single energy transients and applies the principles to direct-current and alternating-current circuits. Double energy transients and the resulting traveling waves, surges and oscillations are discussed and applied to transmission lines. The subject of variable "constant" circuits is briefly treated, and "resonance" has one chapter devoted to its service.

A very good part of the book is its description of how to use oscillographs and methods for making, developing and interpreting oscillograms. Several problems which may be performed in the laboratory are stated, and many representative oscillograms are presented.

The book requires an adequate mathematical preparation and should be useful as a text and as a reference book to electrical engineers who wish to become familiar with the subject.

Standard Lighting with Incandescent Electric Lamps

Compiled by a staff of experts. New York: H. C. Cushing, Jr. 272 pages, 240 illustrations and diagrams, 55 tables.

This is the second edition, revised and enlarged, of this work, which has received the indorsement of the lighting department of the Joint Committee for Business Development, representing the National Electric Light Association and other electrical and associated bodies. The names of the authorities to whom credit is given by the compilers of the book are in themselves sufficient to show its character. They are: S. E. Doane, G. H. Stickney, D. W. Atwater, A.B. Oday, Ward Harrison, A. L. Powell, S. G. Hibben, H. A. Smith, R. E. Harrington, A. S. Turner, C. A. Atherton, M. Luckiesh, Earl A. Anderson, J. H. Kurlander, G. A. Clewell, H. H. Magdsick and J. R. Colville.

In the seventeen parts into which the book is divided will be found comprehensive information on illumination fundamentals and design data, on the lighting of stores, show windows, factories and workshops, offices, drafting rooms, schools, residences, churches, public buildings, hospitals and dental offices; on floodlighting, on lighting for outdoor and indoor sports, on the maintenance of interior lighting systems, on modern practice in street lighting, on electrical advertising, and on the code of lighting for factories, mills and other workplaces, prepared and issued by the Illuminating Engineering Society.

The volume is 6 in. x 9 in. in size and has a leatherette cover and gilt edges.

Die Elektricitaets-Lieferungs-Gesellschaft

By G. Siegel. Berlin: Privately printed by the Allgemeine Elektricitäts Gesellschaft.

This is a "Festschrift" of about 150 pages, with many photographs, tables and maps, giving a history of the development of some syndicated German electrical utilities for the last twenty-five years. The book should be of value to those interested in the economic as well as technical features of power and light properties. A copy is available in the Engineering Societies library.

V. KARAPETOFF.

Books Received

Electric Power Systems. By William T. Taylor. London: Sir Isaac Pitman & Sons, Ltd. 102 pages, illustrated.

High-Voltage Power Transformers. By William T. Taylor. London: Sir Isaac Pitman & Sons, Ltd. 113 pages, illustrated.

Handbook for Electrical Engineers. Second Edition, 1922. By Harold Pender. New York: John Wiley & Sons, Inc. 2,263 pages, illustrated.

Electric Power Plant Engineering. By J. Weingreen. New York: McGraw-Hill Book Company, Inc. 511 pages, illustrated. New edition.

Einführing in die Maxwellsche Theorie der Elektrizität und des Magnetismus. By Dr. Clemens Schaefer. Leipzig: B. G. Teubner. 170 pages, illustrated.

Die Elektrotechnik und die Elektromotorischen Antriebe. By Wilhelm Lehmann. Berlin: Julius Springer.

The Lead Storage Battery. By H. G. Brown. London: The Locomotive Publishing Company. 155 pages, illustrated.

Year Book of Wireless Telegraphy and Telephony. London: The Wireless Press, Ltd. 1,477 pages, illustrated.

Die Theorie Moderner Hochspannungsanlagen. By Dr. Ing. A. Buch. Munich and Berlin: R. Oldenbourg.

La Radiotéléphonie. By Carlo Toche. Paris: Gauthier-Villars et Cie. 98 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

New Bill for Muscle Shoals

Representative Dickinson, a Former Ford Supporter, Has Measure for Federal Operation

A NEW bill dealing with the government's war-time nitrate and power projects at Muscle Shoals, Ala., has been introduced by Representative Dickinson of Iowa, the leader of the "farm bloc" in the House of Representatives. The bill is in many respects similar to the measure introduced in the Senate by Senator Norris of Nebraska, and like it would create a body to be known as the Federal Chemical Corporation. Mr. Dickinson's measure, which has been referred to the House committee on military affairs, has come like a bombshell to the camp of the Ford adherents in the House, inasmuch as its author, with the other members of the House "farm bloc," has been an out-and-out Ford man. Representative Dickinson, when introducing his bill, made public a statement which is said in Washington to mark the breaking up of the "farm bloc" interest in the Ford proposals for Muscle Shoals and to be in the nature of a final blow at these proposals. He is understood to have finally reached the decision that the Ford plan tends toward an indefensible monopoly by an individual. His statement in part follows:

PROPOSALS OF NEW BILL

"The proposed bill will conserve the $100,000,000 of government funds invested in a nitrate plant at Muscle Shoals for future war-time needs and during peace provide for the operation of such plant for the manufacturing of fertilizer without profit except a 4½ per cent interest charge on any additional funds necessary to complete and equip such plant.

"The placing of the Muscle Shoals plant in the hands of any individual tends to monopolize such production in the hands of the individual, besides putting under individual control immense water power of great value for manufacturing purposes. The Ford offer has been subjected to general criticism. Objection is made to giving to any individual the benefits of an investment of $105,000,000, obligating the government for $50,000,000, and placing this great property in a private corporation which would have the added advantages of price control of fertilizer production and would gain a manufacturing advantage in water rights, without supervision or control by any government agency.

"I am led to the conclusion that some plan of federal operation is the only solution that will insure early completion, the use of the plant during war for nitrate production and its operation during peace for the production of farm fertilizer at the lowest possible cost. It is, therefore, provided in the bill that a government-controlled corporation, known as the Federal Chemical Corporation, to consist of five members, three to be appointed by the President, the other two to consist of the Secretary of War and the Secretary of Agriculture, shall be given full power to complete and operate said plant for the manufacture of fertilizer at the lowest possible cost, for distribution among the farmers, with further power to sell the excess water power under the conditions, limitations and safeguards of the national water-power act now on the statute books."

By other provisions in the proposed law the chemical corporation is not to take control of the power from the government dams until these are completed and turned over to it by the Secretary of War. It shall negotiate with the Alabama Power Company for a settlement of the ownership of the Gorgas plant and may, subject to the approval of the President, sell the government's interest in this plant to the company. The three members of the corporation other than the Cabinet ministers are to have salaries of $10,000 each.

How California State Ownership Was Beaten

Owing to Wide Public Ownership of Stock and to an Intelligent and Informed Electorate, the Socialistic Venture Was Overwhelmingly Defeated

FINAL returns on the results of the election in California on the proposed water and power amendment to the state constitution show that one-quarter of the entire population of the state was represented in the vote and that the measure was defeated by a majority of more than 350,000. This is greater than the majority piled up by Senator Hiram Johnson or Governor Richardson, both of whom had clear fields, and greater than the vote cast on any other measure except one submitted to the voters at the election.

The campaign was unusual in character, and the heavy vote cast was clearly indicative of the widespread interest manifest in water-power matters in California. It set at naught the notion which the proponents of the measure sought to capitalize that the campaign was a fight between the power companies and the people. This propaganda the power companies were able to defeat quickly by showing that their fight was not different from that of the people and that, because of the wide ownership of stock by voters in California the fight was really a fight of the people against the politicians.

The power companies for that reason were not called upon to take up the cudgels. They simply invited the citizens of the state to read the provisions of the act and then visualize the conditions which would follow and compare them with the conditions that exist in California today. Attention was directed to the fact that California represented the white spot of prosperity in the United States, that it has suffered no slump as other sections of the country have, and that, while electricity has been difficult to obtain in other sections because of drought and shortage of fuel, the domestic, civic and industrial needs of California are not only amply provided for because of the foresight of the central-station companies, whose power houses are fully equipped to take care of present demands, but all future increases can be readily and efficiently accommodated.

The enormous majority registered against the measure was also taken as evidence that the people of California are in favor of private ownership and operation as opposed to inefficient and wasteful government ownership and operation and are content to rely on the assurances of excellent service at reasonable rates guaranteed to them under the regulatory laws of the state.

FEATURES OF THE CAMPAIGN

The most significant feature of the campaign was that it was not waged by the power companies themselves but by the 101,000 individual owners of public utility stocks residing in the state. Fortunately, when the campaign was at its height, news from Europe, particularly from Italy and France, acted as a boomerang against the advocates of the act for state ownership, because of the fact that in Italy and France, where government ownership of utilities has prevailed for many years, it had been finally discredited as inefficient and wasteful and as imposing too great a financial burden on the government. This news came at a time to be of greatest service to the opponents of the measure.

One of the surprises which the campaign revealed was that municipal ownership men themselves took the stump against the proposed constitutional amendment on the ground that it was detrimental to the best interests of California and repugnant to the safety and welfare of democratic institutions. In addition, civic organizations of all kinds, including real-estate boards, investment bankers, farm and fruit associations and more than 150 local leagues scattered in every city and town of the state, were up in arms against it on the ground that it bordered on a type of socialistic legislation that had injured North Dakota and brought terrible disaster in Russia.

These leagues made much of the fact that the amendment provided for the expenditure of $500,000,000 by a board of five, with authority to acquire without let or hindrance anything and everything necessary to the carrying out of the amendment. This was interpreted as meaning everything, because it was shown conclusively that the development of water power affects everything in California and that the prosperity of the state was absolutely dependent upon an orderly and economic development of its natural resources, which, with the exception of a fast-diminishing oil supply, are restricted entirely to water power.

POWER COMPANIES REALIZED DANGER

Of course, the power companies of the state were the first to realize the danger which threatened them. The proponents of the measure claimed that their power scheme was patterned after that of the Hydro-Electric Power Commission of Ontario, but the power companies were able to show the shortcomings of the latter system through the study and report on it made by Messrs. Murray and Flood. When, in addition, it was brought home to the taxpayers of the state that state ownership would mean greater taxes—the state government of California is run entirely from taxes on public utility corporations—it no longer became a power company fight, but one of very vital interest to every house owner and farmer. Business interests were naturally opposed to the amendment because they feared it would strike at the very root of California's prosperity and stop the flow of capital so necessary to its upbuilding and future growth. Thus the great bulk of the responsible people of California were arrayed against the amendment for reasons other than those associated entirely with water-power development.

From what can be learned the election was not without its lesson to both sides in the controversy. The indications are that efforts will be made to present another but somewhat modified measure to the voters of California in 1924. By that time, however, industrial and power interests feel that sentiment will be stronger and more pronounced against the measure than it was at the recent election, because the more time people have to think over the matter and the more enlightenment they receive on it, the greater will be the opposition.

California State Ownership Campaign to Begin Anew

The state campaign committee for the water and power act of California has issued from its office in San Francisco an appeal for funds with which to continue its work for the passage of the measure, defeated overwhelmingly in the November elections. The committee claims that its successful opponents spent from $1,500,000 to $3,000,000 to defeat the measure, whereas the proponents of the measure expended $136,747.64, most of which was furnished by three or four men. "While these men are willing to bear their part in financing the 1924 campaign," says the circular letter, "they cannot undertake responsibility for so large a part as they carried this year."

To meet the situation, the California State Water and Power League is being organized. The membership will be divided into four groups—(1) contributing members, paying from 50 cents upward for the work each month; (2) paid-up members, contributing $25 in advance covering the two years of the campaign; (3) associate members, paying $5 a year, and (4) working members, who will make no pledge of financial support but will undertake to assist in getting the measure before the public.

Act Legalizing Loop Rates Sought in Wisconsin

As an outcome of the decision of the Wisconsin Supreme Court last June declaring that the municipality is the unit of rate determination and making illegal the "loop" system of establishing charges, the water-power interests of the state are, according to L. E. Gettle, chairman of the Wisconsin Railroad Commission. likely to make an attempt to have a bill passed by the 1923 Legislature making uniform rates legal for interconnected cities served from the same source of hydro-electric power, and thus obviating the necessity of varying rates in accordance with geographical proximity.

Mr. Gettle, who was the chairman of the committee on hydro-electric rates, read a report before the recent Detroit convention of the National Association of Railway and Utilities Commissioners favoring the "loop" plan of rate fixing. He says that the outcome of the Wisconsin decision is being awaited by public utilities and water-power experts in all parts of the country and points out that Utah, Washington and Tennessee, states with extensive developments of water power, have already put into effect rates determined on the "loop" system in direct contravention to the principle laid down by the Wisconsin Supreme Court.

S. E. D. Reviews Year's Work and Discusses Plans

At a meeting of the board of directors of the Society for Electrical Development held Saturday, Nov. 25, President Freeman said he believed that the purposes of the society were more clearly evidenced to the leading men of the industry than ever before and that the opportunity to promote the use of electricity through its various forms of service had been widely recognized. He told of discussion with the leading central-station men of the country, who had gone definitely on record as favoring the further development of the society. In this connection C. L. Edgar, president of the Edison Electric Illuminating Company of Boston and member of the society's executive committee, outlined a plan to insure financial support from all the larger companies.

The president then presented the general results of the program for co-operation with the Joint Committee for Business Development, saying that the relations between the two bodies were now thoroughly understood and that E. W. Lloyd, chairman of the former, had agreed with the officers of the society on definite plans by which the society would carry out work assigned to it. W. L. Goodwin, executive head of the society, said that about $50,000 would be needed for carrying out the immediate program agreed upon.

The work of the society since the last meeting was presented by diagrams showing that its activities now fall under seven broad heads: (1) Newspaper services, (2) trade-paper services, (3) map, cut and sales services, (4) special publications, (5) investigation of fires, (6) statistical services, (7) field work. Many of these services during the past year have been ordered and not merely sent to organized centers. For example, the editors of more than a hundred newspapers have definitely asked the society to furnish them regularly with the newspaper services. All the services are available for the use of any organization interested in the wider application of electricity, and their still wider use is limited only by the funds available. In the development of local electrical leagues the society is anxious to have all these services made useful as a basis for activities, and as far as possible it will put special men on local problems. Mr. Goodwin spoke of the organization of a division of home economics, already undertaken, and of a projected lecture service bureau.

Discussion developed with regard to expanding the board of directors to make it representative of specialized groups of manufacturers, particularly in the merchandising field, and President Freeman appointed F. M. Feiker, W. L. Goodwin and F. W. Bissell as a special committee on this subject.

Mechanical Engineers Discuss Problems

Annual Meeting in New York Has Many Features of Interest to Electrical Men—Animated Discussion on Power Equipment, Management, Test Procedure and Make-up of Codes

THE forty-third annual meeting of the American Society of Mechanical Engineers was held in New York on Dec. 4 to 7. With an attendance of more than 1,600, it was one of the most successful conventions in the history of the society. The outstanding feature was the animated discussion and interest in problems associated with the use of higher steam pressures and temperatures in power-plant work and in connection with the use of stokers and coal and ash-handling equipment for central-station plants. Another prominent feature of the convention was the notable address of the retiring president, Dexter S. Kimball, dean of the Engineering College of Cornell University, on the place of the engineer in modern industrial civilization. President Kimball has been preaching the gospel of social service and the possibilities of the engineer in the political field during the past year and has aroused a great deal of interest throughout the country on this subject.

ASH-HANDLING METHODS

Ash handling was the subject of discussion at one entire session, the feature of which was a paper presented by John Hunter, chief engineer of the Union Electric Light & Power Company, St. Louis, and Alfred Cotton, chief of the research department of the Heine Boiler Company. The paper embraced a very extensive and complete discussion of the methods of removing ashes from basement boiler rooms, the design, construction and capacity of hopper ash pits, systems of mechanical conveyance and elevation, fluid and gas conveyance, and the final disposal of ash. Sufficient description and illustration of all successful methods of handling ash were given to enable those interested in the subject to lay out or criticise intelligently almost any installation with which they may be confronted.

Several engineers discussed the general problem of ash handling, attention being centered on (a) the logical fields for different types of ash-handling equipment, (b) the place and limitations of gas and fluid conveyors, (c) the size of ash pits and storage base, and (d) quenching of ashes.

Unless carefully designed and laid out, the steam-jet ash conveyor is very uneconomical in steam consumption, Eugene Hahn declared. The design of the nozzles is extremely important, and fittings, especially elbows, should be provided which will strongly resist abrasion and can be readily replaced.

The serious effect of small-size ash pits on stoker maintenance was emphasized by T. A. Marsh, who illustrated both good and faulty designs. He strongly advocated much larger ash pits than are ordinarily employed. Commenting on gas-type ash conveyors he contended that they are not suitable where considerable clinker has to be transported. Worn nozzles were pointed to as the chief cause of excessive maintenance in gas-type conveyors.

F. D. Allen maintained that most methods of quenching ashes are inadequate and advocated a system in which water headers run along the outside of the ash hoppers and connect with easily accessible spray nozzles that discharge water over the surface of the ashes. The principal advantages claimed for this system were the more uniform cooling of the ashes and the greater reliability and flexibility of operation. With tight-fitting hopper gates and drains for water discharged into the hoppers the basement floor can be kept dry, and a water seal can be maintained which will increase the economy of operation of the furnace. The speaker also referred to an installation at Durham, N. C., where carbon is being recovered from ash at a cost of 40 cents to 60 cents per ton.

More attention must be given to the working conditions under which boiler refuse has to be handled in designing ash-disposal systems, R. H. Beaumont said. Furthermore, the systems must be laid out in such a way that various means of removal from the plant can be utilized in emergencies.

BOTTOM-DUMP HOPPERS

Of all the systems considered by Mr. Hunter in his paper, N. E. Funk favored the bottom-dump ash hopper with railway or industrial cars for removing ashes. He maintained that this system is most easily operated and maintained, is flexible in operation and can be replaced by some emergency expedient when necessary. No more headroom is required than for other systems, he contended. Ample ash storage is imperative because emergencies will arise when the largest storage will be insufficient. Referring to water-sealed ash pits, he declared that they are somewhat untidy and are amenable to operation only with overhead cranes or grab buckets operated by a locomotive crane. The carrier-ring system of coal and ash handling is objectionable because it may discharge ashes into coal bunkers; the cross-bar conveyor, even when duplicate conveyors are employed, may shut down all the boilers in a row, and the vacuum ash tank is liable to blow up because of the generation of gas. In one 60,000-kw. plant using coal containing 15 per cent ash and operating at 70 per cent load factor it has been possible to handle all the ashes with two storage-battery locomotives, industrial cars and two men, Mr. Funk declared.

N. W. Elmer pointed out that disposal of ash will be a serious problem for all to consider if powdered fuel becomes more extensively used.

In congested sections it is becoming a very big problem how to dispose of ashes, I. E. Moultrop declared. In such places big ash pits are imperative. Furthermore, the ash-handling equipment must be simple and should not break down easily. The ash hoppers should be high enough to permit railway cars, trucks or industrial cars to be run under them to remove the ashes. In emergencies the ashes can be dumped on this floor and removed later.

At Cleveland industrial cars and a skip hoist are employed to handle ashes, asserted T. Mainz. In emergencies the ashes are dumped on the floor. The speaker warned against cutting down the size of ash pits and storage space.

Explaining his reason for adopting submerged ash pits, G. G. Bell said that they prevent the emission of carbon monoxide, corrosive gases and flames and simplify the problem of ventilating the ash room. Furthermore, they cost only two-thirds what other ash pits would have cost. At the Windsor plant ten days' storage is provided in the submerged ash pits, the contents being removed by a crane, conveyor and aërial tramway. The aërial tramway which has recently been installed will take care of conditions for some years to come by filling in ravines around the station. Ashes can be handled with this tramway at a cost of 25 cents per ton, and this cost may be reduced to 12 to 15 cents.

In a written communication from E. H. Tenney it was pointed out that freezing of gates on overhead ash hoppers during cold weather can be prevented by steam lines.

In closing the discussion, Mr. Hunter pointed out that operating engineers are anxious to secure the largest ash pits possible, but monetary conditions sometimes stand in the way. He questioned the economy of recovering carbon from ash in most plants. Despite the comments on gas and fluid ash conveyors, he contended that they had a definite field and must have consideration for handling fine ash or dust. Submerged ash pits appeal to him, he declared, for the reasons previously outlined; besides, they provide considerable storage. In emergencies they can be unloaded by locomotive cranes if sufficient headroom is available. Referring to the disposal of ashes in powdered-fuel plants, he pointed out that John Anderson of Milwaukee has claimed that he has been able to remove 50 to 100 per cent of the ashes by washing the flue gases. He insisted that more consideration must be given to the problem of handling ashes in small plants.

MATERIAL-HANDLING EQUIPMENT

A report was submitted by the committee delegated to develop formulas for calculating the investment justified in material-handling equipment, the yearly cost of maintenance and the yearly profits. Mr. Hunt pointed out that the formulas are very simple to use but cannot be presented without considerable explanation.

STOKER SYMPOSIUM AROUSES INTEREST

A profitable session was held under the direction of the fuels division, with Prof. L. T. Breckenridge in the chair. A symposium on stokers was presented in the shape of four phases, which outlined in detail the field, the operating possibilities, the installation methods and the development of the modern types of stokers. T. A. Marsh discussed the development and use of the modern chain-grate stoker and showed how greater boiler capacity can be obtained by increasing grate size or by increasing the draft. He gave in detail the operating possibilities of the modern chain-grate stoker for power purposes, including a table of results obtained by a number of stations equipped with these chain grates.

In discussing the overfeed-type stoker, G. I. Bouton stated that apparently this type has reached a limit in a stoker having a projected grate area of 100 sq.ft. to 110 sq.ft. in a single unit capable of burning sufficient coal under forced draft to develop about 2,000 boiler-horsepower at the maximum. Mr. Bouton discussed the development and present success in method of operation of the front and side-feed types of the inclined overfeed stoker, and gave illustrations of the settings. The effect of the content of ash in determining the fusion temperature was also discussed.

H. F. Lawrence labeled his paper "The Design and Operation of Underfeed Stokers" and described briefly the distinctive features of the single and multiple retort types of underfeed stokers, giving illustrations of a number of each type as well as particulars regarding their operation and results that have been obtained. The author accented the advisability of giving attention to the secondary feed system and pointed out the types of coal to which this type of stoker is best adapted. He also gave some very good curves and data showing the best types of fans to be used in stokers and a table of settings for the boilers.

The chronological history of stoker development to the present day was the subject of a paper by A. H. Blackburn.

These papers were discussed as a whole by many members, and much valuable information was obtained from those who have had experience with the several types. The consensus of opinion was to the effect that the chain-grate stoker was best adapted for burning high-ash Western coal. In connection with the operation of the chain-grate stokers, however, T. L. Mainz pointed out that among points to be watched is the amount of carbon in the ash and trouble with the seal at the end of the stoker. He said that the best results could be obtained by having a uniform size of coal sent to the grate and that this was a part of the function of the coal-handling system. Another point he mentioned was that the boiler-room dirt must be eliminated when using forced draft under the chain-grate stoker. Further discussion brought out the fact that several types of the modern stoker had solved these problems successfully.

H. C. Heaton of Sargent & Mundy pointed to results obtained by operating chain-grate stokers and said that one of the great features was to insure the proper spreading of the coal and that his experience indicated the movable spout as the most successful means of securing proper spreading.

In a general discussion W. N. Polakov brought out the fact that in many cases the installation of good types of stokers was in itself no guarantee of efficient operation. The human element must be considered and the personnel trained if good results are to be obtained. Mr. Roney also accented the necessity for a skilled personnel, and D. M. Meyers pointed out that, in engineering terms, a stoker's efficiency was the product of the mechanical efficiency by the human efficiency. He asked questions about the formation of clinkers on the underfeed type of stokers and the value of automatic control equipment and the ratio of combustion space to the capacity of a boiler, and also asked what possibilities there were of introducing stokers into marine practice.

Other speakers brought up the point that with modern conditions for obtaining coal it is a necessity to have a stoker that will operate under a wide variation of fuel conditions and, if at present there are seventy-five fuels and five stokers, the ideal thing would be to have one stoker that could burn any of the seventy-five fuels. Discussion brought out the fact that this ideal could not be reached at present, but that several types of stokers could burn a wide variety of fuels with success and efficiency. Another point brought up in this discussion was that the coal-handling equipment is a part of the stoker problem and that the furnace setting in particular is very important to insure proper upkeep of furnace refractory material and the arrangement of the material in the furnace. Devices for obtaining best operation for a given type of stoker and for getting rid of ash and clinker were discussed. O. P. Hood mentioned, incidentally, that a committee was at work to try to standardize engineering details in an anti-smoke ordinance.

QUESTION THE USE OF AUTOMATIC EQUIPMENT

One of the most interesting points in the discussion was regarding the necessity and advantage of using automatic stoker control equipment. The points brought out were to the effect that it was almost a necessity to afford the boiler-room employees proper training facilities, meters and instruments. Automatic equipment, it was pointed out, is a safeguard in regard to pressure maintenance. In many ways it is far from ideal, but much may be expected as it is developed. The parallel

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The Engineer in Statecraft

Dean Kimball Hails His Advent in the Nation's Councils—The Business and the Scientific Types

IN HIS presidential address before the New York City convention of the American Society of Mechanical Engineers last Monday Dexter S. Kimball, dean of engineering at Cornell, dwelt on the increasing disposition of the engineer to play his part in public life, instancing Herbert Hoover and Governor Hartness of Vermont as conspicuous examples of this new tendency. After alluding to the military type and the legal type of political leadership, the first of which had passed in modern democracies and the second of which inevitably harked back to precedent rather than kept pace with change, Dean Kimball said:

"There remain for consideration two other types of mind from which a new industrial leadership may come, namely, the business or financial type and the scientific type. The business type of mind with the aid and counsel of the legal and engineering fraternities has built up modern industry as we now see it. There can be little doubt as to the ability of this type of mind to plan and direct the larger aspects of industry along existing lines. One weakness lies in its apparent inability to appreciate or rather to acknowledge that a new industrial day has dawned in which industry is being viewed more and more as the support of human life and not as a means of producing private, corporate or state profits. If the new industrial leadership comes, therefore, from the business world, the business type of mind, I believe, will have to be greatly modified."

TWO TYPES OF SCIENTIFIC MINDS

Dean Kimball then pointed out that future hope rested upon the scientific type of mind. There are two types, he said, one visionary, unpractical, blazing the way for the world by always seeking out new truths "in science, philosophy, religion and what not." The engineering mind, he said, belongs to the other type. That type is interested in applied science and is always practical.

"No one would presume to say that the engineer alone can solve the industrial riddle, but it is clear that he can make a very great contribution to the solution," he added. "But it becomes increasingly clear that hope of a solution rests with the two groups just discussed. Whether the new leadership comes from one field or the other, or from a combination of the two, the problem of universal well-being offers a challenge and a call to duty that the engineer may not refuse. There is good reason to believe he will do his share of work in attaining the ultimate results desired. Already there are significant signs that he has accepted this duty."

operation of boilers and fans with control based only on steam pressure was mentioned as decidedly a makeshift proposition at the present time, but several members maintained that by using a certain number of the boilers to maintain pressure with manual control of firing maintenance on the remainder of the boilers a good combination for obtaining reliable and efficient operation would be gained.

Industrial Education and Training

One session of the meeting was devoted to the education and training of men for the industries. This was taken up from the standpoint of the correspondence school, extension course and apprentice course in industries, and very valuable material along these lines was compiled and presented by a committee. The statistical information afforded an indication of the great increase in training men for the industries.

Baffling the Boilers

Results of extensive tests on large type W Stirling boilers at Detroit to determine the effects of different baffle arrangements, grades of coal, banking methods, intervals between blowing of flues and methods of operating during low-load periods were presented by P. W. Thompson. As a result of these tests the boilers have been rebaffled with considerable improvement in efficiency and degree of superheat, and the Babcock & Wilcox Company has developed a new design of this type of boiler. The baffling arrangement selected exposed two layers of tubes to the radiant heat of the furnace and allowed the gases to cross the inner bank of tubes at the top, pass the superheaters and then return along the outer bank of tubes to the stack. With this arrangement an average increase of 50 deg. F. in superheat was obtained, the flue-gas temperature was reduced 70 deg. and the draft was reduced 38 per cent.

Changes of the extension grates did not have the desired effect, although it is believed that further study will develop better arrangements of air openings and possibly reduce ash-pit losses. Air leakage from the chamber below the stokers was found to be as much as 25 per cent at high ratings. As much as 2.6 per cent increase in efficiency was obtained with the best coal tested, but clinker trouble was experienced, so that one of the grades giving only 0.6 per cent increase in efficiency was preferable. Energy for boiler auxiliaries averaged between 0.7 and 1.6 per cent for light load and 170 to 200 per cent rating. Considering all economic factors, twelve and a half hours was determined as the most desirable interval between blowing of flues. The coal required for banking in excess of four hours was found to be 8,600 + 105 × hours for floating bank and 8,000 + 280 × hours for dead bank. A study of heat absorbed indicated that five rows of tubes between the upper center drum and each mud drum and ten rows of tubes in the outer banks are more desirable than are the present arrangements.

In the discussion of this paper great commendation was expressed concerning the accuracy and value of the investigation. The expense of such tests, while great, is well justified by the higher efficiency and superheat obtained, declared Dr. Jacobus.

Determination of Pipe Bends

As a result of mathematical study and tests, Sabin Crocker and Sterling S. Sanford presented charts which can be used in selecting the proper size and shape of bends to care for a given expansion and in determining the force exerted by a bend in state of deflection. In general the authors recommend bends of larger dimensions than ordinarily used. Their figures are said to be on the side of safety. In some cases the bends tested showed greater flexibility than was anticipated.

While the contribution of Crocker and Sanford was commended, attention was directed by at least two speakers to apparent oversights that make the calculated results differ from test results. The advisability of considering expansion loops made of straight pipes was suggested by a few speakers. Some questions were raised regarding the effect of pressure and temperature on the flexibility and stress in pipe bends.

W. B. Campbell contended that even some of the conclusions from actual tests are not accurate because they are based on ideal conditions.

This contention was carried still farther by Robert Crane, who said that the assumption that the neutral fiber runs through the center of the pipe bend does not result in accurate conclusions. Furthermore, he contended that the fact that some of the calculated results were greatly different from test results should be sufficient reason for thoroughly investigating the cause.

More attention must be given to flexibility of and stress in pipe bends, asserted F. Hodgkinson. Flexibility can often be obtained with loops composed of straight pipes instead of fancy bends. to permit alignment of pipes more consideration must be given to torsional flexibility and means for allowing it.

J. V. Brady related some trouble with bends which had not been properly annealed. They tended to straighten after being placed in service. He also advocated more consideration of straight-pipe loops, saying that no excessive pressure drops had been experienced with an extensive installation of such expansion loops at Hell Gate.

Mr. Whitney called attention to some U bends which did not allow the deflection calculated, whereas double-U bends allowed more than twice the deflection. He contended that designers need not fear ripples or buckling on the inside of pipe bends since they reduce stress in outside fibers and increase flexibility. Seamless tubing was urged for bends requiring large-diameter pipe, because with its use there is not the danger of rupturing the outside of the bends.

John Stevens referred to installations in which flanges had failed without the bends showing signs of weakness. In Europe, he pointed out, reservoirs are being extensively installed between the steam mains and the turbines. Duplication of such practice was recommended in this country.

George Orrok raised a question regarding the effect of operating steam pressures and temperatures on the fiber stress and deformation in pipe bends.

Feed Heating for High Thermal Efficiency

The problem of determining the correct feed-water temperature for high thermal efficiency was presented by Linn Helander. He considered a 25,000-kw. station, investigating the conditions when using single-stage and multiple-stage condensate heaters, both with and without economizers and treating the subject from the viewpoint of thermal efficiency only. For power plants using single and multiple stage heaters of the condenser type, the temperature of the boiler-feed water as it leaves the heater should not be less than 150 deg. F. when using economizers and not more than 260 deg. F. when not using economizers. Heat balances showed that when using single-stage heating and no economizers better results were obtained from heating the feed water by combining steam from the house turbine and that bled from the main unit than when using the steam from a house turbine alone. Double-stage heating with no economizers also showed better thermal efficiencies when using a larger amount of steam from the main unit than from the house turbine.

The increasing tendency to bleed the main units for heating the feed water with the consequent decrease in use of house turbines was the keynote of the discussion. W. M. Keenan said that in the new Brooklyn Edison plant the heaters will be supplied with steam by bleeding the main turbines. He pointed out that for a single stage the best bleeding point is between 20 lb. and 30 lb. absolute pressure. For two stages the best points are 12 lb. and 100 lb. absolute pressure, respectively.

Commenting on modern practice as to the use of house turbines, Prof. A. G. Christie said that in the future large stations will use one or possibly two of these turbines, the main supply of steam for heaters being taken from the main turbines. O. F. Junggren and F. Hodgkinson both expressed the same opinion basing their remarks on the fact that much better over-all efficiency can be obtained by bleeding the main units. Ideal operating conditions, according to Mr. Junggren, depend on producing the maximum power in the turbine and heating the feed water to the limit by bleeding. Mr. Hodgkinson pointed out that turbines of modern design are now provided with four bleeding points, namely, 140 deg. F., 200 deg. F., 50 lb. and 120 lb. absolute pressure.

Higher Pressures and Temperatures

Higher steam pressures and temperatures were the subject of considerable discussion. Two papers on the subject were presented—one by George A. Orrok and W. S. Morrison (published in considerable detail in the Dec. 2 issue of the *Electrical World*); the other by B. N. Broido. In the latter paper were given results of tests to determine the heat-transmission coefficients of bare and covered pipes at different steam velocities, superheats and pressures. Suggestions were made regarding velocities to select for best economy of transmission.

The discussion from the floor went into practically every phase of this subject—early attempts at high pressure operation, the question of whether higher pressures and temperatures are the way to greater economy, need of balancing fixed charges against fuel cost, possible effect on continuity of operation, effect of prolonged high temperature on metals, value of alloys for fittings, serious problems with pipe flanges, experiences with high pressures and temperatures in the oil distillery field, need of standardizing pipe fittings, economy of regenerative cycles or superheating between stages, higher pressures versus refinement in operation and the use factor of turbines. Every one agreed that reliability and continuity of operation are paramount and that efficiency, flexibility of operation and simplicity rank about on a par in consideration of any new design.

O. F. Junggren contended that past experience has not indicated so far that we have reached the economic limit of pressure, and that engineering ingenuity can be expected to solve all problems.

H. D. Hibbard emphasized the necessity of investigating the effect of continued high temperatures on the elastic limit and tensile strength of metals. Gun steel, he declared, reaches its maximum tensile strength at 950 deg.—about 300 deg. above steel used in power plants.

Dr. D. S. Jacobus pointed out that the problem in using higher pressures and temperatures is more with pipe fittings and flanges than anything else, owing to the falling off in elastic limit. Flanges must not spring or distort and hence they cannot have an extreme overhang.

Referring to experience in the oil-distillery field with high pressures and temperatures, Mr. Millikan declared that valves have been in successful operation at pressures and temperatures up to 1,200 lb. and 1,000 deg. superheat respectively. The chief requirement in such valves is that they shall be made of acid open-hearth steel, be symmetrical and have no flat surfaces and be carefully annealed.

W. J. Wohlenberg contended that there is no need of economizers if the regenerative cycle is used. Mr. Orrok maintained that the more times steam is taken from an expansion stage and returned to the input side the higher the economy will be.

Several speakers, notably I. E. Moultrop, contended that before going to higher pressures and temperatures more attention should be given to refinements in operation. John Stevens presented curves which indicated the effect of coal cost and load factor on efficiency and first cost, while Peter Junkersfeld called attention to the use factor of a number of turbine installations running from twenty to thirty hours per year up to six thousand to seven thousand hours per year. He pointed out that whereas the use factor of one-year-old turbines may be only 44 to 58 per cent, it drops off rapidly as the turbines get older, owing to the economy of using a more modern turbine.

On Wednesday night the American Society of Mechanical Engineers held a joint meeting with the American Economic Association. E. M. Herr, president Westinghouse Electric & Manufacturing Company, and Prof. W. C. Mitchell of Columbia University were the principal speakers.

Kentucky Association of Public Utilities

Assembling at the Phoenix Hotel and the University of Kentucky, Lexington, Ky., on Tuesday, Dec. 12, for its annual meeting, the Kentucky Association of Public Utilities will listen to an excellent program of addresses by prominent representatives of utilities and other industries.

National N. E. L. A. Committees Meet

Public Policy, Customer Ownership, Water-Power Development, Business Promotion and Executive Activities Bring More than a Hundred Leading Executives to Headquarters

MORE than one hundred leading executives of the electric light and power companies of the country attended a series of meetings of the principal committees of the National Electric Light Association in New York City on Dec. 4, 5 and 6. These were the meetings of the public policy committee, the national executive committee, the Public Relations National Section executive committee, the customer ownership committee, the water-power development committee and the Joint Committee for Business Development.

At the public policy committee meeting all matters pertaining to public relations and the general policy of the industry were discussed and recommendations thereon made to the national executive committee.

A report covering the activities of the Public Relations National Section was made by Chairman H. T. Sands and all of these activities were approved by the public policy committee. Mr. Sands reported that the executive committee of his section recommended the continuation of the association's good-will advertising program during 1923. After discussion the recommendation was approved by the public policy committee, which agreed to underwrite the amount necessary to carry on the program.

Chairman John W. Lieb of the joint fuel committee reported that through representation in Washington the National Utilities Association had been able to assist public utilities in all parts of the country in continuing operation of their plants during the recent coal shortage and that this activity was continuing through the present crisis. He reported that the fact-finding commission appointed by President Harding to investigate the coal industry has requested the joint fuel committee to make a report to that commission regarding the utility situation.

The public policy committee appointed a sub-committee consisting of the chairman (Martin J. Insull), S. Z. Mitchell and R. H. Ballard to pass upon the statement of approval of the customer-ownership program which is to be prepared by the customer ownership committee. This will include a plan for policing the securities issues of the industry in order to safeguard the public against fraudulent or valueless issues.

Announcement was made that the radio committee had appointed a sub-committee to take up details of important technical and commercial questions with respect to carrier current and that a report from this sub-committee may be expected at the next meeting.

Customer Ownership Alive

Great Interest Being Manifested by the General Public in Utility Securities

SALES of electric light and power company securities to customers and the public at large will be in excess of $175,000,000 during 1922 and are expected to reach a total of $250,000,000 during 1923, according to reports and estimates received by the customer-ownership committee of the N. E. L. A. during a meeting at national headquarters on Dec. 4 and 5. Almost all the members of the committee were present, and each reported the amount of sales of preferred and common stock issued by his company and by companies in the same district of which he had knowledge. The aggregate was $114,000,000. In addition, it was reported that one of the leading bond houses estimated that bond issues for 1922 would exceed $550,000,000, bringing the total amount of securities issued and sold during 1922 up to approximately $725,000,000, with a probability that the total is many million dollars in excess of this amount.

Every effort will be made by the committee representing the N. E. L. A. and working in conjunction with committees from the Investment Bankers' Association and the National Association of Railway and Utilities Commissioners to police the issuance of securities by electric light and power companies in an effort to protect the public from possible activity by unscrupulous persons or corporations seeking to take advantage of the increased favor electric light and power securities are enjoying in the investment field.

Both the national executive committee and the public policy committee have indorsed the movement and the plan outlined by the customer-ownership committee for its furtherance.

Joint Committee Is Busy

Formation of Local Committees and Provisions Made for Additional Literature

FORMATION of local committees to act as clearing houses for the electrical industry in each of 749 cities and towns where the Joint Committee for Business Development is now represented was planned at a meeting of the committee held in New York City on Dec. 5. It was decided to send letters to representatives of the committee throughout the country, requesting them to form committees of three or more members in their communities to put into action the plans of the business development movement and to furnish information regarding local conditions in the electrical industry. These committees will act as clearing houses for both national and local matters, handling statistical data, furnishing information and making recommendations.

It was announced that 1,100 questionnaires sent out by the Electrical Supply Jobbers' Association and the Association of Electragists International have been returned, and the information is now being compiled at headquarters.

Wiring came in for much attention at the session. Authority was given for the issuance of a pamphlet on wiring, discussing methods for local campaigns and calling to the attention of local electrical interests the importance of high standards of wiring and the necessity of more convenience outlets.

It was reported that the Georgia Electrical Association at its meeting on Nov. 29 had devoted much time to a wiring conference and that the Georgia Railway & Light Company and the Alabama Power Company plan to call meetings of commercial men in Atlanta and Birmingham to discuss wiring programs for the communities in which they operate.

The committee was informed that P. B. Zimmermann, chairman of the electrical lighting department, was preparing a prospectus on home lighting and another on commercial lighting. Chapters on industrial heating are being prepared by C. K. Nichols, chairman of the industrial heating and melting department. A prospectus on industrial cooking is being compiled by C. E. Greenwood, chairman of the domestic and industrial appliance department.

L. L. Holding of the Public Service Company of New Jersey and Charles R. Skinner of the New York Edison Company were made members of the committee, the former becoming chairman of the power department and the latter chairman of the electrical transportation department.

Progress on Many Lines

Executive Committee Hears Good Reports on Inductive Co-ordination and Other Work in Hand

COMPLETION of a set of rules of practice and procedure in line with the joint agreement on principles of inductive co-ordination between the American Telephone & Telegraph Company and the N. E. L. A. was announced by R. F. Pack, fourth vice-president of the N. E. L. A. and a member of the engineering sub-committee on inductive co-ordination, at a meeting of the national executive committee of the N. E. L. A. at headquarters on Dec. 6. It is believed that this will result in facilitating the development of both industries as it will remove one of the great causes of delay in construction and extension work in many parts of the country.

The attendance at the executive committee meeting was the largest this year, representatives being present from every section of the country and from all divisions.

Chairman H. K. Mohr of the membership committee reported a net increase of seventeen members since June 30.

A report upon national activities was made by Executive Manager Aylesworth, who requested those present to urge upon officers of the several divisions they represent the desirability of those divisions fixing the dates of their conventions so that they will not in any way conflict with the national convention. He also urged that every effort be made to have the several state commissions adopt the amended classification of accounts which was adopted by the National Association of Railway and Utilities Commissioners.

A symposium of conditions throughout this country and Canada was presented by the representatives of the several divisions. All reports indicated a very healthy growth in the electric light and power industry, and particularly a growing understanding between utilities and the public, with resultant better public relations and easier financing conditions, which in turn mean more rapid development of electric light and power facilities.

An interesting outline of the California water and power act campaign was presented by Past-president R. H. Ballard, who gave entire credit for the defeat of this act to the citizens' committee and the hundred thousand security holders of the electric light and power companies in California.

Reports showing progress were presented by the chairman of the four national sections. Each outlined in a general way the subjects to be covered in the reports at the national convention in New York in June.

Chairman Hogue of the Commercial Section announced that, in co-operation with manufacturers of electric vehicles, a school for salesmen of electric vehicles will be opened within the next few weeks.

The committee approved the national advertising recommendations of the Public Relations National Section and the public policy committee and appropriated sufficient money to carry on the program during 1923.

Announcement was made by H. P. Liversidge, representing Chairman R. F. Schuchardt of the Technical National Section, that a revision of the "Meterman's Handbook" has been completed, and the executive committee authorized the publication of this handbook, which will be ready early next year.

A résumé of the work of the Joint Committee for Business Development was given by Chairman E. W. Lloyd, and the executive committee approved of the work already done and of plans now completed to give further impetus to the movement.

With the approval of the executive committee, President Smith appointed John W. Lieb as N. E. L. A. representative in the United States Chamber of Commerce delegation to the second general conference of the International Chamber of Commerce in Rome, Italy, March 19 to 26, 1923.

Public Relations Prosper

N. E. L. A. Committee Reports Additional Bureaus of Information and Model Laws

CONTINUATION of the National Electric Light Association's national good-will advertising program during the year 1923 was recommended by the executive committee of its Public Relations National Section at its meeting at national headquarters on Monday, Dec. 4. The recommendation to the national executive committee was that not less than $75,000 should be appropriated and that the importance of customer ownership, the value of the service and the tremendous development now being carried on be stressed in the advertising copy. The meeting was regarded by Chairman H. T. Sands as perhaps the most important meeting of the section's executive committee during the present administrative year. It was exceptionally well attended.

The Information Bureau organization committee reported that two additional committees will be organized and in operation within the next month or six weeks, one for Pennsylvania and the other for Louisiana and Mississippi, with headquarters at New Orleans. John A. Britton, speaking on behalf of the California delegation present, voiced the belief that California is in need of a bureau on public utility information and that one would be organized within the next few months.

In commenting upon the work of the women's committee, Franklin T. Griffith of the Portland (Ore.) Railway, Light & Power Company spoke of the interest that has been aroused by women employees in the activities of the Portland company and in the many domestic applications of electricity. Many women have joined the thirty-two women's organizations in Portland and the surrounding territory, so that whenever a discussion of electricity or the electric light and power company comes up at any of the meetings these women are prepared to refute misstatements.

Chairman P. L. Thomson of the manufacturers' advertising committee stated that his company—the Western Electric Company—is to continue its good-will program and expressed the belief that other manufacturing companies will continue to participate if the N. E. L. A. decides to continue its part in the program.

John C. Parker of the Brooklyn Edison Company, chairman of the committee on co-operation with educational institutions, suggested an annual meeting of from three to five days during the summer vacation or during the Christmas recess which would be attended by college professors, at which time brief but complete information in the form of lectures touching upon all phases of the electric light and power business would be given.

M. S. Sloan of the Brooklyn Edison Company outlined the educational work being done by his company in co-operation with the faculty and students of the Brooklyn Polytechnic Institute. A model law legalizing the investment of savings banks and trust funds in electric light and power utilities securities will be introduced in the New York State Legislature at the request of the State Savings Bank Association. According to Mr. Sloan, who is chairman of the committee on relations with financial institutions, there is $3,000,000,000 on deposit in New York savings banks and the savings banks themselves are eager for a wider field for the investment of surplus funds which at present are lying idle.

Speaking for W. W. Freeman, chairman of the committee on uniformity of state regulatory laws, Executive Manager Aylesworth reported that the draft of the model law is virtually completed.

Chairman Sands announced that the next meeting of the executive committee of the association would be held in Chicago in March, 1923.

Charles A. Coffin Foundation Is Set Up

General Electric Company Creates Fund of $400,000 in Honor of Its Founder, to Provide Rewards for Its Employees and for Utility Companies and Aid for Education and Research

UNDER date of Dec. 2, the president of the General Electric Company issued the following letter in explanation of the Charles A. Coffin Foundation, just established by the directors of the company:

"On May 16, 1922, Charles A. Coffin, in his seventy-eighth year, retired from the active leadership of the General Electric Company. Mr. Coffin has been identified with the development of the electrical industry since 1882. He was the founder and creator of the General Electric Company, of which he has been the inspiration and leader for thirty years. As an expression of appreciation of Mr. Coffin's great work not only for the General Electric Company but also for the entire electrical industry, and with the desire to make this appreciation enduring and constructive, as Mr. Coffin's life and work have been, the board of directors of the General Electric Company created on his retirement and now desire to announce 'the Charles A. Coffin Foundation.'

"GERARD SWOPE, President."

The following account of the objects of the fund and the methods that will be followed in its administration was given out by the company:

"By action of its board of directors, the General Electric Company has set aside a fund of $400,000, to be known as the 'Charles A. Coffin Foundation,' the income from which, amounting to approximately $20,000 per year, will be available for encouraging and rewarding service in the electrical field by the award of prizes to the company's employees and by giving recognition to lighting, power and railway companies for improvement in service to the public, fellowships to graduate students and funds for research work at technical schools and colleges.

"The foundation will be controlled and administered by a foundation committee appointed by the board. This committee, within the limits of the purposes for which the foundation is created, will have power to change the conditions applicable to the distribution of the fund and the amounts for each particular purpose.

HOW THE INCOME WILL BE USED

"The committee proposes to distribute the income of the foundation as follows:

"First—Eleven thousand dollars in prizes for the most signal contributions by employees of the General Electric Company toward the increase of its efficiency or progress in the electrical art. Particularly, the prizes are further to encourage suggestions from workmen. With each prize the company will give a certificate of award. Foremen's prizes are to be awarded for the best department, taking into account its appearance, efficiency of operation and conditions which add to the better conduct of the work and the welfare of the employees. All employees of the company, except executive officers, heads of departments, works managers, superintendents, district office managers and similar executives are eligible for such prizes. In works where employees' representation has been adopted such representatives will co-operate with the prize committee in awarding prizes.

REWARDS TO UTILITY COMPANIES

"Second—A gold medal, to be known as the Charles A. Coffin medal, will be awarded annually to the public utility operating company within the United States which during the year has made the greatest contribution toward increasing the advantages of the use of electric light and power for the convenience and well-being of the public and the benefit of the industry. The company receiving the medal will also receive $1,000 for its employees' benefit or similar fund. A committee to be named by the National Electric Light Association and known as the Charles A. Coffin prize committee of the National Electric Light Association, which shall consist of its president, the chairman of its public policy committee and a third member nominated by them, will award this medal, acting with the advice and co-operation of a committee appointed by the foundation committee. The expenses of the committee are to be paid out of the income of the foundation.

"Third—A gold medal, to be known as the Charles A. Coffin medal, will be awarded annually to the electric railway company within the United States which during the year has made the greatest contribution toward increasing the advantages of electric transportation for the convenience and well-being of the public and the benefit of the industry. The company receiving the medal will also receive $1,000 for its employees' benefit or similar fund.

"A committee to be named by the American Electric Railway Association and known as the Charles A. Coffin prize committee of the American Electric Railway Association, which shall consist of its president, the chairman of the committee on policy and a third member nominated by them, will award this medal, acting with the advice and co-operation of a committee appointed by the foundation committee. The expenses of the committee are to be paid out of the income of the foundation.

"Fourth—Five thousand dollars is to be awarded annually for fellowships to graduates of American colleges and technical schools who, by the character of their work and on the recommendation of the faculty of the institution where they have studied, could with advantage continue their research work either here or abroad; or some portion or all of the fund may be used to further the research work at any of the colleges or technical schools in the United States. The fields in which these fellowships and funds for research work are to be awarded are electricity, physics and physical chemistry. A committee appointed by the foundation committee will award such fellowships and funds for research work, with the advice and co-operation of a committee of three, one to be appointed by each of the following: National Academy of Sciences, American Institute of Electrical Engineers and Society for the Promotion of Engineering Education. This committee is to be known as the Charles A. Coffin fellowship and research fund committee, and the fellowships are to be known as the Charles A. Coffin fellowships. The expenses of the committee are to paid out of the income of the foundation.

"Fifth—In each annual report of the General Electric Company a statement will be made of the awards under the Charles A. Coffin Foundation, and other publicity will be given to such awards.

Formation of Committees

"The Board of Directors of the General Electric Company has appointed as the Charles A. Coffin foundation committee the following officers of the company: A. W. Burchard, J. R. Lovejoy, E. W. Rice, Jr., Gerard Swope and O. D. Young.

"The advisory committee of the General Electric Company will administer the fund within the organization of the General Electric Company. The following committees to administer the fund and to act with organizations outside the company have been appointed:

"Committee to co-operate with the National Electric Light Association—A. H. Jackson, vice-president; J. R. Lovejoy, vice-president.

"Committee to co-operate with the American Electric Railway Association—J. G. Barry, vice-president; A. H. Jackson, vice-president.

"Committee to co-operate with the National Academy of Sciences, American Institute of Electrical Engineers and the Society for the Promotion of Engineering Education—E. W. Rice, Jr., honorary chairman; A. H. Jackson, vice-president; W. R. Whitney, director of research laboratory."

Hoover Urges Quick Action on Colorado Pact

THE ratification of the Colorado River pact signed at the conclusion of a hearing before the Colorado River Commission at Sante Fé, N. M., on Nov. 24 was urged by Secretary Hoover, chairman of the commission, in a statement issued at Los Angeles last week.

"The foundation has been laid for a great American conquest," declared Mr. Hoover. "The harnessing of the giant Colorado River will follow the ratification of the pact by the seven states of the Colorado River basin. Then the Southwest will come into its magnificent heritage of power and life-giving water, and all the nation will be vastly benefited. The first step is to settle the controversy between the upper and the lower districts of the Colorado basin. There can be no development until this is settled. Ratification by the states of the pact agreed upon by the Colorado River Commission will speedily accomplish this. If the matter is forced upon the Supreme Court, it may require years. The next step will be the construction of a control dam in the lower reaches of the river. The commission adopted a resolution urging Congress to proceed toward the immediate construction of the control works."

While the commission made no recommendation concerning the site of the dam, Mr. Hoover said he favored its construction at or near Boulder Canyon. He was emphatic in stating that there was no need to quarrel over the division of the water and said that the big thing about the compact is that it breaks the blockade on development of the whole river.

Colorado River Treaty a Simple Document

Total of 7,700,000 Acre-Feet a Year Apportioned to Each of the Two Basins, with Right of Increase by 1,000,000 Acre-Feet a Year to Lower Basin

THE full text of the compact accepted by the Colorado River Commissioners at their Santa Fé meeting, the successful result of whose deliberations was reported in the *Electrical World* for Nov. 25, comprises only eleven articles and is free from technical or legal verbiage. As indicated last week, it divides the territory watered by the Colorado and its tributaries into two basins. The upper basin includes the territory drained by the Colorado above Lee Ferry and the lower basin the territory drained by the Colorado below Lee Ferry, Lee Ferry being a point one mile below the mouth of the Paris River. Colorado's and Wyoming's interests thus lie in the upper basin, California's and Nevada's in the lower basin, and Arizona's, New Mexico's and Utah's in both. The total amount of water apportioned to each basin is 7,700,000 acre-feet per annum, with the right of increase of use by 1,000,000 acre-feet accorded to the lower basin. Navigation is subordinated to use for domestic, agricultural and power purposes, and power is subordinated to domestic and agricultural purposes. The upper basin is not to take more than 75,000,000 acre-feet in any consecutive period of ten years. If Mexican rights to Colorado River water shall be later recognized by the United States and cannot be supplied from the surplus flow, then the two basins shall share equally in making up the deficiency.

The Treaty in Full

The treaty now awaits ratification by Congress and the seven states concerned. Its provisions follow in full:

"The States of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming have resolved to enter into a compact under the act of the Congress of the United States of America approved Aug. 19, 1921 (42 Statutes at Large, page 171), and the acts of the legislatures of the said states, and have through their governors appointed as their commissioners S. W. Norviel for the State of Arizona, W. F. McClure for the State of California, Delph E. Carpenter for the State of Colorado, J. G. Scrugham for the State of Nevada, Stephen B. Davis, Jr., for the State of New Mexico, R. E. Caldwell for the State of Utah, Frank C. Emerson for the State of Wyoming, who after negotiations participated in by Herbert Hoover, appointed by the President as the representative of the United States of America, have agreed upon the following articles:

"Article I. The major purposes of this compact are to provide for equitable division and apportionment of the use of the waters of the Colorado River system, to establish the relative importance of different beneficial uses of water, to promote interstate comity, to remove causes of present and future controversies, and to secure the expeditious agricultural and industrial development of the Colorado River Basin, the storage of its waters and the protection of life and property from floods. To these ends the Colorado River basin is divided into two basins, and an apportionment of the use of part of the water of the Colorado River system is made to each of them with the provision that further equitable apportionments may be made.

Definition of Terms

"Article II. As used in this compact: (A) The term 'Colorado River system' means that portion of the Colorado River and its tributaries within the United States of America. (B) The term 'Colorado River basin' means all of the drainage area of the Colorado River system and all other territory within the United States of America to which the waters of the Colorado River system shall be beneficially applied. (C) The term 'states of the upper division' means the States of Colorado, New Mexico, Utah and Wyoming. (D) The term 'states of the lower division' means the States of Arizona, California and Nevada. (E) The term 'Lee Ferry' means a point in the main stream of the Colorado River one mile below the mouth of the Paris River. (F) The term 'upper basin' means those parts of the States of Arizona, Colorado, New Mexico, Utah and Wyoming within and from which waters naturally drain into the Colorado River system above Lee Ferry and also all parts of said states located without the drainage area of the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system above Lee Ferry. (G) The term 'lower basin' means those parts of the States of Arizona, California, Nevada, New Mexico and Utah within and from which waters naturally drain into the Colorado River system below Lee Ferry and also all parts of said states located without the drainage area of the Colorado River system which are now or shall hereafter be beneficially served by waters diverted from the system below Lee Ferry. (H) The term 'domestic use' shall include the use of water for household stock, municipal, mining, milling, industrial and other like purposes, but shall exclude the generation of electrical power.

APPORTIONMENT OF WATER

"Article III. (A) There is hereby apportioned from the Colorado River system in perpetuity to the upper basin and to the lower basin, respectively, for exclusive beneficial consumptive use, 7,700,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist. (B) In addition to the apportionment in paragraph (A) the lower basin is hereby given the right to increase its beneficial consumptive use of such waters by 1,000,000 acre-feet per annum. (C) If, as a matter of international comity, the United States of America shall hereafter recognize in the United States of Mexico any right to use of any waters of the Colorado River system, such waters shall be supplied first from the waters which are surplus over and above the aggregate of the quantities specified in paragraphs (A) and (B), and if such surplus shall prove insufficient for this purpose, then the burden of such deficiency shall be equally borne by the upper basin and the lower basin, and whenever necessary the states of the upper division shall deliver at Lee Ferry water to supply one-half of the deficiency so recognized in addition to that provided in paragraph (D). (D) The states of the upper division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification of this compact. (E) The states of the upper division shall not withhold water and the states of the lower division shall not require the delivery of water which cannot reasonably be applied to domestic and agricultural uses. (F) Further equitable apportionment of the beneficial uses of the waters of the Colorado River system unapportioned by paragraphs (A), (B) and (C) may be made in the manner provided in paragraph (G) at any time after Oct. 1, 1963, if and when either basin shall have reached its total beneficial consumptive use as set out in paragraphs (A) and (B). (G) In the event of a desire for a further apportionment as provided in paragraph (F), any two signatory states, acting through their governors, may give joint notice of such desire to the governors of the other signatory states and to the President of the United States of America, and it shall be the duty of the governors of the signatory states and of the President of the United States of America to forthwith appoint representatives whose duty it shall be to divide and apportion equitably between the upper basin and lower basin the beneficial use of the unapportioned water of the Colorado River system as mentioned in paragraph (F) subject to the legislative ratification of the signatory states and the Congress of the United States of America.

"Article IV. (A) Inasmuch as the Colorado River has ceased to be navigable for commerce and reservation of its waters for navigation would seriously limit the developments of its basin, the use of its waters for purposes of navigation shall be subservient to the uses of such waters for domestic, agricultural and power purposes. If the Congress shall not consent to this paragraph, the other provisions of this compact shall nevertheless remain binding. (B) Subject to the provisions of this compact, water of the Colorado River system may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes. (C) The provisions of this article shall not apply to or interfere with the regulation and control by any state within its boundaries of the appropriation, use and distribution of water.

DUTIES OF OFFICIALS

"Article V. The chief official of each signatory state charged with the administration of water rights, together with the director of the United States Reclamation Service and the director of the United States Geological Survey, shall co-operate, ex officio: (A) To promote the systematic determination and co-ordination of the facts as to flow, appropriation, consumption and use of water in the Colorado River basin and the interchange of available information in such matters; (B) to secure the ascertainment and publication of the annual flow of the Colorado River at Lee Ferry; (C) to perform such other duties as may be assigned by mutual consent of the signatories from time to time.

"Article VI. Should any claim or controversy arise between any two or more of the signatory states, (A) with respect to the waters of the Colorado River system not covered by the terms of this compact, (B) over the meaning or performance of any of the terms of this compact, (C) as to the allocation of the burdens incident to the performance of any article of this compact or delivery of waters as herein provided, (D) as to the construction or operation of works within the Colorado River basin to be situated in two or more states, or to be constructed in one state for the benefit of another state, or (E) as to the diversion of water in one state for the benefit of another state, the governors of the states affected, upon the request of one of them, shall forthwith appoint commissioners with power to consider and adjust such claim or controversy, subject to ratification by the legislatures of the states so affected.

"Nothing herein contained shall prevent the adjustment of any such claim or controversy by any present method or direct future legislative action of the interested states.

"Article VII. Nothing in this compact shall be construed as affecting the obligations of the United States of America to Indian tribes.

EXISTING RIGHTS UNIMPAIRED

"Article VIII. Present perfected rights to the beneficial use of waters of the Colorado River system are unimpaired by this compact. Whenever storage capacity of 5,000,000 acre-feet shall have been provided on the main Colorado River within or for the benefit of the lower basin, then claims of such rights, if any, by appropriators or users of water in the lower basin against appropriators or users of water in the upper basin shall attach to and be satisfied from water that may be stored not in conflict with Article III. All other rights to beneficial use of waters of the Colorado River system shall be satisfied solely from the water apportioned to that basin in which they are situated.

"Article IX. Nothing in this compact shall be construed to limit or prevent any state from instituting or maintaining any action or proceeding, legal or equitable, for the protection of any right under this compact or the enforcement of any of its provisions.

"Article X. This compact may be terminated at any time by the unanimous agreement of the signatory states. In the event of such termination all rights established under it shall continue unimpaired.

"Article XI. The compact shall become binding and obligatory when it shall have been approved by the legislatures of each of the signatory states and by the Congress of the United States. Notice of approval by the legislatures shall be given by the governor of such signatory state to the governors of the other signatory states and to the President of the United States and the President of the United States is requested to give notice to the governors of the signatory states of approval by the Congress of the United States.

"In witness whereof the commissioners have signed this compact in a single original, which shall be deposited in the archives of the Department of State of the United States of America and of which a duly certified copy shall be forwarded to the governor of each of the signatory states.

"Done at the City of Santa Fé, N. M., Nov. 24, 1922.

"S. W. NORVIEL,
"W. F. MCCLURE,
"DELPH E. CARPENTER,
"J. G. SCRUGHAM,
"STEPHEN B. DAVIS, JR.,
"R. E. CALDWELL,
"FRANK C. EMERSON.

"Approved: HERBERT HOOVER."

Brief News Notes

Vancouver May Have Two-Million-Dollar Radio Station.—The Canadian Marconi Company, in co-operation with the parent company in England, is contemplating the erection at Vancouver of a wireless station which will permit direct communication with Australia. This would be one of the largest and most powerful radio stations in the world and would probably cost $2,000,000.

Another Lightning Flash Caught by Camera.—Two unusual pictures of lightning flashes have recently been printed in this column—one on page 902, Oct. 21 issue, of a flash photographed in Colorado, and the other on page 1180, Nov. 25 issue, of a flash photographed in British Columbia. Here is a third, this time taken in Maine, across Little Sebago Lake, about 9 p.m. Sept. 15. The photographer is George S. Liebeck, a student at the Worcester (Mass.) Polytechnic Institute, class of 1923.

Low Lighting Rates for Small Consumers at Memphis.—A reduction from 9 cents to 8 cents per kilowatt-hour in residence lighting rates was ordered at Memphis a few days ago by the Public Utilities Commission. Not only was the kilowatt-hour rate reduced, but the commission also established a rate per room which enables the home owner to enjoy a schedule of 5 cents per kilowatt-hour for all energy used in excess of 6 kw.-hr. This means that the small home owner with a five-room house will get the benefit of the 5-cent rate after burning 30 kw.-hr.

Excelsior Springs Company Buys Three Missouri Plants.—The Excelsior Springs (Mo.) Water, Gas & Electric Company, besides purchasing the Brookfield Light & Power Company, as noted in this column last week, has bought the Edina Light Company and the Merchants' Light & Power Company of Novinger, Mo. The combined capacity of these three newly acquired plants is 1,425 kva. With Brookfield serving six cities 110 miles northeast of Excelsior Springs, Novinger about the same distance northeast of Brookfield and Edina 40 miles northeast of Novinger, the Excelsior Springs company, if it should elect to tie together its present properties, would have a line that would reach from a point about 35 miles east of Kansas City to a point about 35 miles west of Keokuk, or a transmission system almost clear across northern Missouri. The Edina and Novinger plants were purchased from R. V. Bartow and L. A. Nickell.

Associations and Societies

New York Electrical Credit Association.—Addresses from Dr. Albert Grant Walton of Stamford, Conn., and from a leading railroad executive are announced for the twenty-seventh annual meeting and dinner of the New York Electrical Credit Association, to be held at the Building Trades Club on Thursday, Dec. 14, beginning at 6 p.m.

Louisville Engineers Dine Below Ground.—A dinner almost 100 ft. below the street level was enjoyed a week or two ago by members of the Engineers and Architects' Club in a condenser chamber of the new power plant of the Louisville Gas & Electric Company at Third Street and the river. Donald McDonald, vice-president of the company, addressed the club.

Georgia Electrical Association.—Leaders in the electrical industry in Georgia met at the East Lake Country Club, Atlanta, on Nov. 29 for the one-day semi-annual convention of the Georgia Electrical Association. "The Hope of the Electrical Industry—the Contractor" was the subject of an address by A. K. Baylor of the General Electric Company, member of the Joint Committee for Business Development and the wiring committee of the N. E. L. A.

Providence Engineering Society Moves to New Home.—Very desirable new quarters have been secured at 44 Washington Street, Providence, R. I., by the Providence Engineering Society, and the organization held a house-warming at its new home on Dec. 1. The society will henceforth have its quarters in the heart of the city, diagonally opposite the Providence-Biltmore Hotel and near the principal railroad and railway facilities. The quarters include a lecture room with a capacity for 250, a secretary's room, library and lounge. Prof. James A. Hall of Brown University is president.

Coming Meetings of A. I. and S. E. E.—Next Monday, Dec. 11, Charles W. Burrows of New York will address the Cleveland Section of the Association of Iron and Steel Electrical Engineers on the commercial application of magnetic analysis in the iron and steel industry. On Wednesday, Dec. 13, C. J. Strago, Allis-Chalmers Manufacturing Company, will speak on gas engines before the Chicago Section. The Pittsburgh Section will celebrate the sixteenth anniversary of the association on Saturday, Dec. 16.

N. E. L. A. Accounting Section.—The date of the meeting of the executive committee of the Accounting Section of the National Electric Light Association has been advanced one week and the meeting will be held on Thursday, Jan. 18, at 10 a.m., at the Hotel Grunewald, New Orleans. It will be preceded on Jan. 16 and Jan. 17 by meetings of the section committees at the same place. The midyear meeting of the executive committee of the Southwestern Geographic Division will follow, on Jan. 19 and Jan. 20.

Lighting Fixture Men's Program.—For the convention of the Lighting Fixture Dealers' Society of America, to be held in the Hollenden Hotel, Cleveland in the week of Jan. 15, 1923, a program has been arranged which contains the following features: "Strong Economic Position of the Dealer," by J. C. English, Portland, Ore.; "A Practical Program for Better Business and 1923 Business Forecast," by a representative of the Babson Institute; "How to Become a Successful Retailer," by Stanley A. Dennis, editor *Electrical Retailing*; "How Glass Is Made," by a representative of the Illuminating Glassware Guild; general discussion on "What Is the Best Way to Reach Business 'Prospects'?" including papers on personal solicitation, circularizing and newspaper advertising; "How to Make Show Windows Attractive," J. Rodger, Chicago; "Compensation to Salesmen," O. A. Barber, besides addresses by C. H. Hofrichter, business manager of the Lighting Fixture Dealers' Society of America, and Robert Biddle, president of the National Council Lighting Fixture Manufacturers. Selling, buying and "piracy" demonstrations will be staged.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

New York Electrical Credit Association—New York, Dec. 14. W. J. Kreger, 47 W. 34th St., New York.

American Physical Society—Boston, Dec. 26-30. D. C. Miller, Case School of Applied Science, Cleveland.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Western Association of Electrical Inspectors—Chicago, Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Wisconsin State Association of Electragists—Milwaukee, Jan. 24-26.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Eastern Division, Atlantic City, N. J., Feb. 15-16.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Commission Rulings

Improper Construction Condemned.—Pointing out that it is contrary to standard practice to run electric wires both above and below telephone wires and in some instances less than a foot away, and that inadequacy of rates is not justification for electrical construction that is not only unserviceable but eminently dangerous to human life, the Missouri Public Service Commission, on the complaint of the town of New Cambria, ordered the Bucklin Light & Power Company and the Macon & Chariton Telephone Company to remedy all defective electrical construction in accordance with standard rules.

Security Issues and Depreciation Fund.—The Missouri Public Service Commission has authorized the City Light & Traction Company of Sedalia to make certain stock and bond issues, holding that neither the overcapitalization alleged nor failure to set aside an adequate fund would justify a refusal to sanction securities for extensions and additions. The necessary funds to amortize bonds and interest for replacement must, however, the commission held, when the bonds have been issued because of the failure of the company to set aside a reasonable sum for depreciation, be paid from income to which the company is entitled as return.

Stock Versus Bond Issues. — In granting permission to the Edison Electric Illuminating Company of Boston to issue additional stock to the value of $5,406,700, as reported in the *Electrical World* of Dec. 2, the Massachusetts Department of Public Utilities dealt at length with the objection made by the city of Boston that the company should be compelled to issue bonds rather than stock. Assuming for the sake of argument that it had the power to make such an order, the commission, after summarizing the reasons that led the city to estimate a net saving of 3½ per cent to the company by bond issues and the company to maintain that it would be less than 2 per cent and might be nothing at all, said: "One must not lose sight of the fundamental fact that money raised by the issue of stock is capital, while money raised by the sale of bonds is just as much a debt as if it were borrowed on short-term notes. This is not a mere matter of definition. It is a fundamental practical distinction. Many individuals and business organizations proceed upon the theory that they are best off when they owe least, and many others have done business on the basis of borrowing when the rates were attractive and money could be easily secured. The gas and electric light companies of this commonwealth have, in general, financed themselves through the issue of stock, and there are many who believe that to this fact is to be attributed, to a very great degree, the general financial soundness of these companies. . . . Debts are bound to mean fixed interest charges, and these in their nature are rigid and have got to be taken care of regardless of the times. Money raised from partners or stockholders, which amounts to the same thing, stands in a much more elastic classification. If the times are hard, the dividends can be reduced or dispensed with and the company still continue entirely solvent and able to perform its public functions. We have had in our official capacity some experience with both types of situations. We have seen gas and electric companies, drifting into hard times, reduce their dividends or cease them entirely and yet continue functioning adequately. We have, on the other hand, seen railroads and railways staggering under the burden of fixed charges and reaching a condition unfortunate not only for themselves but also for those dependent upon them for service. . . . After consideration of all the factors which we perceive or which have been brought to our attention, we are not prepared to override the judgment of the company as to the manner in which it deems it best to raise these funds, at any rate where, from the sum of the amounts sought to be capitalized in comparison with the amount for which the company claims that it has the right to issue permanent securities, we are called upon to deal with the question in a partial and incomplete manner."

Considerations Affecting Extension of Service.—In Condon vs. Edison Electric Illuminating Company of Boston the Massachusetts Department of Public Utilities ordered the company to extend its service along a certain street in Boston, saying: "While there are some facts in favor of the company's contention that the neighborhood will retrogress because of the influence of the railroad and the type of buildings which accompany it, we are inclined to think that a study of the district as a whole shows its character to be predominantly residential, of a character which will probably make it a very likely consumer of the company's product. We think that this will depend not a little upon the company's own attitude. We entertain no doubt that, if the company proceeds to deal with this vicinity in an encouraging and enterprising manner the extension of this service will not only be a benefit to those who get it, but will also prove to be profitable to the company. . . . It is the width of the highways and the excellence of the pavement at this point which have tended to prevent those customers from being served. It would be strange if, because the city of Boston had spent substantial sums of money to make this district particularly attractive, that very fact should lead to the denial of one of the standard conveniences of urban life to its residents."

Recent Court Decisions

Right of Commission to Punish for Contempt.—In Van Hoosear vs. California Railroad Commission a writ of prohibition was granted to the plaintiff by the California Supreme Court giving him relief from a citation for contempt entered against him by the commission for refusing to comply with its order to re-establish water service. The court held that the plaintiff was not the owner of the utility and thus was not subject to the order. It announced that an application for a writ of prohibition restraining the commission from enforcing a judgment of contempt, bringing up a complete record, will be treated as an application for a writ of review and where examination of the record shows the petitioner's inability to obey the order relief from the judgment of contempt will ensue. (207 Pac. 903.)*

Power Company Operating Under Contract with City for Five Years Estopped from Asserting Contract to Be Invalid.—The United States Circuit Court of Appeals in Nebraska has declared, in Central Power Company vs. Central City, a case in which the plaintiff held that the contract between it and the municipality was invalid, that where a city, in reliance on contracts with a power company to furnish it with electricity at specified rates, dismantled its own power plant, and the company recognized the validity of the contract by furnishing electricity thereunder for more than five years, and until after the enactment of a statute empowering the city to enter into such a contract, the company subsequently thereto was estopped from claiming that the contract was void because *ultra vires* at the time it was entered into. (282 Fed. 998.)

Power of Virginia Commission Sustained.—The Supreme Court of Appeals of Virginia has sustained the State Corporation Commission's action in increasing electric rates above those named in an ordinance of January, 1914, between the town of Victoria and the Victoria Ice, Light & Power Company. Suit was brought by the town against the company to have the new rates set aside, but the court, sustaining the police power of the state, declared that the power of a municipal corporation to grant to a public service corporation an irrevocable contract for franchise, fixing specified rates, being a surrender of the power of the state government, must be clearly expressed, and all doubts are to be resolved against its existence. A separate action brought by the town against the company to annul its charter on account of alleged illegalities was also decided in favor of the company. (114 S. E. 89 and 92.)

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

E. L. Kirk Appointed President of Sioux City Service Company

E. L. Kirk is now the president of the Sioux City Service Company, which was consolidated with the Sioux City Gas & Electric Company on Nov. 1. Mr. Kirk was office manager for the Riverside Park Railway Company from 1891 to 1894 and receiver for this company until 1899, when this road and four other lines were consolidated under the name Sioux City Traction Company. He remained as general manager for this firm from 1900 until 1905, when the company was absorbed by the Sioux City Service Company. Mr. Kirk continued as general manager of this concern until his recent promotion to the presidency.

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Capt. William McGregor has been elected vice-president of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I.

Porter Dunlap of McKenzie, Tenn., was elected in the recent general election in Tennessee to the Public Utilities Commission from west Tennessee to succeed W. A. Beasley of Halls, Tenn., who was appointed to fill out the unexpired term of B. A. Enloe, deceased.

Alexander P. McDonald, general manager of the Minnesota Utilities Company, with headquarters at Chisholm, has been appointed superintenden of the Hibbing water and light system. He succeeds W. H. Swartzing, who resigned several months ago on account of ill health.

J. B. O'Neil has succeeded W. A. Campbell as superintendent of the Iron Range district of the Lake Superior District Power Company, with headquarters at Ironwood, Mich. E. O. Sinrud, local superintendent, is acting as assistant superintendent of the Range district.

William H. Atkins, general superintendent of the Edison Electric Illuminating Company of Boston, was the recipient of hearty congratulations Dec. 1 upon the completion of thirty-five years of service with this company, twenty-five of which have been passed in his present position. Various celebrations were held during the day, and Mr. Atkins was presented with a diamond service pin marking his long connection with the company, with a mahogany hall clock from the employees of the operating bureau, with a number of phonograph records containing speeches of congratulation from company officials, and with numerous floral tributes. A special edition of the Waterville (Me.) *Sentinel,* published in Mr. Atkins' birthplace, was prepared in honor of the occasion, and motion pictures of scenes familiar to his boyhood life were shown.

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J. A. Britton Elected President of Bohemian Club of California

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, has recently been chosen president of the Bohemian Club of California, an organization widely known for its artistic and musical achievement and for the unique feature of the annual Bohemian Grove play, given out of doors in a redwood grove. This grove is the property of the club, of which nearly all of the leaders of the electrical industry in the West are members.

J. A. BRITTON

The honor exemplifies the high regard in which Mr. Britton is held for his personal qualities as well as for his official position. It is only one of a number of honors and responsibilities which have been placed upon his shoulders. He is a regent of the University of California and has been chairman of the San Francisco Chapter of the Red Cross as well as a director of the Panama-Pacific International Exposition. He is an active promoter of the city's musical enterprises and all that is best in her civic life.

Mr. Britton was born in Roxbury, Mass., in 1855, but since his thirteenth year has been associated with California. He is nationally known for his work in the N. E. L. A., where he has served as chairman of the public policy committee, as well as for the important engineering and economic advances of his company under his leadership. He is a member also of the A. I. E. E. and of the A. S. M. E.

Arthur and Damon Join Stone & Webster

Capt. James B. Arthur, Ordnance Department, U. S. A., has resigned to enter the organization of Stone & Webster, Inc., Boston, as an engineer in the electrical division. Captain Arthur was formerly an instructor in electrical engineering at the Baltimore Polytechnic Institute and United States Naval Academy and later was associate professor at Johns Hopkins University. During his service with the government Captain Arthur was also in charge of electrical training at the Aberdeen Proving Grounds in Maryland.

John C. Damon, formerly superintendent of service, West Penn Power Company, has also joined the engineering department of Stone & Webster. Mr. Damon is well known in central-station circles. During the war he served as major of engineers in charge of the development and control of the power supply of the eastern Ohio district, besides taking part in the investigation for the government of the power resources of New England.

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J. P. Thompson, formerly assistant treasurer of the California-Oregon Power Company at Medford, has been made assistant general agent of that company.

Harry F. Dart, formerly instructor in electrical engineering, Harvard University, is now engaged in research work for the Westinghouse Lamp Company, Bloomfield, N. J.

C. P. Soderberg, formerly with the Cleveland Wire & Cable Company, Cleveland, is now connected with the merchandising division of the Westinghouse Electric & Manufacturing Company's Los Angeles office.

E. A. Martin has taken charge of the transformer department of the Chicago office for the Wagner Electric Corporation. He was formerly in the Chicago motor division of this company.

E. A. Grimmer, Fred W. Ryder and **Murray Russell** have recently joined the sales force of the Elliott Company, manufacturer of power accessories at Pittsburgh and Jeannette, Pa. In addition to Elliott products they will also sell those manufactured by the associated companies, the Liberty Manufacturing Company, Pittsburgh, and the Lagonda Manufacturing Company, Springfield, Ohio.

S. W. Henderson will remain general manager of the Edina (Mo.) Light Company and the Merchants' Light & Power Company of Novinger, Mo., which have been acquired by the Excelsior Springs Water, Gas & Electric Company. Percy Markham, for many year manager of the Brookfield (Mo.) Light & Power Company, will continue as manager there for the **Excelsior** Springs Water, Gas & Electric Company, which has acquired the Brookfield properties, serving six cities in northeastern Missouri.

S. F. Sowers is now president of the Greenlane (Pa.) Light, Heat & Power Company, replacing S. S. Hartzell.

B. F. Thornton is now chief electrician of the municipal electric light plant at Columbus, Ohio, replacing H. F. Fisher.

W. B. Voth is now manager of the Eastern Dakota Electric Company, Watertown, S. D., replacing M. A. Harrison.

W. A. Buchanan is now assistant district manager of the Kentucky & West Virginia Power Company at Logan, replacing P. H. Powers.

C. E. Blee, formerly assistant general agent for the California-Oregon Power Company at Medford, Ore., has been made assistant engineer.

G. R. Bullock is now secretary and treasurer of the Mount Hope Electric Power & Water Company, Mount Hope, W. Va., replacing N. R. Waldo.

A. T. Gustad, formerly connected as electrical engineer with Murrie & Company, New York City, is now connected with the American Gas Accumulator Company, Elizabeth, N. J., as designing engineer.

Lynn G. Barnes, formerly with the General Electric Company at Schenectady, N. Y., is now resident engineer and electrical superintendent for the International Paper Company at Franklin, N. H.

P. D. Lawrence has been appointed superintendent of power for the Hortonia Power Company, Brandon, Vt. H. H. Perry of Chicopee, Mass., is to take his place as local manager at Bristol, Vt.

Earl R. Witzel has resigned his position as manager and treasurer of the Groton Electric Company, Groton, S. D., and has become vice-president of that company. He is organizing a two-year electrical course at the University of Wyoming.

Frank M. Williams, nominated for the office of State Engineer in New York State seven times and five times elected, who retires from office on Dec. 31, will ally himself with the Technical Advisory Corporation of New York, an organization composed of consulting engineers.

William W. Brennan has been transferred from the engineering department of the Edison Electric Illuminating Company at Brockton, Mass., to the Whitman office, where he will act as general agent of the company in the towns of Whitman, Hanson and Pembroke.

R. W. Everson, sales manager of the Mexican branch of the Westinghouse Electric International Company, has been appointed district manager of the Atlanta office of the Westinghouse Lamp Company. He succeeds Julien Binford, Jr., resigned. Mr. Everson has been associated with the Westinghouse industries for more than twenty-four years and has held a number of important positions.

H. P. Currin, engineer associated with the Eastern Oregon Light & Power Company for the past four years, has resigned his position, and the vacancy has been filled by H. C. Miller.

Melvin D. Engle has resigned his post with the Consolidated Gas, Electric Light & Power Company of Baltimore and is now connected with McClellan & Junkersfeld, New York City.

H. W. Rose, engineer of the Victoria (Tex.) Electric & Ice Company for the last two years, has resigned to become general manager of the H. W. Rose Manufacturing Company, which has just been organized in Victoria.

* * *

Colorado Elects Electrical Man Governor

William E. Sweet, well known to the electrical industry in Colorado, was recently elected Governor of that state on the Democratic ticket in one of the closest campaigns ever waged in the Rocky Mountain region. Governor-elect Sweet, who is a banker and financier, has prominent connections with the electrical industry in Colorado and the surrounding states. He is vice-president of the Albert Sechrist Manufacturing Company, manufacturer of lighting fixtures and electric pressure cookers, is financially interested in an electric utility in Nebraska and has extensive holdings in Colorado industrial organizations.

W. E. SWEET

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Theodore E. Burger has joined the general staff of the Western Electric Company at the headquarters office, New York. For the past year and a half Mr. Burger has been secretary of the Society for Electrical Development, Inc. In making this change Mr. Burger will be again connecting himself with the organization in which he obtained his first electrical experience, he having started with the Western Electric Company at Los Angeles in 1905. He was manager of the branch in that city from 1907 to 1917. He was one of the early presidents of the Los Angeles Electric League.

H. R. Van Deventer, formerly associated with the bureau of patent development of the Westinghouse Electric & Manufacturing Company, has been appointed vice-president in charge of research, manufacturing and patent development of the Dubilier Condenser & Radio Corporation, New York City.

Obituary

Charles B. Fithian, who was associated with Albert Gentel, Inc., electrical contractor-dealer of Philadelphia, for twenty-five years, died on Nov. 25. Mr. Fithian was well known in Philadelphia electrical circles.

Frank W. Smith, general manager of the Sundh Electric Company, Newark, N. J., died recently at the age of fifty-two while playing on the Echo Lake Golf Club course at Westfield. Mr. Smith was a pioneer in the field of electrical control. He had been associated with the Sundh company for eighteen years.

John A. Tracy, head of the New York Telephone Company in Hudson County, N. J., died recently at the Greenville Hospital, Jersey City, following an operation for appendicitis. Mr. Tracy rose from a clerkship in the telephone company to the head of the Hudson division in fifteen years. He was forty-two years of age.

Ralph L. Clarke, assistant manager of the San Diego Consolidated Gas & Electric Company, died in November after an illness of two months. Mr. Clarke had been associated with the company since 1886, when as a young engineer, trained by his father, he joined the Jenney Electric Company, the forerunner of the present company. Rising to be chief engineer and superintendent of electric production, Mr. Clarke was an important factor in the growth of the company. When it was acquired by H. M. Byllesby & Company in 1905 he remained as general superintendent. About two years ago he was made assistant manager.

Leon Vail Garron, manager of the supply department of the Philadelphia Electric Company, died at his home in Woodbury, Pa., on Nov. 23, a victim of pernicious anemia. Mr. Garron became associated with the Philadelphia company in 1899 as a solicitor for the Edison company, but resigned one year later to become connected with the General Incandescent Arc Lamp Company. In 1906 he returned to the Philadelphia Electric Company as assistant manager of the supply department, and he succeeded H. C. Lucas as manager when Mr. Lucas became treasurer of the company in 1911. Mr. Garron was a member of the executive committee of the Electrical Supply Jobbers' Association. He was forty-four years of age.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

The Need for More Electrical Statistics

Manufacturers Should See that the Industry Is Represented Adequately in the Department of Commerce "Survey of Current Business"

By L. S. Horner
Vice-President the Acme Wire Company

APPARENTLY few manufacturers in the electrical industry realize the opportunity which is offered them through the United States Department of Commerce to compile current facts on production, consumption and stocks as usable statistics of their particular industry, otherwise they would certainly have taken alvantage of it to some extent during the past twelve months. It is significant that out of twenty-seven basic industries reporting in the *Monthly Survey of Current Business* as groups only two related even remotely to the electrical industry are included, namely, electric power and copper.

New Viewpoint Toward Business

Great credit should be given Herbert Hoover, the Secretary of Commerce, for his business vision in realizing that census and biennial reports on manufactured products are of interest as history but of no practical value to the active executive who wants current facts showing the trend of activity in all industries. Many business men who heard Mr. Hoover's speech before the United States Chamber of Commerce at Atlantic City in May, 1921, realized that a new era had apparently dawned in the relations of government to industry, and thanks to his driving force, coupled with a business man's point of view, the country has been offered an opportunity to have facts presented in concrete form covering all leading industries, provided that the industries are sufficiently interested to organize themselves so as to furnish the details either through an association of the leaders of the particular industry or by arranging to have details sent to the Department of Commerce and put in proper form for the *Monthly Survey*.

It is assumed that every electrical manufacturer agrees that current facts on such activities as bank clearings, foreign trade, car loadings, idle cars, building activity, steel, copper, rubber, vapor and other products are vitally necessary to run any business intelligently. Why not, therefore, tie into these figures corresponding facts regarding the electrical industry, covering its main activities?

Prosperity or depression trends apply equally to all allied businesses, and the electrical industry has failed to realize its obligation as an industry to make public and give to its customers accurate statistics regarding conditions in the industry. Such information must aid the growth of the electrical art and over a period of years cannot possibly injure any individual interest. The facts, if properly collected by an association, and certainly if given direct to the government, are strictly confidential as regards any individual manufacturer. And if we do not give, we ought not to get.

Some old well-established electrical firm may say, "The facts of my industry are well known to me through a most efficient sales organization." I refuse to agree that such knowledge can be accurate. It must largely be based on the statement of the buyer to the salesman. These statements are frequently inaccurate, intentionally or otherwise. The only reliable facts are production, distribution, stocks and comparative market prices obtained by hearty co-operation from every manufacturer of a given group and distributed monthly by the government in a brief form, where a glance at a table or a group shows the trend of all industries. Is it not better to have this general information in one brief form so that we can see the trend, rather than have to go to a dozen or more publications covering a particular activity and collect from each what we are particularly interested in?

A thorough survey of any subject necessitates a complete study of the subject, but the busy executive must conserve his time and yet have his decisions based on general facts. Why, therefore, object to giving information about your own business, if you benefit by facts given through allied industry?

We certainly agree that it is not good business to base your production or expand your facilities on anything except facts, but the only way to get them is to do your part by indicating in what general direction your industry is going—toward an increasing or decreasing demand. Furthermore, the electrical industries should be just as much interested in their customers knowing what the real conditions are as in knowing this themselves, because such knowledge is constructive and betters the electrical industry as a whole, and the individual manufacturer shares the general benefit. Is it not true that if facts regarding production and distribution of electrical products had been better known to all of us in 1920 there would not have been such high-priced inventories to liquidate on Jan. 1 of 1921 and 1922?

Individual Action Needed

The questions, therefore, for each manufacturing group of the electrical industry to consider and decide are these:

1. Shall we request the Department of Commerce to include in the *Monthly Survey of Current Business* statistics regarding our business?

2. In what form shall the statistics be published to give us a quick picture of the trend of our business?

3. How shall the confidential figures from each company be intelligently tabulated and promptly transmitted every month to the Department of Commerce?

The past twelve months' experience in publishing this survey makes the problem now comparatively simple. Mr. Hoover has appointed a direct representative of his department for the electrical industry, and co-operation and interest can confidently be expected by any manufacturer who takes this matter up with this representative. But let me emphasize this fact. There must be hearty co-operation of the industries contributing the information. Figures obtained by compulsion are of little value. They must be furnished freely, and a manufacturer who furnishes them must realize that the information is for his own benefit as well as for the benefit of his customers and other allied business.

W. M. Steuart, Director of the Bureau of the Census, has stated: "The bureau is perfectly willing to have any individual manufacturer make his report under a code, and under the provisions of the law in regard to confidential data, it will collect the reports and assemble them, to be included in the survey."

Trade Congestion Cramps Our Retail Selling

Conditions Vary with Communities—The Position of the Central Station and Its Increasing Influence in Local Distribution—Three Things to Do

By A MANUFACTURER

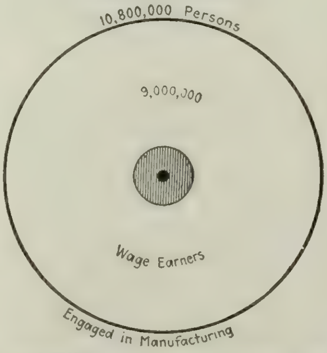
THERE is a natural tendency on the part of men in all lines of industry to feel that things as they are are right and must continue. And because they think from this viewpoint they are inclined to resist trends and influences that indicate impending change.

Not many years ago, for example, the electrical jobber was disposed to take the position that he was entitled to first consideration in the scheme of merchandising merely because he was established. Today, however, I think jobbers realize that they are but one link in the chain and that they must demonstrate their absolute usefulness as part of the distribution machinery for every particular product or be dropped out of the chain as far as that product is concerned. They realize also that there is a limit to the number of dealers that can survive at all in a given community.

CONGESTION OF CONTRACTORS

At the present time there are too many dealers and too many contractors in the electrical industry. The congestion seems to have come about from natural causes. The industry has developed and spread so rapidly that it has afforded means of a temporary livelihood for many who have not been qualified to do business of any kind on scientific and economical lines. The radio craze of last year is a striking example of a development that drew in innumerable little manufacturers and traders who have since been dropping out again in great numbers because they were not qualified to stay in the business. Moreover, one of the great errors in our situation in my opinion is the wholesale union of so-called contractor-dealers. This has brought about an unsatisfactory situation on the contracting side of the business and hampered wiring development in a marked degree. On the other hand, it has multiplied incompetent dealers to such an extent that there is no room for them in the industry. Almost every community has more dealers in it than can possibly make a good healthy profit even if they have the whole available discount over the manufacturers' commercial cost.

Employees Engaged in Manufacturing



THERE are 10,800,000 persons now engaged in work in the manufacturing plants of America. This chart shows the number who are wage earners as compared with the salaried employees, represented by the shaded area, and proprietors or firm members, indicated by the black dot.

But now, I believe, we are going to see the contractors get back into their regular line of business and by efficient methods eliminate the army of so-called "basket" contractors that have sprung up because the legitimate contractors have neglected their regular work. We are also, I hope, going to see the number of retail outlets reduced to a reasonable number in each community. This will bring about a more healthy condition in the industry and a better balance in our distribution.

For say thirty years past we have been going through a period of the most astonishing development in the way of invention, opening up one vast possibility after another. This has naturally drawn in the irresponsible elements that are now causing congestion. I believe we are now going into a period that will be as remarkable as the thirty years that have passed, but marked more particularly by the application of things electrical in every form and the establishment of the merchandising and distribution branches on a stable basis by the development of the legitimate elements in the business and the elimination of those that are superfluous or inefficient.

CENTRAL-STATION INFLUENCE VITAL

Every one connected with the merchandising of electrical products must remember, furthermore, that the central station is not merely an important factor but is the nucleus around which we must build our business. Generally speaking, and omitting the factor of isolated plants, the sale of all electrical apparatus and merchandise in every community depends for its growth on the service of the particular central station of that community, and that particular central station will inherit the trouble from any energy consuming devices attached to its lines. Therefore the central station is interested in seeing that the dealers do not sell inferior material, and the dealers in a given community cannot in the long run prosper if they sell inferior material and continually sow the seed of trouble for the central station.

It must also be borne in mind that all electrical appliances have been largely distributed during the pioneering period by house-to-house selling methods. This house-to-house canvassing has become a nuisance in many communities. It is also an expensive method and in the long run must be abandoned or very considerably modified. The central station is the only organization that has physical contact with every possible electrical customer in the community and can maintain effective house-to-house contact without offense and also in the regular course of business make a chart of the community and know exactly what appliances are in each household. The development of central-station commercial activities and co-operation of the other branches with the central stations therefore becomes increasingly vital.

Gradually all these elements and factors will be resolved and find their place in the operations of the industry.

THREE THINGS TO DO

Without expecting to solve the whole problem promptly, if I were in the jobbing business under present conditions, I would give early attention to a few outstanding points:

1. I would study this central-station question and capitalize it by working with the central station, to influence the contractor to do a more complete wiring job and teach the dealer that he must sell high-class reliable products in order to endure in a given community.

2. Then I would ask the central station to encourage officially the use of high-class products such as I would distribute by making it known to the dealers that the sale of inferior material was looked upon with disfavor and if persisted in would lead necessarily, in the interest of good service, to regulations requiring approval of any product before it could be connected to the central-station lines.

3. Then I would turn to the contractor-dealers and urge all good contractors to go after wiring business and put it on a proper basis. I would urge them to drop merchandising where it does not show them a clear, healthy profit. In this way I would try to do away as far as possible with the innumerable incompetent dealers and "basket" contractors.

If I could make any considerable headway on these points, I believe, I should be well satisfied to devote a year to it before thinking of any other part of the problem.

Survey of Business Conditions

Chicago November Motor Sales Equal October's

Sales of motors for the Middle West territory for November have maintained the level established in October. Of five motor manufacturers, three report an equal volume of sales while two report increases. One of these companies asserted that its sales averaged a 10 per cent increase, while another firm declared that its Chicago sales for November increased 40 per cent over October. A large majority of sales are under 10 hp. for use in various fields, including the pump and elevator industries. Industrials have not been buying the larger sizes. Stocks are in good condition and prices remain firm.

◆

Puts Radio Business at Fifty to Sixty Millions a Year

Radio business is now proceeding at the rate of from fifty to sixty million dollars a year, according to E. E. Boucher, sales manager of the Radio Corporation of America, who spoke before the recent jobbers' convention in Cleveland. He predicts that before Dec. 15 sales will have accelerated so that jobbers' stocks will be cleaned out.

"Experience has shown," he said, "that the department store is not making a success of radio. Some music stores have done a good job, but the electrical man has proved himself to be in the best position and will carry away the business if he will set himself to sell complete units by progressive merchandising methods. The sale of parts will continue to the amateur experimenter, but there will be separate fields for development."

◆

More Intelligent Buying Has Entered Radio Parts Market

Radio-equipment buyers are becoming more particular when buying parts, according to the observation of several New York City merchants specializing in parts. One of them points out that amateurs are asking questions about the outstanding features of this or that part in a more noticeable degree than when the first wave of radio popularity swept the country a little more than a year ago. The matter of price makes no difference to these purchasers. Quality is wanted, he says.

Assembling of parts into efficient sets by schoolboys is being taken more seriously this year, says a leading dealer in the upper west side of Manhattan. Some boys in that neighborhood, he says, have formed a club whose leader buys their parts in collective quantities at reduced prices. This retailer relates a story of a high-school student who refused an inferior make of telephone head set at a very low price and instead placed a small deposit, all that he possessed, on a set which costs almost twice as much, explaining that he would prefer to wait a few weeks in order to get "something that will last."

◆

Urges Flat-Rate System for Service Stations

M. B. Speer, service manager at the Westinghouse Electric & Manufacturing Company's East Springfield plant, addressed the New England Section of the Society of Automotive Engineers in Springfield, Nov. 24, on "Electrical Service." He said few electric service stations are organized and run efficiently and recommended that engineers employ their influence for better arrangements both in the matter of shop equipment and checking up costs. The flat-rate system is recommended to service stations as best.

Faulty work in rewinding armatures was mentioned as a source of loss and trouble in many maintenance establishments, and the extensive sale of unguaranteed and spurious parts was cited as a source of demoralization. The manufacture of inferior apparatus and parts and the springing up of a host of small dealers and service concerns, taken together, has brought about a decidedly unsatisfactory state of affairs, he asserted, and one that in justice to the public and legitimate concerns must be met with concerted opposition. It is the duty of engineers, by intelligent advice, the speaker said, to become a regenerating force in these matters.

◆

Outlook for Washing Machines Is Promising

The constant increase in washing-machine sales is seen in recent reports from that market in all sections of the United States. During the early months of 1922 little activity was shown for this appliance, but since the first days of July orders have been coming in at a rapid rate. Intensive selling efforts by house-to-house canvassing, displays at the agricultural fairs and the "home electric" shows by different electrical clubs and societies have done much to bring about the added interest.

Great activity is shown in the Far West. In San Francisco it was reported several weeks ago that October business has set new records for the past twelve months, but that in some cases the jobbers are reporting rather poor sales for November. One distributor reported that one crew of thirty men sold 120 machines in October, having been assisted by a list of "prospects" secured at several agricultural fairs. Stocks are good in Salt Lake City, where it is reported that several aggressive washer and vacuum-cleaner campaigns were launched in

October, although the response was not particularly gratifying. In the Cleveland territory it is reported that all standard makes are in good demand, jobbers having sufficient orders on hand to insure activity until after the holidays, while manufacturers report production easily absorbed. In Denver central-station campaigning is stimulating interest. Sales in Portland and Seattle have exceeded in many cases the expectations of the dealers, with a consequent shortage in many lines. There is increased activity in the Southern and Eastern territories.

Chicago Industrial Activity Showing Upward Trend

Increased employment and industrial activity in the Middle West have established a new record of electrical energy used, according to figures compiled by the Federal Reserve Bank of Chicago. The September production of electrical energy increased 19.8 per cent over the same month in 1921, while the number of industrial users advanced 8.1 per cent. Increased employment in Chicago is indicated in the reports of the surface and elevated lines made to the Illinois Commerce Commission. The surface lines handled 4,300,000 more passengers in October than during September, while the elevated lines reported a 5 per cent increase in business.

October Eectrical Exports Decline $115,282

Exports of electrical supplies in October show a decrease of $115,282 below September and were $247,559 lower than October, 1921, when they amounted to $5,371,030. In October, 1920, exports of electrical goods amounted to $9,988,215. Few finished manufacturers' exports have lately developed more strength. Normally this trade is hampered by rapid invention and variability of price lists. For the past eighteen months American exporters have also had to contend with renewed competition from a half dozen leading European markets well established in special lines of output many years before the war.

Electrical exports for October, 1922, are shown in table below.

ELECTRICAL EXPORTS FOR OCTOBER, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

	October, 1921 Value	October, 1922 Value
Turbines	....	$26,965
Generators	$779,338	
Direct-current—		
Under 500 kw		32,509
Over 500 kw		133,363
Alternating-current—		
Under 2,000 kw		19,780
Over 2,000 kw		165,390
Accessories and parts for generators		44,661
Self-contained lighting outfits	....	32,265
Batteries	211,758	
Primary—		
Dry		79,714
Wet		2,872
Storage	....	165,044
Transforming and converting apparatus:		
Transformers	464,281	
Power		84,191
Other	....	33,574
Rectifiers		4,929
Condensers, double-current and motor generators, dynamotors, synchronous and other converters	....	50,448
Transmission and distributing apparatus:		
Switches and accessories	176,154	
Switches and panel boards, except telephones		252,640
Switches and circuit breakers	....	119,424
Fuses and fuse plugs		19,652
Meters and measuring instruments	161,462	
Watt-hour and other measuring instruments		53,003
Volt, watt, and ampere meters and other recording, indicating and testing apparatus		66,691
Lightning arresters, choke coils, reactors and other protective devices	....	35,535
Motors, starters and controllers:		
Motors under 1 hp	....	83,791
Stationary motors—		
1 to 200 hp		156,018
Over 200 hp		24,794
Railway motors		112,158
Electric locomotives	236,845	
Railway		10,000
Mining and industrial	....	19,779
Other motors	525,142	6,685
Rheostats, controllers and other starting and controlling equipment	77,735	62,246
Accessories and parts of motors	....	63,874
Electrical appliances:		
Electric fans	$15,444	$45,575
Electric lamps:		
Arc	1,250	3,828
Incandescent—		
Carbon-filament	3,980	2,893
Metal filament	104,889	138,022
Other electric lamps		20,152
Flashlights		31,896
Searchlights and projectors		89,196
Motor-driven household devices		83,928
Domestic heating and cooking apparatus	74,302	76,789
Industrial electric furnaces and ovens		46,279
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries		64,862
Signal and communication devices:		
Radio and wireless apparatus		564,803
Telegraph apparatus	42,769	38,887
Telephone apparatus, including switchboards	163,397	433,016
Police, fire and burglar alarm apparatus		10,285
Railway signals, switches and appurtenances		28,733
Bells, buzzers and annunciators		6,760
Other electrical apparatus:		
Spark plugs, magnetos and other ignition apparatus	78,890	88,373
Insulating material		80,542
Metal conduit, outlet and switch boxes		14,662
Sockets, outlets and receptacles		75,449
Other wiring devices	86,822	143,968
Other electrical apparatus, not elsewhere specified	1,798,655	425,755
Globes and shades for lighting fixtures	....	40,089
Electric glassware, except for lighting		15,976
Electrical porcelain		72,606
Carbons for electric lighting electrodes and batteries	26,526	93,330
Insulated wire and cables (iron and steel)		31,327
Manufactures of aluminum including wire	96,955	93,874
Copper:		
Bare wire	66,900	128,794
Insulated wire and cable	177,536	170 827
Total electrical machinery apparatus and appurtenances	$5,371,030	$5,123,471

Says Electrical Situation in Orient Is Improving

"The general business situation in China is improving," said Julean Arnold, commercial attaché to China, to a representative of the *Electrical World* last week in San Francisco. "It is true that the political situation continues bad, but this does not affect the country as a whole nearly so much as does the political situation in the United States.

"The outlook for foreign export to China of electrical goods is very encouraging, but it is well for American manufacturers to remember that they must have a financial organization to handle the credit situation if they wish to do extended business in China. Three American firms, the General Electric Company, the Westinghouse Electric & Manufacturing Company and the Western Electric Company, have already strong organizations in the Orient and other electrical manufacturers are seeking to gain admission there."

The Metal Market

Copper, Zinc and Tin in Small Demand—Lead Price Advances to 7.10 Cents

Copper, zinc and tin have been in small demand during the last week. Lead has continued strong.

There are more copper sellers at 13⅞ cents delivered today than there were a week ago, and there is no difficulty in getting large amounts of copper for delivery over the next two or three months at this level, where the freight rate is not more than 25 cents per 100 lb. On some desirable business the price has been shaded to 13.80 cents. Two or three lots have been offered by second-hands, and this metal is reported to have been obtainable at 13.75 cents.

NEW YORK METAL MARKET PRICES

	Nov. 29, 1922 Cents per Pound	Dec. 6, 1922 Cents per Pound
Copper		
Prime Lake	13 75	13 87½
Electrolytic	14 00	14 00
Casting	13.45	13 45
Lead, Am. S. & R. price	7.00	7.10
Antimony	6 50	6 50
Nickel, ingot	36 00	36 00
Zinc, spot	7 25	8 25
Tin, Straits	32 20	32 20
Aluminum, 98 to 99 per cent	21 50	21 50

The official contract price of lead of the American Smelting & Refining Company was advanced from 7 to 7.10 cents on Nov. 24.

The advance of the smelting company brought its price about to the level of outside interests for December and January lead. At the new level lead was in freer supply and more was sold for Eastern delivery than for some weeks. For prompt and spot lead premiums continue to be asked, and 7.25 cents would no doubt have to be paid, though practically none is being sold, so that the influence of this price on the major market is practically nothing.

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

IMPROVING business in appliances, motors and lamps is reported. Central-station buying has fallen off noticeably during the past week and little further activity for the next two months is expected. Holiday purchases of flatirons, toasters, novelties, vacuum cleaners and washing machines are heavier, although, because of Thanksgiving Day, the volume of sales for last week was not larger. Conduit stocks, particularly in the Far Western sections, are very low, and jobbers express grave fears for the future. An official of an important radio corporation stated before a meeting of jobbers in Cleveland last week that sales are now proceeding at the rate of from fifty to sixty million dollars a year.

New York

Pole-Line Hardware Demand Falls Off—Holiday Buying Continues Brisk—Fixtures Active

Although last week's volume of business was reduced because of the holiday, there was a considerable impetus given to sales during Friday and Saturday. Much activity in appliances, motors and fixtures is being shown in the present market and there is every indication of further improvement.

Pole-Line Hardware.—Demand has fallen off considerably and there is little activity in new line construction by central stations. Insulators are quiet.

Appliances.—Cooking and heating appliances are arousing more interest, and prices are reported slightly lower because of extreme competition in some instances. Vacuum-cleaner and washing-machine sales for November are said to be in excess of those for October.

Fixtures.—Much activity is reported for commercial sizes. With the completion of many homes in New Jersey and Brooklyn, a good amount of business is going in that direction.

Radio.—Much improvement is noted, and holiday buyers are taking the heavy stocks held over for many months. Dealers report more careful and intelligent purchasing. Prices are reduced.

Chicago

Wiring Demand Good—High-Tension Material Brisk—Motor Sales Lively—Radio Advancing

Business in the electrical industry has had another good week. Although few changes in either demand or price were announced, jobbers report that their main volume continues to swing along briskly. Wiring materials are still in active demand. The high-tension manufacturers reported another lively week. Statements from manufacturers relative to November motor sales indicate that they have equaled or even bettered October's sales.

Wire.—Reports from jobbers indicate that the volume of wiring material sold during the past week is still steady.

High-Tension Equipment.—All firms report a continuing active week. One firm sold a 132,000-volt, 6,000-kva. outdoor substation to a Middle Western utility and two 66,000-volt, 3,000-kva. substations to another Western utility. Another company reports brisk business on 33,000-volt and 66,000-volt fuses.

Motors.—Sales on motors for November have equaled the volume sold in October. Most of this equipment is under 10-hp. for use in the motorization of standard machinery, including lathes and machine tools. Motor stocks are in good shape and prices are firm.

Fuses.—The call for the 30-amp. fuse has increased slightly, which jobbers attribute to the seasonal demand for better lighting systems. Stocks are normal.

Radio.—With the advent of the opera season, an improved demand for radio has been noticed, although the main volume is not so great as expected. Stocks are in good shape since both vacuum tubes and head sets are available.

Boston

Lamp Demand Active—Brisk Motor Business—Weatherproof Wire Quiet—Irregular Conduit Deliveries

Gradually improving business is reported in all parts of electrical New England. General industry is gaining, and while conditions have not reached normal in the textile field, they are growing better. Central-station energy sales are increasing with great rapidity. Building operations continue to absorb much new capital, and so far labor conditions appear in better shape than in some other sections. Retailers of electrical goods are well "set" for a heavy holiday trade. Jobbers' stocks in Boston are showing none too much margin over current requirements, and deliveries from outside New England are greatly hampered by railroad embargoes. Prices are firm and tend to stiffen in flexible armored conductor and weatherproof wire.

Lamps.—The demand is very active and stocks are comfortably meeting it. Small mercantile establishments are responding to sales efforts by lighting departments of central stations and dealers.

Motors.—The rate of increase in business over last year continues to be well maintained, with some fluctuations above or below in comparing particular weeks now and twelve months ago. Second-hand stocks are being depleted, and much interest is evident among appliance manufacturers, who are now considering their fractional-horsepower motor needs in 1923.

Wire.—Rubber-covered wire is moving very actively on building construction jobs. Weatherproof is quieter, although prices trend upward in the additions for sizes above the current base. Deliveries are in good shape, especially from New England factories. Bare wire is dull.

Rigid Conduit.—Scarcity prevails in some sizes among local jobbers, but by "shopping around" immediate needs can usually be met. Deliveries are irregular and uncertain, owing to railroad embargoes.

Cleveland

Radio Improving—Good Wire Stocks—Porcelain Prices Reduced—Heater Demand Falls Off

Judged by the volume of traffic offered to the railroads, general business maintains itself satisfactorily. Moderate weather in November has relieved the traffic congestion of the month before and car loadings continue at a rate not much below the record of two years ago. Radio has shown much improvement and conduit has become more available. Prices generally are firm and distribution is fairly equal between advances and declines.

Wire.—Activity in No. 14 rubber-covered continues, but from good stocks. A slight tendency to advance prices is noted.

Conduit.—Although stocks have been recovered, the demand for the larger pipe continues in good volume. Prices have not yet indicated a decline. Armored cable is steady and prices are firm.

Poles and Pole Line Hardware.—Fair activity is noted and one jobber reports stocks reduced. Prices are firm.

Porcelain.—A limited market and large stocks have had a tendency to reduce prices.

Lamps.—Smaller types continue to be in good demand despite partial suspension of building activity. Dealers are prepared for an expected activity in Christmas-tree lamps. Commercial fixtures and wiring devices are steady, but dealers are not recovering stocks.

Heaters.—Demand has fallen off sharply, but this is due to mild weather and prices remain firm. The holidays and colder weather are expected to create an active market by next week. Stocks are normal.

Radio.—Jobbers and dealers report greater demand with the regaining of popularity. Many dealers are reducing current stocks with sales.

Atlanta

Heavy Movement of Armored Conductor — Meter Stocks in Good Shape—Fuses Active

Business conditions in general in the Southeast remain about the same. The long drought continues, but the ability to obtain cars for coal shipments is tending to relieve the situation and no curtailment of power is expected at the present time. Jobbers and dealers report the trade as very brisk and the outlook bright for a big holiday season. Stocks are in excellent shape. Collections have improved during the past sixty days, but jobbers expect them to slow up until the first of February on account of the holidays.

Armored Conductor. — A steady movement is reported, with the building program indicating a continuation of satisfactory sales. Only fair stocks are on hand, but deliveries are good.

Meters.—The movement in this line is fair to good, the best sales being reported in the 5-amp. and 10-amp., two-wire sizes. Stocks are in good shape with prices steady.

Fuses.—The fall demand is in evidence, both in plug, cartridge and renewable types, with an increasing tendency on the part of industrial plants to standardize on the renewable fuse. Stocks and deliveries are good.

Commercial Lighting Fixtures. — Building activities throughout the section are responsible for a steady movement in this line. The tendency is toward purchasing the better class of fixture. Stocks are good, but deliveries are only fair to good.

Schedule Material.—The demand in this line is excellent, particularly for sockets, rosettes and snap switches. Sufficient stocks are on hand to meet the requirements.

Motors.—An increase in motor sales is reported and deliveries are beginning to lengthen. Spotty stocks are in the territory. Prices are steady.

St. Louis

Air Heaters Are Steady—Lower Tape Prices—Trucks Attracting Renewed Interest

The midweek holiday caused substantial reductions in sales last week; in fact, buying generally shows decreasing tendencies except for the holiday demand. On the other hand, manufacturing plants are operating on increasingly heavier schedules, especially the stove, furniture, automobile and steel plants. Power equipment continues to be one of the most active lines, and sales for the week were of good volume. Central-station energy sales and power-plant demands are making new records. Collections show improvement, some reporting them on a forty-five-day basis, and many of the long-standing obligations have been liquidated. Money rates are lower and loans are more readily made. Money and credit conditions in the South are substantially better since this year's crops have been sold.

Air Heaters. — Favorable weather conditions are causing steady sales, both wholesale and retail. Dealers are keeping low stocks, and those of jobbers are moderate.

Tape.—Prices are slightly lower, representative quotations in 50-lb. lots being 35 cents per pound in both friction and rubber. Demand is falling, with stocks conservative but ample.

Ironers.—A distributor reports that sales are about double those of last year, the increased demand being a result of consistent educational work. Stocks are excellent.

Electric Trucks.—This business has been dormant in St. Louis for a number of years, but renewed interest exists, bakeries and laundries being recent purchasers, and it seems probable that a number of concerns will adopt them next year.

San Francisco

Conduit Stocks Are Very Low—Schedule Material in Demand—Lamp Stocks Fair

Local stocks in general are in good shape, although conduit and some wires are badly needed.

Conduit.—November showed slight improvement over October. Comparatively few carloads were received, and these were immediately broken up for urgent jobs. Occasional raising of eastbound embargo enables a few carloads to be shipped from mills to Atlantic Coast for re-shipment by water. Many urgent calls were satisfied by substitutions of brands, but at the present time there are almost complete shortages up to and including the 2-in. size.

Schedule Material.—Record-breaking building added to local campaigns for convenience outlets have produced heavy and it is thought steady demand. Prices are fairly steady now after a general advance. There have been individual shortages but no general dearth.

Lamps. — Demand is very good. Stocks are fair. Several jobbers report that 1921 carry-overs are now sold and that their new stocks are being drawn upon. Fancy lamps are rather slow.

Batteries.—Dry-battery sales hold up surprisingly well, according to local manufacturers.

Flashlights.—Selling well above last year's volume.

Salt Lake City

Merchants Co-operating in National Advertising Campaign—Porcelain Is Active with Inadequate Stocks

Merchants in this territory are co-operating quite generally with the national advertising campaign for electrical Christmas gifts. Stocks that will be called for during the holiday buying are in good shape generally. In some instances, however, immediate delivery cannot be made on orders for hollow ware. The market is an active one for porcelain, with stocks inadequate. Building activities have slowed down since stormy weather set in. The tax-paying exigency has been felt adversely in collections, but the general tendency is in the direction of improvement.

Portland–Seattle

Conduit Continues in Steady Demand —Stocks of Outlet Boxes Low with Slow Deliveries

Lumber production is still above normal and shipments are increasing. General export shipments were less for November than they were a year ago owing primarily to a shortage in the wheat crop. This is offset to some extent by the greatly increased fruit shipments. The number of building permits for November was slightly less but the value appreciably greater than for the same month last year. Building for the first eleven months of 1922 is greater than for the same period in 1921 by at least 30 per cent. Postal receipts are also showing an appreciable gain. Skilled labor is in good demand. Electrical jobbers reflect the same spirit of optimism in their reports. Good movements of merchandise are not confined to any particular group of items. Prices have been held fairly stable for some weeks, but there is a pronounced upward tendency which may reflect itself in higher prices at any time. The demand for Christmas goods is setting in well.

Conduit.—Rigid conduit continues to be in heavy demand. Stocks are short and deliveries are still uncertain. Prices are steady.

Outlet Boxes.—Demand is excellent, but stocks are rather low and deliveries slow.

Denver

Holiday Business Absorbing Interest—Flashlights Active—Report Radio Sales Increased 300 per Cent

Holiday business is absorbing the interest of local electrical men. Dealers' orders are increasing, and jobbers report ample stocks to meet demand, except in some numbers of heaters and hollow wire. Co-operative advertising of radio, vacuum cleaners and electrical Christmas gifts is responsible for considerable interest. Conditions are improved over last year and satisfactory volume is anticipated.

Flashlights.—Batteries are moving better than cases, although both are reasonably satisfactory.

Radio.—Increase of 300 per cent in sales reported. Parts are moving better than they have for a number of months.

Fixtures.—Glassware demand still holding up even with decreased building operations. Replacement business is good.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Hoover Suction Sweeper Raises Capital Stock to $6,000,000

The Hoover Suction Sweeper Company, Canton, Ohio, has increased its capital stock from $2,000,000 to $6,000,000, and a new organization will be effected under the name of the Hoover Company. It is said the capital stock has been increased with a view of enlarging the manufacturing facilities and engaging the production of other electrical household appliances.

M. S. Wright Company Organizes Sweeper Vac Appliance Firm

To facilitate its internal administration, the M. S. Wright Company, manufacturer of vacuum cleaners, Worcester, Mass., has organized as a subsidiary the Sweeper Vac Appliance Company. The capital stock is $25,000. Henry R. King, general sales manager of the Wright company, is president; Clifford L. Wright, treasurer, and Walter C. Chandler, secretary.

Siemens Concern Celebrates Seventy-fifth Anniversary

On Oct. 12 the Siemens & Halske Aktiengesellschaft celebrated its seventy-fifth anniversary in Berlin, Germany. It was on Oct. 12, 1847, that Werner Siemens, the inventor of the dynamo and a multitude of other electrical devices, together with the mechanician Halske founded a small shop in Berlin for the purpose of manufacturing telegraph apparatus. From that day to this the executive control of the company has been in the hands of the Siemens family and the concern has branched out so that now it employs ninety thousand people and has more than sixty foreign offices. It is largely due to the fidelity of the management to the principles laid down by Werner Siemens that the company enjoys its worldwide fame.

Taplet Manufacturing Company Organized by E. A. Jenkins

E. A. Jenkins, actively associated with the H. T. Paiste Company, Philadelphia, for many years, has purchased the pipe-taplet portion of that company's business, including machinery, patterns, patents and good will. The Taplet Manufacturing Company has organized to conduct the new business and is to be entirely distinct and separate as to management and ownership. The Taplet company has its sales and manufacturing departments at 3907 Powelton Avenue, Philadelphia.

The Hart & Hegeman Manufacturing Company, Hartford, Conn., formerly exclusive selling agents for the Paiste pipe taplets, has resigned this agency.

Manufacturers Oppose Hull Bill

Representatives of the National Association of Manufacturers, the National Metal Association, the National Founders' Association and thirty-nine state associations of manufacturers appeared on Nov. 29 before a House naval subcommittee to oppose enactment of the Hull bill, which would require the government to manufacture in arsenals and navy yards all articles for its use. The manufacturers contended that the bill would put the government in competition with private business on an unfair basis.

Wirt Company of Philadelphia Elects Stuckey President

The Wirt Company, 5221 Greene St., Philadelphia, manufacturer of electric lighting appliances, announces the retirement of its president, Charles Wirt.

At a meeting of the board of directors of the company held Monday, Nov. 13, the following officers were elected: P. H. Stuckey, president; H. J. Thayer, vice-president, and C. H. Chandler, secretary and treasurer. The active management of the business will devolve upon Mr. Stuckey, formerly treasurer and general manager, who has been associated with the company for more than twelve years.

Westinghouse Opens Its Bridgeport Sales and Service Quarters

To improve its service in the Bridgeport (Conn.) district, the Westinghouse Electric & Manufacturing Company has recently opened sales offices and service station facilities at Bruce Avenue and Seymour Streets, Bridgeport. These quarters will be used as a combined sales, service and warehouse center, with modern repair-shop facilities and stocks of material needed for immediate delivery on maintenance and other field repair work.

About 10,000 sq.ft. of floor space has been assigned to the initial installation, and all classes of repair work will be covered from large turbo-generators to small motors, etc.

All of Fairfield County, Conn., will be within easy reach of the new quarters, and the establishment will be in close touch with the New York and other Eastern offices of the company. W. P. Sidle has been appointed manager of the service department at Bridgeport, and George McElroy has been appointed sales manager.

Fifteen Million Dollars of Western Electric Common Stock Offered

The Western Electric Company, Inc., announced last week that it would sell $15,000,000 of its common stock to its stockholders at $100 a share. Each stockholder can subscribe to one share of the new stock for each two and one-third shares of common stock standing in his name on Nov. 28. The right to subscribe expires Dec. 27, and payment in full must be made by Dec. 30. The money will be used to retire the $15,000,000 issue of the first 5s of 1922, which mature Dec. 31.

The company is controlled by the American Telephone & Telegraph Company through a 98 per cent ownership of the 350,000 outstanding shares of no-par-value common stock. Early in the year the American Telephone & Telegraph Company sold $115,000,000 of common stock.

Establishes Pioneer Industrial Electric Heating Store

What is believed to be the first store in the country to display industrial electric heating apparatus alone on a demonstration-sale basis is in operation at 194 Friendship Street, Providence, R.I., under the proprietorship of C. I. Hayes, for many years a manufacturer and distributor of this class of equipment.

Through the co-operation of the Narragansett Electric Lighting Company, Providence, the establishment has been quoted a rate satisfactory for demonstrations, and a 30-kw. transformer installation has been made to supply energy at 110 and 220 volts. More than 1,000 kw. in industrial heating apparatus of the Hayes organization's production is in service on the lines of the Narragansett company.

The organization has engaged J. E. Hines as sales manager. Mr. Hines' thirteen years' service with the Hoskins Manufacturing Company, Detroit, have fitted him for the work undertaken at Providence. At present the activities of the concern are largely confined to southern New England on account of the policy of the house to maintain service to customers utilizing this type of equipment. The Hayes products are manufactured in a plant of the organization outside the city limits, and the display room at the new store is utilized to demonstrate these and other equipments for which it is a sales representative.

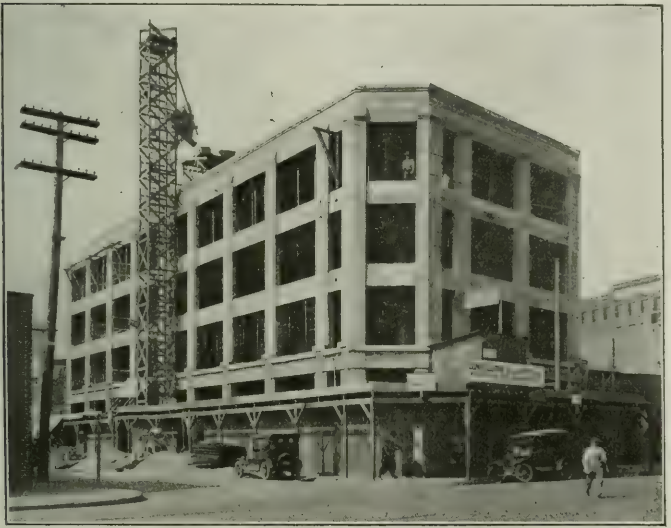
The equipment on display includes a metal heater, a heavy-duty furnace, a water heater, a temperature-regulating panel, "hump method" equipment for steel hardening, high and low temperature furnaces, ovens, glue pots, recorders and control apparatus.

The B-R Electric Company, Fifteenth and Walnut Streets, Kansas City, Mo., has under construction a five-story-and-basement reinforced-concrete warehouse at 1411 Walnut Street, which the company expects will be ready for occupancy April 1, 1923.

Illinois Electric of California Building to Cost $250,000

The new building of the Illinois Electric Company shown in the accompanying picture is being erected at West San Pedro and Boyd Streets, Los Angeles, at a cost of $250,000.

In addition to serving as office and warehouse of this organization in the Southwest, many features new to a wholesale house have been introduced. The company has installed a complete servicing department with a stock of parts sufficient to take care of all equipment handled by it and is prepared to handle repairs at cost for dealers not in a position to do their own service work.



NEW BUILDING OF LOS ANGELES JOBBING FIRM

Much attention is being given the street-lighting and industrial lighting departments, and a model display of modern methods of illumination is to be installed which will not only serve as an example to the customer in the electrical field but will enable salesmen to bring in their industrial "prospects" for a practical demonstration of modern lighting methods.

This California company was organized in 1911 with but four employees; it now has a staff of more than 100. With the rapidly growing demands of this section of the country in view, the present headquarters of the company are being planned to care for future expansion.

The Brown-Boveri Company, Baden, Switzerland, has just obtained an order for a 10,000-kw. turbo-generator for the first government station at Moscow. It is said that additional orders will be placed with this company by the Moscow authorities.

The National Carbon Company, Madison Avenue, Northwest, and One Hundred and Seventeenth Street, Cleveland, manufacturer of electric batteries and kindred specialties, is said to have tentative plans for the establishment of a new service and factory branch at Dallas, Tex.

The Koch & Sterzel Company, Dresden, Germany, manufacturer of transformers, has recently completed an installation for obtaining an alternating potential of 1,000,000 volts at the Freiberg Porcelain Works. This installation will be used for the examination of high-voltage insulators. Koch & Sterzel intend building another installation with an alternating potential of 2,000,000 volts.

The Freeman Electric Company, 803 South State St., Trenton, N. J., manufacturer of electrical products, has revised plans for a one-story unit at its proposed new factory at Mead and Prince Streets, including improvements in the present building. E. H. Freeman is president of the company.

The Connecticut Electric Manufacturing Company, Bridgeport, Conn., manufacturer of electrical supplies, is erecting a one-story, 50-ft. x 120-ft. steel addition at its plant on Bishop Avenue, Bridgeport.

H. Sutter, 428 Erie Street, Elmira, N. Y., is arranging for the installation of equipment in a local building for the manufacture of radio equipment and parts.

The International Oxygen Company, Newark, N. J., announces that A. A. Heller has taken over its management in place of L. W. Hench, secretary and general secretary, resigned.

The Crompton & Knowles Loom Works, Inc., Worcester, Mass., has awarded a contract for a one-story addition to its Providence plant, 50 ft. x 170 ft., with a basement. The main floor will be equipped as an erection shop.

The Chemical Equipment Association, comprising manufacturers of equipment essential to manufacture in the score or more chemically controlled industries of the continent, has established national executive offices at 1,328 Broadway, New York City. It has begun active work through a national membership for the fostering of trade in chemical equipment and for the improvement of practices in the production and distribution of such equipment and in the performing of engineering services incidental thereto.

The Safety Car Heating & Lighting Company, Dixwell Avenue, New Haven, Conn., manufacturer of electric lighting and heating equipment for railroad service, will erect a new one-story plant addition, 106 ft. x 115 ft.

The Kerite Insulated Wire & Cable Company, 30 Church Street, New York City, with plant at Seymour, Conn., is arranging for the sale of common stock for $1,000,000, provided by an increase in capital from $200,000 to $1,200,000, a portion of the proceeds to be used for extension and improvements to the plant.

The Mitchell Vance Company, New York City, lighting fixture manufacturer, announces that Henry H. Russell is now associated with its organization as an executive sales representative. Mr. Russell is well known for his development of unusual selling "stunts." Some years ago, while in California, he signed contracts in a captive balloon 3,500 ft. over the city of Los Angeles. About two years ago he conceived the idea of delivering an electric range by airplane from Atlanta to Rome, Ga., a distance of 75 miles. The delivery was made in eighty-seven minutes, and on its arrival a successful demonstration of electric cooking was given before the Rome Women's Club.

The Lewis Electric Manufacturing Company, Inc., 1400 Niagara Street, Buffalo, which was recently incorporated to manufacture mechanical appliances, will have its early production done by contract and some time later will be in the market for equipment for factories of its own. Standard production will probably not begin until about Jan. 1. E. Sears Yates is secretary of the company.

The Royal Fixture Corporation, Milwaukee, has been incorporated with a capital stock of $50,000 to manufacture electric illuminating fixtures, lamps, electrical devices, etc. The building at 85 Thirty-fifth Street has been taken over and is being equipped as a machine and assembling shop. The principals are David C. Loppin, 679 Forty-eighth Street, and Sam Rabucehin, 844 Eleventh Street, Milwaukee.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

The representative of a firm in the United States desires an agency in Palestine (No. 4,506) for electric bulbs for motor cars, of single and double contact, lamps and lanterns, agricultural implements, etc.

Purchase and agency is desired in Switzerland (No. 4,510) for engineering equipment and supplies, refrigerator equipment, power transmissions, driving belts, etc.

Purchase is desired in Hungary (No. 4,512) for iron sheets for generators and transformers and galvanized-iron sheets.

Agency and purchase is desired in New Zealand (No. 4,526) for self-contained electric plants and material suitable for installations for residences, offices, farms and shops; electric novelties and small engines, suitable for shops, dairies and farm use.

Purchase is desired in Canada (No. 4,527) of a direct-connected generator to develop from 350 hp. to 500 hp., twenty motors from 10 hp. to 75 hp., transmission machinery for lumber, etc.

Purchase and agency is desired in India (No. 4,565) for motor cars, motor cycles, electric fittings, automobile parts and accessories, etc.

An agency is desired in India (No. 4,576) for electrical goods, motor accessories, etc.

The following inquiries have recently been received by the Philadelphia Commercial Museum, which will furnish the names and addresses of the inquirers by mentioning the number given:

An agency is desired by a firm in Barrancas, Venezuela (No. 40,296), for electric lighting sets of about ten lamps capacity, with air-cooled motor, low voltage and necessary storage batteries, at a price from $60 to $80.

Catalogs and price lists are desired in Mazatlan, Mexico (No. 40,297), of electrical apparatus for medical purposes, including a Rhumkorff coil for producing 8-in. sparks.

An agency is desired in Switzerland (No. 40,301) for wireless telephone apparatus.

Catalogs and price lists are desired in Mexico City (No. 40,307) of electric baking ovens.

PROPOSED ELECTRIC PLANT FOR SAN JOSÉ, COSTA RICA.—The municipality of San José, Costa Rica, has decided to install a new electric power plant of sufficient capacity to supply electricity to light the entire city and to furnish power for industrial plants.

ERECTION OF LARGE HYDRO-ELECTRIC PLANTS IN CZECHOSLOVAKIA CONTEMPLATED.—Plans are reported under way for the construction of large hydro-electric plants at Seestadtl and Kaaden. Work is also under way in linking up the power stations in northeastern Bohemia.

New Apparatus and Publications

RAPID TRANSIT SYSTEMS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 44,018, entitled "Metropolitan Subways and Elevated Systems," in which it describes the principal characteristics of several large rapid-transit systems.

ELECTRIC RANGES.—The Standard Electric Stove Company, Toledo, Ohio, is distributing a catalog covering its electric cooking apparatus, including ranges, coffee urns, combination griddle, broiler and toaster, hot plates, etc.

RAILWAY ELECTRIFICATION.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has published a pamphlet (Reprint No. 128) containing an article on "Advantages of Railroad Electrification," by R. J. O'Brien of its heavy traction department.

VENTILATING SET.—The L. J. Wing Manufacturing Company, 352-362 West Thirteenth Street, New York City, is distributing a folder covering its "W-S Vent Set" for ventilation of residences, offices and laboratories.

BATTERY CLIP.—The Mueller Electric Company, 1,583 East Thirty-first Street, Cleveland, is distributing a leaflet calling attention to the improvement in its No. 21-A "Universal" battery clip.

DETECTOR AMPLIFIER UNIT.—A complete detector-amplifier unit for amateurs, professionals and schools has been brought out by the Betts & Betts Corporation, 645 West Forty-third Street, New York City.

New Incorporations

THE CADDO (TEX.) ICE, LIGHT & POWER COMPANY has been incorporated with a capital stock of $30,000 by Peter Swenson, S. T. Swenson and O. C. Goodwin.

THE KING'S ROAD ELECTRIC LIGHT LINE, Jacksonville, Fla., has been incorporated with a capital stock of $3,000 to distribute electricity for light and power purposes. The officers are: Albert Klein, president; George F. Foy, vice-president; J. R. McKinley, secretary, and P. C. Nickerson, treasurer.

THE MISSOURI ELECTRIC LIGHT & POWER COMPANY, St. Louis, Mo., has been chartered by L. M. Egan, F. J. Boercher, L. E. Boehm, J. E. Young and others. The company will take over the property of the Union Electric Light Company of St. Louis. Under the charter the company is authorized to issue 250,000 shares of preferred capital stock, par value $100 each, and 650,000 shares of common stock of no par value.

THE NORTHERN INDIANA POWER COMPANY, Kokomo, Ind., has been granted a charter with a capital stock of $3,500,000. The company proposes to acquire seven utility companies operating in northern Indiana. The directors are Joseph H. Brewer and Charles O. B. Murphy.

THE NORTH MISSOURI POWER COMPANY, Excelsior Springs, Mo., has been incorporated with a capital stock of $1,500,000 to take over the properties of the Excelsior Springs Water, Gas & Electric Company and its subsidiaries. W. A. J. Bell is president and S. W. Henderson vice-president and general manager.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—The Edison Illuminating Company contemplates extensions and improvements in present power plants, lines, etc., during 1923, to cost about $4,500,000.

MARLBORO, MASS.—The Board of Aldermen has decided to replace the lamps now in use on East Main, West Main Mechanic and Lincoln Streets with 600-cp. "Nova Lux" lamps.

SAUGUS, MASS.—The Universal Tide Power Company has been granted permission to issue $35,000 in capital stock; the proceeds to be used for additional equipment, etc., to its local power plant.

WORCESTER, MASS.—The New England Power Company is preparing plans for a number of transmission lines and new central distributing plant for the eastern Massachusetts district, to cost about $200,000.

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Middle Atlantic States

LANCASTER, N. Y.—The Public Service Commission has granted the Depew & Lancaster Light & Power Company permission to erect an electric lighting system in the towns of Java, Sheldon and Bennington under franchises granted by the three townships.

MECHANICSVILLE, N. Y.—George P. Ide & Company, Troy, will erect a power house at their proposed local factory, to cost $100,000. Edward T. Loth, 253 Broadway, Troy, is architect.

PARMA, N. Y.—The Public Service Commission has granted the Cooper Electric Corporation, Hilton, permission to construct an electric plant to supply service in Parma. It also approved the exercise by the Cooper Electric Company of certain franchise rights granted to the Hilton Electric Light, Power & Heat Company.

NEW YORK, N. Y.—The Empire State Ice Company, 76 West Monroe Street, Chicago, will install electric power equipment, ice and refrigerating machinery at its proposed plant at 161st Stret and Grant Avenue, to cost $200,00

POTSDAM, N. Y.—The Public Service Commission has granted the St. Lawrence Transmission Company permission to construct a transmission and distribution system in the towns of DeKalb and Hermon.

TONAWANDA, N. Y.—The Tonawanda Power Company will install a lighting system on Military and River Roads.

CAPE MAY, N. J.—The Atlantic (N. J.) City Electric Company will build a transmission line from Cape May to Wildwood Junction and extend its distributing system in this section. The local utility properties recently acquired will be merged with the main system.

ELIZABETH, N. J.—The lumber plant, including sawmill, power house and equipment, of the Heidritter Lumber Company, South Front Street, was damaged by fire recently, causing a loss of about $100,000.

HAMMONTON, N. J.—The Littlefield Ice & Coal Company will install electric equipment in its proposed ice-manufacturing and cold-storage plant, to cost about $60,000.

MILLVILLE, N. J.—The Court of Errors has affirmed a decision by Supreme Court Justice Thomas W. Trenchard upholding the right of city of Millville, under an act of 1917, to construct an electric distributing system.

SUMMIT, N. J.—The Commonwealth Electric Company and affiliated interests, the Commonwealth Water & Light Company, the Lakewood & Coast Electric Company and the Lakewood Coast Water & Electric Company have been acquired by the Albert Emanuel Company, 61 Broadway, New York. The new owner plans immediate extensions and improvements.

FREEBURG, PA.—The Pennsylvania Power & Light Company, Allentown, is planning to extend its transmission line from Selinsgrove to Freeburg to furnish electrical service here.

HAMBURG, PA.—The Hamburg Gas & Electric Company has received permission to acquire the properties of the Greenwich, Lenhartsville, Albany, Bern and Richmond Electric companies, operating in this vicinity. The lines will be merged with the system of the purchasing company and extensions and improvements made.

HUNTINGDON, PA.—The Cover Electric Company contemplates extensions and improvements, to cost about $25,000.

JOHNSTOWN, PA.—The Penn Public Service Company has received permission to acquire the properties of the Lumber City, Confluence, Boswell and Armagh Electric Companies. The systems will be merged and extended.

LANSFORD, PA.—The Pennsylvania Power & Light Company will build a transmission line from its Hauto power plant to Lansford via Northampton.

MORGANTOWN, PA.—The Superior Block Coal Company, recently organized, wil install electric power equipment at its local properties. Harold S. Smith heads the company.

PHILADELPHIA, PA.—The Pennsylvania Sugar Company, 1045 North Delaware Avenue, will build a one-story power house at its plant. Bids will be asked early in January.

SCRANTON, PA.—The Adams Electric Company, the Adams Power Company and the York Power Company, recently organized to operate in West Manheim, Mount Joy and Berwick Township, plan to erect transmission and distributing lines. F. Heinbokel, Scranton, is treasurer.

YORK, PA.—The Gilbert Wall Paper Company, 728 Linden Avenue, will build a one-story power house at its proposed new factory on State Street. J. A. Dempwolf, Casset Building, is architect.

BALTIMORE, MD.—The American Ice Company, Calvert Building, will install electric power equipment at its proposed new plant on Edon Street, to cost $100,000. G. Leslie Weir, 41 East Forty-second Street, New York, is architect.

HAVRE DE GRACE, MD.—The property of the Havre de Grace Electric Company has been purchased by the Northern Maryland Electric Company, Oxford, Pa. Work will begin at once by the new company on the erection of a transmission line to connect Havre de Grace with Port Deposit.

WOODMONT, MD.—The installation of a municipal electric light plant in Woodmont is under consideration. Post office address is Little Orleans.

CLIFTON, W. VA.—The Clifton Coal Company plans to rebuild its power house, recently destroyed by fire.

HUNTINGTON, W. VA.—The Coal River Collieries Company will install motors and other electric equipment at its properties, to cost about $100,000.

JANELEW, W. VA.—The Monongahela Power & Railway Company contemplates the installation of a commercial light and power service here.

LOGAN, W. VA.—The Kentucky & West Virginia Power Company contemplates rebuilding its local plant, recently destroyed by fire, causing a loss of about $30,000.

LOST CREEK, W. VA.—The Vulcan Coal Company will install electric power equipment at its properties.

MARTINSVILLE, VA.—The American Furniture Manufacturing Company plans to build a power plant in connection with its proposed furniture factory.

WASHINGTON, D. C.—Bids will be received by the Bureau of Suppies & Accounts, Navy Department, until Dec. 19 for one switchboard for the Puget Sound Navy Yard (Schedule 343); also for a quantity of flashlights and batteries for Eastern and Western yards (Schedule 344).

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, until Dec. 12 for 250 landing light switches, for use at Fairfield, Ohio, and Keyport, N. J. (Circular 23-71).

WASHINGTON, D. C.—Bids will be received by the Board of Commissioners, District Building, until Dec. 14 for electric lighting fixtures for the new Eastern High School.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Dec. 18 for condensers, telephone generators, resistances, vibrators, etc. (Circular PR-12858-1CP); also, until Dec. 15 for 4,000 hand-receiver cords, 2,000 switchboard transmitter cords, 800 switchboard connector cords, etc. (Circular PR-13270-1CP); until Dec. 19 for armature for motor generator, rectifiers, switches, etc. (Circular PR-13228-1CP.)

North Central States

DETROIT, MICH.—Tentative plans are being prepared by the Detroit Edison Company for a generating plant at Slocum's Island, to cost about $8,000,000, with transmission system. A substation will be erected at Ecorse Avenue and Dearborn Street.

LANSING, MICH.—The United Produce Company will install electric power equipment in its proposed refrigerating and cold-storage plant, to cost about $200,000. Warren M. Holmes, Tussing Building, is architect.

ST. JOSEPH, MICH.—Plans are being prepared by Cahill & Douglas, engineers, 217 West Water Street, Milwaukee, for a power plant and smokestack for the Whitcomb Hotel.

COSHOCTON, OHIO.—The Ohio Service Company, which has purchased the properties of the Sugarcreek (Ohio) Light & Power Company, the Battery Company and the Cadiz (Ohio) Electric Light & Power Company, is planning to erect a 12-mile, 33,000-volt transmission line from New Philadelphia to Sugarcreek; a 4-mile line between Strasburg and Zoar, and a 26-mile, 33,000-volt line from Dennison to Cadiz, via Conotton, Bowerston, Jewett and Scio. The company has been granted franchises in Scio and Jewett.

ELYRIA, OHIO.—The Ohio Public Service Company is securing right-of-way to Ashland, 55 miles, for a new 132,000-volt transmission line. The cost is estimated at about $1,500,000.

LORAIN, OHIO.—The City Council has authorized the Ohio Public Service Company to install an ornamental lighting system, to cost about $15,000.

CLINTON, IND.—The Wabash Valley Electric Company plans to erect a transmission line to connect its power plants at Clinton and Sullivan. New distributing lines will be installed along the route in Vigo County.

GARY, IND.—The Gary Street Railway Company will make extensions to its system, including the installation of new equipment, to cost about $500,000.

CHICAGO, ILL.—E. J. Brach & Sons, 215 West Ohio Street, will build a power house in connection with their three-story candy-manufacturing plant to be erected at 401 North Kilpatrick Street.

FORT ATKINSON, WIS.—Bonds to the amount of $38,000 have been voted for improvements to the municipal electric light plant.

KENNAN, WIS.—The Village Board has engaged Earl D. Jackson, Endicott Building, St. Paul, consulting engineer, to prepare plans for a municipal hydro-electric plant, with steam auxiliary power station, to cost about $35,000.

KENOSHA, WIS.—A proposition has been submitted to the County Board of Supervisors, the cities of Kenosha and Racine by the Wisconsin Gas & Electric Company offering to install electric lamps on the Sheridan Road between these two cities, a distance of 12 miles. The company has installed twenty 400-cp. (sample) lamps for a distance of 1 mile to demonstrate the possibilities of highway lighting.

KIEL, WIS.—The Board of Supervisors of Manitowoc County has granted the Oslo (Wis.) Light & Power Company a franchise to erect transmission lines in the towns of Manitowoc Rapids, Cato and Newton.

KIEL, WIS.—The Wisconsin Public Service Company, Green Bay, has petitioned the Board of Supervisors of Manitowoc County for permission to erect transmission lines between Manitowoc Rapids and Valders, from Manitowoc Rapids to Newton, between the east and west boundaries of the town of Cato and in the town of Rockland.

MILWAUKEE, WIS.—The Milwaukee Electric Railway Light & Power Company contemplates extending its transmission line from Whitewater to West Allis.

MILWAUKEE, WIS.—The Railroad Commission has granted the Milwaukee Electric Railway & Light Company permission to issue $6,500,000 in bonds, part of the proceeds to be used to reimburse the treasury for expenditures for extensions already made and also for future extensions.

OAKFIELD, WIS.—The Eastern Wisconsin Electric Company has acquired the property of the Oakfield Light & Power Company. Improvements in the transmission line are contemplated by the purchasing company.

SHEBOYGAN, WIS.—The installation of an ornamental lighting system on North Eighth Street is under consideration by the lighting committee.

STEVENS POINT, WIS.—The Consolidated Water Power & Paper Company is considering enlarging its local hydro-electric plant.

WAUSAU, WIS.—The Wisconsin Valley Electric Company contemplates the erection of a 20,000-volt, three-phase transmission line from Edgar to Stratford.

ROCHESTER, MINN.—The Wisconsin-Minnesota Light & Power Company has submitted a proposal to the City Council to furnish electricity in this city. The proposed plan provides for the erection of a transmission line from Rochester to connect with its station at Red Wing, at a cost of about $100,000, to be paid by the city, the company to reimburse the city in five yearly installments. To meet the increasing demand for electricity, it is stated that it will soon be necessary to install a generating unit at the municipal electric plant and the company offers this plan as a substitute.

BOLIVAR, MO.—Alexander & Baity, 535 West Commercial Street, Springfield, Mo., it is reported, are considering installing an electric light and power plant in Bolivar, to cost about $32,000.

KANSAS CITY, MO.—Electric power equipment will be installed in the proposed addition to the grain elevator of the Missouri, Kansas & Texas Railroad Company, to cost about $2,000,000.

MOUNTAIN GROVE, MO.—Extensions to the municipal electric light plant and waterworks system, to cost about $25,000, are under consideration.

ST. LOUIS, MO.—The Litton Veneer Company, Rockford, Ill., will build a power house at its proposed local plant on Nettleton Street.

HUBBELL, NEB.—Bonds to the amount of $10,000 have been voted for the construction of a transmission line to Superior, Neb.

WAHOO, NEB.—The first electric light district of Saunders County has applied to the State Railway Commission for permission to issue $30,000 in bonds for the purpose of erecting a transmission line from part of four precincts lying south and east of Wahoo to the city, where connection will be made with the municipal electric light plant. C. E. Kellar is secretary of the company.

KANORADO, KAN.—Plans are being prepared for a transmission line and a local distributing system. W. B. Rollins & Company, Exchange Building, Kansas City, Mo., are engineers.

Southern States

DAVIDSON, N. C.—Bonds to the amount of $60,000 have been voted for the installation of a municipal electric light and water plant.

HIGH POINT, N. C.—The Robbins Knitting Company will build an electric substation at its proposed local mill.

FLORENCE, S. C.—The Palmetto Light & Power Company contemplates improvements to its system, to cost about $32,000.

GREAT FALLS, S. C.—The Republic Cotton Mills, Inc., will build an electric generating plant in connection with its proposed new mill, to cost about $1,000,000. J. E. Sirrine, Greenville, S. C., engineer.

SEBRING, FLA.—Plans are being considered for extensions and improvement in the municipal power plant, recently acquired from the Sebring Light & Water Company.

DOTHAN, ALA.—The Houston Power Company has applied to the Public Service Commission for permission to extend its transmission line from Slocomb, Ala., to Graceville, Fla., to furnish electricity in the latter place.

GADSDEN, ALA.—The Gulf States Steel Company will build a transmission line to its local plant, which will be electrified.

HATTIESBURG, MISS.—The Acme Flooring Company, recently organized, will build a power house in connection with its proposed local hardwood mill.

MAGEE, MISS.—Improvements to the municipal electric plant and waterworks to cost about $25,000, are under consideration. Swanson-McGraw, Inc., United Fruit Building, New Orleans, are consulting engineers.

HEBER SPRINGS, ARK.—The City Council has granted E. F. Stanfield and associates a fifty-year franchise to furnish electricity in Heber Springs.

COUSHATTA, LA.—The Gulf State Land & Lumber Company will install electric power equipment at its lumber mill.

LECOMPTE, LA.—The Council is considering an issue of $40,000 in bonds for extensions to the municipal electric lighting system and waterworks.

OKMULGEE, OKLA.—The Phillips Hi-grade Refining Company will build a power house in connection with improvements and extensions to its plant, to cost about $500,000.

TULSA, OKLA.—The Taylor Paper Company, Memphis, Tenn., will build a power house in connection with its proposed local mill, to cost about $100,000.

CADDO, TEX.—The Caddo Ice, Light & Power Company will make extensions to its power plant and ice-manufacturing plant.

JEFFERSON, TEX.—Plans are being prepared by the Jefferson Ice & Light Company for the installation of a street-lighting system, to cost about $30,000.

PERRYTON, TEX.—A bond issue of $35,000 is being arranged for a municipal light and power plant.

ROCKDALE, TEX.—The Texas Power & Light Company, it is reported, is planning to extend its transmission lines in Milam County to take in all the lignite mines and to erect a 2,300-volt line to Cameron, and also to Milano and Hearne, 30 miles further on.

SPEARMAN, TEX.—Bonds to the amount of $55,000 are being arranged, part of the proceeds to be used for extensions to the municipal electric light plant.

Pacific and Mountain States

TACOMA, WASH.—An ordinance has been passed authorizing an appropriation of $40,000 for the purchase of electric lamps.

PORTLAND, ORE.—The Pacific Power & Light Company is considering the construction of a transmission line to connect with the systems of the Montana Power Company and the Puget Sound Power & Light Company, to cost about $1,000,000.

VERNONIA, ORE.—A franchise has been granted to George Burdick for the installation of a light and power system.

BAKERSFIELD, CAL.—Plans are being prepared for the installation of an ornamental lighting system in the business district and an improved system in the residential section.

CARPINTERIA, CAL.—Steps have been taken by the local Chamber of Commerce for the establishment of a new lighting district here.

EXETER, CAL.—Plans are being considered for the installation of an ornamental lighting system on Pine Street, to cost about $6,400.

FRESNO, CAL.—The installation of new electroliers in Commercial Park is being advocated by H. E. Patterson, manager of Fresno County Chamber of Commerce.

LOS ANGELES, CAL.—The Cemet Oil Company will erect a power house in connection with its proposed refining plant on East Twenty-sixth Street, to cost about $1,000,000.

LOS ANGELES, CAL.—Electric power equipment will be installed in the proposed ice-manufacturing plant to be erected at Mormon Island by the Union Ice Company, San Francisco, to cost about $400,000.

MERCED, CAL.—The Turlock Irrigation District has applied to the Board of Supervisors of Merced County for a franchise to extend its electric system into Merced County.

PLACERVILLE, CAL.—Application has been filed with the Federal Power Commission by M. C. Seagrave of San Francisco for a combined power and irrigation project, including a dam and reservoir, on the headwaters of the Cosumnes River, near Placerville. The plans call for a development of about 13,000 hp.

WATSONVILLE, CAL.—Bonds to the amount of $225,000 have been voted for the purchase of the plant and distributing system of the Watsonville Power Company.

Canada

VANCOUVER, B. C.—The British Columbia Electric Railway Company contemplates erecting a new transmission line from Lake Buntzen to the suburbs of Vancouver.

ST. JOHN, N. B.—The City Council is considering the installation of an electric distribution system, including pole lines and underground conduit system.

TRURO, N. S.—A resolution has been adopted by the Town Council recommending the electric light commission to enter into a contract with the Nova Scotia Power Board to supply electricity in Truro.

ATWOOD, ONT.—The Atwood Lighting Company contemplates the installation of an electric lighting system.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 14, 1922)

1,435,255. Change-Over Switch; E. Puxon, Hamilton, Ontario, Canada. App. filed July 5, 1919. For auxiliary supply source.

1,435,256. Conductor for Electric Furnaces; K. C. Randall and H. A. Travers, Wilkinsburg, Pa. App. filed July 10, 1918. Several hollow conductors twisted around common axis.

1.435,257. System of Control; L. G. Riley, Wilkinsburg, Pa. App. filed Jan. 6, 1921. Method of determining whether railway controller is actuated too rapidly.

1,435,259. Measuring Instrument; F. W. Boller, East Orange, N. J. App. filed July 30, 1917. Limited indicating space such as between 30 amp. and 40 amp.

1,435,262. System of Control; K. A. Simmon, Edgewood Park, Pa. App. filed Feb. 18, 1920. Multiple-unit systems for railway service.

1,435,265. Coil-Supporting Means for Transformers; A. W. Thompson, East McKeesport, Pa. App. filed Aug. 7, 1917. Coils clamped rigidly in position.

1,435,281. Magneto; H. G. Cox, Chicago, Ill. App. filed June 23, 1919. Construction of armature.

1,435,306. Butt-Welded Thin-Walled Tubing; G. V. Johnston, Chicago, Ill. App. filed June 9, 1919.

1,435,328. Distortion-Measuring Apparatus; H. Nyquist, Woodridge, N. J. App. filed Jan. 23, 1920. Measures distortion of telegraph signals.

1,435,333. Telephone-Exchange System; L. Polinkowsky, New York, N. Y. App. filed June 14, 1919. Employ machine-switching apparatus.

1.435.348. Automatic Ringing Circuits; J. P. Toomey, New York, N. Y. App. filed June 5, 1919. Adapted for small switchboards.

1.435,380. Electric Regulation; J. L. Creveling, White Plains, N. Y. App. filed April 9, 1917. Applicable to generator used to charge storage battery.

1,435,392. Heating Element; C. J. Heisler, Los Angeles, Cal. App. filed March 5, 1921. Reinforced lead-in wire to prevent burning out.

1,435,421. Electric Lighting Fixture; H. C. Scharff, St. Louis, Mo. App. filed July 30, 1920. Universal joint for wall brackets.

1,435,427. Lamp; W. L. Stewart, Worcester, Mass. App. filed March 16, 1921. Combined gas and electric table light.

1,435,447. Telephone-Tranmission System; W. H. Bendernagel, Queens, N. Y. App. filed Dec. 9, 1919. Amplifying repeater in cord circuit.

1,435,455. Electric Current Controlling Device; H. P. Donle, Meriden, Conn. App. filed Feb. 2, 1920. Vacuum-tube type.

1,435.468. Electric Range; G. W. Hart, West Hartford, Conn. App. filed June 5, 1922. Fuses and switches on face plate.

1,435,470. Apparatus for Brazing Thin Metal Parts; W. F. Hosford, Oak Park, Ill. App. filed March 19, 1920.

1,435,474. Advertising Device; A. H. Jackson, London, Eng. App. filed April 22, 1922. Motor-controlled sign for street cars.

1,435,507. Method of Forming Ball Bearings; R. W. Sellew, New Britain, Conn. App. filed Oct. 19, 1920. Housing for bearings welded together.

1,435,559. Electric Water Heater; F. E. Shepard and J. E. Phillips, Tampa, Fla. App. filed June 5, 1922. Porcelain body, carbon electrodes and water spacing between electrodes.

1,435,596. Power-Transmission Mechanism; W. Fels, Elizabeth, N. J. App. filed May 16, 1918. Motor drive applied to reciprocating carriage.

1,435,671. Anode; M. E. Stewart, Perth Amboy, N. J. App. filed March 10, 1922. Anode for electroplating bath with cross-section in form of cross.

1,435,675. Automobile Alarm; C. D. Vollmer and M. Laskowitz, St. Louis, Mo. App. filed July 23, 1919. To prevent theft of car.

1,435,701. Electric Regulation; J. L. Creveling, Tucson, Ariz. App. filed March 8, 1916. For variable-speed generator-charging batteries.

1,435,703. Recovery of Zinc; J. T. Ellsworth, Park City, Utah. App. filed Dec. 17, 1921. By electrolysis.

1,435,711. Switch Box; E. H. Kruse, Fort Wayne, Ind. App. filed March 5, 1921. Adapted to be mounted in partition so that its front is flush with wall.

1,435,742. Production of Refractory Metal Alloys; B. D. Saklatwalla and Arthur N. Anderson, Crafton, Pa. App. filed April 8, 1920. Carbon used as reducing agent in electric furnace treatment.

1,435,749. Signal; G. P. Springfield, Evansville, Ind. App. filed July 27, 1921. Indicates when trolley car starts or stops.

1,435,754. Electric Signal Lamps; M. J. Strasberger, Chicago, Ill. App. filed May 23, 1921. Indicates number of seats vacant in theater.

1,435,757. Radio-Tuning Coil; Floyd Swink, St. Louis, Mo. App. filed May 8, 1920.

1,435,812. Electric Spot-Welding Machine; F. M. Cushing and W. L. B. Cushing, Los Angeles, Cal. App. filed April 7, 1920. Thermo-siphonic system of cooling electrodes.

1,435,813. Alternating-Current Generator; F. Cutting, Tuxedo Park, N. Y. App. filed June 26, 1918. High-frequency radio generator.

1,435,819. Multicontact Electrical Connection; L. H. Des Isles, Chicago, Ill. App. filed Jan. 21, 1918. Thermo-electric circuits readily connected to common instrument.

1,435,827. Electric Motor Short-Circuiting Mechanism; H. I. Finch, St. Louis, Mo. App. filed June 12, 1920. For induction-repulsion motors.

1,435,831. Electric Smoothing Iron; J. G. Fisher, McLean, Va. App. filed Sept. 2, 1921. Current controlled by switch placed in handle.

1,435,868. Telemechanic Installation; A. M. Mayer, Levallois-Perret, France. App. filed Sept. 23, 1920. Transmitting motion by telegraph or radio.

1,435.870. Automatic Circuit Breaker; N. E. Nelson and O. Nelson, Seattle, Wash. App. filed Oct. 3, 1919. Remotely controlled breaker for high-voltage motor circuits.

1,435,875. Electroplating with Alkaline Bath; C. H. Proctor, Arlington, and C. J. Wernlund, Woodbridge, N. J. App. filed Dec. 27, 1921. Method for introducing mercury into solution.

1,435,886. Separation of Solids from Liquids; W. Acton and W. M. McKean, Paisley, Scotland. App. filed Nov. 22, 1920. By passing electric current through aqueous sludge.

(Issued Nov. 21, 1922)

15,495 (reissue). Wireless Signaling System; I. Langmuir, Schenectady, N. Y. App. filed Jan. 29, 1920. Heterodyne system of wireless transmission.

1,435,914. Electrical Welding Apparatus; A. Churchward, New York, N. Y. App. filed March 19, 1919. Portable rail-bonding plant.

1,435,919. Chill; J. W. Fay, Milwaukee, Wis. App. filed Aug. 27, 1921. Relates to chills used for cooling or solidifying molten metal while welding.

1.435,931. Telephone System; J. H. Levis, Jr., Rochester, N. Y. App. filed Nov. 15, 1915. Distinctive and positive recall signal.

1,435,941. Radio Direction Finder; James Robinson, Andover, Eng. App. filed Nov. 12, 1918. Pair of aërial coils in vertical planes rotated until no appreciable difference in signal is found.

1,435,946. Magnetic Chuck; F. L. Simmons, Millbury, Mass. App. filed Nov. 5, 1914.

1,435,950. Telephone-Exchange System; S. B. Williams, Jr., Brooklyn, N. Y. App. filed Sept. 24, 1920. Control for charging booster battery.

1.435,966. Ignition System; C. F. Kettering, Dayton, Ohio. App. filed Aug. 5, 1918.

1,435,968. Telephone Trunk Circuits; G. W. Kuhn and Eric R. Lundius, Brooklyn, N. Y. App. filed April 10, 1918. Relates to talking circuits between operators of associated exchanges.

1,435,980. Means for and Method of Reducing Cross Talk in Four-Wire Circuit; R. A. Renshaw, Woodhaven, N. Y. App. filed Jan. 2, 1920.

1,435,989. Electrically Heated Intake Manifold; M. A. Simon, St. Louis, Mo. App. filed Nov. 7, 1921.

1,435,994. Method of Electrically Welding in Series; A. C. Taylor, Warren, Ohio. App. filed Nov. 28, 1921. Welding together heads and stems of valves for combustion engines.

1,435,995. Electric Resistance Welding; A. C. Taylor, Warren, Ohio. App. filed March 11, 1922. Welding parts the connecting faces of which are uneven.

1,435,996. Method of Electric Resistance Welding; A. C. Taylor, Warren, Ohio. App. filed March 11, 1922. Method of welding tubing, tanks and other hollow ware.

1,436.034. Electric Heating Unit or Hot Plate; L. R. Hamlin, Kokomo, Ind. App. filed April 11, 1921.

1,436,035. Electric Sadiron; L. R. Hamlin and Jesse Jackson, Kokomo, Ind. App. filed July 13, 1921. Improved terminal clip for resistance element.

1,436,060. Heater for Automobile Radiators; R. B. Strong, Coldwater, Mich. App. led Dec. 8, 1921. Hood placed in front of radiator containing electric lamps to prevent freezing.

1,436,089. Electrical Water-Heating Device; Svend Gorlov, Miami, Fla. App. filed Feb. 27, 1922. Pipe attachment consisting of two electrodes with water completing circuit.

1,436,123. System of Electrical Distribution; T. W. Varley, New York, N. Y. App. filed Sept. 6, 1919. Car-lighting system.

1,436,135. Telephone-Exchange; J. L. Wright, Cleveland, Ohio. App. filed July 12, 1917. Semi-automatic system employing switching mechanism.

1,436,137. Elevator Floor Safety Switch; C. M. Aldred, Charlotte, N. C App. filed Dec. 22, 1921.

1,436,152. Electrical Energy Translating Apparatus; A. Churchyard, New York, N. Y. App. filed April 28, 1919. Motor and generator for welding combined in one machine.

1,436,165. Electrical Registering System; C. L. Goodrum, New York, N. Y. App. filed Oct. 6, 1919. Registering number of calls on party telephone line.

1,436,183. Station Indicator; F. Mashinski, La Grange, Ohio. App. filed April 23, 1921. Audible signal operates when indicator changes.

1,436,206. Transmitter; L. B. Speed, New York, N. Y. App. filed Nov. 19, 1919. Improved microphonic transmitting device.

1,436,212. Rheostat; A. R. Swoboda, Newark, N. J. App. filed Dec. 6, 1920. Small variable resistance.

1,436,244. Loading Unit; W. Fondiller, New York, N. Y. App. filed Sept. 3, 1918. Loading of telephone lines.

1,436,245. Electrical Engine of the Reciprocating Type; Kurt M. Geisler, Hackensack, N. J. App. filed Nov. 19, 1920. Automatically makes and breaks the several circuits for solenoid windings.

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Help the World Think Electrically

EVERY forward step in the perfection of radio communication marks an advance in international thinking. Every increase in the speed of steamships, in the service of foreign mails, in the exchange of newspaper correspondence, in the activity of export trade and in the volume of travel, for business or pleasure, makes the world smaller and brings the man whom we are wont to call "the foreigner" just a step nearer the family circle.

This contact starts conversation, and conversation induces thinking, and thinking on common subjects, even from two sides, develops gradually and inevitably a community of interests. Out of that comes understanding.

THE world war set up an intimacy between America and the nations of Europe that had never existed before. After the war there arose financial, economic, social and political problems of universal concern. We have got into the habit of watching and discussing each other's affairs. And as men get to thinking together they want to do business together.

Some interesting concrete evidence of this comes out of Washington. A little over a year ago the Bureau of Foreign and Domestic Commerce was receiving about 800 inquiries a day. Today they are pouring in at the rate of 3,200 a day, all manner of questions about foreign peoples—what they wear, what they eat, what they buy, how to ship and sell things to them. There is a great ground swell of interest rising in this country. In spite of money troubles abroad, in spite of tariff walls at home, it grows and grows. As Lloyd George put it, Europe discovered America long ago, but now the people of America are individually discovering the peoples of the Old World.

Recently in Honolulu the Pan-Pacific Union met and representatives of all the Pacific countries discussed problems of this group, embracing the Americas, North and South, and the Far East. And, as is true everywhere, the central theme was the development of natural resources. How can the wealth of all these lands be exploited to the relief and advancement of humanity? And one of the inevitable answers is: Harness the water powers of the world. In Japan, China, India, Africa, New Zealand, Europe, South America water runs to waste that can and will some day serve and enrich these peoples.

NO NATION has given greater study to the problem of water-power development than the United States. No nation produces to the same extent the diversified equipment required. Does not this all indicate an opportunity that should have more purposeful attention within our electrical industry and more thought from American business men?

The minds of all men today are steadily working out into the sunlight of the world's great meeting place — thinking together. We must help the world think electrically.

James A. Lighthipe

A pioneer in electrical engineering and a specialist in transmission-line construction who has had a marked influence on hydro-electric developments in the West.

IN THE minds of some people a really big man in any particular walk of life must be in a measure separated from his fellows by his very greatness. The subject of this sketch is one of the pioneers in electrical engineering and construction, a big man, but one who is very close to those with whom he comes in daily contact. He is one of the men who for a considerable period stood at the side of Thomas A. Edison and helped him to work out abstruse problems. Through the intervening years he has been a student of electrical affairs, a leader in electrical progress and a tower of strength to the organizations with which he has been connected. With it all he is intensely human, loving his fellowmen, understanding their weaknesses and ambitions, and beloved by his associates.

Mr. Lighthipe was born in Orange, N. J., and received a course of training in the Edison laboratories at Menlo Park. On Oct. 11, 1879, the first successful incandescent lamp was produced, and he was one of the few electrical pioneers who were present. Soon afterward he went to London and worked with the Edison Telephone Company on the system installed there. Later he spent two years building the telephone system in Belgium, after which he returned to London and was associated with the British Insulite Company. Later the Edison company started a factory near Paris, where he helped construct the first Jumbo generator for the Milan company in Italy. Following this he spent a year in Berlin installing Edison plants. Mr. Lighthipe's experiences abroad covered about five years. In 1884 he returned to America and engaged in the installation of Brush arc-lighting sets. He worked in Trenton, Philadelphia and Wilmington and was then sent to San Francisco as superintendent of construction of the Edison Consolidated Electric Company.

From an engineering standpoint Mr. Lighthipe's principal contribution was his work in connection with the Folsom-Sacramento transmission line, which was the real beginning of polyphase generation and transmission. Soon after this a three-phase line was built from the Santa Ana River to Los Angeles for the Southern California Power Company, and Mr. Lighthipe had charge of this work, the first transmission line to be operated at 33,000 volts. In 1908 he became connected with the Southern California Edison Company as chief electrical engineer, and he has had a prominent part in working out the hydro-electric development program of that company.

Mr. Lighthipe is a fellow of the American Institute of Electrical Engineers and was vice-president of that society for two years.

Editorial Comment

Electrical World, December 16, 1922
Volume 80 Number 25

The Engineer's Opportunity for Constructive Leadership

THE engineer, like all other human beings, is pleased when he is told that which he wishes to hear; his vanity is tickled when it is pointed out to him that he deserves a higher place in the sun than has ever been given to him. These facts are not, however, the only excuse for according high commendation to Dean Kimball's presidential address at the recent convention of the American Society of Mechanical Engineers in New York City. The enthusiasm with which the address was received on its delivery and when it appeared in the press the next day has not been diminished by cold analysis of his remarks and their real significance.

Alluding to the fact that the civilization of the past few decades has, largely as a result of engineering enterprise, created economic conditions requiring a new form of leadership that offers to the engineer a challenge and an opportunity for service, Dean Kimball was honest and constructive enough to point to the recognized limitations of the engineer in trying to undertake or carry these responsibilities. There is, of course, nothing new in the statement that progressive and aggressive leadership is necessary today since the passing of the Rooseveltian type. Dean Kimball's analysis of the situation shows why and how the engineer may fit himself to assume this leadership. He points not to an easy accomplishment which might minister to the engineer's self-esteem, but rather to an arduous task which will tax his ability and strength.

The Proposed Elimination of the Tax-Exempt Security

A RECOGNIZED limitation in the obtaining of funds for public utility growth has been the situation created by the combination of the graduated income tax and the exemption from tax of the huge amount of government, state and municipal securities. The latest figures indicate about thirty-one billion dollars as the amount of the public debt, practically all of which is tax-free. This figure is growing at a rapid rate. Government statistics in this case show too conclusively the tendency, easily understood, of the man with large sums of money to invest to choose the tax-free security rather than the taxable security. It is therefore with real enthusiasm that public utility executives must listen to President Harding's consistent recommendation that Congress pass and propose to the states a constitutional amendment which would prohibit further issuance of tax-exempt securities.

There are many, of course, who urge that the states will never consent to placing a tax upon their securities on account of the states' rights question and the natural desire of government to obtain its funds at an advantage over private enterprise. The growing optimism with which the possibility of passing this amendment is discussed seems to indicate a weakness in the first objection, and the second objection is at least partly answered by the very natural difference between the price of government and the price of private securities due to the comparative safety of investment. The graduated income tax, it will be admitted, is here to stay. The other factor—the tax-exempt security—must be the point of attack, and every logical argument points to the legitimacy of its elimination.

From the standpoint of the public utilities alone, including the steam railroads and the telephone and telegraph, it has been figured on competent authority that the deficit in supplying capital requirements runs almost one billion dollars per year under the needs of the present situation. The electric light and power industry is in better shape to absorb what funds there are available for investment in public utilities than are any of the others, but the situation is serious enough to enlist the active support of the proposed constitutional amendment by those in the industry.

Commission Decisions Made Only on Facts Shown

REFERENCE was made several weeks ago to the Maxwell-Brady case in Nebraska in which the Railway Commission of that state barred a power line from a highway on a showing of evidence that it would interfere with the proper working of a railroad signal installation. No attempt was made at the hearing to show that there are many miles of such parallels in successful operation in various parts of the country. It is now understood that there are several cases of the same nature in Kansas which will come before the commission of that state for decision as to whether power lines shall be built on highways paralleling steam railroads.

In the discussion of these cases and others of like nature some central-station engineers have evidenced a disposition to assume that regulatory commissions have arbitrary power to bar utilities from the highways. The truth is that no commission has any power to act except on facts submitted in evidence. The facts must justify the decision made or the courts may be called on to adjudicate the case. In the Nebraska case the commission gave its decision on the evidence. It had no right to take into consideration the fact that evidence might have been produced that would have led to a different decision. In pending and future cases involving the same question there are only two courses of action open. The first and the preferable one is to perfect a working agreement between the utilities involved that will cause the withdrawal of cases already submitted to the commission and prevent future ones. If such an agreement cannot be reached, then care should be taken to see that the commission is put in possession of all the facts on which its decision should be based. Meantime engineers and executives who seek legal advice as to whether a commission has the right to make certain specific decisions should remember that an answer in the affirmative always carries with it the significant modifying phrase "upon proper showing of fact."

Too often central-station men ask their lawyer an abstract question and fail to acquaint him with the specific facts. He cannot render a correct opinion as to the commission's powers in an individual case without knowing these facts. It is one thing to say that as a matter of law a commission can, if the facts warrant it, bar a power line from a highway. It is quite another matter to say that the facts as adduced in the case in point would warrant the commission in doing so.

Fuel Economy Depends on Research

PROSPECTS are bright that the near future will see very marked developments in boiler-room practice, and it may well be that the problems of combustion, heating-surface distribution, radiation, absorption and conduction will be reduced so as to permit the same quantitative accuracy that exists in the field of electricity.

In the article by J. B. C. Kershaw in this issue a splendid summary and prophecy on combustion and boiler-room practice gives America cause for congratulation in that the foundational research work is credited to our engineers, and in addition the leadership in size and efficiency of boiler-room equipment. In reading over this article and those recently presented at the convention of the American Society of Mechanical Engineers one is struck by the unanimity of agreement on the important features in the problem. Uniformity in the size of fuel, the importance of baffling and the fact that it can best be determined by trial, the necessity for skilled personnel even with automatic equipment, the advantages to be gained from preheated air and the present unsatisfactory knowledge and use of refractories are outstanding elements.

On the other hand, many points are made by the author with which American engineers disagree. He thinks the boilers at the River Rouge plant of the Ford company mark the peak of accomplishment and predicts a recession to smaller units. Yet it is reported that boilers of 30,000 sq.ft. and of even 40,000 sq.ft. of heating surface are now in process of production in this country. Moreover, his "absence treatment" of the stoker and detailed treatment of the stepped grate arouse surprise in an American engineer. The stoker is here to stay and makes possible the use of our large units.

Food for thought and experimental research is contained in the latter part of the article, where the author alludes to the use of pressure-gas-fired boilers with preheated air. Some very ingenious furnace designs are shown, and in particular details of nozzles for properly handling gas and air. The combination of pressure gas firing with a radiant refractory bed offers splendid possibilities for economies in combination with byproduct plants and even with the use of powdered fuel.

A continuation of the research and development work of the central stations, the Bureau of Mines and other agencies vitally concerned in the fuel problem seems fully warranted by present glimpses of still greater economies in the burning of fuel.

Rural Lines Built by Taxation a Step Toward Municipal Ownership

AUTHORIZATION of townships or some other subdivision of the state to issue bonds and otherwise provide for the construction of rural-service lines has had more or less discussion in several parts of the country. The plan on which irrigation or drainage districts have been formed is the model generally suggested. Such suggestions have in most instances not come from central-station sources, but there are several cases in which organized central-station interests have seriously considered the proposal as a way of meeting the insistent demand for rural service.

Unless central-station men are willing to admit that present distribution methods are a failure and unless they want to head toward ultimate municipal ownership of all utilities, they cannot afford to support such a method. It is only another effort along the line of the schemes just defeated so emphatically in California and South Dakota. Rural service will be either a success or a failure. If it is to be a failure, putting some subdivision of the state into the business of distributing energy will not redeem it. On the contrary, it is likely to aggravate the situation, and, the service once established on a profitless and inefficient basis, the privately owned central station will suffer with it because the rural-service systems will be tied into the distribution and transmission systems of private companies. To cut loose a municipally owned system that had proved a menace to the rest of the service would be no "picnic" job, particularly in view of the inevitable political entanglements it would entail.

If rural business is to be a success, the electric light and power companies can make it one more quickly than any other agency. Back of them is a fund of experience and knowledge on which to draw. They must face the problem as it stands today fairly and squarely. Quasi municipal ownership will not help.

Opportunity for Sales of Stock to Customers

PAYMENT of $625,000,000 will be made to the holders of war savings stamps on the first of the year. There is no way of estimating their number, but it is well known that countless wage earners and persons of small incomes helped in this way to finance the war. No town or city in the country but boasts of many such government security holders. Some of them now will become the prey of stock swindlers, others will dissipate in thriftless expenditure the investment made five years ago, while a great many will deposit the money they receive from redeemed savings certificates.

Why not interest all of these people in the securities of electric public utilities? We cannot have too many stockholders from the rank and file of the community, and the security we can offer them is safe and sound. Moreover, the rate of return is higher than that paid by the government or by the savings banks. Every electric public utility having stock to sell should therefore advertise locally to reach these holders of war savings stamps, and it should in addition acquaint the local banks which will receive the certificates for redemption with the opportunity for investment that the electric public utility of the town offers. It would be a pity if this huge fund made up of accumulated savings of hard-working people were wasted or improvidently invested for want of counsel.

The Last Stand of the Private Plant

THE elevator frequently furnishes the excuse for the owner of a private plant in a large office or apartment building to refuse central-station service. He can be shown that high-pressure heating is false economy and that the lighting load is a poor excuse for operating in competition with the light and power company. But he thinks the combination of heating, lighting and high-pressure steam-hydraulic elevator service justifies him in remaining independent of central-station supply.

The article by W. H. Whitton in this issue shows the fallacy of such a position and offers helpful suggestions to central-station power salesmen. Independently of the value of the individual load, central-station service should be universal in a large city if all possible advantage is taken of diversity to insure economical operation. The author points out the improvements in operating speed and in safety through use of modern electric elevators aside from the rental value of the building space saved. The micro-elevator service now avalable with the multiple-voltage control is a splendid achievement and places the electric elevator in a class by itself.

On the other hand, the central-station company looks to motor designers and elevator manufacturers to develop the high-speed alternating-current passenger-elevator equipment to a degree comparable with the direct-current type in order to render better service to buildings in districts where direct-current distribution is not installed.

Will-o'-the-Wisp of Electric Heating

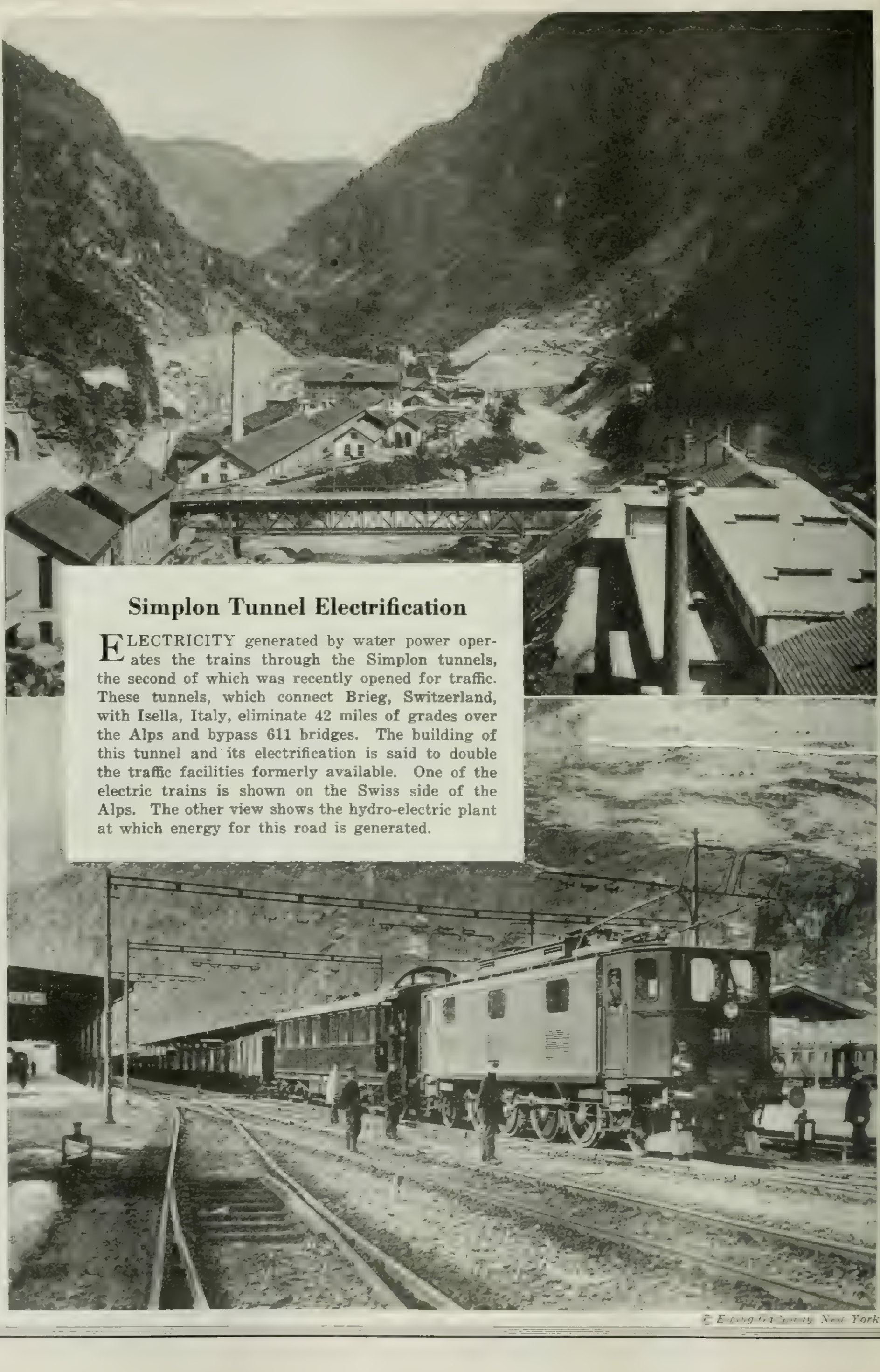
OCCASIONALLY some people with authority in the electric light and power industry get a notion which is so white hot that no matter how much cold water is poured on it it just sizzles and refuses to go out. The chimneyless town is a typical example. It grips the mind and fires the imagination. No coal, no ashes, no dirt, no soot, no worries—nothing but cozy comfort, and all through the instrumentality of electricity. Was ever anything so ideal or more alluring? And yet when we contrast this ideal with fact and experience how sadly shattered it becomes! If electric heat is required intermittently, as for cooking or to take the chill from a room in the cool evenings of the fall or spring, it can be used to advantage and economically; but to heat an average house electrically in any section of this country where winter prevails is out of the question. Electricity is not destined ever to take the place of coal or other fuels for heating residences or offices on an extensive scale.

As against the cheapest hydro-electric power, coal at present prices, even though burned inefficiently, will heat a house at one-quarter the cost. Where energy for heating is obtained from coal-burning stations its use is nothing short of wanton. The chemical energy in a ton of coal is equal to approximately 7,500 kw.-hr. of electrical energy. Granting that 40 per cent of the heat is lost up the chimney, there is still 4,500 kw.-hr. available. Electrical energy, assuming that there were enough line and transformer capacity available to carry the load and that a rate as low as one cent per kilowatt-hour were offered, would therefore be comparable to coal at $45 a ton. Few central-station companies can offer a one-cent rate, and fewer still can afford the extra investment necessary in lines and transformers to feed a heating load which at best would be used only four or five months in the year. Here and there locations may be found, such as the Gila or Mojave deserts or the southernmost part of Florida, where the amount of heat required is so small that it is economical to make it all electrically. In almost every other section of the country electric heat is out of the question except as an auxiliary to some other form. Patrons who seek this luxury should be apprised of its great cost and discouraged in its use as a matter of public policy.

Applications of the Ring System

A RING system of mains giving a chance of feeding from two directions, and therefore security against interruption from any single break, has long been recognized as desirable, though it has seldom been used. A short paper by P. O. Reyneau gives some recent novel applications of the ring which we trust will go far toward overcoming the timidity of operators who shun anything, however good, until it becomes "standard"—that is, recommended by those who belong with the ultra-conservative by nature or interest. A group of points to be fed scattered over considerable territory can often be reached more easily by a ring than by any tree system of mains, and hence the ring has automatically been pushed into service. But the case considered by Mr. Reyneau is quite a different one. It assumes a system of distribution already in existence which has been overloaded to the point where relief is imperative. Generally the trouble could be remedied best by raising the voltage from the existing figure inspired by overcaution to that indicated by good transmission practice. This, however, involves scrapping or otherwise losing value on a large number of transformers.

At this point comes a chance for working the ring system for feeding at a really effective voltage the existing distributing system at properly chosen points, and incidentally perhaps linking together two or more efficient generating systems. The ring voltage must, of course, be governed by the general conditions. Sometimes it may be good judgment to work at a voltage to which the general distribution can be eventually raised; at other times the ring pressure may best run high and the extra transformation be permanently retained. In either case the ring gives a most efficient and useful feed for the service. Every effort should be made, however, to relieve the distribution difficulties before resorting to an extra transformation. The three-phase, four-wire system, to which we have frequently referred, is about the easiest preliminary remedial measure. Its too infrequent use seems due to sheer old-fogyism and lack of initiative. When circumstances require more relief than this simple expedient can give, the ring system of high-tension feeding is surely worth trying. The only difficulties it brings are those inseparable from any attempt to hold service in face of line failures. Good progress is being made in automatic protective devices for use in such situations. One should not forget, however, that an extra transformation is always an expensive matter in energy lost and when undertaken should be coupled with the transference of all practicable load to the higher distribution voltage.



Simplon Tunnel Electrification

ELECTRICITY generated by water power operates the trains through the Simplon tunnels, the second of which was recently opened for traffic. These tunnels, which connect Brieg, Switzerland, with Isella, Italy, eliminate 42 miles of grades over the Alps and bypass 611 bridges. The building of this tunnel and its electrification is said to double the traffic facilities formerly available. One of the electric trains is shown on the Swiss side of the Alps. The other view shows the hydro-electric plant at which energy for this road is generated.

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Economical Use of Bituminous Fuels

Three Essential Conditions to Insure High Degree of Efficiency and Absence of Smoke and Unconsumed Gas—Choice of Boilers —Inclined and Stepped Grates—Gas and Coaldust Firing

By JOHN B. C. KERSHAW
Combustion Engineer, London

HOW to burn coal efficiently is ever present with central station engineers. Developments of late in regard to the use of low-grade fuels, new types of fuels, new designs of boilers and combustion chambers and new stoking apparatus have come about very rapidly, particularly in Europe. The writer of this article gives a résumé of the present thought and practice in combustion engineering as applied to the use of bituminous fuels of all grades and in all forms.

The article is both informational and speculative and will serve to bring American readers up to date in regard to European opinion and practice. It may also serve to bring about some valuable comments from American engineers. Fuel is a vital element in central station operation and its proper use is an obligation that is of national interest.

A STUDY of the scientific facts and data relating to the subject of combustion shows that three conditions are essential if the combustion of solid bituminous fuel is to be carried out with high efficiency and without the production of smoke or of unconsumed hydrocarbon gases. These conditions are:

1. A sufficiency of air in order to provide for the complete oxidation of the carbon in the fuel to CO_2 and of the hydrogen to H_2O.

2. A sufficiently high temperature to cause the ignition of the hydrocarbon gases immediately they are liberated from the coal.

3. A design of furnace grate and fire bar which permits rapid mixture of the incoming air and of the evolved hydrocarbon gases, and sufficient draft to produce the desired effect.

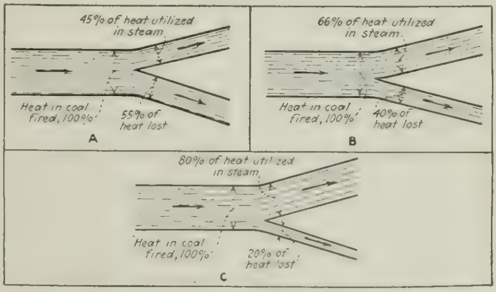
Low efficiency and smoke production in the present-day boiler plants, when fired with bituminous coal, are generally due either to insufficient air supply at the periods when the hydrocarbon gases are being evolved most rapidly from the fuel or to inadequate mixing of the air and of these hydrocarbon gases. At an earlier date badly designed furnaces and inadequate combustion space were the usual causes which produced smokiness and low evaporative power. One pound of ordinary bituminous coal requires theoretically 12 lb. of air (147½ cu.ft.) in order to burn it completely and to produce nothing but CO_2 gas and water vapor. In practice from one-and-a-half to twice this weight of air is necessary per pound of fuel, and therefore the amount of air which must be carried either through the fuel or above it into the furnace amounts to between 40,000 lb. and 54,000 lb. (500,000 cu.ft. to 650,000 cu.ft.) per ton of fuel burned.

As regards temperature, the hydrocarbon gases will not ignite, even with an excess of oxygen present, unless the whole of this gas mixture is raised to 1,300 deg. F. and the problem of burning bituminous coal with high efficiency in boiler furnaces is very largely one of providing sufficient air and raising it to the ignition point of these hydrocarbon gases as quickly as possible. When cleaning the fires the temperature sometimes falls below 1,300 deg. F., and the hydrocarbon gases are distilled from the coal and pass up the chimney unburned because the ignition point of these gases has not been attained.

The older view was that smoke was caused by these hydrocarbon gases in a partially consumed state coming into contact with the cooler surfaces surrounding them but this view has been somewhat modified by the results of the investigations of Kreisinger, Augustine and Katz with a Murphy side-feed stoker and furnace of special design.*

The opinion these investigators have formed is that the volatile matter of the coal leaves the fuel bed in the form of heavy hydrocarbons, and that in the case of bituminous fuels 12 per cent of this combustible volatile matter is in the form of tarry matter. These tars are decomposed by the high furnace temperature, especially if oxygen be absent, into lighter hydrocarbons with separation of solid carbon particles, or soot. This decomposition of the tarry matter proceeds, step by step, in a number of consecutive reactions, each accompanied by the separation of more carbon or soot. The length of time during which these reactions occur is believed to be very short, not more than one-tenth of a second, and in this time the combustible gases will have traveled only one foot from the fuel bed.

If this theory of soot formation be correct, the cause is not so much too early contact of the gases with water-cooled plates or tubes, but the high temperature and absence of oxygen at the surface of the fuel bed, and the correct remedy is to increase the air supply over the surface of the fuel. If sufficient oxygen were in fact present at the moment of distillation of these heavy hydrocarbons, they would burn completely to CO_2



RESULTS ACHIEVED WITH PRESENT-DAY EQUIPMENT IN CENTRAL-STATION PLANTS
A—Worst results. B—Average results. C—Best possible results.

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*U. S. Bureau of Mines. Bulletin No. 135.

and H_2O without first decomposing and depositing soot. After the soot has once formed it is well known that it is difficult to burn. The soot is of complex molecular structure, and its combustion when floating in a gas stream, even in presence of an excess of oxygen, will occur only very slowly, or perhaps not at all, before it has traveled out of the combustion chamber of the boiler.

Black smoke, however, contains not merely a portion of the solid carbon of the fuel in the form of soot particles, but also partly consumed carbon in the form of carbonic-oxide gas. It is the loss of the thermal units which would be obtained by the complete combustion of this gas which forms the chief item of loss when smoke is produced. The criticism, therefore, that the amount of solid carbon in smoke is so small (when estimated by weight) that it can be considered negligible from the heat-economy point of view is ill-informed; for the solid carbon or soot is simply an indication that bad conditions of combustion exist in the furnace of the boiler, and the chief cause of loss is that invisible gas, carbonic oxide.

One of the earliest writers on the subject of combustion and a more rational system of firing boilers was an engineer named C. Wye Williams, who wrote a small book entitled "The Combustion of Coal" and published it in Liverpool in the year 1841. Mr. Williams was years ahead of his time as regards his comprehension of the needs of boiler furnaces for the combustion of bituminous coal. He realized clearly that a supply of air above the grate was an essential condition of obtaining high efficiency with this class of coal, and that in order to obtain thorough admixture of this air and the volatile gases it was better to admit the air, preheated if possible, through the fire door in fine streams. The use of air grids in fire doors was one practical result of his teaching on this subject, but as a rule the air openings in these door grids were never designed sufficiently large to admit the whole of the air required.

As already stated, effective mixing and a temperature of at least 1,300 deg. F. are of supreme importance to good combustion, and neither of these conditions is easy to maintain in the water-cooled furnace of a hand-fired boiler.†

According to Kreisinger's experiments, the fuel bed of a hand-fired boiler furnace acts principally as a gas producer or gas retort, and the oxygen which passes up with the air between the crevices of the grate bars is all used up before it has passed through more than three or four inches of the thickness of the fuel. The products of combustion in this part of the fuel bed are largely CO_2 and a smaller percentage of CO. At a height of three or four inches from the grate the CO_2 content of the gases reaches a maximum of 12 to 18 per cent. As the CO_2 passes through the upper layers of the fuel bed it is reduced by contact with the incandescent carbon to CO, which thus forms 16 to 30 per cent of the combustible gases distilled near the surface of the fuel bed.

Excess Air Is Essential

The ratio of the weight of air which can be supplied through the grate to each pound of coal gasified remains constant at about seven to one. This ratio, according to Kreisinger, holds over a very wide range of rate of gasification. The faster the air is supplied the more rapidly the fuel gasifies, but the combustible content of the gases at the surface of the fuel bed remains nearly constant. Therefore the amount of air supplied through the grate determines only the rate of combustion, and not its degree or completeness. For the complete combustion of 1 lb. of average coal at least 14 lb. of air is necessary. As only 7 lb. of air per pound of coal can be supplied through the grate, another 7 lb. must be supplied over the fuel bed, in order that the gases rising from the fuel bed may be completely burned. Since roughly one-half of the combustion process takes place in the fuel bed and one-half in the combustion space, the addition of air above the fuel for completely burning the gases and preventing smoke is essential. This additional air should be introduced, he states, close to the surface of the burning fuel, if possible, in many fine streams to facilitate its mixing with the combustible gases rising from the fuel bed.

Combustion a Complex Problem

It is apparent, therefore, from what has been stated above, that the difficulties met with in burning bituminous coal are due to the fact that it is a very complex substance and that when heated it burns partly as a solid and partly as a gas. The latter must be burned quickly, otherwise it will escape up the chimney; and hence large volumes of heated air are necessary and the needs of the furnace as regards air supply are constantly changing. This leads one to the firing rule that "little and often" is the best means of feeding boiler fires with fuel, since by this method the fluctuations in the evolution of combustible gases are reduced to a minimum. It is certainly unfortunate that so little attention has been devoted in the past to the training of stokers in the scientific principles underlying the practice of their art. The fact that the efficient conversion of the latent heat energy of coal into radiant heat in the furnace of a boiler demands a high degree of skill and considerable technical and scientific knowledge has been ignored or overlooked. Firemen's wages also have been standardized much too low in relation to the importance of their work. The wrong class of men in consequence have been attracted to the job, and these have been placed in charge of boilers without any regard to the smallness of the ratio of the total wages paid in the boiler room to the total cost of the fuel.

Mechanical stokers have become popular on both sides of the Atlantic largely because they obviated the difficulties caused by the short supply of skilled men for stoking, and also because they fulfilled the stoking rule of adding fuel "little and often" to the fires, without any opening of the furnace doors. The perfect mechanical stoker has yet to be invented, however, and, as will be proved later, mechanical stokers when applied to narrow-flued boilers are very far from being so efficient as they are claimed to be. Many types of mechanical stokers are operating quite successfully, however, under water-tube boilers, and when put in charge of a competent man they enable some of the cheaper classes of bituminous fuel to be burned smokelessly and with a fairly high degree of efficiency.

The ordinary moving bar of some of these mechanical stokers requires to be cleaned at intervals. To do this the hopper feed is stopped and the grate is burned bare, the dampers being gradually closed as the fuel burns off and completely closed during cleaning. When the cleaning is finished the feed is restarted, and the coal first fed will often be ignited by previous backward burning and will at once flame. If the draft is good, the coal will burn very fiercely; but it requires a long time to get the grate fully covered again, during which time cold air is rushing freely through the bare grate and is diminishing the duty and efficiency of the boiler and of the economizer. If to check this the boiler dampers are closed, there will be too small a volume of air drawn in above the fire to burn the gases, and black smoke will be made.

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†Several valuable contributions to the scientific study of the conditions actually obtaining in the fuel beds of boiler furnaces, both when hand-fired and when mechanically operated, have been published by the U. S. Bureau of Mines, and Bulletins Nos. 135 and 137 and Technical Paper No. 139, by H. Kreisinger and others, may be mentioned as of special interest.

The chain-grate stoker is free from this difficulty and is probably the most widely used form of mechanical stoker. The special defect of this stoker is the tendency of the fuel to burn thin or into holes on the links or bars of the grate, and for air leakage to occur through these on a considerable scale before they are noted and closed up. Another defect is the liability of the fuel to be burned away before the ash-dumping hopper is reached at the end of the grate travel; and the device which has been introduced of air-cut-off plates under the rear of the grate does not always serve to check the air leakage at these points.

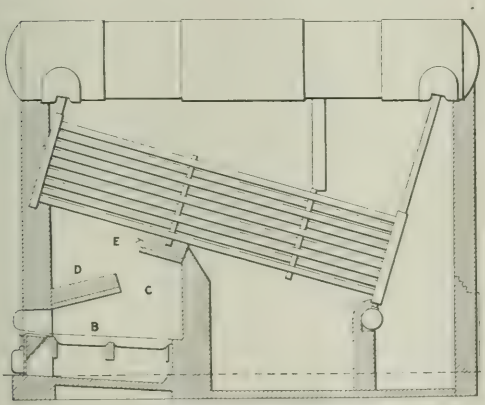

FIG. 1—WATER-TUBE BOILER SETTING WITH MILLER'S DESIGN OF ENLARGED COMBUSTION CHAMBER

The fuel employed for mechanical stokers requires to be carefully selected and graded to one size, if good results are to be attained; and since many of the bituminous mines in the United States are still unprovided with up-to-date washing and screening machinery, the choice of fuel for a boiler installation equipped with mechanical stokers is more limited than for hand-fired plants. Other disadvantages are that boilers fitted with mechanical stokers cannot respond so easily and quickly to sudden demands for steam and that there is considerable risk of unburned fuel being thrown away with the ash when the rate of feed and speed of the chain grate is suddenly accelerated.

The shortcomings of present-day methods of burning fuel for steam generation are partly due to faulty boiler-furnace design and partly to lack of intelligence and efficiency in operation of the plant. It is no doubt true that in some of the latest and most up-to-date examples of boiler plant many of these defects have been remedied or overcome. The general level of efficiency, however, in the average steam power plant is far below the maximum attainable and in some of the smaller installations is disgracefully low. So long as this is the case, articles dealing with the scientific principles of combustion and emphasizing the conditions which must be observed in boiler design and working in order to obtain high efficiencies are both necessary and useful.

A paper by David Brownlie, read before the members of the Institution of Mechanical Engineers in London in March, 1920, dealt with the results of an investigation of the efficiency of mechanical stokers when applied to internally fired boilers. The result showed that under ordinary working conditions the efficiencies were far below those attained, or claimed by the makers, under the test-trials when installed.

Brownlie's paper gave exact figures for the performance of eighty typical mechanically fired boiler plants in the United Kingdom in thirteen different industries, more than 290 boilers and a coal consumption of 715,000 tons per annum being involved. The average net working efficiency of these boilers was only 59 per cent. It is highly probable that a similar investigation in America would show an equally low efficiency.

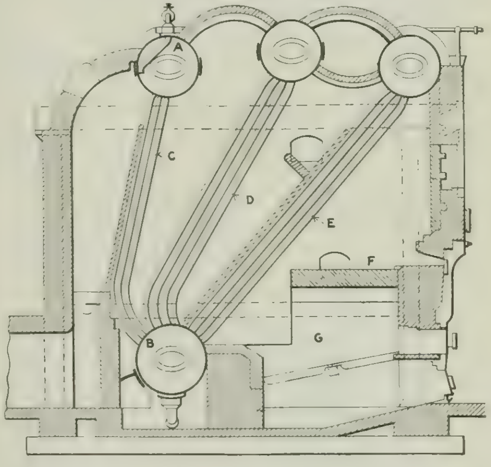

FIG. 2—WATER-TUBE BOILER SETTING WITH STIRLING DESIGN OF ENLARGED COMBUSTION CHAMBER

The fundamental requirements of a good boiler are (1) that it shall produce a maximum quantity of dry steam with the consumption of a minimum amount of fuel, and (2) that it shall possess some reserve of steaming power.

For those plants which are located where adequate supplies of good lump or well-graded small coal are available at a reasonable cost the choice lies between the large shell type of internally fired boiler and the large water-tube boiler. The former type, however, is not adapted for burning low-grade fuels with high ash content, since these demand for their satisfactory combustion some form of brick-lined combustion chamber and a mechanical ash-handling equipment. The comparatively restricted furnace and ash space of the internally fired boiler is inadequate for these additions, and when low-grade fuels, in either the dust or the lump form, are to be burned the water-tube boiler should be adopted.

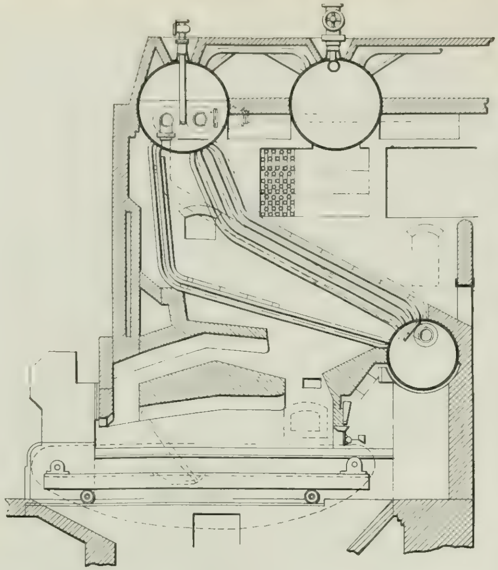

FIG. 3

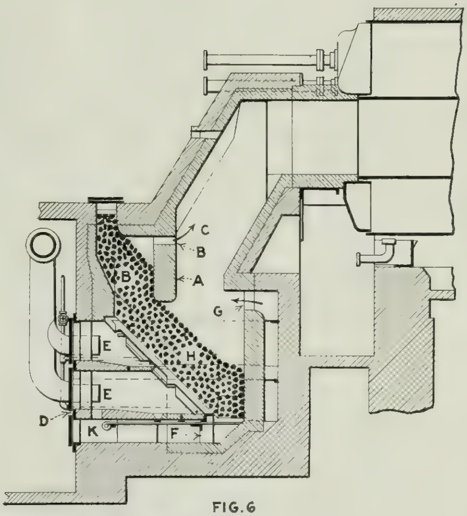

FIG. 6

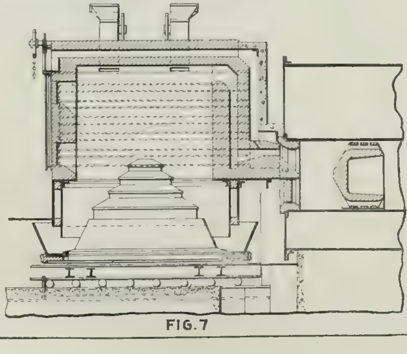

FIG. 7

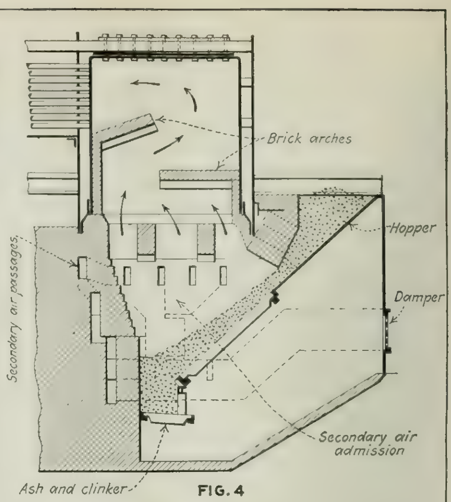

FIG. 4

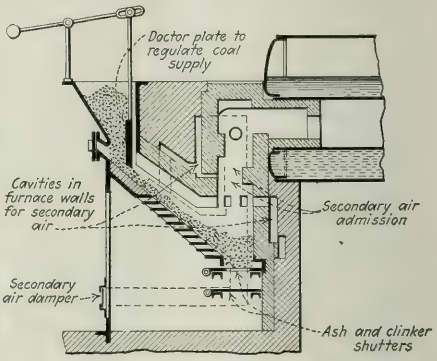
Doctor plate to regulate coal supply
Cavities in furnace walls for secondary air
Secondary air admission
Secondary air damper
Ash and clinker shutters

FIG. 5

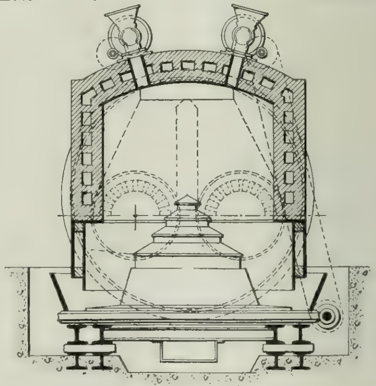

FIG. 8

VARIOUS TYPES OF BOILERS AND FURNACES

Fig. 3—Furnace of a German design for burning very wet fuels, such as lignite, on chain-grate stokers.

Fig. 4—Inclined grate, applied to locomotive type of boiler. (See detailed description on opposite page.)

Fig. 5—Stepped grate, applied to Lancashire boiler. (See detailed description on opposite page.)

Fig. 6—The Bergman system of half-gas firing for wet fuel. (See detailed description on opposite page.)

Fig. 7—Mills' external furnace for boiler firing (section photograph).

Fig. 8—Mills' external furnace for boiler firing.

Where the power demand is large and a battery of ten to twenty boilers is required, it is the wisest course to install boilers of each type so that the plant, regarded as a whole, may possess the special advantages of each. The battery of internally fired boilers would thus be operated with the better classes of fuel, either by hand or by mechanical stokers, and would be relied upon to provide the main steam supply and to take any bad feed water that came along. The water-tube boilers, on the other hand, would be operated with mechanical stokers and the poorer classes of fuel and would provide steam for the periods of exceptional activity.

In very large plants a vertical tubular boiler might also be included in order to make use of the fine coal dust which collects on the floors and ledges of mines, the sludge from coal-washing installations, and also the breeze from coke-oven plants. These waste materials can be purchased at remarkably low rates and yield a dust fuel of good calorific value.

The general conditions which must be observed in the design and setting of any type of boiler, if high efficiencies are to be maintained, are the following:

(a) The furnace grate and combustion chamber of the boiler must be adapted to the physical and chemical characteristics of the fuel to be burned, and the heated gases must not be allowed to come into contact with water-cooled plates or tubes before perfect combustion has been attained.

(b) The plates or tubes which are in contact with the water on the one side and with the hot gases on the other should be of ample superficial area to raise the steam required under normal conditions from each boiler without undue forcing of the fires, and the internal design should be such that the discovery of any corrosion or cracks may be made easy during the periodic inspections.

(c) All portions of the heating surfaces exposed to radiation from or to actual contact with the hot flame and gases should be constantly covered with water, and the accumulation of scale on these surfaces should never be allowed to exceed ⅛ in. in thickness.

(d) The circulation of the water in boilers of the large shell internally fired type should be promoted by some mechanical means at the dead points, notably underneath the ash boxes.

(e) The side and center flues of the shell-type boiler should be provided with mechanical scrapers in order that flue-dust may be regularly removed without interfering with the work of the boiler. Poor draft, especially when burning low-grade fuels, is often caused by the blocking of the flues with dust which ought never to have been allowed to accumulate. The poorer the fuel the more frequent should be the cleaning of the flues, and the cleaning of the exterior of the tubes from dust is no less necessary in water-tube boilers.

Detailed Description of Illustrations Shown on Opposite Page

In the true stepped grate, shown in Fig. 5, plates are arranged as in a staircase—but the "risers" are omitted and the openings thus left afford access for air. In Fig. 4 the simple inclined grate is shown fed from a hopper; the ash and clinker collect on the short bars, and secondary air is admitted through lateral passages controlled by a damper. The gases thence proceed to the boiler, which in this case is seen to be of locomotive type, with two brick arches to divert and mix the gases and to spread them over the surface of the dome of the combustion box before they escape to the tubes.

The stepped grate of Fig. 5 is shown applied to a somewhat similar furnace erected in front of a fire-tube boiler. The coal supply from a hopper is regulated by a doctor plate; secondary air is admitted and is regulated by a damper, which controls the access of air to the cavities in the furnace walls. These air cavities in the walls not only provide means for preheating the secondary air supply, but they also assist in keeping the side walls cool and prevent the formation of clinker. All refractory-lined furnaces for underfired boilers should be constructed on this principle, since it assists materially in prolonging the life of the furnace lining. Ash and clinker are deposited on the lower shutter and may be let down by withdrawing the upper shutter.

Fig. 6 is a sectional elevation of the Bergman furnace applied to a fire-tube boiler. This figure shows that provision is made for separate and controlled air supplies to the upper and lower portions of the inclined grate, and that a dividing wall or hanging bridge at *A* shuts off the top portion of the grate from the combustion chamber of the furnace, save for the opening at *C*. This converts the upper portion of the grate into an inclosed drying chamber for the fuel. Boiler efficiencies of between 70 and 80 per cent are claimed for this type of furnace construction.

(f) In water-tube boilers the arrangement and number of the baffles have great effect upon the thermal efficiency, and it is a mistake to assume that one fixed arrangement of the baffles is the best for all classes of fuel.

(g) The outer brickwork of the boiler setting should be made absolutely air-tight, since the infiltration of air into the flues through faulty bricks and cracked joints not only spoils the draft but leads to large heat losses. It is well to build the outside walls with a 3-in. air space inclosed between the two thicknesses of brickwork and to fill this space with some material of low heat conductivity in granular form. The outer side of the double wall should be painted or tarred at frequent intervals in order to close all cracks and joints. In some cases sheets of asbestos or iron plate have been built into the outer wall for the purpose of rendering the brickwork air-tight.

(h) The exposed portions of the boiler shell and of the main steam-pipes should be covered with a thick layer of some good heat-insulating material in order to reduce convection and radiation losses. The heat lost by radiation from uncovered boilers, especially when these are unprotected from atmospheric influences, is far greater than is suspected and in small isolated plants is one of the most customary sources of inefficiency.

Furnace Design for Water-Tube Boilers

The large water-tube boiler has been installed in the majority of modern electric power generating stations because of its high steaming capacity and its ability to carry a load much above its rating for a considerable time without injury. The rapidity with which steam can be raised from a boiler with banked fires is another point in its favor. Its advantages over the internally fired type of boiler are its refractory-lined combustion chamber and the consequent ability to burn low-grade fuels with high ash content, with the aid of the traveling-grate type of mechanical stoker.

In many instances, however, the combustion chamber of these boilers, as originally planned and erected, is much too small, and the raising of the boiler shells and tubes on their supporting framework 18 in. to 24 in. leads to a considerable increase in the efficiency of the boiler. Another defect of design in the furnaces of water-tube boilers encouraged the tendency for the hydrocarbon gases evolved from the fuel to pass up as straight streams unmixed with the air.

As regards the methods for attaining a more thorough admixture of the air and volatile hydrocarbon gases, steam jets, hot-air jets and "baffling" are the devices employed.

The use of steam jets is the most popular, but unless carefully controlled these jets consume much more steam than is suspected and lead to considerable losses of heat in the chimney gases. Brownlie here again has carried out a large number of practical tests, under working conditions, which have proved that with these aids to more perfect combustion steam consumptions of from 4 to 8 per cent of the total steam generated are quite common. The steam also has an erosive action on the jets, so that these are continually being enlarged and passing more steam than they were designed for.

A small pump to provide hot air and arrangements for forcing this air under pressure into the combustion chamber at selected points, in order to produce whirling and eddying effects upon the burning gases, make a better method of aiding the chemical changes in the combustion chamber. If this plan be combined with the skillful use of "baffles," the efficiency of the boiler and furnace will be raised to its maximum point. As already stated, striking effects can be obtained in some cases by altering the number and arrangement of the baffles in water-tube boilers.

The best method of baffling, however, can be found only by actual trials with the selected fuel; and no one arrangement of the baffles will suit all classes of fuel. Horizontal or only slightly inclined baffles and tubes also collect much flue dust, and when low-grade fuels are being burned on chain-grate stokers arrangements must be made whereby the dust can be removed periodically without interfering with the work of the boiler. The use of the hot-air blast referred to above is best for this purpose.

It may be pointed out with respect to chain-grate stokers that it is a mistake to assume, as is often done, that when once the best rate of fuel feed and speed of travel of the fuel along the grate has been determined for any particular grade of fuel the boiler can be left in charge of common laborers or unskilled men. The lesson taught by experience is that mechanical stokers demand skilled supervision and management, if they are to yield their highest results.

FUTURE IMPROVEMENTS AND DEVELOPMENTS

The tendency of power development at present is overwhemingly in the direction of larger units. All the extensions of or new power stations, planned or in progress, are equipped with very large water-tube boilers, mechanical stokers and induced or forced draft. The tall brick chimney stack of earlier days, with an ornamental stone-faced base, is now replaced by a much more economical short steel uptake from the waste-gas flue at the back of or directly over the economizer. As a rule, each boiler and economizer unit, or pair of boilers, is provided with its own chimney stack. This change from a tall to a short chimney has been rendered possible by the substitution of artificial for natural draft and by the more scientific control of the combustion process and consequent absence of black smoke.

As regards the size and capacity of these modern boilers, the new Dalmarnock station of the Glasgow Corporation is equipped with boilers of the water-tube type, with a normal rating of 50,000 lb. of steam per hour, the heating surface of each boiler being 6,948 sq.ft. and that of the economizer attached to it 5,155 sq.ft., a total of more than 12,000 sq.ft. for the combined unit. The steam pressure at which these boilers are worked is 275 lb. per square inch, and the steam is superheated to 700 deg. F.

The Manchester Corporation has followed Glasgow's example by substituting four water-tube boilers with a capacity of 100,000 lb. steam per hour (at a working pressure of 225 lb. per square inch) for the original battery of twenty-four boilers at the Stuart Street station in Manchester. Each of these large boilers is planned as a self-contained unit with economizer, superheater, forced and induced draft and independent chimney shaft. Each boiler is provided with four grates and has a heating surface of 14,000 sq.ft. and an economizer heating surface of 8,500 sq.ft., giving a combined heating surface of 23,000 sq.ft.

In America still larger boilers of the water-tube type have been erected and worked. The power station of the Duquesne Electric Light Company at Colfax, Pa., is equipped with boilers which possess 20,876 sq.ft. of heating surface, and the new power house of the Ford Motor Works at River Rouge, Mich., has beaten this with boilers measuring 26,470 sq.ft., or nearly double the size of the boilers at the Stuart Street station. The furnace alone of each one of these enormous boilers measures 23 ft. x 25 ft. x 55 ft. in height and will accommodate eight Ford motors side by side on its floor. It is probable that this represents the extreme limit of development in the size of steam-power units under existing conditions, and that the pendulum will now swing back in the direction of smaller and more easily controlled boilers and furnaces for steam generation.

INCLINED AND STEPPED GRATES

Stepped grates have been neglected in the past in America for various reasons, one of which was that external furnaces were considered unsuitable and uneconomical for use with the internally fired type of boiler and that the horizontal traveling grate stoker has always been the type preferred for the large water-tube boiler.

On the continent of Europe the inclined or stepped grate has been regarded with much greater favor, and especially in Germany it has been used extensively for burning fine coals, lignite, peat, tanbark and sawdust. Since low-grade fuels are likely to be more extensively used for steam raising in America in the near future, the following information respecting the design and working of this type of grate may be found of value.

A stepped or inclined grate affords the simplest means of moving the fuel along the grate as combustion proceeds, since the weight of the fuel automatically closes up all empty spaces and prevents excessive admission of air. When the angle, which ought to be adjustable, is properly chosen, an even or uniform bed of fire can therefore be obtained by this method of construction without the use of any mechanical or auxiliary device.

Two forms of inclined grate have been used abroad. In the first the grate is of the usual form with straight bars but is inclined at a steep angle, as in Fig. 4. This still retains the disadvantages that small coal and coal dust easily fall through the bars and that coal of a strong coking property, or one which produces much clinker, does not give good results when burned on such a grate. Grates of the form of Figs. 4 and 5 are usually inclined at an angle of 45 deg., and when the grate angle is adapted to the fuel being burned there will be no empty or uncovered places in the fire. Much carbonic oxide is produced and unburned hydrocarbons are given off from the thick mass of fuel by this system of firing, but as the fire thickness and the secondary preheated air supply are controllable, the combustion can be made perfect and smokeless.

A recent German development of the inclined grate and of the "half-gas" method of firing boilers is that of Bergman.‡ This system is based on the observed fact that four distinct and separate processes are concerned in the combustion of coal. Bergman claims that these are most efficiently carried out when arrangements are made for each one to be completed before the next is initiated or started. The Bergman furnace provides therefore, first, that the coal shall be supplied only with sufficient heat to drive off the moisture. The temperature is then raised and the volatile gases are driven off from the dried fuel. Finally, the coke is gasified, and all the gases produced either by carbonization or gasification are burned, with an adequate supply of heated air.

A somewhat similar system of boiler firing has been experimented with in the United Kingdom by E. C. Mills. In Mills' design the external furnace in front of the boiler partakes more of the ordinary gas-producer form, and the air required for gasification of the fuel is drawn through a double-walled chamber surrounding the furnace.

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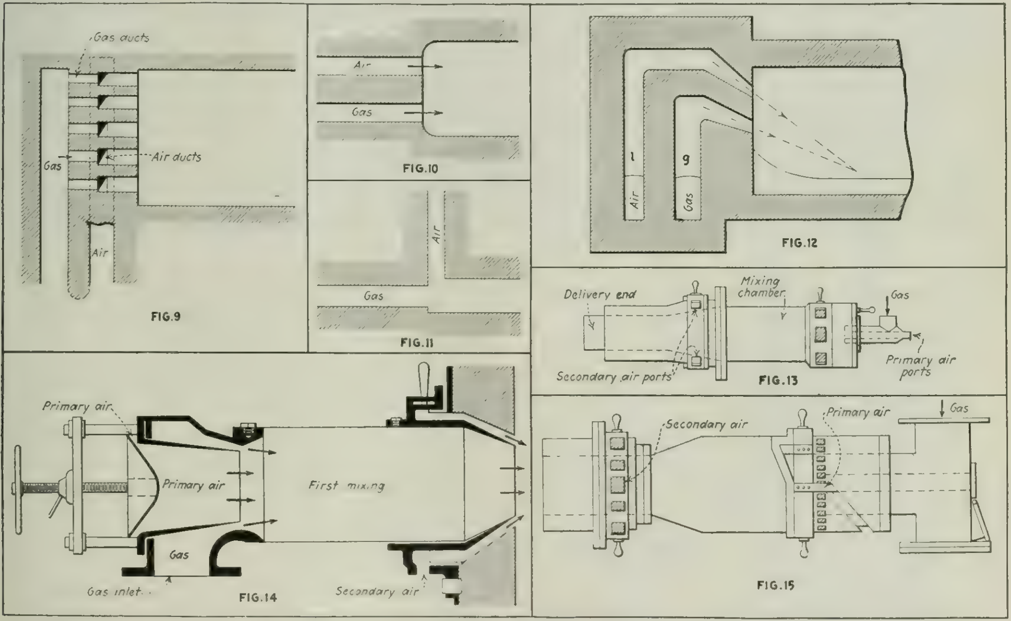
‡*Zeitschrift des Vereines deutscher Ingenieur*, Vol. 66, Feb. 11, 1922.

Figs. 7 and 8 are sectional elevations of the Mills furnace applied to a Lancashire or Cornish boiler. According to data given by the designer himself, in a paper read before the Engineering Section (G) of the British Association meeting at Manchester, the furnace gave a steam production of betwen 10.23 lb. and 11.47 lb. per pound of fuel and showed a saving of 18 per cent over the ordinary method of firing.

As compared with systems of firing by use of producer gas manufactured in the usual manner, it is claimed for these two systems of "half-gas" firing that the heat produced during the first stage of gasification is trapped and utilized, whereas in the ordinary producer-gas process this heat is dissipated and lost.



FIGS. 9 TO 12—ARRANGEMENT OF GAS PORTS AND AIR PORTS FOR FIRING BOILER FURNACES WITH PRODUCER GAS UNDER NORMAL PRESSURES. FIGS 13 TO 15—TYPES OF BURNERS FOR GAS FIRING UNDER PRESSURE

If a wide furnace is to be gas-fired, the air and gas should be divided up into several streams, as shown in Fig. 9. If a long flame be desired, the arrangement of Fig. 10 is best, since here the gas and air enter the furnace in parallel streams and the combustion period is much more prolonged. If the length of the furnace is short, the air and gas ports may be arranged as in Figs. 11 and 12, in order that the preheated air may be delivered into the furnace above the gas, since the mixing of the two is more complete and rapid when the air is injected above the gas. Figs. 13, 14 and 15 show the types of burners employed when the gas is used under pressure and draws in the air for combustion on the injector principle.

The use of gas for power generation purposes is likely to extend in the near future, for there are many advantages to be derived from this system of firing. Gas producers can be operated now with all classes and varieties of cheap fuel and with recovery of any of the byproducts for which there may happen to be a demand in the neighborhood of the power generating station. The chief reason why gas is a better fuel than solid coal for any form of heating is that with the former the air required to burn the fuel can be reduced almost to the theoretical amount, and the tests made with the Bonecourt boiler have shown that under these conditions very high furnace efficiencies, even as high as 90 per cent, can be attained.

An important feature of all systems of gas firing is the ease with which the secondary air can be preheated and controlled. If this preheating be carried out with otherwise wasted heat, the economy of the system is obvious. The Siemens regenerative gas-fired furnace owed its instant success in the steel and glass industries to the recognition and application of this principle.

The methods of obtaining admixture of the gas and air when employed upon a large scale for heating furnaces have not received sufficient attention from boiler engineers. It is not always possible to use the high-pressure system of gas firing for boilers which simplifies the mixing of the combustible gases with air, and therefore diagrams of the various methods of firing furnaces with gas and air, at pressures only slightly above the normal, are given here.

As an example of a gas-fired boiler installation, the power plant at the coke ovens of the Société des Houillères de Montrambert, in France, may be referred to.[‖] The producer here is operated with what was really a waste product, namely, coke-breeze and mine waste, testing 45 per cent ash and yielding a value of only 7,200 B.t.u.'s in the calorimeter. The coke consumption of the producer averages 1,100 lb. per hour. The boiler used is of the Buttner water-tube type, having a heating surface of 860 sq.ft. It is installed, like so many boilers at collieries, in the open air and is unprovided either with economizer or feed-water heater. The patented process and equipment of the Surface Combustion Company of

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[‖] *Chemical and Metallurgical Engineering*, Nov. 24, 1920.

New York is used for the firing of this boiler. This process of gas firing is based upon that of Bone. It consists in mixing intimately, in their exact chemical combining proportions, the gas with the air necessary for its combustion and in projecting this mixture into a porous bed of refractory material at a speed sufficiently high to avoid any possibility of back-firing. Almost instantaneous combustion of the gas takes place in contact with the hot surfaces of the refractory bed, which is thus rapidly brought into incandescence and serves as a source and reservoir of radiant heat.

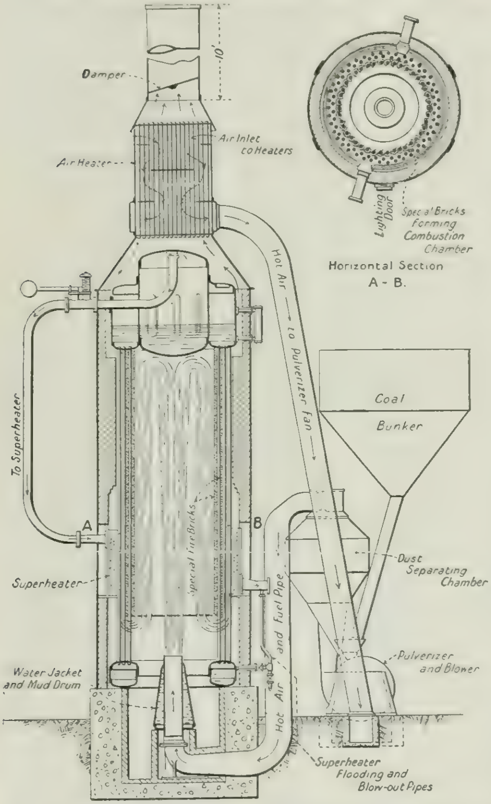


FIG. 16—BETTINGTON VERTICAL-TUBE BOILER FOR DUST FUELS

The average steam production was found to be 1,900 kg. per hour (4,200 lb.) with a gas consumption of 2,485 cu.m. (87,800 cu.ft.) per hour measured at the holder and of 1,990 cu.m. (70,300 cu.ft.) per hour measured at the nozzle of the burner. The temperature of the gas at the holder averaged 49 deg. C. As the gas was saturated with water vapor at this temperature, the consumption calculated by the holder was corrected for the normal pressure and temperature at the works laboratory, account being taken of the volume of water vapor contained.

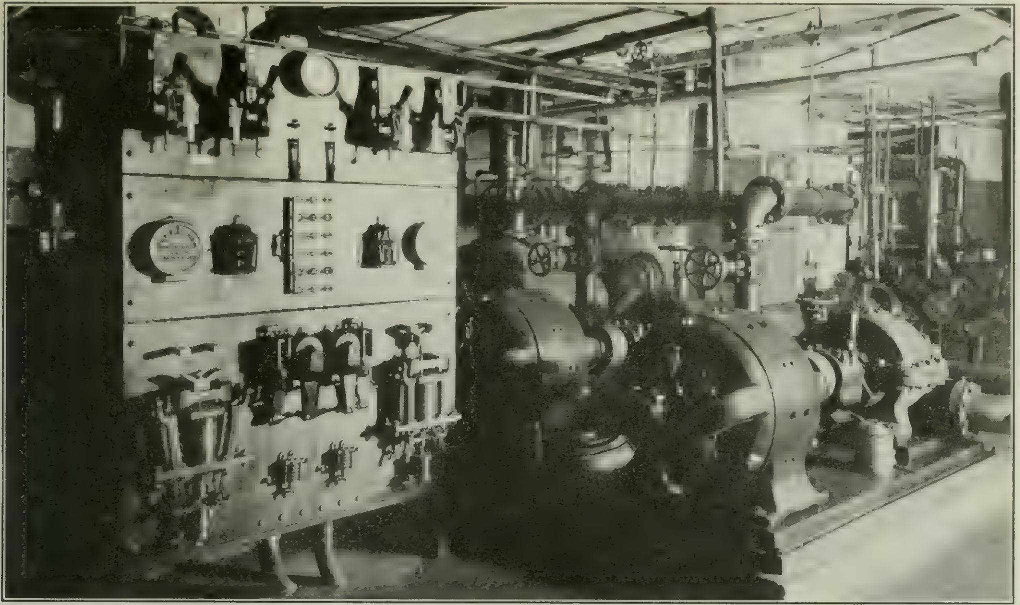
The calorific value of the gas was controlled by a Junkers calorimeter and varied during the test from 813 (minimum) to 902 (maximum) calories per cubic meter (91.3 B.t.u. to 101 B.t.u. per cubic foot). From these figures the over-all thermal efficiency of the boiler was calculated as equal to 73.3 per cent. This efficiency could without doubt be improved appreciably by use of a clean boiler placed under cover and equipped with the usual aids to heat economy.

Limits of space will not permit any very detailed discussion of the methods of burning coal by grinding it to a fine powder and then injecting it with the aid of an air blast into the furnace of the boiler. The writer of this article inspected the first experimental demonstration of the Schwartzkopf method of firing (as it was then called) in the United Kingdom at the collieries of Richard Evans & Company, at Haydock near St. Helen's, twenty years ago; but the method did not at that time find favor with English engineers, chiefly owing to the difficulties met with in drying and grinding the coal. It has been left therefore to the ingenuity and inventiveness of American engineers to develop it and to convert it from a partial failure into an assured success. The great advantage of the method over the ordinary methods of firing is that, owing to the intimate mixture of the coal dust and air, the air required for complete combustion of the fuel can be reduced almost to the theoretical proportions, and that the rate of firing can be varied within wide limits by merely turning a control wheel or handle. The use of a preheated air blast also enables very high temperatures and complete combustion to be attained. The chief difficulties now met with in applying this method of firing, in fact, are due to the high temperatures attained, since the difficulties of drying and grinding the fuel have been overcome satisfactorily.

The problem of refractories is therefore now the most pressing one. The furnace walls are called upon to stand the bombardment of particles of semi-fused ash at temperatures of 3,500 deg. F. and over, while in many cases the ash is reduced to the liquid state and then collects in this condition at the bottom of the combustion chamber. Special designs of boiler and combustion chamber are therefore required for the efficient and economical combustion of fuel in the pulverized state. As the problem of ash disposal is rather a difficult one to solve with this method of firing, its adoption is likely to increase the demand for washed slacks and fuels in which the ash contents have been reduced to a minimum.

Boilers of the vertical-tube type such as the Bettington or Kestner boilers seem to be the best adapted for dust firing, since in these types the particles of burning fuel have a free upward and downward path and the molten ash does not impinge upon any refractory lining of the boiler until it falls into the special receptacle provided for it at the base of the setting. The issue of the *Engineer* for Aug. 17, 1921, contained a description and tests of such an installation. From the figures published in that article, the thermal efficiency of the boiler is seen to have ranged from 74.9 up to 82.6 per cent with various classes of fuel, the highest efficiency being obtained with a Wetbank slack containing 2.2 per cent moisture (Fig. 16).

The latest development of this method of firing is the design of a pulverizer which will produce a satisfactory dust fuel without any previous drying of the coal. It is claimed that this pulverizer, with the necessary blower and burner, can be attached to the boiler front and operated as when required. If this apparatus fulfills all the claims made for it, it will solve the difficulties of applying this method of firing to small installations of one or two boilers, for up to the present time the pulverizing plant could only be operated economically when erected and worked in large units.



TYPICAL ELECTRO-HYDRAULIC ELEVATOR EQUIPMENT

Typical electro-hydraulic installation, with control board. Two 60-hp. motors operate two two-stage, 350-gal.-per-minute pumps. At full operating pressure of 140 lb. per square inch both motors automatically cut out. When pressure drops to 115 lb. the leading unit cuts in; if pressure drops to 110 lb., the second unit cuts in. By daily reversals of the switch shown on the middle panel the lead alternates between the units, thus equalizing the wear and tear on the parts.

Economic Value of Elevator Electrification

Importance to User and Central Station—Economy of Change-over—Space Released for Rental—Greater Safety, Speed, Smoothness and Average Mileage Claimed—Extent of Electrification Justified

By W. H. WHITTON
New York Edison Company

IN NEW YORK CITY the elevator load is large enough to justify considerable effort to obtain the business, since about twenty-three hundred elevators of the steam or hydraulic type are in operation in about a thousand buildings. If these were all converted to electric operation, the revenue to be derived from the load would bring in more than a million dollars annually to the central-station company supplying the energy. Elevator service would be improved, and, besides, the public interest as a whole would be served by the elimination of the coal wastages inherent in the operation of steam hydraulic equipment.* Whether the building manager be public-spirited or not, he is concerned with this question of coal conservation, since his pocketbook and the public interest are on the same side of the balance.

But, regardless of whether a city possesses enough of an elevator load to have it considered by itself in terms of central-station value, the elevator situation must be studied by central-station engineers because of its relation to the isolated electric plant, and in this connection recent reports of the New York Edison Company may be found of value. Since the private electric plant is most successful where there are other high-pressure steam requirements, and since these are so often represented by the hydraulic elevator, a special study has been made of this field, together with a program for replacing hydraulic elevators with the newest types of electric cars. Usually the change-over of the elevator has resulted in the closing down of the entire high-pressure plant.

As indicated by numerous cost studies, the expense of operation where steam-driven hydraulic elevators are employed is greatly in excess of corresponding figures prevailing in buildings having electric equipment and using steam only for heating. It is common knowledge that the cost of maintaining high-pressure boiler plants has risen enormously within the last few years, yet so long as the steam pumps are maintained the owner can hardly dispense with his boiler-room equipment. This is the angle of the elevator problem most interesting to the central-station man, since, as already mentioned, it links it definitely to the isolated electric plant situation.

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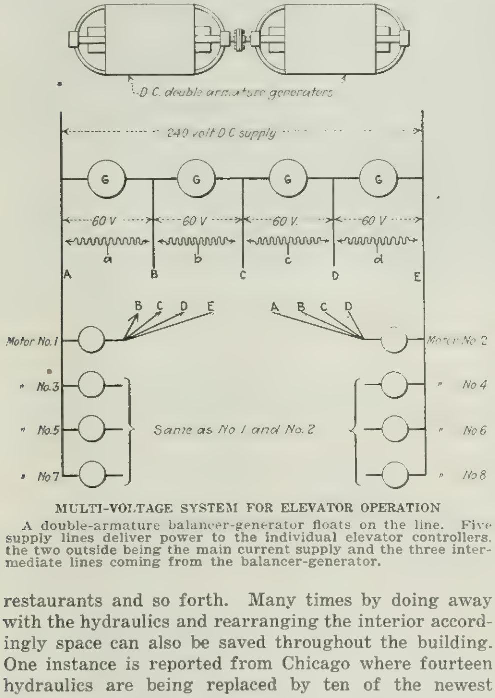
*It is estimated that about 270,000 tons of coal would be conserved annually on Manhattan Island alone by the replacement of existing hydraulic elevator equipment by electric equipment.

The summarized conclusions of a few typical cost studies which are printed herewith in tabular form will serve to illustrate the method followed in determining the question of relative operating costs.

Besides the saving of money in operation, there are many excellent business arguments for either replacing or rebuilding the older elevator equipment. One of the chief of these is the amount of space, often valuable, that can be recovered by doing away with the steam and hydraulic equipment, especially since with the newest type of electric elevator the necessary motors are best housed in a penthouse on the roof, just over the elevator shaft. Much of the space gained, it is true, is in the basement, but this has its value, being available for bank vaults, safety-deposit companies, restaurants and so forth. Many times by doing away with the hydraulics and rearranging the interior accordingly space can also be saved throughout the building. One instance is reported from Chicago where fourteen hydraulics are being replaced by ten of the newest electric elevators, this saving in the number of cars being caused by the greatly increased speed and flexibility of service possible with the latest micro-drive type, which automatically brings the car to the exact level of the floor when the stop is being made. By rearranging the corridors about 4,500 sq.ft. per floor is being saved on the first ten floors and a total of about 60,060 sq.ft. for the entire building. At even a moderate rental per square foot, the value of the space which has been recovered mounts into many thousands of dollars.



MULTI-VOLTAGE SYSTEM FOR ELEVATOR OPERATION

A double-armature balancer-generator floats on the line. Five supply lines deliver power to the individual elevator controllers. the two outside being the main current supply and the three intermediate lines coming from the balancer-generator.

It is not always that basement space possesses commercial value, but in many instances it does. In a large downtown office building in New York about 5,000 sq.ft. of space liberated by the abandonment of the private plant and the electrification of the elevators is now occupied by safety-deposit vaults. The generating units and steam pumps were removed, and as the new elevator motors are installed on the roof of the building, practically the entire space formerly occupied by machinery was made available for renting. At the moderate figure of $2 per square foot, the rental value is $10,000 yearly. To this might properly be added the value of adjacent space the use of which for commercial purposes was made possible by the elimination of the plant equipment.

In an uptown office building similar changes resulted in freeing about 4,000 sq.ft. of space, which has been rented by a popular-priced restaurant for a long term of years. In this case also adjacent space formerly wasted became available for rental when prospective tenants were relieved of the presence of an undesirable neighbor.

Such instances as the foregoing are quite common. More unusual is the case of another office building in which the hydraulic equipment was installed in two shafts, one alongside each of the two banks of elevators. With the electrification of the elevators these shafts are now available, at comparatively little expense, for the reception of two additional elevators—an advantage, in a building of growing elevator demands, that can hardly be overestimated.

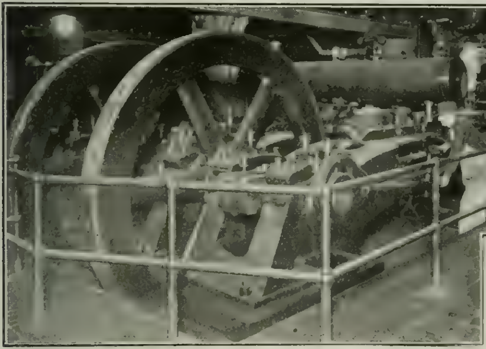
The greater average speed attained by the gearless-traction-type electric elevator, especially when equipped with the new micro-drive apparatus for exact and rapid leveling at the floor stops, is a feature of great practical value to the managements of modern buildings. While the rated speed of the best hydraulic may be equal to that of the new electric, the actual operating speed of a hydraulic in daily service conditions is greatly reduced by its comparative lack of flexibility in stopping and starting, instances being common where at the time of densest traffic the average speed falls off materially.

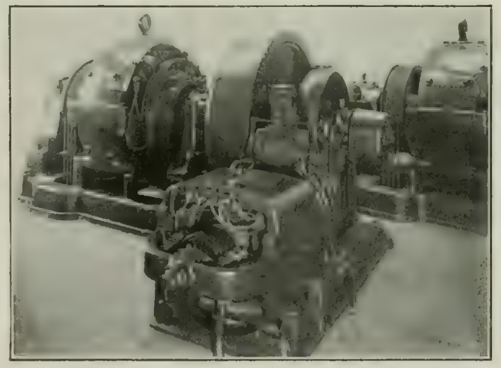
Mileage tests of a bank of eight elevators in an office building, made before and after electrification, show that the car travel has increased from 683 miles per week to 740 miles per week. The improvement in the service is even greater, however, than these figures indicate, for it is now possible to run the cars on an easily kept and regular schedule, whereas formerly it was practically necessary during the rush hours to operate each car at the maximum the operator could coax out of it—without much regard to established schedules. The carrying capacity has therefore been increased to an extent much greater proportionately than the mileage figures indicate, with the result that the overcrowded condition which formerly prevailed during the peak hours is now a thing of the past.

Again, there is the greater degree of safety involved in the mechanics of the electric traction type. Added to other safeguards is the fact that should either the car or the counterweight ground, the cable tension is instantly released and the tractive power of necessity ceases. The dangerous "creeping" of cars at the floor levels during stops, the cause of so many accidents, is also eliminated.

The recently developed multivoltage system, offered as the very latest improvement in electric elevator practice, also suggests possibilities worth studying by the central-station engineer. Roughly speaking, the multivoltage system does away with the usual resistance control for governing elevator acceleration and retardation and substitutes for it a system in which the same effect is obtained by a series of voltage steps, from 60 to 240 where the latter is the normal operating voltage. The mechanism used represents essentially a compensating set floating on the 240-volt lines and giving intermediate voltages of 60, 120 and 180, with resistances that halve these voltage steps. During acceleration and retardation the elevator motors are thrown directly across the various voltage steps available. Certain decided advantages are claimed for this system, besides the smaller amount of current needed for resistance purposes as compared with the usual methods of resistance control. As the first inrush of starting is taken only at one-quarter voltage, peak-load effects on the line from starting currents are practically eliminated, the line load is much steadier and the maximum demand may be very considerably reduced.

Besides those points of technical advantage, greater speed and smoothness of running are noted by those who have had an opportunity of testing comparative methods of operation. This is apparently so marked, especially when the multivoltage system is combined with micro-drive, that in one instance of replacement a saving of four cars is being effected, while still affording an expansion of service over the old equipment. Claims are made of decreased energy consumption due to the use of the voltage steps. Installations of this type have been made recently in Chicago, Detroit and New York from which test reports will be awaited with interest. It is also to be noted that this multivoltage system may be adapted for alternating as well as for direct current, although the cost of the necessary equipment is reported to be greater.





TYPICAL HYDRAULIC AND STRAIGHT-ELECTRIC ELEVATOR EQUIPMENTS

This triplex steam pump (at left) which formerly furnished power for the operation of eight hydraulic elevators, has been replaced by an equipment of multivoltage micro-drive "electrics," the last word in elevator practice.

At right, micro-drive installation. The main motor is at the left, the micro-drive motor, mounted on the same bedplate, in the foreground. In making a landing the microdrive motor cuts in, automatically brings the car to the exact floor level, and holds it there.

The energy requirements of electric pumping units for elevator service have been established, by repeated tests, at about 10 kw.-hr. to 10.5 kw.-hr. a car-mile. This value will, of course, vary somewhat with local conditions, but it seems fairly representative of average performance. The mileage of elevator cars is naturally subject to greater variation. In hotels the daily travel is found to run from about 15 to 20 miles per car, in department stores from 5 to 8 miles, and in office buildings from 15 to 30 miles.

A typical hotel installation which after electrification was the subject of careful observation for a period of several months will serve to illustrate these values. There are four elevators, operated by three pumps of 75 hp. each, equipped with automatic control, which relieves the engineer of any close supervision. The total elevator travel averages 38 miles daily, or 20¾ miles per car. The consumption of current was 850 kw.-hr. daily, representing 10.2 kw.-hr. per car-mile. The peak load, occurring between 9 and 10 a.m. and repeated between 6 and 7 p.m., amounted to 60 kw. The load factor is therefore a most satisfactory one—virtually 60 per cent.

In presenting to building owners the subject of change-over of elevators there are two programs that can be offered. One is the complete renovation of the elevator equipment, calling for the replacement or rebuilding of the old hydraulic apparatus. At the same time, all high-pressure steam should if practicable be eliminated, steam pumping and other equipment being replaced by electric and the boiler plant adapted for low-pressure heating. In hotels and large apartment houses this usually involves electrifying the existing refrigerating machinery and furnishing some source of high-pressure steam needed in laundry mangles. This can readily and economically be done by small gas-fired boilers or, where the steam requirements are heavy, by devoting one of the existing boilers to high-pressure duty, using a closed system. As may be seen, this complete program involves a considerable degree of expense, although it produces also the largest degree of saving.

Should the management not wish to incur so much cost, a substitute program can be suggested, involving the retention of the present elevators, but changing the method of operation from steam pump to electric. While this requires from two to two and one-half times as much energy for operation as does the best type of electric elevator, it greatly reduces the initial cost of the change.

To judge which of the two programs is advisable, it is necessary to balance the decreased operating cost of the 100 per cent renovation against the increased capital required to make the change. Choice is a financial rather than an engineering problem, one of the elements, however, being the exact condition of the existing hydraulic machinery. If it is in excellent condition, the management may decide to content itself with merely doing away with the old steam pumps, whereas if the equipment is approaching obsolescence it will probably be decided to anticipate an outlay which must be made in any event within a few years.

In a specific instance of recent occurrence, involving twelve office-building elevators, there was a difference in cost as between complete electrification and the installation of electric pumping units of about $200,000. Assuming a rate of 12 per cent to cover interest and depreciation, the saving in fixed charges in favor of the latter type was $24,000 annually. The consumption of energy was placed at about 290,000 kw.-hr. annually for straight "electrics" and at 720,000 kw.-hr. for "electro-hydraulics," or an excess for the latter of 430,000 kw.-hr. This represented, at the electric service rates available to this class of consumer, enough less than the saving in fixed charges more than to pay for the additional cost of labor and repairs attendant on the use of the hydraulic equipment, and as the latter was quite modern and in excellent condition and other modifying factors fairly offset each other, it was decided to proceed with the electric pumping outfit. The results, it may be said in passing, have been extremely satisfactory. It must be realized, however, that this form of electrification offers little if any improvement in the elevator service—unless the replaced steam pumps are in poor condition. It has the great advantage, of course, of placing back of the elevators a reliable and adequate source of power.

RELATIVE MECHANICAL OPERATING COSTS OF BUILDINGS USING HYDRAULIC, ELECTRO-HYDRAULIC AND STRAIGHT-ELECTRIC ELEVATORS

Owing to the fact that all engine and boiler-room expenses are so closely interwoven with those directly chargeable to elevator operation, these expenses have been included in the following cost comparisons

Case No. 1—Semi-apartment, semi-transient hotel in which the generating plant was abandoned several years ago, but without change to the hydraulic elevators and other equipment requiring high-pressure steam for operation, the latter including pumps, refrigeration machinery, etc. Consideration is now being given to the electrification of all this apparatus, and two methods of elevator treatment are being studied—first, the substitution of electric pumps to operate the present hydraulic equipment; second, the complete replacement of the elevators by new electric machines.

	Hydraulic	Electro-hydraulic	Straight Electric
Coal	$80,500	$47,600	$47,600
Water	14,531	13,800	13,800
Labor	26,484	20,100	17,250
Ash removal	3,000	2,400	2,400
Repairs and supplies	15,000	10,200	7,000
Purchased electricity	33,673	56,117	52,042
Total	$173,188	$150,217	$140,092

Case No. 2—Fourteen-story bank and office building in which eight hydraulic elevators have recently been replaced by electric, this change following the abandonment of the generating plant, which occurred about two years before.

	Hydraulic	Straight Electric
Coal	$25,220	$13,000
Water for boilers	166	
Labor	25,069	15,534
Ash removal	1,630	900
Repairs and supplies	6,607	3,847
Purchased electricity	16,625	21,625
Total	$75,317	$54,906

Case No. 3—Group of three office buildings, equipped with hydraulic elevators, which were supplied with steam and electricity from a common private plant. Slightly more than a year ago the local plant was abandoned and electric pumps were installed to operate the twelve hydraulic elevators. The following tabulation gives the actual operating costs for the year prior to the changes and for the year subsequent:

	Hydraulic	Electro-hydraulic
Coal	$56,369	$24,086
Water	3,945	2,000
Labor	28,144	13,631
Ash removal	4,199	1,244
Repairs and supplies	6,224	2,754
Purchased electricity		21,944
Total	$98,881	$65,659

In the first of the cases summarized on this page operating cost estimates are given of both electric pumping and straight electric substitutions. There is an additional saving with the latter of about $10,000, without considering interest and depreciation on the investment. In this building, which is a hotel, the determining consideration will probably be the condition of the hydraulic equipment. It is far from new, and if an expert examination indicates the necessity of early replacement, it will hardly be advisable to invest in a new electric pumping equipment, the useful life of which will necessarily be controlled by the remaining life of the worn-out hydraulic apparatus.

ELEVATOR ELECTRIFICATION PROMPTS OTHER APPLICATIONS

By making detailed engineering studies of conditions in various buildings equipped with hydraulic elevators the Edison company has assisted in bringing about the electrification of equipment in more than two hundred buildings in recent years. Something more than five hundred machines are involved in these structures, which include fifty-four office buildings, fifteen hotels, twenty-one apartment houses, more than a hundred mercantile buildings and fifteen listed as miscellaneous. While the income represented by these elevators is by no means inconsiderable, of greater importance is the much larger load in light and power that has in many instances accompanied the elevator business, through the abandonment of other plant equipment, including generators, refrigerating apparatus, pumps, etc. For instance, in a typical case of electrification the elevator consumption amounts for the year to 287,000 kw.-hr., but as the abandonment of the building's private plant accompanied the substitution of electrical equipment, the new business secured through the agency of the elevator change totals 877,000 kw.-hr. yearly. Similar relations prevail in other installations of the kind.

The value of this field to the central-station company is therefore apparent; and when it is remembered that the property owners who modernize their holdings in this way obtain both substantial monetary savings and greatly improved service, it will be realized that elevator electrification contains in it a feature that is vital to every fundamentally sound business transaction—the element of mutual benefit.

Conference on Radio Standardization

THE Bureau of Standards of the Department of Commerce has called a conference on radio standardization to be held on Friday, Jan. 12, 1923, in New York City. The call is issued at the request of the Institute of Radio Engineers, the National Radio Chamber of Commerce, the Radio Apparatus Section of the Associated Manufacturers of Electrical Supplies, the National Retail and Dry Goods Association, the American Radio Relay League and the Radio Corporation of America.

Invitations are being issued to all national associations of an engineering and technical nature known to be interested in radio standardization, and radio manufacturers will be represented through the trade associations of which they are members. The purpose of the conference is to consider broadly (1) whether a formulation of standards for radio apparatus and service shall be made; (2) if so, what general classes of apparatus or service shall be included, and (3) what procedure shall be recommended for carrying out the conclusions reached by the conference. It is expected that any radio standards formulated will be so prepared that they may ultimately be adopted with the approval of the American Engineering Standards Committee.

Power Loops Assure Reliable Service to Industries

Provide Means of Carrying Greatly Increased Loads with Existing System—Virtually Bring Generating Station to Load

By P. O. Reyneau*
Philadelphia Electric Company

HIGH-VOLTAGE power transmission loops or rings seem the inevitable solution of the present overloaded state of many of our low-voltage transmission systems and many of our large distribution systems. Some means of delivering large blocks of energy at a point distant from the power stations are essential to the further development of the central-station industry. This must be accomplished in such a manner that the voltage at the different points of delivery is approximately the same as that at the generating end of the previously installed system feeders. These points of contact are used for tying into the existing system, thereby reinforcing it and increasing its capacity by reducing its distance from a power feed.

The process is somewhat similar to that of bringing the power station out to some weak spot in the system. Many systems have outgrown their range and their ability to handle load because they were planned at too low a voltage. Rather than raise that voltage to the required value and scrap an enormous amount of materials which would be rendered obsolete by that increase, the logical and most simple thing to do is to establish a power ring, thereby not only making use of present equipment but obtaining in most instances larger capacities and greater economies than could be obtained by raising the voltage throughout the feeder system. It is evident that there are limitations at present to the voltage used on the distribution system itself and that increasing this voltage to the maximum allowable without reducing its distances of feed would not give relief for a long period.

The idea of the power ring is not a new one. Its first application was found in interconnecting distance plants to care for the requirements of towns many miles apart, each one too small to warrant a generating plant of its own. Often the development of water power made it necessary to transmit energy long distances to some point of utilization, and this necessity automatically has resulted in a power ring. Examples of such conditions are numerous, particularly in the Middle West and in the West. There is in existence in the West a ring at 44,000 volts of an approximate length of 175 miles, connecting eight towns, three of which have generating plants. Another ring at 33,000 volts connects over a distance of more than 300 miles numerous small towns and four plants. These two rings have been in operation a good many years and are typical. They have proved flexible to operate, able to handle considerable load, and have given good service. More recently, however, the power ring has been devised to tie into an existing system or to reinforce an extensive transmission system with load relatively scattered.

Several large power companies have already laid out such a scheme and started to work in that direction. One company is establishing a complete ring of high-voltage double-circuit transmission lines linking two main generating plants. On that ring at somewhat regular intervals are established step-down transformers that tie into a lower-voltage system which in turn feeds the distribution system. Every station of that kind can be served in either direction on two lines, thus providing a high grade of service by sectionalizing the lines in case of trouble, repair or inspections. Another large company is planning and has started work on a tie line between two stations at a considerable distance from each other, using a double-circuit line and planning to establish distribution points every 20 or 30 miles along the main line. Here similar flexibility will be obtained by making the line able to carry all the load feeding it from either end.

The latest development in the use of a power ring is the direct linking of the generating plant by means of a high-voltage transmission line to various points of an area of concentrated load such as a large city.

It is probable that such a high-voltage power loop will soon be found necessary even in the most congested power districts, possibly using for the lines rights-of-way jointly with the railroads, unless underground cables can be developed to handle voltage far above the present standards.

All of the operating features of such power loops have not been worked out, by any means. For instance, automatic relay protection to sectionalize automatically the portion of the transmission line in trouble has not proved entirely satisfactory, switching equipment is not entirely perfected, and the electrical and mechanical strains imposed on such a system by the enormous value of the possible surges have not all so far been anticipated with suitable protection. However, rapid progress is being made in these directions, and it can be confidently predicted that completion of these rings will find equipment ready to meet the several tests. The necessity of absolute reliability for such sources of power cannot be overemphasized. It must be insured.

PRINCIPAL REASONS ENUMERATED

Among the principal reasons which have brought about the necessity for power rings can be enumerated:

1. Generating stations of very large capacity have been found necessary on account of the scarcity of sites, the difficulty of finding sufficient cooling water, and principally, the need for economical operation resulting in the lowest possible cost per kilowatt-hour.

2. The handling of large quantities of power at relatively low voltage is an impossibility both physically and economically. The investment required is too high and the energy losses are out of all proportion.

3. Bringing large blocks of power out of the power house at the present practical underground cable voltage becomes more and more difficult on account of the lack of space for building duct runs. This fact points to the necessity of the establishment of a few outgoing lines of large capacity.

4. Owing to high short-circuit current values the switching and controlling at low voltage of large amounts of power becomes very difficult and invites serious breakdowns.

From the foregoing it can be seen that the power ring promises relief of overloaded conditions in an economical manner by making use of present equipment until its usefulness is gone. A single ring in any one system, if properly located, will provide sufficient capacity to meet the requirements for several years to come.

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*Formerly assistant electric engineer Detroit Edison Company.

Eight Years of Customer Ownership

Through Comprehensive Publicity Combined with the Organization and Enthusiasm of Its Employees the Pacific Gas & Electric Company Has Sold More than $35,000,000 Preferred Stock at a Cost of 84 Cents per Share

By **E. J. BECKETT**
Assistant Treasurer Pacific Gas & Electric Company, San Francisco

JUNIOR financing has always been rather a bête noir of corporation management. It is not difficult to dispose of bond issues secured by mortgage and protected by all kinds of restrictive provisions as to equity and earnings. It is a more difficult matter to sell junior issues, even though these securities may be of unquestionable merit. This is particularly true in the public utility field. Public service corporations under state regulation are limited to a reasonable return on the capital invested in the business and are unable to offer to investors in their stock the opportunities for speculative profit which are frequently held out as an inducement to prospective purchasers of industrial issues. On the other hand, large amounts of new capital are absolutely essential to the successful conduct of any public utility operating in a growing territory. The electrical industry especially, on account of its tremendous development in recent years, is constantly in the market for additional funds to keep abreast of the demands made upon it.

Under these circumstances the "customer ownership" movement, involving the direct sale of securities of a public service corporation to the residents of the territory served, constituted a long step forward in utility operation. It provides an inexpensive and efficacious method of raising new capital through the sale of junior securities, and to a very large degree it has solved the problem of stock financing. In this respect alone the plan has been well worth while. Its greatest merit, however, lies in the fact that in increasing the popularity of public utility securities with the investing public throughout the country it has promoted and established a cordiality of relationship and understanding between the utilities and the public which ten years ago seemed hardly possible of accomplishment.

TABLE I—EXPENSE INCURRED IN THE SALE OF $35,000,000 WORTH OF FIRST PREFERRED STOCK JUNE, 1914, TO SEPTEMBER, 1922

	Cost per Share
Commissions (now limited solely to employees	$0.34
Advertising	0.272
Printing, paper and postage (includes circulars to consumers, etc.)	0.115
Special solicitors	0.006
Department salaries and expense	0.103
Total	$0.836

In the short space of eight years the "customer ownership" movement, initiated in California, has swept the country from coast to coast. It has been adopted by utilities large and small all over the United States, including such companies as the American Telephone & Telegraph Company, Commonwealth Edison Company of Chicago, Pacific Gas & Electric Company, Northern States Power Company, Southern California Edison Company, Public Service Corporation of New Jersey and literally hundreds of others. It is probable that at least five hundred million dollars' worth of stock has been sold under this plan and that several hundred thousand new stockholders are now partners in public utility enterprises. In California alone the two premier hydroelectric companies have sold an aggregate of $70,000,000 par value of stock to almost seventy thousand local investors.

When in June, 1914, the Pacific Gas & Electric Company launched its initial campaign for the sale of preferred stock to its customers and employees it became the first public utility in the country to adopt this "local ownership" as a definite policy. This method of selling the company's securities was undertaken at the suggestion of A. F. Hockenbeamer, second vice-president and treasurer of the company, and it is under his direction that the program has been so successfully carried out. The company's measure of success in this direction can best be stated in terms of the volume of stock sold. From the inception of the plan to Oct. 28, 1922, embracing all of the war period and the precarious conditions which followed, total direct sales aggregated $35,071,900. This represents an average of virtually $10 worth of stock of this one company to every man, woman and child in California. More than twenty-five thousand individual sales were made.

It might have appeared at the time that the company could hardly have chosen a more inauspicious moment for entering upon a new and untried financial policy. Within a very few weeks of its preliminary announcements the outbreak of the European war threw the investment markets of the country into a chaotic condition. The instant success attendant upon the initiation of the local ownership idea, however, in spite of this confused and unsettled financial condition, proved beyond the shadow of a doubt that not only was the conception fundamentally sound, but that it provided a new and important means of supplementary financing even under the most adverse conditions; and experience has shown that it operates equally well in periods of general prosperity and in times of depression.

GENERAL PLAN OF CAMPAIGN

The main features of this company's stock-selling plan have not been materially changed during the period of eight years in which it has been operative. Without attempting details, it may be said that the sales methods comprise three principal activities:

A. Bringing prospective customers into offices:
  1. By circulation.
  2. By newspaper advertising, reading notices and display cards.

B. Teaching offices how to handle these "prospects":
  1. By personal contact with the head of stock sales department.
  2. By circulars giving facts and selling arguments.
  3. By keeping a personal representative of the manager of stock sales moving among the various offices.

TABLE II—STOCK SALES DURING PERIOD FROM JAN. 1 TO OCT. 9, 1922

No. of Shares Bought by Individual Stockholders	Sales		Par Value	
	No.	Per Cent of Total	Amount	Per Cent of Total
1 to 5	4,172	53.4	$1,196,200	13.6
6 to 10	1,788	22.9	1,618,400	18.4
11 to 20	909	11.6	1,417,000	16 0
21 to 50	783	10.0	2,753,900	31.3
51 to 100	123	1.6	880,100	10.0
101 and over	43	0.5	941,800	10.7
Totals	7,818	100.0	$8,807,400	100.0

C. Maintaining the enthusiasm of the organization:
1. By assigning quotas to divisions.
2. By paying a small commission to employees.
3. By stimulating and informative bulletins issued from time to time.

The relative importance of the various features of the company's selling campaigns are, in a general way, reflected in the statement of expenses as tabulated here, although, in our judgment, the circularization of customers is probably the most important single feature of a campaign of this character, laying the foundation for the success of subsequent campaigns of advertising and personal solicitation. The expense of circularizing consumers is comparatively small. In this company's experience, extending over a period of more than eight years, the total cost of printing, paper, postage and other incidentals connected with the issuance of circular letters was only 11.5 cents per share of stock sold. Advertising cost was 27.2 cents per share, and all expenses together aggregated only 83.6 cents per share of stock sold. This low selling cost is undoubtedly attributable largely to the enthusiastic support of the entire personnel of the company. This work on the part of employees was mainly gratuitous, no commissions at all being paid during the first five or six years to members of the organization. Another decidedly important factor was the widespread and favorable publicity accorded us in the local press, owing largely to the novelty of the plan and its direct appeal to the public. A summary of selling cost, which includes every item entering into the sales campaign, is shown in Table I.

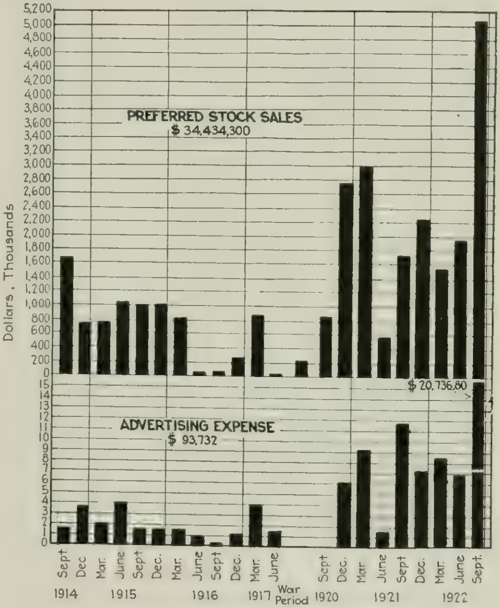
That public service corporations which finance themselves through the local sale of stock are really owned by the public, men and women "even as you and I," cannot be doubted after a glance at a typical list of utility stockholders. An analysis was made by the Pacific Gas & Electric Company of the occupations of 1,307 of its stockholders residing in Alameda County. This was not a selected list, but the cards were taken at random. The result showed that these 1,307 stockholders were engaged in eighty-six different occupations. The list is too long to reproduce here, but the following occupations embraced in the first four letters of the alphabet are indicative of the whole:

Occupation	No. of Stockholders	Occupation	No. of Stockholders	Occupation	No. of Stockholders
Accountants	19	Butchers	5	Clergymen	8
Apartment house owners	4	Capitalists	6	Cobblers	2
Artists	3	Captain in army	1	Contractors	7
Bankers	6	Carpenters	20	Cooks	3
Barber	1	Cashiers	4	Dentists	3
Blacksmith	1	Chauffeurs	2	Doctors	13
Brokers	4	Cigar makers	3	Draftsman	1
Business men	8	Clerks	52	Dressmakers	5
				Druggists	5

Of these thirteen hundred stockholders, 507, or 38.8 per cent, were found to be women.

An examination of all sales made by this company in the period from Jan. 1 to Oct. 9, 1922, revealed the rather interesting fact that the number of subscribers for one-share, five-share and ten-share lots was almost identical, 1,252 individuals subscribing for one share each, 1,272 for five shares each and 1,278 for ten shares each, these three classes aggregating approximately one-half of the 7,818 subscriptions received during that period. As will be observed from Table II, 53.4 per cent of all subscriptions received in this period were for five shares or less, 76.3 per cent, or upward of three-fourths, for ten shares or less, and only one-half of one per cent were subscriptions of more than one hundred shares each.

The advantages, both to the utility and to the public, of this kind of distribution of securities among local investors have been so often pointed out that it seems superfluous to repeat them here. The management of the Pacific Gas & Electric Company, however, believes that to reap the fullest benefits of this mutuality of interest the public service company should not stop with the mere creation of a large body of local investors. It has endeavored to make each stockholder realize that he is an actual partner in the business and that his interest in the enterprise should not end with the receipt of his quarterly dividend checks and his signature on an annual proxy. The management feels that the company's stockholders are entitled to a full and frank exposition of its affairs, its problems, prospects and policies, as well as of its earnings. With this end in view a series of meetings was inaugurated some months ago at which the stockholders in various communities were addressed by the company's executive officers. These meetings were uniformly successful, the aggregate attendance running well into the thousands. It is believed that the policy of "making every stockholder a real partner" constitutes another pioneer movement on the part of the Pacific Gas & Electric Company.



RENEWED ACTIVITY FOLLOWED THE WAR

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

The Automatic Plant and the Industrial Consumer

To the Editors of the Electrical World:

I have read the article "Automatic Plant Replaces Cable Drive" printed in the *Electrical World* for Nov. 4, page 977, and am very much interested in the subject. As you know, the Pacific Coast Division, N. E. L. A., has appointed two sub-committees, one of the electrical apparatus committee and the other of the hydraulic committee, to prepare a paper and collect data on automatic and semi-automatic plants. These data will be ready for publication in the near future. Robert C. Denny of our company is on the committee and has done a lot of work in getting data, and I know that his paper will be most interesting and valuable.

There is no question that there is a large field for development in automatic and semi-automatic plants. There are many locations where a small automatic plant can be installed at a reasonable cost and where the operating expenses would not be so high that the investment would not be justified. Then again there are many industrial plants which if they could tie in with power companies' systems could afford the initial cost of installing an automatic plant and could afford to operate it continuously, whereas if the attendance is large the expense would be too great to run for twenty-four hours a day. We ourselves have three semi-automatic plants on our system and are equipping two more; one of 4,500 kva. capacity and the other of 3,000 kva. We shall have these plants on our system by next spring.

The Southern California Edison Company is also doing the same thing, and there is a new plant going in near Banning, Cal., which, I understand, will be automatic in every way.

Eventually the demand for power will be such that advantage will be taken of all low heads. Automatic plants will be installed, and in the aggregate they will produce many thousand kilowatt-hours.

E. A. QUINN,
General Superintendent.
San Joaquin Light & Power Corporation,
Fresno, Cal.

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Depreciation Reserve as Viewed by the Utilities Commissioners

To the Editors of the Electrical World:

I have looked over with much interest your report of the Detroit meeting of the National Association of Railway and Utilities Commissioners, published in the *Electrical World* of Nov. 18, page 1119, and desire to call your attention to one point with regard to the discussion on depreciation. I am inclined to think that any one reading this report would infer that the sense of the meeting was in favor of the setting up of a straight reserve based upon accurate life tables and cost less scrap value.

This ignores a very important statement made by Mr. Jackson and received with apparent approval by the delegates, in which he called attention to the fact that on account of the equalization of renewals the accumulation of a depreciation reserve through the method outlined above results in building up an enormous fund for which the utility would at no time during its future life find a legitimate use. This fact, while it has been recognized for some time by a number of the more careful students of depreciation theories, has not so far as I know been publicly emphasized, and Mr. Jackson's statement was to me one of the most important ones made during the entire convention.

W. H. MALTBIE,
Attorney-at-Law.
Baltimore, Md.

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Economic Limit for Automatic Plant

To the Editors of the Electrical World:

Personally I have not had occasion to work out the details of any automatic generating station such as that described in the article "Automatic Plant Replaces Cable Drive," printed in the *Electrical World* for Nov. 4, page 977. I believe, however, that where small power possibilities exist near larger existing stations the smaller developments can be economically constructed and operated automatically with the necessary control coming from the large station.

Here in California there are a number of possible large developments which can be economically constructed, and I do not think the small automatic station is generally feasible as long as there are many promising large undeveloped possibilities waiting to be constructed.

A good development is one where the kilowatt-hour cost will be less than 4 mills at the switchboard and which at the same time is not too far from its load. Wherever the automatic plant can measure up to these conditions it would be feasible in California.

L. JORGENSEN,
Consulting Engineer.
San Francisco, Cal.

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Appliance Selling by the Central-Station Company

To the Editors of the Electrical World:

Referring to articles on merchandising appliances which have recently appeared in your magazine, and particularly those by John F. Gilchrist of the Commonwealth Edison Company and E. B. Seitz of the American Washing Machine Manufacturers' Association, I desire to express my appreciation of the attention that is being given to this subject at present, since, from the central-station point of view, the increase of merchandising is most desirable in improving the load factor of residential business and also affords an opportunity to increase the activities of the sales department with no increase in expense to the company or the buyers of its electrical service.

The analyses of merchandising costs and losses submitted by Mr. Gilchrist are of immense value, but in analyzing them one should be acquainted with the local conditions surrounding each company so as to be able to take into consideration any special reasons that result in variations of particular items of selling expense or other costs.

I feel that the important lesson to be derived from all such studies is the necessity of improving turnover and thus reducing the percentage of expense, excepting the cost of the goods themselves. Even here oftentimes, with larger purchases, there is an opportunity to accomplish some reduction in cost of the goods.

Mr. Seitz suggests that central-station companies can obtain a volume in appliance sales equal to the sale of electricity to residence customers. It is very possible that this goal can be attained, although, with the marked increases that are taking place in the sales of electricity for cooking and water heating to residential customers, I am of the opinion that, for the present at least, the central-station goal should be that of having its volume of appliance sales equal its sales of electricity for lighting purposes to residential customers; in other words, to attempt to have a volume of sales that runs from $20 to $25 per residential customer per year. I feel certain that when this volume shall have been reached the central station which carefully scrutinizes its expenses and does not pay unwarranted commissions or unduly load its merchandise department with commercial and general expense will find that its merchandising business profits correspondingly.

The question of discount which the retailer should receive and the resulting "spread" between selling price and cost price to the retailer introduces many problems which cannot be satisfactorily answered by results obtained by any one central station. I feel that there is great danger in having this spread too large, since the resulting higher prices to the ultimate consumer tend to retard the volume of business. Moreover, the greater spread does not force the central station to secure a greater turnover of stock and thus a larger volume of business.

Again, in determining the discounts, consideration properly could be given to the different situations existing as between the central station operating next door to the manufacturer or the jobber, thus requiring the carrying of little or no stock, and the central station operating a considerable number of offices in widely scattered territory, hundreds of miles from the nearest jobber and thousands of miles from the manufacturer.

W. R. PUTNAM,
Vice-President and General Manager.
Boise, Idaho.

Keeping Up Morale in Isolated Plants

To the Editors of the Electrical World:

I am heartily in accord with ideas expressed in your recent editorial on "Keeping Up Morale in Station Operation." Because of the isolated location of most hydro-electric plants keeping up the morale of the force is oftentimes even more essential to successful operation than is the case with steam plants. While it is not always possible or practical to provide new work for the staff, various means can be used to keep the men interested and on their toes. Suggestion systems must be handled with a good deal of tact so as not to give a man the idea that his suggestions receive no consideration. Due recognition should be given where a practical workable idea is presented. On the other hand, if a man has gone to the trouble of working up an idea, he at least merits an explanation from his chief as to why it will not work, if such is the case.

Promoting rivalry between the staffs of the different plants, where there are more than one on a system, is provocative of excellent results as regards general cleanliness and appearance. Affording the men an opportunity of seeing as much of the system as possible will give them a much better understanding of many operations and generally put them on a more friendly basis with the rest of the operating division.

While keeping veterans in service is an excellent policy, it is very often difficult to prevent such men from getting into a rut. The introduction of student training courses has a twofold benefit in this connection. While serving to train men for the company's service, those pursuing these courses are encouraged to carry on their studies by correspondence and other means and to learn the "why" as well as the "how" of plant operation. The older men soon realize that if they don't get busy the youngsters will soon know more about the plants than they do themselves, with the result that soon they are all making a closer study of their work.

FREDERICK KRUG,
Superintendent of Hydro-Electric Plants.
Porto Rico Railway, Light & Power Company,
Comerio Falls, Bayamon, Porto Rico.

Laminated-Frame Arc-Welding Generators

To the Editors of the Electrical World:

In your issue of Oct. 28 K. L. Hansen of Milwaukee again refers to the use of reactance in series with a variable-voltage generator. I want to say again that he has entirely missed the point on this subject. The use of the stabilizer is to act as a flywheel in the arc circuit. The demands of the arc itself are rather wide and almost instantaneous changes in voltage. The method of changing this voltage in any machine built must be a gradual process, comparatively. Since the arc demands instant change and the machine is going to give a gradual change, it is self-evident that something must be put between the machine and the arc in order to compensate for the deficiency in the machine itself.

Now, the point which was made in my letter covering this matter is that the laminated machine will make these changes very much more rapidly than the cast machine. In fact, the cast-frame machine is so sluggish that in order to get good operation a stabilizer is absolutely essential, and that stabilizer must be of very great reactance if any successful welding is to be done. With the laminated machine, however, the necessity of this large stabilizing effect can be largely done away with. Or, put in another way, with a certain stabilizing effect in the reactance, the ease of operation is very much greater with the laminated machine than with the cast machine. Of course, the point could be immediately made that the laminated machine has no advantage over the cast machine, provided the reactance is made large enough. Unfortunately, however, this is not true, and with any size of reactance which is economically possible the result of the laminated-frame machine will always be better than the result of the cast-frame machine.

Another thing which comes into the matter very strongly is the fact that the laminated machine will react the same way under all conditions of excitation, while with the cast machine the reaction will be very different under high density in the yoke as compared with a lower density, so that on a cast machine in order to get the same operation all the way through the range of the machine a reactance of varying size should be used.

It is always both in electrical matters and in moral matters a good deal easier to prevent than to cure. In other words, it is a good deal better for all concerned to get an apparatus which of itself does not require much curing than to get something which requires a lot of it and then very efficiently put in a lot of curing. That, perhaps, in a homely way, is the difference between the two types of apparatus.

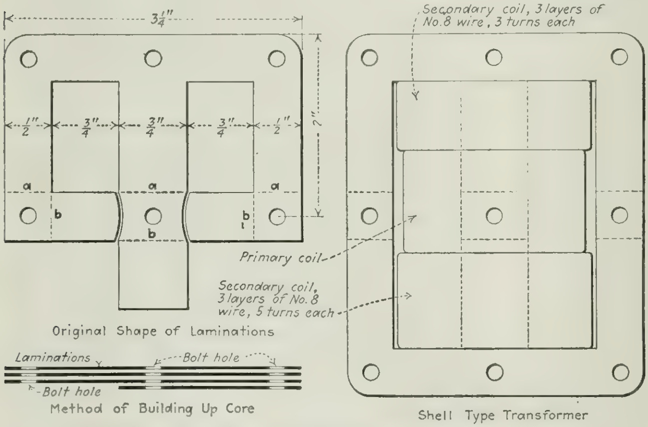
J. F. LINCOLN,
Vice-President.
Lincoln Electric Company,
Cleveland, Ohio.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of
Economically Utilizing Electrical Energy

Phantom Load Easily Made for Testing Meters

A SUCCESSFUL and easily constructed phantom-load box for testing 110-volt and 220-volt watt-hour meters with a capacity up to 20 amp. has been used by the writer in testing meters for the Salem (Mass.) Electric Lighting Company. It consists of a small shell-type transformer shown in the accompanying illustration with a secondary winding having the proper voltage to force the desired amount of current through the current coils of a rotating standard and the meter to be tested. The cost of materials was almost nothing, as an obsolete type of Westinghouse 200-volt power meter, some No. 8 scrap wire, five wire connectors and a wooden box furnished all of the material.



3¼"
½"
¾"
¾"
¾"
½"
a
a
a
b
b
b
Primary coil
Secondary coil, 3 layers of No. 8 wire, 5 turns each
Original Shape of Laminations
Laminations
Bolt hole
Bolt hole
Method of Building Up Core
Secondary coil, 3 layers of No. 8 wire, 3 turns each
Shell Type Transformer

PHANTOM LOAD MADE FROM PARTS OF OBSOLETE METER GAVE VERY SATISFACTORY RESULTS

The core of the load box was made up of the laminations which had formed the magnetic path for the potential coil flux in the power meter. The shape of the laminations as they were used in the meter is shown in the illustration. On the drawing showing the original shape of laminations the dotted line *a* shows how the laminations of one element were cut and the dotted line *b* shows how the laminations of the other element were cut. This method of cutting made one set of laminations $\frac{5}{8}$ in. shorter than the other.

The core is built up by laying the current and potential coils on their sides so that their cores were in line and then placing the middle leg of one of the long laminations in one and another long lamination in the other end of the coil until the bolt holes in the legs coincided. Assuming that the ends of the second lamination were on top of the first lamination a short lamination was placed on top of the first, which brought the short lamination into the same plane as the second. This is shown in detail in the lower left illustration. A long lamination was then placed on top of the short one, and on the other side of the core a short lamination was placed on the long one. This procedure was continued until the core as built up fitted the coils.

All laminations were bolted together through each corner and both sides. As the ends of the middle leg came under the coil, it was impossible to bolt them together, but they were forced together with wooden wedges under the primary coil. This method of building the core gave a very tight magnetic circuit, and no trouble was experienced from humming.

The primary windings consisted of one of the potential coils of the 200-volt power meter, while the secondary was made up of two coils of No. 8 wire insulated with cotton sleeving. The latter had nine and fifteen turns respectively, making a total of twenty-four turns. They were connected in series and three taps were brought out, so that the voltages that could be obtained were 37.5 per cent, 62.5 per cent and 100 per cent of the total voltage on the twenty-four turns.

A wooden case was made to inclose the core and windings, and the primary leads were brought out of the side near the top with two small connectors fastened in the wood. The three secondary taps were brought out vertically through the top on the opposite side from the primary. The box is 3 in. high, 4 in. wide and 4.75 in. long over all. The total weight is 4.5 pounds.

The characteristics of the load box are such that the impedance of the meter to be tested and the impedance of the rotating standard, together with that of the leads, regulates the current to the proper value. When light load is desired the increased impedance of the light-load coil of the rotating standard reduces the current to a value between 5 per cent and 10 per cent of full load. As an example, when testing a 10-amp., 100-volt Westinghouse meter the writer obtained values of 95 per cent of full load of the meter using the fifteen-turn coil of the secondary and a 15-amp. current coil in the rotating standard. With the same circuit twenty-four turns gave about 150 per cent of full load and the nine-turn coil gave a 50 per cent load. In making the light load test by using the 1.5-amp. coil of the rotating standard, twenty-four turns gave 8 per cent load, fifteen turns gave 5 per cent load and nine turns gave 3 per cent load. The load box has worked equally well with 5, 15 and 20-amp., 110-volt and 220-volt meters of several different makes.

The power factor of the phantom load was measured and was found to be 97.4 per cent for full load and 91.7 per cent for light load. The power factor measured was that of a test circuit which consisted of a 10-amp. meter, 15-amp. current coil of rotating standard, 10-amp. ammeter and the test leads. When measuring the power factor of the light load the 1.5-amp. coil of the rotating standard was used.

The performance of this load box was compared with that of a house-lighting load and also with a States test board using the same watt-hour meter and standard. Both the States test board and the house load agreed with the phantom-load box within one-half of 1 per cent on full and light loads.

WALTER A. CHURCHILL,
Electrical Engineer.
Eastern Massachusetts Electric Company,
Salem, Mass.

Standard Voltage Ratings for Oil Breakers

VOLTAGE ratings for oil circuit breakers and other switching equipment are among the new standards and recommended practices adopted at the fall meeting of the Electric Power Club held at Asheville, N. C. Standard interrupting capacities for oil circuit breakers have also been adopted. These standards and recommended practices are given in the following paragraphs:

The standard voltage ratings of oil circuit breakers and other switching equipment up to 73,000 volts inclusive shall be as follows: Maximum rating in volts—750, 2,500, 4,500, 7,500, 15,000, 25,000, 37,000, 50,000 and 73,000.

Until Oct. 1, 1923, 44,000-volt and 66,000-volt ratings will be standard in addition to 50,000-volt and 73,000-volt ratings for switching equipment other than oil circuit breakers.

The 50,000-volt and 73,000-volt ratings are standardized for oil circuit breakers for application to the many existing systems operating at voltages above 44,000 volts and 66,000 volts, as well as to systems operating at the latter voltages, which are the recognized normal voltages for new systems.

Above 73,000 volts, the standard voltage ratings corresponding to standard normal system voltages shall be as follows: Standard rating (normal voltage)—80,000, 110,000, 132,000, 154,000 and 220,000.

Maximum rated oil circuit breakers and other switching equipment, except bus supports, shall have nameplates marked "——— volts maximum rating." Standard (normal) rated oil circuit breakers and other switching equipment, except bus supports, shall have nameplates marked "——— volts normal rating."

Standard (normal) rated oil circuit breakers and other switching equipment may be applied on systems having a maximum voltage not more than 5 per cent above the nameplate rating, but dielectric strength tests shall be based on the nameplate rating. (Applications at 5 per cent above the nameplate rating may not be made in case of maximum-rated oil circuit breakers and other switching equipment.)

Arc Amps.	Rated Voltage	Arc Amps.	Rated Voltage
3,200	4,500	10,000	15,000
2,500	7,500	14,000	15,000
2,000	15,000	20,000	15,000
3,000	15,000	30,000	15,000
4,500	15,000	40,000	15 000
7,000	15,000	60,000	15,000

The recommended practice for the standard interrupting capacities for oil circuit breakers shall be as tabulated above.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Pilot-Light Control for Furnace Electrodes

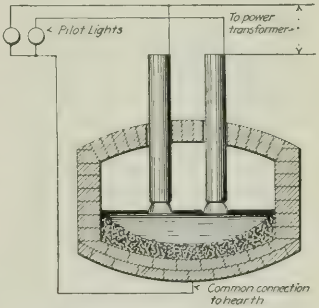
IN ANY furnace where two or more electrodes are used one of the main problems in operation is the proper regulation of the electrodes. There are now available a number of automatic-control systems which, when functioning properly, give excellent regulation and an even, well-balanced load. These automatic regulators are expensive, however, and for small furnaces are often cumbersome and impracticable, so that a large proportion of such furnaces are and probably will continue to be hand-operated.

The principal objects of regulation are to maintain the correct power input and to prevent surges and large fluctuations in the power. In furnaces depending on hand control the operator regulates the power by observing ammeters or wattmeters placed within his line of vision from the controls and moving the electrodes up or down accordingly.

However, there is another phase of regulation, not so often mentioned, which is of greater importance to the melter in the proper operation of the furnace, namely, keeping equal arcs on the various electrodes. For example, consider the single-phase Heroult type of furnace illustrated herewith. With the ammeter, wattmeter and voltmeter showing correct readings, it is possible for one electrode to be buried in the melt and the other to be carrying twice the normal arc. Such a long arc is difficult to maintain and is continually breaking. When it does break the operator is often at a loss as to which electrode to lower to re-establish the arc, and about half of the time he will lower the one already dipping in the melt. His only recourse is to lower both electrodes until the circuit is closed and then adjust them by raising and lowering each one until a slight movement of either will vary the current.

Even then he does not know that the arcs are equal, but only that there is an arc on each electrode, and unequal arcs will cause uneven heating. Moreover, when bringing up the carbon in a steel melt, to have an electrode dipping into the metal for as little as five minutes will often result in excess carbon.

The aforementioned conditions were met with during experimental work in a 300-lb. single-phase furnace of the Heroult type used for melting iron and steel. This furnace is part of the equipment of the Northwest Experiment Station of the United States Bureau of Mines and is situated in the College of Mines laboratory of the University of Washington. Automatic control for this furnace was not to be procured, and when close regulation of conditions was wanted the irregularities of hand control caused annoying troubles, until the following expedient was employed:



POSITION OF ELECTRODES INDICATED BY BRILLIANCY OF LAMPS

Two ordinary 40-watt tungsten-filament lamps were set upright on a shelf near the meter board and in full view from the hand controls, with each lamp connected to one electrode (or busbar) as shown in the illustration. For convenience the left-hand lamp should be connected to the left-hand electrode, and the right-hand lamp to the right-hand electrode. The lamps have a common connection to the metal bath in the furnace. Usually all that is necessary is to connect them to the shell of the furnace, but if that does not work, a steel bar similar to the bottom electrode of a Girod furnace can be buried in the hearth.

In operation the brilliancy of the filament will vary with the drop in potential between the electrode and the bath. A lamp of this type will glow dull red at 15 volts and will safely stand surges up to 125 volts. When the power is on and no arc has been drawn the lamps will simply be in series across the busbars and will glow with equal brilliancy. When current is flowing through the furnace they are lighted equally only when both arcs are exactly the same. The slightest change in either arc is quickly and accurately indicated by the lamps. If one electrode should touch the bath, its pilot light would instantly go black. These lights, therefore, show the exact position of the electrodes at all times. To install this apparatus for three-phase operation it is necessary merely to add one more lamp connected to third electrode.

C. E. SIMS,
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Bureau of Mines, Seattle, Wash.

Calculating Dry-Vacuum Pump Sizes

Rapid and Practically Accurate Means for Their Determination Described—Charts Developed by This Method Are Applied to Two Practical Examples

USING a constant determined from actual test data gives much more accurate results in calculating the size of dry-vacuum pumps than can be obtained by the use of an average volumetric efficiency as determined by previously known methods. The process employed in finding this constant and its applications were outlined in a paper presented by E. W. Noyes and H. V. Sturtevant, engineers with the Sullivan Machinery Company of Claremont, N. H., before the annual meeting of the American Society of Mechanical Engineers, held Dec. 4 to 7 at New York.

Working with actual test data, values were obtained from which a "constant" curve was plotted, this curve giving closely accurate results from 80 per cent perfect vacuum up. With the aid of this "constant" curve two charts shown in the accompanying illustrations have been plotted. By means of these it is possible to determine rapidly and with sufficient accuracy (1) the size of pump required to exhaust a given volume to a specified degree of vacuum in a predetermined time or (2) the time required to exhaust a given volume to a specified degree of vacuum where the vacuum pump is already installed.

The problems which may be solved with the aid of the two formulas shown on the curves vary in nature, but two typical cases worked out illustrate the application of the curves.

First and most important is the case where it is desired to determine the size of pump required to exhaust a given volume to a certain degree of vacuum in a predetermined time. This problem may be approached from two different angles: The r.p.m. of the pump may be assumed and the required piston displacement per revolution determined, or the piston displacement per revolution may be assumed and the total revolutions or r.p.m. calculated.

Problem I.—Given a volume of 5,000 cu.ft., including the piping between the pump and tank, it is desired to find the size of pump required to exhaust the tank to a vacuum of 26 in. in thirty minutes. Barometer, 29.5 in.

(a) Assume that the pump will run at 280 r.p.m. The percentage of perfect vacuum = 26 ÷ 29.5 × 100 = 88.1 per cent. Using the chart at the left, follow line at 88.1 per cent horizontally until it intersects the curve, then vertically downward to the base line, when the piston displacement will be found to be 10.15 cu.ft. This is the piston displacement per revolution required to exhaust 1,000 cu.ft. from atmospheric pressure to 26 in. with 300 revolutions of the pump. Hence:

Displacement per revolution = (10.15 × 5,000 ÷ 1,000) × [300 ÷ (280 × 30)] = 1.814 cu.ft.

This is the actual piston displacement required with a pump running at 280 r.p.m. to exhaust 5,000 cu.ft. to 26 in. in thirty minutes. Allowance has been made for leaks such as are always present in the average installation. For excessive leakage, however, a small factor of safety may be added.

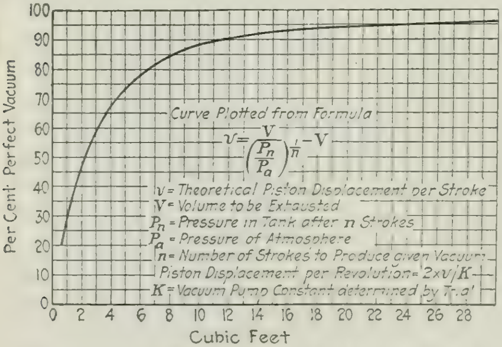
(b) Assume piston displacement per revolution = 2 cu.ft. Using the chart at the right, follow line at 88.1 per cent horizontally until it intersects the curve; then vertically downward to the base line, where the number of revolutions is found to be 305. This is the total number of revolutions required to exhaust a volume of 100 cu.ft. from atmospheric pressure to 26 in. with a pump of 1 cu.ft. displacement per revolution. Hence:

Total revolutions = (5,000 ÷ 100) × (305 ÷ 2) = 7,625.

R.p.m. = total revolutions ÷ time in minutes = 7,625 ÷ 30 = 254.

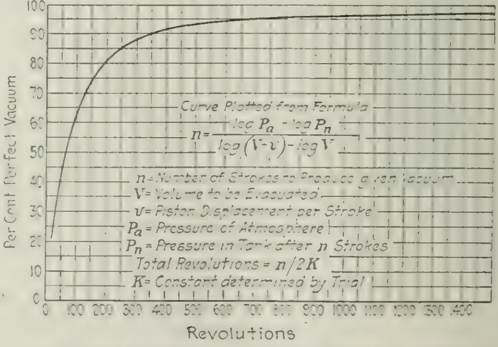
This is the actual r.p.m. required with a pump of 2 cu.ft. piston displacement per revolution to exhaust 5,000 cu.ft. to 26 in. in thirty minutes.

The second type of problem the solution of which may be obtained



PISTON DISPLACEMENT REQUIRED BY DRY-VACUUM PUMP TO EXHAUST A CLOSED SPACE

The horizontal scale represents the piston displacement per revolution required to exhaust a volume of 1,000 cu.ft. from atmospheric pressure to any per cent vacuum with 300 revolutions. For a different volume or number of revolutions the piston displacement varies directly as the volumes and inversely as the revolutions.



REVOLUTIONS REQUIRED BY DRY-VACUUM PUMP TO EXHAUST A CLOSED SPACE

The horizontal scale represents the total revolutions required to exhaust a space of 100 cu.ft. from atmospheric pressure to any per cent vacuum with a pump of 1 cu.ft. piston displacement per revolution. For different volume or displacement the total revolutions vary directly as the volume and inversely as the piston displacement.

by use of the curves is the one in which a vacuum pump is already installed and it is desired to determine the time required to exhaust a given volume to a certain degre of vacuum.

Problem II.—Given an 18-in. x 8-in. pump running at 300 r.p.m., how long will it take to exhaust a tank of 2,500 cu.ft. capacity from atmospheric pressure to 26 in. vacuum? Barometer, 28.4 in. Piston displacement per revolution, 2.34 cu.ft. Percentage of perfect vacuum $= 26 \div 28.4 \times 100 = 91.5$.

Using the chart at the right, follow line of 91.5 per cent horizontally until it intersects the curve, then vertically downward to the base line, when the revolutions are found to be 415. This is the total number of revolutions required to exhaust a volume of 100 cu.ft. from atmospheric pressure to 26 in. with a pump of 1 cu.ft. piston displacement per revolution. Hence:

Total revolutions $= (2{,}500 \times 415) \div (100 \times 2.34) = 4{,}433.8$.

Time required = total revolutions ÷ r.p.m. $= 4{,}433.8 \div 300 = 14.8$ minutes.

This is the actual time required, allowance having been made for leaks such as are present in the average installation.

Obviously, if the system under consideration has two or three times the leakage area that was present in the system from which the curves were obtained, then the size of pump determined from them will be too small, or the number of revolutions required to exhaust the system in a given time will be too small. However, even if this leakage factor had been included, it is doubtful whether in the majority of cases it could be made use of.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

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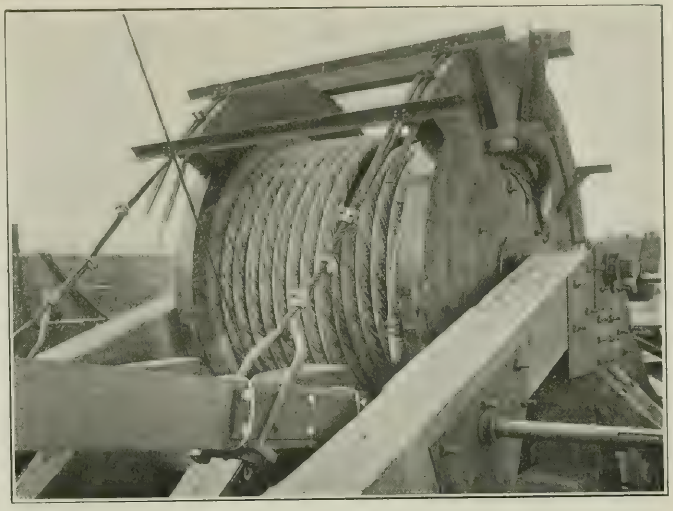
Cable Reel Brake to Lay Submarine Cable



SIMPLE AND EFFECTIVE BRAKE ON REEL ELIMINATES ALL UNEVEN STRAINS ON SUBMARINE CABLE

ONE of the important considerations in laying a submarine cable is to provide braking equipment that will avoid jerky action, prevent excessive heating of the braking surfaces and insure holding the cable under all conditions, regardless of the length of cable paid off the reel. The sad experiences of many companies with temporary brake drums mounted on the sides of cable reels demonstrated to the Northwestern Electric Company of Portland, Ore., that an efficiently designed equipment with large brake surfaces was necessary.

The accompanying illustration shows a cable reel with specially designed brake mounted on a barge which was planned and built by the engineers of this company for laying a three-conductor, 250,000-circ.mil, 13,200-volt armored submarine cable across the Columbia River at Vancouver, Wash. A standard cable reel was equipped with strap-iron rims and cast-iron bearings and mounted on steel shafting. A double-rim brake was constructed similar to the automobile type. Oak brake blocks were used with a total braking surface of 20,088 sq.in. Lever arms 2 in. x 8 in. were used of sufficient weight and leverage when acting on the brake to stop and hold the cable with no additional external force. These safety levers are in turn operated with a reverse lever arm easily handled by one man.

With the large area of braking surface used it was possible to grease the surfaces so that the cable could be run out at a constant speed with jerking eliminated. All that is required to stop the cable is for the operator to let go of the reverse lever and the weight of the lever arms combined with the greased braking surface brings the cable to a smooth, sliding stop. At no time does the braking surface become even appreciably warm. The brake on each rim was designed to take care of the entire load in case of failure on either rim. By unbolting the large U-bolts shown in the picture the entire braking frame can be swung back, permitting the reel of cable to be placed in or taken out of the frame at will.

The entire equipment was designed for permanent use in laying submarine cables across the Willamette and Columbia Rivers, and the whole is removable so that a barge is required only during cable laying operations.

E. F. PEARSON,
Electrical Engineer.
Northwestern Electric Company.
Portland, Ore

◆

Meter Installation Costs for Industrial Plants

AN ANALYSIS of installation costs of forty 13,200-volt meters serving various industries was recently prepared by the engineering department of a large central-station company in the East. The accompanying tabulation covers these costs, together with various information as to the types of meters, sizes, etc., involved. For the entire group twenty-eight customers were served. These costs extend through approximately the last decade, and duplications are omitted.

Ampere Rating	Type	Cost of 13,200-Volt Meter	Cost to Install	Total Cost
10	D-6	$594.00	$44.75	$638.75
15	DS-4	370 41	40 00	410.41
15	D-6	665.00	47.22	712.22
15	D-6	625.00	57.50	682.50
20	D-3	294.54	30 60	325.14
30	D-6	295.68	27.80	323.48
30	D-6	295.68	32.33	328.01
30	D-6	295.68	23.17	318.85
30	D-6	710 18	51.30	761.48
30	D-3	295 68	25.31	320.99
30	D-6	768.43	48.80	817.23
30	D-6	770 25	47.20	817.45
30	D-6	295.68	41.25	336.93
60	DS-4	257.66	9.25	266.91
80	DS-6	372.94	38.90	411.84
[illegible]	West.	282.38	25.22	307.60
100	DS-6	309.64	21.96	331.60
100	DS-6	309 64	27.36	337.00
100	DS-6	309.64	45.25	354.89
150	DS-4	311.62	22 21	333.83
200	DS-4	372.91	37.50	410.41

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Loose-Leaf Distribution System Maps Easy to Make and Use

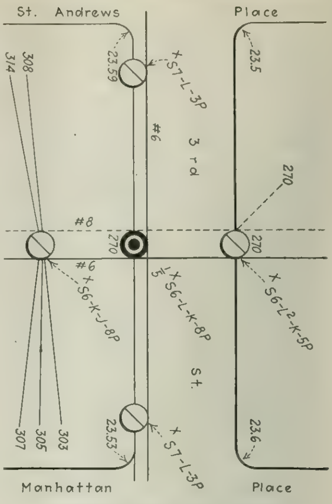
LEDGER-TYPE loose-leaf books for keeping distribution system record maps have been in use by the Southern California Edison Company for several years and have proved highly satisfactory. The feature of the system is that individual maps are of a comparatively small size, 31 in. x 18 in., and so are easily handled.

The maps are kept in atlases of uniform size, 35 in. long and 18½ in. wide. The binders are of the loose-leaf type, so any page can be removed without interfering with the other pages. Each atlas when completed contains about 200 pages. These pages are made of a fine quality of blueprint cloth and are numbered in sequence in the upper right-hand corner. On each margin of each page a 1½-in. border is left, and in these, in smaller figures than the page number, are placed the abutting map numbers, so that the maps showing lines extending over more than one section may quickly be found. On the right-hand edge of each page an index tab bears the page number.

The original tracing of each map is drawn from official county or city maps on tracing cloth, and from these tracings negative prints are made. White prints are made from the latter. The tracings are filed and corrected for any street or property changes, at which time new pages are made. It is a very essential element in the maintenance of such a complete mapping scheme to keep the street names and property changes up to date at all times. An important factor of a mapping system is the scale used. The scale adopted is 100 ft. to the inch. This allows ample space for indicating all poles, circuits, services, street addresses and a complete list of material used on each pole.

One of the most satisfactory features in connection with this system of maps is the minute detailing of the equipment on each pole, thus making it simple to give the actual valuation at one pole or any number of poles on any given street, property line or alley.

All poles are indicated on the maps by small circles of an average size of ⅛ in. in diameter. A red circle signifies that it is a company-owned pole and a black circle signifies a pole owned jointly with another company. The interest owned by the company in any combination pole is indicated as shown in the accompanying chart.



SECTION FROM TYPICAL MAP

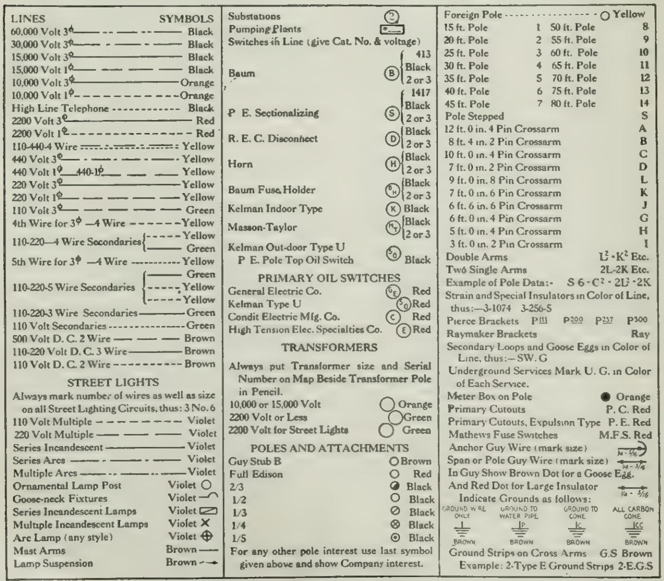
For example, on a map is a certain pole bearing the following symbols: 877E,S5,L^{2}L, K. This indicates that it is Southern California Edison Company pole No. 877E; the symbol S5 indicates that it is a 35-ft. stepped pole; the letter E that it was set originally by the Southern California Edison Company, and it is further shown to be supporting three 9-ft., eight-pin cross arms and one 7-ft., six-pin cross arm.

All wires are designated by an identifying color and their size by small figure of the same color; thus No. 2/0 in red indicate that there are three No. 2/0 primaries in that particular section. A long-dashed red line indicates a 2,200-volt, three-phase primary feeder, a solid red line a three-phase, 2,200-volt primary main, and a short dotted line a single-phase, 2,200-volt primary.

All transformers are indicated on the maps by circles about ¼ in. in diameter. If they are on a pole, the circles are drawn around the circle indicating the pole; if not, it is indicated that they are on private property. Their size and serial number are shown in pencil immediately adjacent to the circles. The color of the circles designates the primary voltage of the transformers, a green circle signifying a 2,200-volt transformer. The secondary voltage is indicated by the color of the line running from the transformer.

Data for the compilation of the maps are obtained from the property clerks, who issue the material to the line crews installing it, and from the field clerks, who make a record of the work as done. Diagrams are drawn in the field showing exactly how the material was installed.

M. McNeal.
Southern California Edison Company,
Los Angeles, Cal.



LINES	SYMBOLS
60,000 Volt 3φ	Black
30,000 Volt 3φ	Black
15,000 Volt 3φ	Black
15,000 Volt 1φ	Black
10,000 Volt 3φ	Orange
10,000 Volt 1φ	Orange
High Line Telephone	Black
2200 Volt 3φ	Red
2200 Volt 1φ	Red
110-440-4 Wire	Yellow
440 Volt 3φ	Yellow
440 Volt 1φ 440-1φ	Yellow
220 Volt 3φ	Yellow
220 Volt 1φ	Yellow
110 Volt 3φ	Green
4th Wire for 3φ —4 Wire	Yellow
110-220—4 Wire Secondaries	Yellow Green
5th Wire for 3φ —4 Wire	Yellow
110-220-5 Wire Secondaries	Green Yellow Yellow
110-220-3 Wire Secondaries	Green
110 Volt Secondaries	Green
500 Volt D. C. 2 Wire	Brown
110-220 Volt D. C. 3 Wire	Brown
110 Volt D. C. 2 Wire	Brown

STREET LIGHTS

Always mark number of wires as well as size on all Street Lighting Circuits, thus: 3 No. 6

110 Volt Multiple	Violet
220 Volt Multiple	Violet
Series Incandescent	Violet
Series Arcs	Violet
Multiple Arcs	Violet
Ornamental Lamp Post	Violet ○
Goose-neck Fixtures	Violet
Series Incandescent Lamps	Violet ▭
Multiple Incandescent Lamps	Violet ×
Arc Lamp (any style)	Violet ⊕
Mast Arms	Brown —
Lamp Suspension	Brown →

Substations	②	
Pumping Plants	▭	
Switches in Line (give Cat. No. & voltage)		
Baum	Ⓑ	413 Black 2 or 3
P E. Sectionalizing	Ⓢ	1417 Black 2 or 3
R. E. C. Disconnect	Ⓓ	Black 2 or 3
Horn	Ⓗ	Black 2 or 3
Baum Fuse Holder	BH	Black 2 or 3
Kelman Indoor Type	Ⓚ	Black
Masson-Taylor	MT	Black 2 or 3
Kelman Out-door Type U P E. Pole Top Oil Switch	SO	Black

PRIMARY OIL SWITCHES

General Electric Co.	GE	Red
Kelman Type U	SO	Red
Condit Electric Mfg. Co.	Ⓒ	Red
High Tension Elec. Specialties Co.	Ⓔ	Red

TRANSFORMERS

Always put Transformer size and Serial Number on Map Beside Transformer Pole in Pencil.

10,000 or 15,000 Volt	○	Orange
2200 Volt or Less	○	Green
2200 Volt for Street Lights	○	Green

POLES AND ATTACHMENTS

Guy Stub B	○	Brown
Full Edison	○	Red
2/3	◕	Black
1/2	○	Black
1/3	⊘	Black
1/4	⊗	Black
1/5	⊙	Black

For any other pole interest use last symbol given above and show Company interest.

Foreign Pole			○ Yellow
15 ft. Pole	1	50 ft. Pole	8
20 ft. Pole	2	55 ft. Pole	9
25 ft. Pole	3	60 ft. Pole	10
30 ft. Pole	4	65 ft. Pole	11
35 ft. Pole	5	70 ft. Pole	12
40 ft. Pole	6	75 ft. Pole	13
45 ft. Pole	7	80 ft. Pole	14

Pole Stepped	S
12 ft. 0 in. 4 Pin Crossarm	A
8 ft. 4 in. 2 Pin Crossarm	B
10 ft. 0 in. 4 Pin Crossarm	C
7 ft. 0 in. 2 Pin Crossarm	D
9 ft. 0 in. 8 Pin Crossarm	L
7 ft. 0 in. 6 Pin Crossarm	K
6 ft. 6 in. 6 Pin Crossarm	J
6 ft. 0 in. 4 Pin Crossarm	G
5 ft. 0 in. 4 Pin Crossarm	H
3 ft. 0 in. 2 Pin Crossarm	I
Double Arms	$L^2 \cdot K^2$ Etc.
Two Single Arms	2L-2K Etc.
Example of Pole Data:-	S 6 - C^2 - 2L^2 - 2K

Strain and Special Insulators in Color of Line, thus:—3-1074 3-256-5

Pierce Brackets	P111	P200	P237	P300

Raymaker Brackets	Ray

Secondary Loops and Goose Eggs in Color of Line, thus:—SW. G

Underground Services Mark U. G. in Color of Each Service.

Meter Box on Pole	● Orange
Primary Cutouts	P. C. Red
Primary Cutouts, Expulsion Type	P. E. Red
Mathews Fuse Switches	M.F.S. Red
Anchor Guy Wire (mark size)	¼ - 5/16
Span or Pole Guy Wire (mark size)	¼ - 5/16
In Guy Show Brown Dot for a Goose Egg. And Red Dot for Large Insulator	¼ - 5/16

Indicate Grounds as follows:

GROUND WIRE ONLY	GROUND TO WATER PIPE	GROUND TO CONE	ALL CARBON CONE
BROWN	P BROWN	K BROWN	ICC BROWN

Ground Strips on Cross Arms	G.S Brown
Example: 2-Type E Ground Strips	2-E.G.S

LINES, POLES, TRANSFORMERS, SERVICES, LOADS AND CONSUMERS' ADDRESSES ARE ONLY PART OF THE INFORMATION SHOWN

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Merchandising at the Customer's Door*

How Salesmen Organized in Crews Operating from Electric Trucks Demonstrate and Sell Electric Appliances in Customers' Homes, Making Delivery on the Spot

By J. E. Tills
Head Appliance Salesman Commonwealth Edison Company, Chicago

OUTSIDE sales work in Chicago, when considered as the source from which the sales come, can be divided into four parts as follows: Campaign trucks, location of stores, industrial and commercial appliances, and miscellaneous sales. These sales efforts can best be shown by discussing each of them in turn and going into detail regarding their business-building adaptations.

Campaign Trucks

Appliance selling from campaign trucks is based on the theory of carrying the goods to the buyer's own door as we feel that in this manner we can reach the class of people who do not have an opportunity freely to visit our electric shops. Our first serious attempt at taking electrical appliances from door to door was in the year 1910, when with a horse and wagon we put a crew of salesmen in certain residential districts, canvassing for electric flatirons, percolators and toasters. In 1915 we expanded to the use of three trucks, and we are now using eight electric trucks, employing about 120 salesmen and continuing this work every day in the year. Our organization for this work consists of eight crew captains, eight truck drivers and about fifteen salesmen assigned to each crew. The city has been divided into eight districts and one crew put in each, their efforts being limited to that particular district to which they are assigned. The district is laid out in maps and is canvassed by the salesmen from door to door. In this manner the captain is able to cover his district about every six or eight weeks.

The routine of a crew on an average day is about as follows: In the morning the captain calls with his truck at the warehouse, where a load of appliances is checked out to him by the storekeeper. From there the truck is driven to a designated point in the district where the salesmen meet about 8:30 in the morning. The captain then assigns districts to each salesman and checks out to him samples of the particular appliance which is being campaigned. The salesman, calling from door to door, sells the article carried and returns the sales ticket and first payment to the captain. At the end of the day the truck returns to the warehouse, where the goods are checked back, the sales tickets being used to clear goods sold. In case articles are sold which are not carried on the truck they are either taken out for delivery next day by the captain or the sales ticket is sent through our regular routine and the goods delivered by our stores department.

Salesmen's Compensation

We have tried a number of different methods of paying salesmen on this work, including salary, drawing account and straight commission, but believe that we have the most success when paying on a straight commission basis. Our commissions are figured very liberally, and to them are added bonuses for quantity of sales. The captains are paid on the salary basis with commission on goods sold. Besides this, they work for a weekly prize for the three highest district sales, with a smaller prize for all that reach a certain quota.

Our salesmen are hired by means of newspaper advertisements and receive one day of intensive schooling, where they are taught company policy, operation of appliances, filling out of order forms and some selling arguments. The next morning we personally conduct them to a truck where they are put in the hands of a captain for further help and instructions.

When a new man begins his selling work with a crew he is instructed to call at the back doors as this has proved to give the best results inasmuch as the housewife is more often working in the kitchen or the rear portion of the home. Besides, the usual speaking tube and bell in the front hallway often prevent direct communication. We encourage the salesmen to impress upon the customer that a representative of the Commonwealth Edison Company, the central-station company which furnishes them with their electric light service, is calling and that any goods which they buy are backed by the reputation of this company.

When a sale is made the salesman delivers the article which has been demonstrated and which is in first-class condition. In the case of a washing machine it is only necessary for the salesman to obtain permission for a demonstration. A machine is then sent on a special truck, and a washing machine salesman goes with it to close the sale. The salesman who called first receives his regular commission.

At different seasons in the year we campaign with different appliances, but still find that the 6-lb. household iron is our leader during the summer months. In the spring and fall, particularly during housecleaning, we stress the sale of vacuum cleaners, and a good winter leader has proved to be the table lamp. In the fall last year we put on a special effort for the sale of table lamps which were especially designed for us. We sold more than eight thousand last year, and at the time of writing we are starting on our sale of table lamps for this year with a mark of 20,000 before us. During the early part of this fall we were also very successful in the sale of spot heaters.

We have found that by continually going back over the same territory about every eight weeks we have educated the public to buy in this manner, and we find a better reception and more business each time. In our sales efforts we endeavor to tie up closely with our electric shops. Our salesmen can reap considerable benefit from the electric shops' advertisements which appear in the daily papers, and in turn many sales come into the electric shops which are a direct result of the canvassing done by the salesmen.

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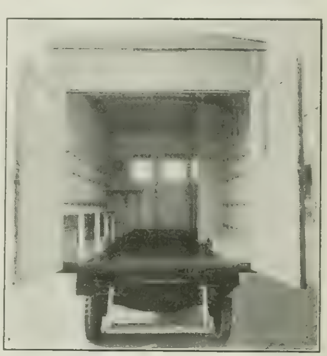
*Abstract of a paper presented before the meeting of the new-business co-operations committee of the Ohio Electric Light Association at Dayton, Nov. 22, 1922.

Increasing business which enhances the need for carrying large supplies of goods to the districts has caused us to outgrow the original size of electric truck, and we have designed and have had built by the Walker Vehicle Company of Chicago a special large truck. Space is provided for a desk and stationery for the captain of the wagon, and a built-in cupboard for small appliances, such as curling irons, heating pads, etc., is installed on one side. A collapsible bench is also provided for salesmen. A typical load consists of 100 ironing boards, twenty portable lamps, 120 irons, percolators and toasters, twenty fans, fifty boxes of fuses, fifty two-way sockets, ten extension cords, two vacuum cleaners and one utility table. This truck makes 17 miles an hour and will travel 65 miles per trip. Two of these trucks are now in operation and two more will be on the streets in a few weeks.

Our sales effort on this campaign work in 1915 netted the neat little sum of approximately $44,000, and from this beginning we have grown until the figures for the first ten months of this year show a gross business of more than $400,000. Wagon sales for 1921 were in the neighborhood of $350,000, and our total sales from all sources were $439,000, showing an increase of $180,000 over 1920. For the year 1922 our sales from all sources will be over $1,000,000. For the month of October our wagon sales amounted to $87,500, with a total sale for the month of $109,300.

LOCATION OF STORES

Having in mind the desirability of centering some special sales efforts on washing machines, we have put this work in the hands of a separate subdivision and have secured six desirable locations in different parts of the city from which as headquarters crews of salesmen operate in canvassing for electric washing machines. While these are known as branch stores of the company, they are in reality of greatest value as a central operating point for the washing-machine crews. Each store is furnished with a Ford truck having a body especially built to carry two washing machines. The salesman canvassing for washers arranges for demonstrations with the customer, and he and the captain take the machine in the truck, making the demonstration and if possible placing the machine. This allows for quick service on telephone calls or any other leads received which require prompt attention. Several of the above salesmen are employed one day a week at our main electric shop, where they sell washers from the floor and obtain leads to be followed up on the outside. The method of remuneration for these men is straight commission. Every effort is made to pay the commission promptly as we have found this important in holding men. We are placing over 150 washers a month through these branches.



INTERIOR OF TRUCK SHOWING ARRANGEMENT FOR CARRYING APPLIANCES

This division handles all industrial and commercial appliances such as glue pots, soldering irons, tailoring irons and ventilating fans. At present we have six salesmen on this work. We try to get men with some technical education as it is necessary for them to combine engineering ability with salesmanship.

A great deal of time must be spent on so-called missionary work as many industrial and commercial establishments do not know of the new and efficient appliances that are now on the market for their needs. Our efforts along these lines are closely tied with our electric shop through an arrangement whereby we obtain display space and window trims.

Our salesmen take care of all sales in the electric shop on this kind of goods, each man remaining in the shop two days a week and working outside four. In this manner many leads are obtained for "follow-up" and the salesman is able to arrange appointments with the customer to visit the shop and see the goods on the day he is on duty.

We have in view merchandising electrical appliances to factory, store and office as thoroughly as we now do to the housewife. Our sales for the first ten months of this year show a gross of $150,000 as against $87,000 for 1921.

MISCELLANEOUS

Lighting salesmen, power salesmen, sign salesmen and others in the contract department are encouraged to sell appliances. In many cases when they are calling about light and power they are able to expatiate on the uses of electrical appliances. These men are on a salary basis and are paid in addition a commission on all appliances sold.

The combined demand from these four sources gives us a steady amount of business during the entire year. The gross sales from month to month vary only slightly.

While we feel justly proud of this business, I wish particularly to call attention to the opportunities opened by a door-to-door campaign such as we are promoting. With the proper organization it is possible to "put over" almost any merchandising campaign desired. Last year our total volume from the sources mentioned was nearly half a million dollars, and with this in mind we set our mark this year for a million dollars. From figures now available it is evident that we shall pass the mark easily.

METHODS BUILD BUSINESS

The Commonwealth Edison Company believes in building up a large merchandising business on electrical appliances and further believes that door-to-door canvassing is a successful and satisfactory method of doing this. I consider this plan of carrying sales effort directly to the customer's door of first importance, as by this method we reach the women who use and purchase electrical appliances. They are interested in these appliances as labor savers, and it is possible by these sales to increase greatly the use of electricity, thereby materially increasing the income of the company and at the same time keeping the central station at the front in electrical merchandising circles.

Night School for Central Station Employees

CONSISTENT with its policy of enabling employees to advance themselves, the San Diego (Calif.) Gas & Electric Company has opened night-school classes for those who desire to gain further knowledge of mathematics and engineering.

The course offered is primarily one of practical mathematics. Use of logarithmic and trigonometric tables, of the slide rule, and the more or less practical use of such formulas as are to be found in handbooks, will be taught. For those who wish it mechanical drawing, with especial relation to ability to read mechanical drawings, is available.

Surveying, including the ordinary uses of the transit and level, with actual manual experience, is also to be taught. Some study of the working of the steam-engine indicator and figuring horsepower will be offered also.

Those who are taking correspondence courses at home are especially urged to attend, and thus do their work in the class. They can get in this way practical assistance and personal attention. This should enable them to do such work faster and more satisfactorily to themselves.

Through the courtesy of the superintendent of schools of San Diego a room in one of the public schools has been made available for the purposes of the classes two nights a week. No charge is made for the courses except for those taking mechanical drawing, who will have to furnish their own instruments and materials.

Thirty employees have already enrolled, including a large number of foremen of various shops. The practical value of the course is expected to be proved in daily use.

Samuel Insull Upholds Community Ownership

COMMUNITY ownership of utilities, instead of municipal ownership, was advocated by Samuel Insull, president of the Commonwealth Edison Company, at a recent meeting of the Central States group of utilities commissioners at Indianapolis. Speaking on "Local Public Utilities," Mr. Insull said that, like others who are interested in local securities, he is in sympathy with the enactments of various states looking to proper regulation of the issuance of stocks.

"I am a great believer in community ownership of public utilities," he said, "but I am also a great believer in the incentive for gain that goes with personal management, as against state or municipal management. I do not believe in municipal ownership, but I do believe in community ownership, and am hoping the day will come in all the communities in which I operate when most of the consumers of our service—which would mean most of the citizens—will have a direct personal stake in the properties.

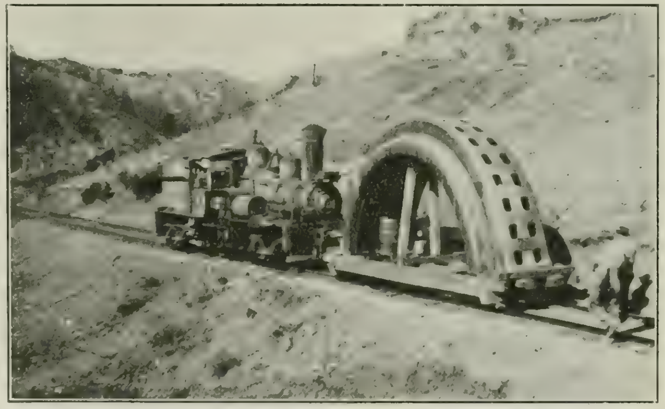
"There is another side to this subject that I think is of particular importance to cities of the character of Indianapolis. The gas business and the water business are, of necessity, more or less local in their nature. But electrical transportation and the distribution of electrical energy for all classes of service are not local in their nature.

"This is a problem that is of greater vital importance to the communities that we serve than it is to the owners of the properties themselves. It is but natural that the men and women who invest in our securities should not confine all their eggs to one basket. But the community itself is confined to the development of this particular territory, and it is up to the community, assuming that the utilities are properly regulated and honestly managed, to see to it that the regulation is on such a basis as will enable these utilities to function and to prepare years ahead—an average of two or three years ahead—for the necessities of every community in which they operate. Show me a community where the local public utilities are not prosperous, and I will show you a community where there is no progress, where there is no improvement from year to year and where the wealth of the citizens is not increasing."

Pictures Visualize Construction for Stockholders

By Paul B. McKee

Vice-President and General Manager
California-Oregon Power Company



THIS PICTURE SHOWED STOCKHOLDERS HOW GENERATOR FRAME WAS TRANSPORTED

UNDER the customer-ownership plan almost universally employed by central-station companies it is advantageous to depart somewhat from the older forms of reports to stockholders. The majority of the new stockholders are not familiar with matters of business and finance, and very few indeed know much about public utilities. To keep customer stockholders informed of the progress and plans of the company it has been found necessary to give more attention to the compilation of the reports sent out. Important points to be borne in mind are:

1. Interest and personal appeal to the layman stockholder.
2. Avoidance of technical and financial terms or phraseology which may not be clear or easily understood by the lay mind.
3. Attractiveness, neatness, simplicity and brevity.
4. Pictures of construction work, showing how the money that has been raised through the sale of stock is being spent.

The first report to the stockholders of the California-Oregon Power Company was sent out in the form of a letter on the company's letterhead. Three pictures taken with a post-card size camera, showing construction work in progress and a map of the company's system, were attached. One of these pictures, showing the transportation of the upper half of a large generator frame being installed at one of the company's hydro-electric plants, is reproduced here. Another showed construction work at the power house, and the third one showed men working on a new 130-mile transmission line.

The letter told of the company's customer-ownership plan, earnings, increase in load, business conditions, the outlook in the community served and the construction program for the year. The company's slogan is "Partners in progress," and the last paragraph of the letter read: "We are anxious that as much of this issue as possible be sold in the territory in which the company operates so that our customers may truly be referred to as 'our partners in progress.'" Each letter bore the personal signature of the vice-president and general manager, and it was felt that it had a greater personal appeal than a printed pamphlet. Furthermore, the cost was considerably less because of the comparatively small number of stockholders during the early stages of the customer-ownership campaign.

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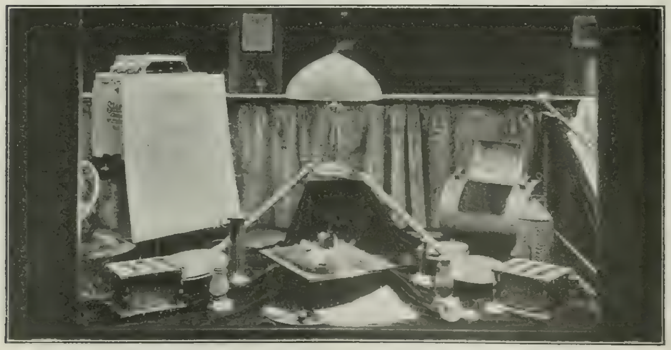
From Tinder Box to Push Button

CENTURY-OLD and modern methods of heating and lighting were effectively contrasted in a recent window display of the Worcester (Mass.) Electric Light Company. A model constructed by O. R. Underhill, superintendent of the appliance department, of an old New England meeting-house standing on a hill focused attention on the window. Appropriate placarding of the advantages of modern home wiring and lighting units pointed out the advantages of electric service as they are manifest in 1922.



WINDOW SHOWS IMPROVEMENT IN HEATING AND LIGHTING METHODS

◆

Salem (Mass.) Company Sells Heaters from Truck

A RECENT merchandising survey made by the Salem Electric Lighting Company showed that only one customer in fourteen used an electric heater. Taking advantage of the coal situation, the company's sales crew organizer, T. S. Saylor, put one of the crews through a short, intensive heater sales schooling. One of the company's trucks was decorated with posters, filled with heaters and sent out with the crew. Outlying districts of the city where houses were unprotected proved to be the most fertile field, and every home in the section was canvassed street by street. The heaters were demonstrated from the corner of a room if possible, and sales were made on the basis of a one-dollar deposit, with the balance in four monthly payments.

This method of merchandising resulted in the sale of 200 electric heaters, making up a very substantial residential load which usually comes at off-peak hours.

From this sale the company found that an overnight free trial did not pay, that the poorer class of people was best from a straight canvassing viewpoint, that the sales averaged one to every eight demonstrations, that one out of every ten sales was returned in the course of a month, and lastly, most important of all, that the crew should be commanded to tell each "prospect" the heater's cost of operation per hour.

What Other Companies Are Doing

Montevideo, Minn. — Twenty-five per cent of the families of this city are shareholders in the Northern States Power Company, which supplies service to the 1,260 homes in the community.

Montgomery, Ala. — The Montgomery Light & Water Power Company is carrying out an advertising and demonstration program to push the sale of electric appliances. A feature which has been introduced is a school of household science which any woman in the city may attend. The school is under the direction of Mrs. Adele Delahay, editor of the household department of the Montgomery *Advertiser* and *Alabama Farm Facts*. The company expects through the school to boost the use of electric appliances in the home.

Fond du Lac, Wis. — Managers and superintendents of the Wisconsin plants of the Northwest Utilities Company will meet in this city on Jan. 25, 1923, for the purpose of formulating and placing in operation new service, extension and improvement plans for the new year.

Chicago, Ill. — Sales of electric and gas appliances by the Public Service Company of Northern Illinois for the first ten months of 1922 totaled more than $700,000. New power business up to Oct. 7 amounted to 17,195 hp., as against 15,363 hp. for 1921.

Malden, Mass. — During the first ten months of 1922 the Malden Electric Company completed $53,745 of house-wiring work. The two best months were March and October, the totals for these being respectively $9,369 and $8,279.

Oklahoma City, Okla.—The Oklahoma Power Company and the Public Service Company of Oklahoma, subsidiaries of the Middle West Utilities Company, have inaugurated a progressive movement in Oklahoma. This includes an organized effort to instruct women employees of the companies in matters of service and courtesy to the public. Miss Rose E. McKee, assistant secretary of the Middle West Utilities Company, with headquarters in Chicago, visited Tulsa recently for the purpose of organizing women employees of the Oklahoma companies. Forty women attended the Tulsa meeting.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Generation, Switching and Control

A New Type of Direct-Current Machine.—Alexander Rothert.—The author describes a design of direct-current machine for which a great saving in active material is claimed. Other advantages are a reduction in the voltage per commutator bar, an increase in the number of bars and a lower minimum voltage. Details of the construction employed are given, together with a full data sheet for the construction of a 1,000-kw. turbo-generator using this machine. — *Electrician*, Nov. 17, 1922.

Investigations of Arcs on Automatic Air Breakers.—W. Schälchlin.—The results of tests made with automatic circuit breakers on 16-cycle single-phase currents of up to 800 volts and several thousand amperes are discussed. It is shown what form the magnetic field assumes around differently shaped contact pieces and how to form these contacts to obtain the maximum blow-out effect upon the arc. Very good results have been obtained from trapezoidal contact pieces with one or more parallel slots in the direction of the travel of the arc. With properly shaped contact surfaces it is possible to design a breaker to open safely 1,000 amp. at 800 volts within one cycle, without the use of an anxiliary blowout field.—*Bulletin de l'Association Suisse des Electriciens*, October, 1922.

Hydro-Electric Development and Steam Equipment

Hydro-Electric Development on the Abitibi River.—James Dick.—The completion of the hydro-electric plant at Twin Falls on the Abitibi River for the Abitibi Power & Paper Company adds 24,000 hp. to the power now developed by the company in this vicinity and will be used for the operation of its largest paper mill, at Iroquois Falls, Ontario. A general description is given of the reservoir and dam construction, generating stations, electrical equipment, etc.—*Canadian Engineer*, Nov. 7, 1922.

Fuel Economy.—A series of three articles taken from the report of the fuel economy committee of the British Association. The committee first considers the coal situation of Great Britain, giving figures on the amount of fuel mined. The figures for importation of petroleum products into the United Kingdom during each of the five years from 1917 to 1921 inclusive are given in tabular form. Progress has been made toward the solution of the problem of the chemistry of coal. The fuel committee has carefully considered data and proposals relating to the cause and prevention of industrial smoke and has been pleased to note progressive movements due largely to the increasing study of fuel economies in the various companies in regard to smoke abatement throughout the country. A good deal of valuable investigation work has recently been done in the direction of testing the efficiency of domestic heating and cooking appliances, with results of considerable interest in connection with fuel economy in homes which burn about 40,000,000 tons of coal per year and also the bulk of the gas and some of the coke manufactured.—*Engineer*, Sept. 29, Oct. 6 and Oct. 13, 1922.

Control of the Combustion Process.—J. B. C. Kershaw.—In the fifth and concluding article covering fuel economy in steam power plants the author deals with the control of the combustion process. The criteria of efficient fuel combustion are the temperature of the exit gases and their percentage of carbon dioxide. After demonstrating why this should be so, the author deals with the apparatus necessary to determine the carbon-dioxide content. Various types of automatic carbon dioxide recorders are described, and a precaution advisable in their installation and for their efficient working is emphasized. Temperature measurements should be taken regularly and if possible recorded continuously. From the data obtained by carbon-dioxide records and temperature measurements it is shown how heat losses may be calculated.—*Beama*, November, 1922.

Transmission, Distribution and Substations

Transformers Rated at 110,000 *Volts.*—A description of the first transformer of this voltage to be built by any English company. These transformers are to be used in the Mangahoa power station on the North Island, New Zealand. Each group of these transformers consists of three single-phase, 4,000-kw. units connected in delta on the low-tension side and star on the high-tension side, and seven of these single-phase units have been supplied, the odd transformer serving as a spare. The low-tension side is wound for 10,750 volts and 10,500 volts.—*Engineer*, Oct. 20, 1922.

Graphic Method for the Exact Solution of Transmission Lines.—C. H. Holladay.—This paper, presented at the Vancouver convention, describes a quick method of constructing the vector diagram of a power line, from which it will be possible to read directly the voltage, current, power and power factor at either end of the line.—*Journal of the A. I. E. E.*, November, 1922.

Illumination

Relation Between Barometric Pressure and Intensity of a Hefner Standard Lamp.—A. Boltzmann and A. Basch.—To check previous data obtained in a pneumatic chamber on the influence of the light intensity of a Hefner lamp under various air pressures, the authors undertook a series of very exact photometric measurements on this type of lamp at four different altitudes. They found an average change of luminosity of 0.0004 hefner-candle per millimeter variation in the barometric pressure. These tests showed a perfect check with the results obtained in 1911 by Butterfield.—*Elektrotechnik und Maschinenbau*, Oct. 29, 1922.

Cotton-Mill Lighting.—J. M. Ketch.—It is necessary in lighting cotton mills to take account of the long rows of high machines. This is materially facilitated by the almost uniform grouping of machines in the average cotton mill. It is important that the lighting be so arranged that each work surface will receive light from the proper direction, and this makes it necessary that the luminaires be grouped with respect to the machine arrangement rather than with respect to the bay dimensions. The general acceptance of the RLM dome and bowl-enameled lamp by cotton-mill engineers and architects makes it possible to suggest standard lighting designs which fill the requirements of practically all cotton-mill processes. A number of such standard-group lighting designs are discussed in this paper.—*Transactions of the I. E. S.*, October, 1922.

Units, Measurements and Instruments

Testing of Hydrometers.—The circular presents information necessary to make possible the construction and verification of hydrometers on a uniform basis, to indicate the facilities now available at the Bureau of Standards for their verification, and to anticipate the adoption by the bureau of more comprehensive specifications. These specifications define the requisite qualifications for hydrometers in order that they may be accepted for official verification or test and are provisional in that they are subject to such revision as may render them better adapted to the requirements of hydrometer users or to the facilities of the makers and of the testing laboratories. In cases where the standard scales chosen differ from those frequently used with respect to the standard temperature selected, temperature correction tables and, where possible, conversion tables to permit the intercomparisons between the standard scales and other scales have been prepared and are published in Circular No. 19 of this bureau.—*Circular No.* 16 *of the Bureau of Standards.*

Testing Methods of Tinned Copper Wire for Rubber Insulation.—K. Yokobori.—The author has investigated several methods of testing tinned copper wire, giving the results obtained with various kinds of materials. From the investigations he offers two methods for testing tinned copper wire. The first is to use 22 per cent solution of sodium sulphide, and the second is to use a sodium-sulphide solution prepared by dissolving 10.7 grams of sulphur in a hot solution which contains 100 grams of caustic soda, and after cooling diluting to the specific gravity of 1.142. Both of these solutions can be prepared easily at any place without the necessity of resort to a chemical laboratory. —*Report of the Electrotechnical Laboratory, Tokyo, Japan.*

Motors and Control

The Theory of Commutation.—B. Walsemann.—The author shows mathematically that the commutation problem on all types of machines having a commutator may be simplified materially if the collecting brushes are of suitable shape. It is common practice to use a rectangular cross-section for the brushes. If, however, a triangular or trapezoidal section is compared in performance with the usual rectangular brush, it is shown that a perfectly sparkless operation of a commutator may be obtained without the use of auxiliary poles or other means.—*Elektrotechnische Zeitschrift*, Nov. 2, 1922.

Locating Faults in Direct-Current Armatures.—B. A. Briggs.—Testing for grounds in parallel windings with a lamp circuit and with a low-reading voltmeter is considered. A short treatise on the effects of grounds in armature windings is included.—*Power*, Oct. 31, 1922.

Treatment for Motors in Steamy and Wet Places.—N. B. Smith.—When motors must operate with the minimum of interruption to service under the conditions which obtain in packing plants, the ingenuity and skill of the repairman are taxed to a high degree. The author explains in detail the inspection and repair methods employed in the maintenance of the motors in the Chicago plant of Swift & Company. These methods are the result of many years of experience and are so effective, the author claims, that a rewound motor can confidently be expected to give 100 per cent longer service than a new, standard motor.—*Industrial Engineer*, November, 1922.

Heat Applications and Material Handling

Repulsive Effect Upon the Poles of the Electric Arc.—A. Sellerio.—An investigation on the nature of the arc and the evaporation of electrodes at different temperatures which shows that in the arc there is a repulsive effect upon the poles increasing with the current. The range of pressure is less than 10 dynes with current up to 20 amp. This pressure does not vary much with the arc length. The carbon quality has a great influence on the pressure. The tests showed that metallic salts cause an increase in the pressure on the cathode and diminish that on the anode. With uncored carbons the repulsion on the cathode appears smaller than that on the anode.—*Philosophical Magazine*, October, 1922.

Electric Fodder Conservation.—Dr. Bockelmann.—Basing his observations upon several years of experience, the author recommends the general use of the electric method for fodder conservation. At the bottom of the silo a large steel plate is placed, connected to one pole of the electric supply, which can be 220-volt direct current or 220/380-volt alternating current. The silo is then filled with the cut greens, on the top of which rests a heavy wooden cover lined on its under side with zinc. This cover forms the second electrode. The current is adjusted to about 50 amp. The passage of the current through the fodder will heat it until a temperature of 50 deg. C. has been reached, at which the conservation process is finished. As a rule electricity generated at night at a low rate is used.—*Elektrische Kraftbetriebe und Bahnen*, Oct. 10, 1922.

Electrophysics, Electrochemistry and Batteries

Electromagnetic Lines and Tubes.—S. R. Milner.—The author extends the conception of the tubes of force of electrostatic and magnetostatic fields to the general electromagnetic field, when this is considered as a four-dimensional entity. The paper deals with a transformation from the electromagnetic equation into terms of lines, the construction of electromagnetic lines, a flux theorem for each of four electromagnetic tubes, a second theorem relating to the twist of each tube, an electromagnetic five-vector characteristic of the field, and the construction of unique sets of tubes.—*Philosophical Magazine*, October, 1922.

Asbestos Products as Dielectric.—W. S. Flight.—The author traces limitations imposed upon electrical machinery by the necessity of restricting temperatures to those at which the dielectrics employed suffer no deterioration. Results are given of tests, showing that by the employment of inorganic materials the limiting temperatures (now about 100 deg. C.) may be raised to 200 deg. C., with an increase in output per unit weight of machinery and a saving in cost. This account of the properties and possible uses of asbestos is followed by tests of asbestos insulating wire, asbestos paper, asbestos cement board and tests on various molded products formed from asbestos.—*Beama*, October and November, 1922.

Traction

Philadelphia Rapid Transit Greatly Augmented.—The city-owned elevated line to Frankford is now operated under a five-year lease by the Philadelphia Rapid Transit Company. The estimated annual traffic of this line is 33,000,000 passengers. A comprehensive description is given of the steel superstructure which carries the concrete floor upon which ballasted track is laid. The design was made with economy in maintenance as a prime consideration.—*Electric Railway Journal*, Nov. 25, 1922.

French Railway Begins Electrification Program.—A. H. Candee and L. E. Lynde.—After a careful investigation into the subject of electrification, the railroads of France have decided to electrify more than 5,000 miles of their tracks. The Paris-Orleans road is taking the initial step in electrifying approximately 145 route miles, including its main line from Paris to Vierzon. The fact that a complete steam division is to be electrified insures a direct comparison between operation by steam and by electricity, and it is expected that many interesting facts will be elicited.—*Railway Electrical Engineer*, November, 1922.

Telegraphy, Telephony, Radio and Signals

Effective Capacity of a Pancake Coil.—G. Breit.—The author calculates the effective capacity of a pancake coil and then verifies the calculation with two experimental cases. Typical equations are given for cases when the coil is grounded at the center, grounded at the periphery and when it is insulated.—*Philosophical Magazine*, October, 1922.

Construction and Operation of a Two-Circuit Radio Receiving Equipment with Crystal Detector.—The construction and operation of a home-made and inexpensive two-circuit radio receiving set employing a crystal detector is described in this circular. The cost of the materials need not exceed $15. The descriptions are elementary and explicit so that the set may be constructed by persons having no previous experience with radio.—*Circular No. 121 of the Bureau of Standards.*

Performance of a Radio-Telegraphic Transmitter.—Norman Lea.—The paper deals with the performance of a commercial type of 1½-kw. spark transmitter installed at the post office station at North Foreland, England. The electrical quantities in the various circuits are discussed, and experimental results are given which will enable a complete analysis of the losses to be arrived at.—*Proceedings of Institution of (British) Electrical Engineers*, Vol. 60, No. 312.

The Wave Antenna for 200-Meter Reception.—H. H. Beverage.—The antenna described is a new type of unidirectional antenna which has been developed by the author and engineers of the General Electric Company. This paper is confined to the elementary theory and practical considerations of this antenna. It considers the feed-back antenna, damping circuits, design of antenna and transformer, and gives a brief account of the resulting performance of this apparatus.—*Q. S. T.*, November, 1922.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Busbars, Mechanical Forces on.

We have recently completed an investigation of the mechanical forces on busbars, in connection with the design of the Queenston generating station. The work was undertaken because of certain disagreements between authorities as to the proper formula for calculating the mechanical forces. The particular problem was to calculate the stresses on busbar supports in the neighborhood of a tap connection to a transformer or oil switch.—*C. H. Van Asperen, Hydro-Electric Power Commission, Toronto, Ont.*

Corona Voltmeter for 300 Kv.

A high-tension voltmeter based on the corona principle (*A. I. E. E. Trans.*, Vol. 39, 1920, page 1057) was built in accordance with the specifications of its inventor, Dr. J. B. Whitehead. Its range is 50 kv. to 300 kv. effective. The containing tank is designed to withstand a pressure of 75 lb. per square inch. The point of corona formation can be observed (a) visually, (b) with telephone receivers, and (c) with a direct-current galvanometer. An accuracy of better than 1 per cent for the crest value is expected of this instrument.—*Hydro-Electric Power Commission Toronto, Canada.*

Demand, Volt-Ampere, Measurement of.

The commission's long-continued investigations upon the comparative theoretical merits of the various methods of determining demand have been for the present concluded, and a summary of the findings was published in the Annual Report for 1920. As an outcome of this investigation there has been carried out a study of the most praticable method of measuring volt-amperes as a basis for demand. Some interesting results have been obtained, and it has been found possible to measure volt-ampere demand on a commercial basis which is fair and satisfactory both to utility and user.—*Hydro-Electric Power Commission of Ontario, Toronto.*

Furnace, Arc, Regulation of.

In an arc furnace with two or more electrodes above the bath one of the main difficulties in operation is the proper regulation of electrodes. Automatic regulators are too expensive for small furnaces. The following simple device has been found satisfactory with a 300-lb. Héroult-type single-phase furnace for melting iron and steel. An ordinary 40-watt tungsten-filament lamp was connected between each electrode and the metal bath. The two lamps are lighted equally only when both arcs are exactly the same. If one electrode should touch the bath, its pilot light would be extinguished. Thus the operator simply regulates the arcs for an equal brilliancy of the two lamps.—*C. E. Sims, U. S. Bureau of Mines, Seattle, Wash.*

Lightning Arresters.

The publication of the operating data on several types of arresters in a paper presented before the Institute by D. W. Roper in November 1919, has apparently acted as a great stimulus to the designers and manufacturers of lightning arresters. At the present time three new types of arresters are being offered for service tests, and there will apparently be at least two additional types offered within another year. The development of equipment for testing lightning arresters with large capacity and steep wave front has been of great help in classifying the different types of arresters as to the relative protective value against surges.—*A. I. E. E. Sub-committee on Lightning Arresters.*

Poles, Wood, Preservative Treatment for.

An investigation has resulted in the confirmation of the previous recommendation of open-tank treatment.—*Overhead Systems Committee of the N. E. L. A.*

Reactors, Current-Limiting, High-Voltage.

A new high-voltage reactor has been developed for high-voltage tie lines. The windings are constructed and insulated in a manner similar to transformers and are immersed in oil contained in a steel tank. In order to get a straight-line volt-ampere characteristic, the iron cores are omitted, and to prevent the flux from passing into the tank and causing excessive losses a short-circuited winding is placed adjacent to the walls of the tank. In water-cooled reactors the copper cooling coils are utilized also for the flux shielding winding.—*A. I. E. E. Sub-committee on Current-Limiting Reactors.*

Relay for Storage Battery Reserve.

When a generator is driven by a prime mover whose speed varies within wide limits, it is necessary to have a storage battery which is automatically disconnected from the generator when the emf. of the latter is below the battery voltage. A sensitive relay with a stationary electromagnet and two movable coils has been developed which closes or opens a magnetic contactor switch between the generator and the battery.—*Franz Kaestner, Berlin, Germany.*

Speech and Hearing.

In connection with the telephone work, the following experimental investigations have been made: (a) The relative importance of various frequency ranges in spoken sounds; (b) the limits and other characteristics of the normal and impaired auditory sense, with application to aids for the deaf; (c) the minimum audible pressure variation of tones from 60 to 4,000 double vibrations per second, with the results of measurement on eighty ears.—*H. Fletcher and R. L. Wegel, Western Electric Company, New York City.*

Research in Progress

Cables, High-Tension.

Research is under way at the Massachusetts Institute of Technology on maximum permissible temperature, ionization in high-voltage cables, use of 1 per cent antimony in lead sheath (this item is carried over from last year in accordance with the recommendation in the 1922 report), limiting dielectric stress in high-voltage cables, additional tests of Hochstadter cable (long-time tests as recommended in 1922 report), dielectric strength tests of high-voltage cable, thermal resistivity of paper insulation, emissivity of lead, test for impregnation of high-voltage cable, relation between insulation resistance and dielectric strength, single-conductor cable for three-phase transmission, carrying capacity of transmission cable revision of cable specifications, fireproofing of cable and specifications for furnaces, torches, gloves, boots, lanterns, etc.—*Underground Systems Committee of the N. E. L. A.*

Circuit Breakers, Oil, Duty Cycle of.

The representatives of the Power Club, the N. E. L. A. electric apparatus committee and the A. I. E. E. protective devices committee are co-operating in attempting to clarify the basis for the interrupting capacity rating of oil circuit breakers. A fairly definite understanding has been reached on the following two points: (1) A duty cycle terminates with the breaker in the open position; (2) the condition of the breaker at the end of the duty cycle must be good enough to be capable of closing and carrying the full rated current. The question of the starting point of the duty cycle—that is, whether it should be the open or the closed position of the breaker—is still under discussion.—*B. G. Jamieson, Chicago, Ill.*

Oscillograph with Vibrators at Right Angles.

An oscillograph is under construction which is equipped with two vibrators at right angles so that currents varying according to two different functions may be photographed upon a stationary plate in rectangular co-ordinates. — *Massachusetts Institute of Technology, Cambridge, Mass.*

Relays, Further Study of.

The following questions have been docketed for future study: (1) Protection of high-voltage underground cables; (2) merits of split-conductor cable; (3) protection of generators, transformers, rotary converters, etc.; (4) special relay applications, for example in automatic and remotely controlled stations; (5) standard symbols to represent relays in single-line diagrams.—*A. I. E. E. Sub-committee on Relays.*

Apparatus Available for Research

Insulation, Thermal Conductivity of.

An apparatus is available for measuring the thermal conductivity of the insulation of a section of an armature coil. Heat is supplied at one end of the coil, and as heat is carried away through the insulation as well as lengthwise of the conductor, the temperature at the inner and outer surfaces of the insulation give an accurate means of determining the relative values between the insulation and copper as to thermal conductivity. These temperatures are measured by properly placed resistance coils.—*Hydro-Electric Power Commission of Ontario, Toronto.*

Suggestions for Research

Heating, Electric, of Water for Residences

An important loss of heat takes place in installations in which water is taken directly from the city mains. The stored hot water gravitates and siphons back into the mains. Perhaps a non-return valve could be inserted in the supply pipe and a safety valve fitted somewhere else in the domestic piping system.—*M. R. Meldrum, Niagara Falls, Ontario.*

Illumination in Tanning Industry.

Special illumination is needed for sorting and matching large numbers of individual skins into groups of one or more shades. There is no method of artificial lighting that has been found universally satisfactory for this purpose. *W. E. Broughton and J. J. Brophy in the A. I. E. E. Journal, September*, 1922.

Magnesium, Manufacture of.

The apparatus used in the production of magnesium is very similar to that used for aluminum and consists of a cell in which anhydrous magnesium chloride is kept in a fused state by direct current. The industry being new and the process intricate, many improvements are possible in the apparatus. Further investigation of the physical properties of magnesium is desired, with the view of its use in alloys. Magnesium has a much greater tensile strength than aluminum, and if the cost of manufacture can be reduced, it will replace aluminum in many alloys.—*N. E. L. A. Electrochemical Processes Committee.*

Radio for Central Stations.

Investigations into broadcasting service to the public through an existing central-station distribution system, carrier current on overhead high-tension transmission lines and radio application on large distribution systems for location of faults, energizing relays, etc., are suggested. *N. E. L. A. Electrical Apparatus Committee.*

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Astoria System Hit Hard

But Speedy Resumption of Electric Service Follows the Fire in That Oregon City

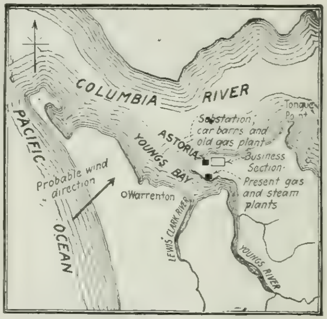
DESTRUCTION of the electric light and power distribution system in about thirty-five city blocks in the heart of Astoria, Ore., was caused on Dec. 8 by the fire which started at 2:30 a.m. and burned until noon. The loss includes that of the meters and transformers in the burned area, which comprised the main business section of the city and some residence blocks.

The part of the city destroyed was built principally on filled-in land, some parts of which have been filled to the street level, but the part which burned first was filled to within about ten feet of the street level. The paved streets in this section were supported on timber trestles, and the tunnel thus formed was used for electric light and telephone cables, gas and water mains and sewers. This tunnel construction provided a flue for the burning timber that carried the fire throughout the burned area in a short time, causing the failure of both the gas and water mains because of the loss of the supporting structure and the falling of the street pavement. The failure of the water supply in certain sections from this cause proved a serious handicap in fighting the fire. The railroad and steamship properties were separated from the burned area by means of a sea wall and were little damaged. The telephone system was destroyed throughout the burned area, but, owing to the very efficient response of that utility, service throughout the rest of the city was given the following day. At least fourteen blocks of street-railway track were destroyed and through service has since been interrupted. The gas system suffered many broken mains, but service was resumed the following day.

Energy in Restoring Service

The Pacific Power & Light Company owns and operates the street-railway, electric light and power and gas properties, and much credit is due the company for the promptness with which service was resumed by all these properties. Fortunately the main electric feeders for the burned district were on Boundary Street, just beyond the fire zone, and this area was soon cut off from the rest of the city. Many arc lights were back in service on the first night, and within twelve hours after the fire nearly every light and power customer outside the burned area was receiving uninterrupted electrical service. The new steam-electric plant and the Young's Bay gas plant, as well as the Astor Street substation, were outside the fire zone, but the local offices were burned. Virtually all the records, however, were saved.

It has been reported that the property loss of the Pacific Power & Light Company will amount to at least $175,000. The industrial district of the city was not harmed, but the entire commercial section was wiped out and no one has yet hazarded an estimate as to what the revenue loss will be to the various utilities.



SKETCH SHOWING VULNERABILITY OF ASTORIA TO FIRE

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Rumored Consolidation of San Francisco Companies

Rumors are current in the financial district of New York City that the Great Western Power Company of San Francisco has been purchased by the Pacific Gas & Electric Company. Up to the time of going to press the *Electrical World* has been unable to obtain any confirmation of this report in either New York or San Francisco.

◆

Northern States Power Gets Permit for St. Croix

At the meeting of the Federal Power Commission at Washington this week a preliminary permit was awarded to the St. Croix Falls Improvement Company, a subsidiary of the Northern States Power Company, covering the development of power on the St. Croix River in Wisconsin. The conflicting applications of the city of St. Paul and of Markham, Kelsey, & Druar, were denied.

Plans for A. I. E. E. Meeting

Midwinter Assembly in New York Will Include Many Notable Features

CHICAGO is to be linked in with the midwinter convention of the American Institute of Electrical Engineers, to be held in New York City from Feb. 14 to Feb. 17, by means of long-distance telephony and amplifying instruments. This contemplated joint session will take place on the evening of the first day, when there will be a paper on telephonic "loud speakers" and an illustrated lecture on European railroad electrification. The morning of that day will be devoted to registration, and in the afternoon, under the auspices of the transmission and distribution committee, papers will be presented on cable design, operation and tests, including a specialized discussion of dielectrics.

On Thursday, the second day, papers contemplated for presentation in the morning, under the auspices of the telephone and telegraph committee, will deal authoritatively with machine switching, transmission over long land cables, the use of alternating currents in ocean cabling and the use of wave antennas. In the afternoon papers of general interest are to be presented, including a discussion of railroad electrification. An interesting feature will be the demonstration of new kinematic devices applied to machines and transmission lines.

On Friday the morning session will be under the auspices of the electrophysics committee, and advances in the art will be described by **Dr. A. E. Kennelly**, **Dr. Carl Hering**, **W. D. Nottingham**, **Karl B. McEachron** and other specialists. In the afternoon a session is planned for the meters and measurements committee, which has prepared papers on the application of thermocouples, kilovolt-ampere measurements and new developments along the lines with which the committee is concerned.

The Institute dinner dance will be held on Friday evening, and visits of inspection are planned for Saturday.

Other Conventions Under Way

Preparations, it is announced, are well in hand for the other 1923 conventions of the Institute. The Pittsburgh meeting in April will accent transmission and distribution line practice and protection. For the June meeting at Swampscott, Mass., a complete discussion of railroad electrification is planned. At the Pacific Coast convention at San Francisco in September transmission-line, transformer and substation practice will be the dominating themes of the meeting.

Edison Medal to Millikan

Director of Norman Bridge Laboratory of Physics to Receive This Honor for 1922

THE EDISON medal for the year 1922 has been awarded by the Edison medal committee of the American Institute of Electrical Engineers to Dr. Robert A. Millikan of Pasadena, Cal., for "his experimental work in electrical science."

Dr. Millikan was born in Morrison, Ill., in 1868, is a graduate of Oberlin, class of 1891, and was granted a Ph.D. from Columbia in 1895. He also holds degrees from Berlin and Göttingen, Northwestern, Pennsylvania and Amherst. He took up the teaching of physics at Oberlin in 1891 and from there went to the University of Chicago, where he became assistant professor of physics in 1901, associate professor in 1907 and professor in 1910. In 1921 he became director of the Norman Bridge Laboratory of Physics at the California Institute of Technology, where he is also chairman of the administrative council.

Probably the best known and most noteworthy of Dr. Millikan's works are his so-called "oil-drop" experiments, undertaken for the purpose of making precise measurements of the fundamental electrical quantity. These experiments proved conclusively that all electrons are alike, and the results obtained have been of inestimable value in the calculations of physical constants.

Second only to the oil-drop experiments is his work on photo-electric effect and his measurement of the *h* constant, which has to do with growth and decay of photo-electric phenomena. This work is recognized as the best experimental check on some of the Einstein hypotheses. His more recent work has tended toward a definite bridging of the gap between light and X-ray phenomena.

Although Dr. Millikan's claim to recognition rests particularly on his experimental researches, his work during the war and in the formation of the National Research Council, on which he served as executive head, is particularly noteworthy. To Dr. Millikan is undoubtedly due a great share of the credit for whatever good resulted from the activities of America's scientists. He contributed not only from his own great store of knowledge but was a driving force in directing the activity of others. Dr. Millikan is also the author of numerous books on physics and has contributed largely to the technical press on the same subject.

Previous Recipients of the Medal

The Edison medal was founded by the Edison Medal Association, composed of associates and friends of Thomas A. Edison, and is awarded annually by a committee consisting of twenty-four members of the American Institute of Electrical Engineers for "meritorious achievement in electrical science, electrical engineering or the electrical arts." Previous awards of the medal, beginning in 1909, have been made to Elihu Thomson, Frank J. Sprague, George Westinghouse, William Stanley, Charles F. Brush, Alexander Graham Bell, Nikola Tesla, John J. Carty, Benjamin G. Lamme, W. L. R. Emmet, Michael I. Pupin and Cummings C. Chesney.

R. A. MILLIKAN

Cincinnati Meter Meeting Well Attended

There was an attendance of 123 at the open meeting of the meter committees of the National Electric Light Association, the Ohio Electric Light Association and the East Central Geographic Division, N. E. L. A., held at the Hotel Gibson at Cincinnati on Nov. 23. Of those present eighty represented public utilities and the remainder were visitors and representatives of manufacturers. B. W. St. Clair of the General Electric Company, using binocular and other microscopes, showed the effect of improper handling on meters and exhibited instrument jewels and pivots in various processes of manufacture. Fred Mort of the Westinghouse Electric & Manufacturing Company talked on the relation of the meterman to the central-station organization and the economic importance of the meterman.

A review of the development of the electric meter was given by W. F. Pyle of the Duncan Electric Manufacturing Company, and particular stress was laid on the factory checking methods that make possible the successful quantity production of watt-hour meters. M. I. Stein of the Leeds & Northrup Company talked on the selection of potentiometers for meter department work and emphasized the fact that practice has proved the principles laid down in the former edition of the "Meterman's Handbook." S. C. Henton, a past-chairman of the Ohio Electric Light Association committee, called attention to the value of the co-operative work between the various associations represented. D. J. Angus of the Esterline-Angus Company discussed the losses that should be measured in power houses and some recent installations designed for that purpose.

Federal Operation Needless

Kearns, Attacking Ford's Muscle Shoals Project, Also Opposes Dickinson Bill

ADVERTING to the bill introduced into the House by Representative Dickinson of Iowa, a member of the "farm bloc" and a former supporter of the Ford offer, to authorize government ownership and operation of the Muscle Shoals development, Representative Kearns of Ohio, who, like Mr. Dickinson, is a member of the military affairs committee, which handles the bills dealing with this project, gave out a statement the other day in which he expressed his satisfaction that "the truth in regard to the so-called Ford offer is finding the light." Mr. Kearns, however, went on to condemn the Dickinson bill as unnecessary and wrong in principle, saying:

"The advocates of the Ford offer urged the acceptance of it to save the government from government operation of the nitrate plants. The advocates of government operation of the nitrate plants urge that scheme to save the government from endowing Henry Ford with a government subsidy. Neither course is necessary. Congress has already provided sufficient funds to carry on the work of completing the Wilson Dam at Muscle Shoals up to September, 1923. Doubtless a further appropriation will be made by this Congress, available within the next fiscal year. That is all that need to be done about Muscle Shoals.

"The nitrate plants at Muscle Shoals are being maintained and would be available for the making of munitions of war if required. The Muscle Shoals properties are earning a substantial income from the lease of the government's steam plant unit on the Warrior River and the Sheffield steam plant. If the nitrate plants are to be used for fertilizer production, everybody who has any real information on the subject well knows that they cannot be so used until the completion of the Wilson Dam. It is practically a certainty that long before the Wilson Dam can be completed scientific knowledge in relation to the production of atmospheric nitrogen will be tremendously advanced. This is no time to make plans for nitrogen fixation which could not in any case be carried out for three or four years.

"The Ford propagandists have been diligent in getting to the public statements relative to the making of fertilizer at Muscle Shoals, but in none of these statements that I have read or heard have they told the farmers the truth about the Ford offer. Mr. Ford's proposition does not guarantee the manufacture of fertilizers, but he does have in mind, if he should get these properties and a hundred-year lease of the water power at Muscle Shoals, the carrying on of a gigantic manufacturing plant for his own selfish purposes. I cannot bring myself to believe that the government ought to finance his scheme for him.

"So far as government ownership and operation at Muscle Shoals is concerned, this administration has pledged to the people there shall be less government in business and more business in government."

Brooklyn Edison to Increase Capital Stock

M. S. Sloan, president of the Brooklyn Edison Company, has issued a notice calling a special meeting of stockholders to be held on Dec. 22 for the purpose of authorizing an increase in the company's capital stock from $30,000,000 to $50,000,000. The board of directors has recommended the increase so as to provide for an issue of stock to meet the cost of additions made and to be made to the company's properties. Application has been made to the Public Service Commission for authority to issue the capital stock for such purposes. All the stock issued as a result of the proposed capital increase will be offered to the stockholders for subscription.

Cities Service Company May Declare Stock Dividend

A special meeting of stockholders of the Cities Service Company has been called for Dec. 28 to consider increasing the amount of common stock from $100,000,000 to $400,000,000, at the same time calling for expressions of opinion as to the advisability of declaring part of this increase as a stock dividend. According to a circular sent out by Henry L. Doherty, president of the company, the suggestion has been received that book surplus be declared out as a stock dividend and further that a stock dividend be declared sufficient to make the outstanding stock approximately equal the property values.

"Many corporations having large surpluses," the circular says, "have deemed it advisable to declare out such surpluses in the form of stock dividends, while others have definitely decided not to do so. However, the preponderance of opinion is that capital obligations should be made to equal property values as nearly as possible. It is understood that some of the corporations that have not as yet taken action intend to do so before Dec. 31, but deem it wise to defer action to the latest possible date in order that they may be guided by anything that may be developed by the heated discussion of the question which is now on, and have the benefit of any court decisions bearing on the subject that may be handed down in the interim. It is also their wish to take into consideration public opinion, which is now rapidly crystallizing, as it will have a decided influence on future legislative action."

$100,000,000 Capitalization for Commonwealth Edison

Announcement has been made by Samuel Insull, president of the Commonwealth Edison Company, Chicago, that the stockholders of the company will be asked on Feb. 26 next to vote an increase of the authorized capitalization of the company to $100,000,000. This is to care for future expansion of the company's business. The first steps were taken in this direction last week when the directors voted to issue $12,000,000 additional 8 per cent capital stock which will be offered to shareholders at $100 par on the basis of one share for each five now held. This issue will bring the total outstanding stock to $72,000,000, with $80,000,000 authorized. The offer is open to stockholders of record on the company's books at 1 o'clock Dec. 23, and the subscription books will close at 5 o'clock Feb. 1. Stockholders may pay for the new stock either in a single payment on or before Feb. 1, in four installments beginning on that date and ending with Nov. 1, 1923, or in ten monthly payments starting with Feb. 1 and ending Nov. 1. Interest will be paid on all installment payments at the regular dividend rate of 8 per cent.

In a statement supplementing the announcement Mr. Insull indicated that the new issue is simply a step in the regular financing occasioned by the construction program that will enable the company to accept and care for the great amount of new business offered it. Mr. Insull implied that it was the intention to make use of junior securities to a considerable extent in financing the additional facilities and that he believed the volume of business would continue its present rate of increase four or five years at least, which is as far ahead as he thought any one should venture to look.

Water-Power Project in Northeast Tennessee

The application of the Holston River Power Company to the Federal Power Board for a preliminary permit covering the development of three power sites on the Holston River in northeast Tennessee marks the entry into the field of projected development of a promising power area on the upper tributaries of the Tennessee River. The development of power in this region has not been attempted heretofore because of the lack of an industrial or utility load. It is believed, however, that northeastern Tennessee's power resources will be developed with a fair degree of rapidity as has been the case during the last fifteen years with relatively small water powers in North Carolina and in other sections of the South.

The moving spirit in the Holston River project is J. R. Paull of 52 Wall Street, New York, who is the president of the newly organized Holston River Power Company. Mr. Paull is an official of the Clarion River Power Company and is an experienced judge of the possibilities of water-power development. It is the intention of the company to install an aggregate of 75,000 hp. at the three sites which are included in the project.

The power resources of northeastern Tennessee are covered in the recent report made to Congress by Major H. C. Fiske, the district engineer officer with headquarters at Chattanooga.

St. John, N. B., Plans Municipal Electric System

Refusal of the New Brunswick Power Company to sell its plant to the city of St. John for an amount fixed by the Supreme Court as representing the valuation of its property in 1920 has been followed by active steps toward development of municipally controlled electric service. The City Council has appointed a permanent hydro commission of seven members, with power to erect and operate an electrical distribution system.

It is planned to have this system parallel that of the power company. Power will be obtained from the provincial government's hydro-electric plant at Musquash, the government having authorized a contract for delivery of power to the city. The City Council did not accept any of the four compromise proposals of the power company, the bonds of which are largely held in the United States.

Massachusetts Commission Asks for New Laws

Recommendations for legislation have been filed with the Secretary of State of Massachusetts by the Massachusetts Department of Public Utilities which renew requests made last year but not acted upon. The proposed laws include one to forbid two public utility companies from making contracts with each other when the same persons are officials of both companies and one to forbid public utilities from depositing their funds with private banking houses. The commission also asks for authority to enter premises for the examination of electric light meters. The present law, enacted in 1920, permits the commission to enter for the examination of gas meters.

Among the changes recommended in the "blue sky" law regulating the sale of securities are the following: Giving the commission power to require the suspension of the sale of securities within the seven-day period allowed between the time of filing notice of intention to sell and the filing of the statement now required; authorizing the commission to require special reports upon companies by engineers or accountants at the expense of the companies; authorizing police officers to arrest without a warrant any person who is believed to be violating the blue sky law, and eliminating a defect in the law governing revocation of licenses of stock brokers and stock salesmen.

Kentucky Men for Good Public Relations

This Proves the Dominating Theme at Lexington Convention of Public Utilities Association—Separate Meeting Conducted and Attended Solely by Women an Innovation

MOST of the speeches and papers at the convention of the Kentucky Association of Public Utilities, which met in Lexington, Ky., on Tuesday of this week, dividing its sessions between the Phoenix Hotel and the University of Kentucky, had as their keynote the importance of fostering good relations between the service companies and the public. One hundred and seventy-eight delegates were registered, and the convention was the most successful yet held. A noted feature was the women's meeting in the afternoon held at the university, when addresses were made to the women teachers and students by Miss Frances Jewell, dean of women; Miss Virginia Anderson, instructor in the College of Engineering; Mrs. Florence A. Tate, chairman of the women's public information committee, East Central Division, N. E. L. A., and Miss R. E. McKee, chairman of the same committee for the Great Lakes Division.

E. F. Kelley, secretary of the association, presented his report, in which he emphasized the value of newspaper publicity, urging that facts be given to the reporters—not attempts at propaganda.

President L. B. Herrington in his address alluded to successful customer-ownership campaigns carried on in the state during the past year. He urged that the work of the publicity bureau of the association be extended. Speaking of the suspicion that still lurks in the minds of some members of the community, he said: "We shall never be able to get all the people on our side, but if we continue to take the people into our confidence, if we patiently explain our problems to them, if we are careful about the safety of our employees and the public, if we give good service, if we charge reasonable rates, if we select competent and courteous employees, if we show a progressive and industrious spirit, if we give our customers an opportunity to become partners with us in the business, we shall gain the respect, confidence and good will of the large majority of the people."

PUBLIC RELATIONS PARAMOUNT

W. B. Fisher, secretary of the Louisville Home Telephone Company, was unable to attend owing to illness, and his paper on "Proper Relations Between Utilities and the Public an Asset" was read by the secretary, who also read the papers of Charles N. Manning, president of the Security Trust Company, Lexington, on utilities as community builders, and Brainard Platt of the Louisville *Courier-Journal* and Louisville *Times*, on "What Is News with Relation to Public Utilities?" Mr. Platt dwelt on the distinction between news and advertising.

Donald McDonald, vice-president of the Louisville Gas & Electric Company, talked on "The Public Servant," utilizing as texts "The servant is worthy of his hire" and other Biblical sayings, from which he drew the moral that, while the utility should take care to be a good servant, the public on its part should take care to be a good master.

James P. Barnes of the Louisville Railway Company presented a good paper on "Internal Public Relations," showing that the internal as well as external organization must be right.

AT THE UNIVERSITY

Dr. Frank L. McVey of the University of Kentucky opened the joint session with the students in the chapel of the university and introduced Samuel Insull, president of the Commonwealth Edison Company of Chicago, who talked for youth, telling of "Tom" Edison's early efforts back in the seventies and eighties and tracing developments down to the present day. He held that opportunity for the young man today is greater than it was in those days for the man who is willing and ready to make necessary sacrifice in order to succeed.

The afternoon session opened with a talk by F. Paul Anderson, dean of engineering, University of Kentucky, on the proper training of the right men for public utility work. He said that with a combined academic and technical training men were better suited to become high executives than with merely a technical training.

A. S. Nichols, general manager of the Paducah (Ky.) Electric Company, speaking on the topic "Looking Forward," held that before the public can be educated utilities must first educate themselves. Mr. Nichols dwelt on certain conditions existing between utilities and consumers which work against good will. W. S. Cramer of the Lexington Water Company talked on "The Foundation of Public Service."

A resolution was passed protesting against any change in the present tax laws of Kentucky, which were declared to be the best ever enforced, even though the utilities were unjustly taxed by them on both capital and franchise.

The Lexington utilities were hosts on Monday evening at a dinner given to the association. President Herrington was toastmaster, and the speakers included Dr. McVey, George R. Hunt, attorney, and A. D. Harmon of Transylvania College, at Lexington.

THE NEW OFFICERS

These officers were elected for the ensuing year: President, W. H. Horton, Covington; first vice-president, J. P. Pope, Lexington; second vice-president, J. P. Barnes, Louisville; treasurer, P. S. Pogue, Louisville; secretary, E. F. Kelley, Louisville. The new executive committee will comprise John G. Stoll, Lexington; Donald McDonald, Louisville; A. S. Nichols, Paducah; L. B. Herrington, Louisville, and H. J. Cochran, Maysville.

Loose Plea Likely to Fail

Probable Rejection of Sixteen-Year-Old Application for License to Develop Water Power

FROM the evidence submitted at a hearing held on Dec. 11 before Secretary of War Weeks it is very apparent that the Federal Power Commission will not grant the application of C. E. Loose for permission to develop a power project on the East Walker River in California. Senator Smoot of Utah appeared in behalf of Colonel Loose's application, while Senator Pittman of Nevada was among those who appeared against it.

The opposition to the Loose application comes from the Walker River irrigation district, where the farmers would be forced to obtain water at a much greater expense if they were precluded from using the reservoir site covered by the application. Power is available from the two transmission lines which already cross the region, and it is contended that there is no urgent need for the development of additional power, whereas the cultivation of 25,000 acres of land depends on the site being devoted to irrigation.

The main significance of the Loose case is that it affords a pointed example of how private capital is lost and enterprise discouraged by governmental delays. Colonel Loose applied for permission to develop this site in 1906. Since that time he has expended $150,000 in connection with the project. A considerable portion of the sum, it is true, was expended for legal services, but large amounts were expended for land and engineering investigations. In his presentation of his case before Secretary Weeks Colonel Loose pointed out that he had grown old waiting for a decision from the federal government as to this project. For more than sixteen years the matter has been before the government without any decision for or against him. Conditions in 1906 were such that power from this site would have been a great factor in the development of the region. Now conditions have changed.

Councilmen of Los Angeles Want Company's Plant

Five members of the Los Angeles City Council voted recently for a resolution asking the California State Railroad Commission to fix a valuation on the electric plant of the Los Angeles Gas & Electric Corporation as a first step toward acquisition of that plant by the city. These councilmen maintain that the purchase of the plant would save a million dollars annually to users of light and power and thousands of dollars additional in costs of litigation. The resolution was passed.

Kaukauna Has an Electrically Heated Building

The electrically heated administration building at Kaukauna, Wis., though not completed, is in a state to provide quarters for both the post office and the electrical and water departments of the city. The building will not be finished until about March 1, and it will cost about $140,000. Building plans provide room for other city departments.

The electrical equipment in this two-story building has a total capacity of 304½ kw., with three 75-kw. transformers stepping down a transmission voltage of 2,300 to 230. There will be twenty-two heaters on the ground floor and twenty-five on the second. These heaters are rated at from 2 kw. to 5 kw. and are recessed into the walls. An indirect electric radiator of 75-kw. rating is mounted in the fan room. Steam boilers are installed to provide heat should electrical service fail. The electrical equipment was provided by the Electric Heating & Manufacturing Company of Seattle, Wash.

Federal Power Commission on Navigability

The annual report of the Federal Power Commission, lately issued, gives the following explanation of its ruling that the Menominee River, which forms part of the boundary between Wisconsin and Michigan, is non-navigable:

"The question of navigability is not one of fundamental formulas, and there is no more probability that it can be removed from the domain of individual judgment than that our laws in general can be drawn with such precision that the services of the courts in their interpretation can be dispensed with. The Menominee is technically navigable, but owing to the fact that the laws of the states afford full protection to its commerce and the proposed dam would not obstruct it, the commission made formal finding that the river was not navigable."

Byllesby on Relations of Banker and Engineer

The relationship that should subsist between the banker and the engineer was the topic of Col. H. M. Byllesby before the Western Society of Engineers at Chicago last week. Among other things Colonel Byllesby said:

"The engineer may dream himself into starvation over plans and projects which may be of the most far-reaching, profitable and, withal, beneficent nature, but unless he is able to interest and to command the services of the financier the engineering work will not be produced.

"As a rule only a part—a small part frequently—of the total amount of money provided for a given engineering work at the financier's hands is supplied by himself. In fact, the professional finders of money for engineering projects—even the largest banking houses—find it necessary, in order to enable them to continue to finance new projects, to distribute among their clients, the great army of investors, the stocks or bonds which in the first instance they purchase. The financier operates at least 80 per cent with the money of his clients.

"A feature which is making the financing of projects increasingly difficult is the extent to which various state governments are interfering with the conduct of corporations and the extent to which in other cases the federal government is increasing the weight of its paternal hand upon such enterprises.

"A certain amount of regulation is necessary, but the regulation which goes too far is destructive to real progress. While it may hold back a relatively few men or corporations immorally disposed, it prevents useful and profitable employment of many others whose work would be beyond criticism."

Yale Broadens Engineering Courses

Lectures by prominent engineers are being made part of the program of development of the engineering courses in the Sheffield Scientific School of Yale University along broader cultural lines. These lectures will deal with the engineering profession as a whole—with its history, opportunities and obligations, its attitude toward public and private needs, its notable achievements and kindred topics. Special lecturers are being chosen both for their knowledge of engineering and for their experience in dealing with public problems. The first lecturer was John Hays Hammond. The second was L. W. Wallace, executive secretary of the Federated American Engineering Societies, who spoke at Yale on Tuesday last, his subject being "The Engineer in Industry."

Fuel Shortage Affects Southern Systems

Customers Using Secondary Power Have Had Their Supply Curtailed and Many Large Users of Primary Power Are Being Rationed Until Copious Rain Shall Relieve the Situation

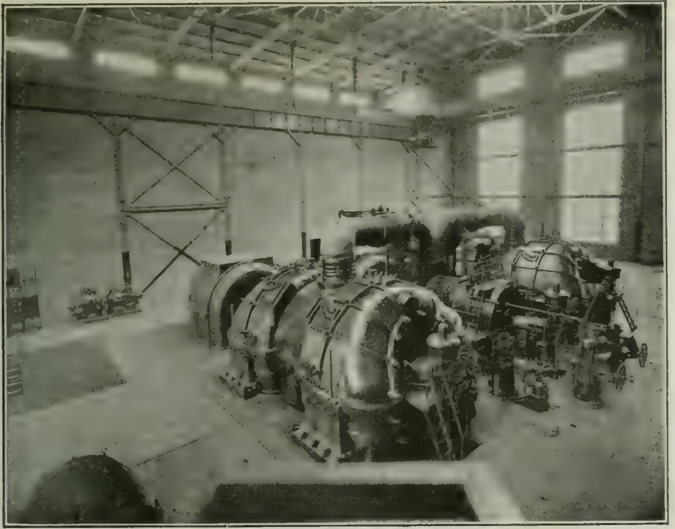
OWING to drought and serious curtailment of coal supply many of the central-station companies in the Southern section of the country have been brought face to face with a serious power shortage. In the Carolinas in particular it has been necessary to cut off secondary power customers and greatly to diminish the supply of power to primary customers. On that account the National Fuel Administrator has been importuned by the Southern power companies to come to their assistance by seeing that an emergency supply of fuel is available at the Sheffield plant leased by the Alabama Power Company from the national government.

As is well known, the states of Georgia, Alabama, North and South Carolina and Tennessee are operated electrically on a superpower zone system so arranged that any one of the large power companies may take or give electrical energy as occasion arises. The Georgia Railway & Power Company is the connecting system between the large steam reserve plants of the Alabama Power Company and the great transmission systems in the Carolinas, central Georgia and Tennessee.

Normally the system of the Georgia Railway & Power Company generates for its own purposes an excess of 1,000,000 kw.-hr. a day and during the period of drought transmits to the neighboring companies from the plants of the Alabama Power Company approximately 500,000 kw.-hr. a day. Fifty-two cities and towns in north Georgia are dependent upon the Georgia Railway & Power Company for their electricity, and in all of these except one the water for both domestic and fire uses is pumped electrically with energy supplied from the company. In addition, more than 200 large industrial plants are connected to the company's system and 1,500 small manufacturing establishments with loads of 100 hp. and less.

The Georgia company is operating every horsepower of steam equipment that will turn over and has cut off many of its large customers, who are

GOVERNMENT PLANT AT SHEFFIELD LEASED BY ALABAMA POWER COMPANY



INTERIOR OF SHEFFIELD PLANT

now operating their own steam equipment at the expense of the Georgia company, in order to tide over the emergency. Out of a total water storage equivalent to 70,000,000 kw.-hr., a supply sufficiently ample to have taken care of any normal drought, the Georgia company has only 10,000,000 kw.-hr. of water storage remaining. If the superpower system is to function, this 10,000,000 kw.-hr. of water storage must be retained for the use at the plant at Tallulah Falls, which is operated to capacity for a short period each day when the peak load comes on.

The part played by the steam plant at Sheffield, Ala., is very important as it affects operation over the entire system. It is pointed out that in addition the supply of ample fuel at Sheffield will conserve the fuel resources of the South in a very marked degree. The plant there is of recent construction and is highly efficient. It is possible to produce a kilowatt-hour on less than 2 lb. of coal at this plant, and if the station cannot continue to operate, it will be necessary to operate steam plants in other sections that are incapable of producing a kilowatt-hour on less than from 4 lb. to 6 lb. of coal. Moreover, the coal haul at Muscle Shoals is not more than 50 miles, while the coal haul to other plants, in the event that the Sheffield plant shall be forced to shut down, will, on the average, be well in excess of 200 miles.

The Carolina Power & Light Company and its subsidiaries supply forty different towns and cities in central and eastern North and South Carolina. In these towns and cities are fifty cotton mills, employing some 860,000 spindles. During the year 1921 this section was visited by a severe drought, with the result that the power supply had to be curtailed for a considerable period. Finally it was concluded that it would be practicable to relieve this situation if the government plant at Sheffield could be leased. This was accomplished last year, and the effect was very marked on the supply of energy in the Carolinas because of the energy pumped into the interconnected system from the Sheffield plant in Alabama.

Because of the general power shortage in the South the Sheffield plant was put into operation on the first of September this year after a renewal of the contract by the Secretary of War, and the North Carolina companies, being short of power, have been supplied with 5,000 kw. during the daytime and up to as much as 20,000 kw. during the night. On account of the present difficulty in obtaining fuel, the night supply has been cut to 7,000 kw.

At the present time the Carolina companies are producing the maximum power possible in their plants, both steam and hydro-electric, so that any curtailment in the power received from the Sheffield plant in Alabama will necessitate curtailments to the cotton-mill industry. The steam plant at Sheffield, as is well known, forms part of the Muscle Shoals plant owned by the government. It contains a 60,000-kw. steam turbine set, but the station is not operated to maximum capacity owing to the fact that the transmission circuits are only capable of carrying from 30,000 kw. to 35,000 kw. This energy is being distributed over the interconnected system traversing Tennessee, Alabama, Georgia, South Carolina and North Carolina. In the *Electrical World* of Dec. 2 attention was directed to the five-day service forced by the drought on the customers of the Southern Power Company.

Federal Board Personnel

Another Effort to Be Made to Authorize Power Commission to Employ Its Own Staff

WATER-POWER development and the operation of the water-power act have reached the point where, it is believed, Congress cannot longer decline to consider legislation authorizing the Federal Power Commission to employ its own personnel. The work before the commission is such that a considerable number of high-class engineers must be added to its staff if valuations are to be undertaken and engineering investigations made. At present the commission is drawing its personnel from the Departments of War, Agriculture and the Interior—the three government agencies directly concerned with the use of the streams for power-producing purposes—but no department in Washington will loan as many persons as an outside agency requests, and even those that are transferred are relinquished reluctantly.

There is another outstanding difficulty in attempting to operate with a borrowed force. It is impossible to exercise the same control over personnel when the allegiance is vested elsewhere. This tends to cause difficulties in organizing and carrying out the work and makes it difficult to get a well-balanced staff.

Arguments in Opposition

Although the same argument which was brought forth early in the life of the water-power act unquestionably will be presented again in opposition to an amendment which will authorize the commission to hire its own staff—the fear that a great regulatory body like the Interstate Commerce Commission would be built up—it is believed that this fear has been largely set at rest by the manner in which the commission has been conducted and by the trend of the development of the industry. The main opposition will be based on the ground that the only genuine interest which the federal government has in the matter of water-power development comes from obstructions which necessarily must be placed in navigable streams and from the use of government lands. Those interests are in the custody of the three departments mentioned. Some believe a better relationship with those departments can be maintained if the power commission's personnel is drawn from them. There is also the matter of the economies which can be effected because of the field forces already maintained by the existing departments. With the possible exception of the San Francisco districts, the field forces of the three departments concerned probably would be able to handle the commission's work without additional cost.

Legislation will be asked also which would bring all the existing projects under the Federal Power Commission. A number of enterprises are operated under permits granted before the Federal Power Commission was established.

Pacific Jobbers Hear Optimistic Forecasts

The regular quarterly meeting of the Pacific Division, Electrical Supply Jobbers' Association, was held at the Hotel Coronado, Coronado Beach, Cal., on Dec. 7, 8, and 9. At an open meeting on Saturday morning S. M. Kennedy, vice-president in charge of public relations and service of the Southern California Edison Company, spoke on electric business development for 1923. He said that his company will bring in 125,000 hp. of additional energy next year. The sale of this power in the districts served by the company means that there will be about 30,000 new residential consumers and approximately 57,000 hp. in motor load added. He estimates that 30,000 new residential consumers will spend $15,000,000 for ranges, water heaters, appliances, wiring, meters, services and distribution lines. Of this amount, $6,000,000 will be for labor and $9,000,000 for material. Motors and wiring will represent an expenditure of $1,140,000. The jobbers and dealers are very much interested in the $18,000,000 of the total of $30,000,000 which will be spent for materials and supplies by the customers and the company itself in carrying out this program. Mr. Kennedy's estimates show that the company must sell 1,500 ranges and 500 water heaters, representing an investment by the consumers of $400,000. So far as the sale of the ranges and water heaters is concerned, he feels that an accepted policy is necessary. These will be sold largely through the contractor-dealers, but the company will assist in the financing of the sale and the installation where necessary. The arrangements will be such that the dealer can buy ranges and water heaters and make the same profit that the company will make on direct sales to the customer. Sixty additional salesmen have already been put out in the field to carry out this sales program.

A. W. Childs, commercial manager of the same company, outlined the range and water-heater campaign in greater detail. He feels that the sale of appliances can be handled by the contractor-dealers, but that, owing to the inability of the dealer to finance range and water-heater sales, the company will have to get behind this campaign to carry it through successfully.

H. W. S. Berry, sales manager of the Western Electric Company at San Francisco, spoke on the work of the Society for Electrical Development to arouse more interest among the jobbers, manufacturers and central-station men on the Pacific Coast.

California Co-operative Campaign's Plans for 1923

Plans for the work of the California Co-operative Campaign for 1923 were discussed at a meeting of the advisory committee held at the Hotel Coronado, Coronado Beach, Cal., on Dec. 7. Robert L. Eltringham, manager of the campaign, said that through larger appropriations which have been asked for 1923 the work of the campaign will be very much enlarged. The work will be directed along two major lines, education within the industry and education of the public. Those within the industry must themselves be more thoroughly convinced of the merits of electrical appliances before they can expect to convince the public that it should use them.

Ten "electrical homes" will be exhibited during the year, five in the north and five in the south of the state. High-class woman demonstrators will be employed by the campaign to show these homes. At the beginning of 1922 an average of two convenience outlets to each new home built were installed. Now the average is one and a quarter to each room. This shows what can be accomplished through properly directed publicity. The campaign for convenience outlets and better wiring in the home will be pushed with even greater effort during the coming year. Ten illuminated billboards will be erected along the main arteries of travel of the state to tell the message twenty-four hours a day. Charts are being prepared to show what each convenience outlet means to each branch of the industry. This will be expressed in terms of the increased kilowatt-hours used and the value in dollars and cents of the additional wiring and appliances sold.

It is also planned to lay particular stress on the campaign for better store and window lighting. A portable window-lighting exhibit is being made up which will be moved from place to place for giving demonstrations to store owners, managers and employees. A survey made this year by the field men of the California Co-operative Campaign indicates that there are possibilities in this field little realized by those in the industry. An appropriation of $65,000 has been asked for to carry on all branches of the work for the coming year.

San Diego Electric Club's Activities

A campaign to stimulate the giving of electrical Christmas gifts has been put on by the Electric Club of San Diego, Cal. Colored posters printed on cloth a yard square are carried by all automobiles used in the electrical industry, and similar signs printed on paper are used in windows, bearing the words "Give electrical Christmas gifts." Large buttons bearing the same words are worn by those engaged in the industry. Five thousand smaller buttons were distributed to the schoolchildren to carry the message into the homes. One thousand dollars is being spent in co-operative advertising, and all stores are carrying attractive store and window displays. The plan was considered so good by the California Electrical Co-operative Campaign that it has been carried to San Francisco and Los Angeles.

Calvin W. Rice Describes South American Trip

At a business session of the American Society of Mechanical Engineers held in connection with the New York convention last week Calvin W. Rice, the society's secretary, delivered an address on his recent visit to South America, where he participated in the international engineering congress held in connection with the Centennial Exposition at Rio de Janeiro, Brazil.

Mr. Rice said that three definite steps had been achieved toward unity of the Americas, North and South. "First," he said, "action has been taken toward effecting a permanent organization to carry out the plans of the congress at Rio; second, a standardization bureau, as suggested by Secretary of Commerce Herbert Hoover, is to be established in every American country; third, the dream of a transcontinental railway is approaching the stage of reality. A meeting to further this project will be called by the nations of Pan-America."

General Beach Reports on Wilson Dam

Expenditures on the Wilson Dam at Muscle Shoals will be made at the rate of $625,000 per month until September of next year, when the existing appropriation available will have been exhausted. This information is contained in the annual report of the Chief of Engineers, which was submitted to Congress on Dec. 4. With regard to the power house, General Beach says:

"The work of exploration in the south abutment was continued by driving horizontal tunnels and by drilling well holes. The lower tunnel was extended about 500 ft., and the upper tunnel about 600 ft., making the total length of the former about 825 ft. and of the latter about 980 ft. About 230 ft. of intermediate tunnel and upraises were driven and about 900 ft. of well hole drilled. Conditions proved to be about as expected. Practically all of the machinery for the first four units was received from the contractors and unloaded and stored in a shed constructed therefor."

As to the condition of the project at the end of the fiscal year, General Beach says:

"All preparatory work in the nature of camps, roads, railroads, plants, shops, etc., is completed. Earth excavation for the lock is 90 per cent completed and rock excavation 18 per cent. About 66 per cent of the excavation and foundations for the dam are completed and about 35 per cent of the concrete placed. About 48 per cent of the excavation for the power house section is completed and approximately 4.6 per cent of the concrete placed. The work as a whole is about one-third completed. The total expenditures on the existing project have been $16,557,687.17, of which $16,281,759.65 was for new work and $275,927.52 for maintenance due to cessation of work."

Ohio Power Company's New Generating Station

Details concerning the generating station which the Ohio Power Company is preparing to build at Philo, 14 miles south of Zanesville, on the Muskingum River, have been reported. They indicate that the station will be started with two generating units rated at 35,000 kw. each and will have an ultimate rating of 250,000 kw. The Philo generating station will be tied in by high-tension lines with the other properties of the American Gas & Electric Company and is designed to form part of the superpower system of the Middle West. The station will cost approximately $20,000,000, including the transmission lines, and will be larger than the Windsor plant owned by the same company near Wheeling, W. Va.

In addition to this plant at Philo, the Ohio Power Company, through its holding company, is taking over the electric light and power system at Lima, Ohio. The main source of the energy to be distributed and sold at Lima will be the new plant on the Muskingum River. The transmission line from that plant will extend in a westerly direction and interconnect with the present north and south line of that company between Newark and Fremont. The line to be built from Philo to Canton, connecting up the present Sunnyside substation, will be operated at 132,000 volts and will give the company the advantage of connections with other light and power companies which are tied in with the Windsor plant.

The Ohio Power Company has improved its property at Canton and has also completed a 22,000-volt extension line south of Canton which takes in several small communities.

Another Large Electric System for Indiana

Gary is to become the headquarters and center of one of the largest electric lighting and power systems in Indiana, according to an announcement to the effect that heads of the Gary syndicate which controls the Calumet Electric Company have acquired ownership and control of the Wanatah-La Crosse Electric Company and have organized the Consumers' Electric Company. The Wanatah-La Crosse system covers the entire eastern part of Laporte County, while the Calumet Electric Company covers most of Porter County and half of Lake County. With the extensions already planned the major portion of three counties will be covered. A connecting power line will be built from Flint Lake to a point near Wanatah where the line will connect with the Wanatah-La Crosse system and operate the purchased system and the connecting line. Rural lines will extend both north and south from the connecting line.

The Consumers' Electric Company and the Calumet Electric Company are to be operated under the same management and will virtually be one system, with general headquarters at Gary. The operating energy for the entire system will come from the Northern Illinois Public Service Company's plant at Blue Island, Ill. The Wanatah-La Crosse system has been obtaining its energy from the Laporte Electric Company. Charles Chase, president of the Gary Street Railway Company, the Gary & Valparaiso Railway Company and the Calumet Electric Company, will become president of the Consumers' Electric Company.

Activities of Federal Power Commission

Favorable action toward granting a license to the Wyoming Power Company for a constructed project on Bighorn River, near Shoshone, Wyo., was taken by the Federal Power Commission at a recent meeting. Granting of the license had been protested by John T. Clarke, but the commission decided that the legal rights of the protestant would not be affected by issue of the license.

The commission has received an application from the Pigeon River Lumber Company of Wisconsin Rapids, Wis., for a preliminary permit for five power dams within 15 miles just above the mouth of the Pigeon River, which would develop approximately 40,000 hp. The Imboden Hydro-Electric & Manufacturing Company of Imboden, Ark., has applied for a license for a diversion dam, canal and power house in Spring River, near Imboden, Ark., to develop 2,400 hp. for public utility use. The Kaweah Molybdenum Mines Company of San Francisco has applied for a preliminary permit for a dam, pipe line and power house in the Kaweah River, in Tulare County, Cal., to develop 250 hp. for mining.

Plan to Electrify Boston's Railroad Terminals

A bill authorizing the incorporation of the Boston Rapid Transit Company, for the purpose among other things of financing the electrification of the railroads entering the North and South Stations in Boston, has been filed in the Massachusetts House of Representatives. Under the terms of the bill the transit company is authorized to issue stock to the amount of $100,000,000, with the right to increase the amount.

The new company offers to electrify the Boston & Maine, Boston & Albany and New York, New Haven & Hartford Railroads for a distance of 15 miles from the State House. It is proposed to extend the Highland circuit of the Boston & Albany through a proposed union station in the Back Bay and thence, by subway or otherwise, to the Boston, Revere Beach & Lynn terminal, also connecting with the Boston & Maine at the North Station.

Brief News Notes

Wisconsin Votes by More than Two to One Against Increasing Debt to Purchase Utilities. — Official figures show that the constitutional amendment submitted to the voters of Wisconsin at the November elections allowing cities to increase their debt limit to 10 per cent of their assessed valuation for the purchase of public utilities was defeated by a vote of 212,857 to 103,352.

Louisville Utilities to Maintain City Commission.—At a recent meeting of the City Council of Louisville a bill was passed under which the Louisville Gas & Electric Company, like the three other local utilities, will pay $10,000 a year toward the upkeep of a commission which will check their operations and furnish information to the city relative to operating costs. The utilities are said to favor this plan as a basis of rate making.

New Jersey Public Service Corporation Reduces Rates.—The directors of the Public Service Corporation of New Jersey have voted to reduce the unifrom electric lighting rate and the uniform retail power rate, effective with December sales. This will result in a saving of at least $1,600,000 a year to consumers. More than 99 per cent of all the corporation's customers will be affected. The new base rate will be 9 cents a kilowatt-hour instead of 10 cents, with corresponding cuts in the second, third and fourth steps of the lighting rates.

Status of Ship Electricians Discussed.—A plea for the recognition of electrical men serving on ships as officers was made by G. A. Pierce, Jr., chief electrical engineer of Cramp's shipyard, at a recent meeting of the New York Section of the A. I. E. E. Particularly necessary, Mr. Pierce said, is a change in the rules of the United States Steamboat Inspection Service, which make it obligatory for the electrical man on shipboard to sign on as an oiler. Steps must be taken, in the opinion of Mr. Pierce and others who took part in the discussion, to give electricians a definite standing and a commensurate rate of salary and to enable them to obtain licenses, preferably as engineer officers.

Ohio Utility Purchases Three Plants. —The Ohio Service Company, Coshocton, Ohio, has purchased the Sugarcreek Light & Power Company, the Zoar Battery Company, including the water-power plant, and the Cadiz Electric Light & Power Company. The Ohio Service Company has also obtained operating franchises in Scio and Jewett. It is adding a new boiler room with coal bunkers and coal-handling equipment to its New Philadelphia steam plant No. 2. The following transmission lines will be constructed: A 12-mile, 33,000-volt line from New Philadelphia to Sugarcreek; a 4-mile, 13,000-volt line between Strasburg and Zoar, and a 26-mile, 33,000-volt line between Dennison and Cadiz through Conotton, Bowerston, Jewett and Scio.

Barcelona to Have International Electrical Exposition.—An "international exposition of electrical industry" is to be held in Barcelona, Spain, in 1924, according to an announcement just issued by its promoters. An admirable site in the center of the city has been selected for the show, which is to be advertised extensively in foreign countries. Particulars can be had by addressing Bureau de l'Exposition, 2 Rue de Lérida, Barcelona.

Plan Wireless System for Canadian North.—Plans for a chain of wireless stations extending right into the Arctic Circle are being completed. The stations will be operated by the Canadian government, the primary purpose being to keep its various officials in touch with one another. Six stations are planned, five of which will be in the Northwest territories and another at Dawson, in the Yukon district. The stations on or near the Mackenzie River will be at Fort Smith, Fort Resolution, Fort Simpson, Fort Norman and Fort McPherson.

A Big Wisconsin Contract.—The Wisconsin Public Service Corporation and the Peshtigo Paper Company have entered into a ten-year contract whereby the former is to supply the latter with electrical power up to a maximum load of 3,300 hp. The paper company owns a small hydro-electric plant at Potato Rapids, about 6 miles west of Marinette, which is entirely inadequate to its needs. The new 66,000-volt transmission line connecting the High Falls lines with Marinette passes close to the Potato Rapids power house, and the energy to be sold to the paper company will be delivered to this plant. It is estimated that from five to ten million kilowatt-hours a year may be consumed under the contract.

New England Run-off Report Completed. — Hydro-electric engineers in the East have followed with interest the work of the committee on run-off of the Boston Society of Civil Engineers which has been in progress for the past few years and is now published in the form of a comprehensive summary. This report can be obtained in reprint form at a nominal charge at the headquarters of the society, 715 Tremont Temple, Boston. The full report of the committee contains such voluminous data that the duration tables and complete run-off records for twelve stations were not printed in the report now available, but they can be seen at headquarters. The report includes a grading of stations in accuracy, a map of New England showing gaging stations and drainage areas, representative hydrographs and duration curves, a list of papers submitted to the committee upon stream gaging and allied topics, comparisons between run-off records and methods of making records, and comment. The co-operation of the United States Geological Survey and many private organizations has contributed to the report's informational value. Arthur T. Safford, Lowell, Mass., is chairman and C. H. Pierce, Boston, secretary of the run-off committee.

Western Colorado Power Company Withdraws Request for Revaluation.—In 1920 the Western Colorado Power Company asked the Colorado Public Utilities Commission to revalue its properties in Durango, Montrose, Olathe, Ouray, Ridgway, Silverton and Telluride. The company, it was supposed, desired to have the valuation of these properties increased and thus to be entitled to a corresponding increase in rates. Dec. 4 had been set for a hearing, but on that date Bulkeley Wells, president of the company, asked the commission for permission to withdraw the request, and this permission was granted. There were many protests from the cities concerned, and it is believed that the company withdrew its plea in the interests of good public relations.

Oklahoma Light & Power Company Reduces Rates Voluntarily—By purchasing the plant of the Washita Electric Power Company at Pauls Valley the Oklahoma Light & Power Company has been enabled to announce a reduction in the light and power rates of 1 cent per kilowatt-hour, making the rate 15 cents with a 10 per cent discount for prompt payment. This change was voluntary on the part of the company and brings the rates close to those in effect prior to the war. The company has also lowered its rates at Ada and Holdenville. The new rate at Holdenville was a result of conferences between the company and the commission and is 16 cents per kilowatt-hour for the first 20 kw.-hr. per month. That at Ada was reduced 1 cent per kilowatt-hour for the first step of 100-kw.-hr., making the rate 12 cents.

Growth of Electric Service in Tennessee.—Chattanooga is to develop into the great hydro-electric power dvelopment center of the South, according to B. C. Edgar, vice-president and general manager of the Tennessee Electric Company, who bases his belief on the steady increase in power requirements in the city in the last few years and the certainty of greater demand in the immediate future. The present installed capacity of the hydro-electric units of the new consolidated Tennessee Electric Power Company is: Parkville (Ocoee No. 1), 15,000 kw.; Ocoee No. 2, 10,500 kw.; Hale's Bar, 37,100 kw.; Great Falls (Rock Island), 7,800 kw.; total, 70,400 kw. Two new industries now erecting plants in Chattanooga will add 24,000 kw. The steam-power stations of the company develop 30,750 kw., and a new 12,000-kw. unit is to be installed next year. The combined hydro-electric and steam-power rating of the Tennessee Electric Power Company when the additions in sight are finished will be close to 200,000 hp.

Associations and Societies

Southwestern Electrical and Gas Association.—The 1923 convention of the Southwestern Electrical and Gas Association will be held in Fort Worth, Tex., on May 15-17. G. H. Clifford is the chairman of the convention committee.

Essex County Electrical Club.—An organization under this name has been formed at Salem, Mass. Regular monthly meetings are held, with a dinner and speeches and discussions on electrical topics. S. Fred Smith, manager of the Salem Electric Lighting Company, is president; E. R. Dickenson is vice-president and George E. Tell secretary-treasurer.

Waste in Industry Discussed by New York Engineers.—"The Elimination of Waste in Government Engineering" was the subject of a discussion of the New York City sections of the four national engineering societies at a joint meeting held on Wednesday evening this week. John T. Pratt, chairman of the National Budget Committee and director of railroads and financial, industrial and engineering corporations, was listed as the principal speaker.

Section Group Meetings of the N. E. L. A.—Besides the meeting of the Accounting National Section committees of the National Electric Light Association to be held at New Orleans on Jan. 16-18, as stated last week, there will be group meetings of the Commercial National Section at Denver on Jan. 24-26 and of the Technical National Section at New York from Jan. 29 to Feb. 1 inclusive. The rural-lines committee of the N. E. L. A. will meet at headquarters in New York on Feb. 2 and 3.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

American Physical Society—Boston, Dec. 26-30; New York, Feb. 24. D. C. Miller, Case School of Applied Science, Cleveland.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Western Association of Electrical Inspectors—Chicago. Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Wisconsin State Association of Electragists—Milwaukee, Jan. 24-26.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Eastern Division, Atlantic City, N. J., Feb. 15-16.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

American Institute of Mining and Metallurgical Engineers—New York, Feb. 19-21.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Recent Court Decisions

Power Company Not Liable for Damage to Steamboat Running Into Submerged Stump Left by Company.—In Steiner vs. Mississippi River Power Company damages were sought because of the collision of a steamboat with a submerged stump on an island in the Mississippi River from which island the company had removed the timber. The Supreme Court of Iowa sustained a directed verdict for the defendant based on contributory negligence. (190 N. W. 9.)*

Limitation on Powers of New Jersey Commission.—In setting aside an order of the New Jersey Board of Public Utility Commissioners fixing rates for the Acquackanonk Water Company and other water companies, which thereupon brought suit against the board to annul its decree, the Supreme Court of New Jersey pointed out that, inasmuch as under an amendment to the public utility act it may review on a writ of certiorari and set aside any order made by the board, the court may set aside an order fixing rates and give a utility time in which to file its schedule. (118 At. 535.)

Responsibility for Death from Explosion in Power House.—In Rosebrock vs. the General Electric Company and the Tonawanda Power Company, the Appellate Division of the New York Supreme Court has affirmed the decision of the court below in which the manufacturing company was held liable and the central-station company not liable for the death of Edwin Rosebrock, one of thirteen men killed by an explosion in the Tonawanda power house on Oct. 31, 1920. Similar verdicts were returned in the trial court in several other cases which have not yet been heard on appeal. Eight cases remain to be tried. The amount awarded to the plaintiff, the widow of Rosebrock, is $30,000.

Use of Public Highways.—In sustaining an order of the New York Supreme Court denying a motion of the city of New York to force the Empire City Subway Company to put into effect a revised schedule of rentals for the use of electrical subways owned by it and rented to electrical utilities, the Appellate Division said: "The difficulty with the appellant's position is that the commissioner has suddenly increased by 60 per cent a rental which has been accepted as fair and reasonable for years, and has failed to show any circumstance or fact which justifies this action, and has by its own showing demonstrated that the commissioner adopted an erroneous theory of the statutes and the contracts in arriving at his decision, and has asked for a discretionary order to be granted which will injuriously affect others and may, by its own admission, be detrimental to the public; for the corporation counsel says that these tenants, being public service corporations, are fortunately situated in that they can pass the burden of any increase on to be borne by their customers." (196 N. Y. S. 94.)

Commission's Power to Fix Amount of Security Issues Sustained.—In Hillsdale Light & Fuel Company vs. Michigan Public Utilities Commission the plaintiff sought a writ of certiorari to get the Michigan Supreme Court to review a commission order limiting stock and other security issues sought by the company. The court dismissed the writ, holding that the commission may fix the amount of stocks and bonds of a corporation, that reproduction cost less depreciation is not conclusive evidence of value in approving stock and bond issues, that the evidence supported the finding of value for capitalization purposes, and that the commission had not erred in refusing to accept items of appraisal for overhead construction costs as respects the stock and bond issue.

United States District Court in Alabama Declares Water-Power Act Constitutional.—Suit was brought in the United States District Court in Alabama by the Alabama Power Company against the Gulf Power Company and others to condemn lands of riparian owners under the federal water-power act. The defendant challenged the constitutionality of the law. Overthrowing this allegation, the court declared that, although absolute property in and dominion over navigable streams, tidewaters and the underlying soils is vested in the states, such rights are subordinate to the power of eminent domain of the United States to condemn lands for improvement of navigation, under the power of Congress to regulate foreign and interstate commerce. Congress is not empowered to dam up navigable streams for the sole purpose of generating hydro-electricity for the sale thereof, the court asserted, but the act is none the less constitutional as against the contention that it trespasses on the power of the states to control and regulate or use their navigable waters, since the principal purpose of the statute is the promotion of navigation and since it provides that nothing contained in the act should be construed to affect or interfere with the laws of the respective states "relating to the control, appropriation, use or distribution of water used in irrigation or for municipal or other uses, or any vested right acquired therein." It is also constitutional as against the contention that it constitutes a delegation of legislative functions to the power commission rather than the bestowal of administrative duties. The court took judicial notice of the fact that the Coosa River is a stream navigable in fact, at least in part, in Georgia and Alabama, although it may not be known as a matter of common information at what particular place between its mouth and its source its navigability ceases. The capability of use by the public for purposes of transportation and commerce is, the court held, the true criterion of the navigability of a river, rather than the extent and manner of its use. Congress, it said further, can delegate the right of eminent domain to a federal agency selected pursuant to congressional authority, an agency for carrying out its policy and principles in an administrative way in the development or improvement of navigation. (283 Fed. 606.)

Commission Rulings

Depreciation Reserve Insisted Upon.—The Fairview municipal power plant, situated at Fairview, Utah, has been authorized by the Public Utilities Commission of Utah to increase its rates for electrical service by 1 cent per kilowatt-hour for residence lighting service and 10 per cent for flat-rate service. A 10 per cent discount is allowed for prompt payment. The increase was opposed, officials of the town representing that no depreciation reserve had been set aside to take care of replacements, and the commission expressed the view that the plant would be in much better condition had it not been for this failure. The commission placed the depreciable physical property value of the plant at $25,000 and on this value set $1,979 as the minimum annual amount to be set up as depreciation.

Discrepancy Between Rates for 25-Cycle and for 60-Cycle Service. — In authorizing revised rates for the town of Kilbourn the Wisconsin Railroad Commission observed: "The utility purchases 25-cycle energy, the greater portion of which is converted by means of a frequency changer to 60 cycles. This conversion necessarily results in a loss which consumers other than 25-cycle users should bear. Comparison of the proposed 60-cycle and 25-cycle power schedules, however, shows that bills covering energy used under either of these schedules are identical up to 30 kw.-hr. consumption per month. Between consumptions of 30 kw.-hr. and 90 kw.-hr. per month, however, bills under the 25-cycle schedule exceed those under the 60-cycle schedule for similar consumption. While this difference is not excessive, it is apparent from the character and cost of the energy supplied each of these classes that the difference should be eliminated or at least be in favor of the 25-cycle user. In order to clear up this discrepancy, which has been pointed out to the officials of the village, it appears equitable to change the first step in the proposed 60-cycle power schedule, inasmuch as no rate for this service has been applied heretofore, and make it identical with the 25-cycle power schedule."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

C. S. Cook Vice-President of Duquesne Company

C. S. Cook, formerly general manager of the Duquesne Light Company, Pittsburgh, has been appointed vice-president of the company. Mr. Cook has been general manager of the company since March 1, 1917, when he was chosen to fill the vacancy caused by the death of Robert S. Orr. He was born in Massachusetts and was educated at the Worcester Polytechnic School, from which he was graduated in 1885. Previously to his connection with the Duquesne company he had, since 1887, been associated with the Westinghouse Electric & Manufacturing Company, and when he left that company in 1917 he was manager of the railway and lighting department in charge of all commercial operations relating to power machinery for public service corporations.

C. S. COOK

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Gano Dunn, who has been president of the J. G. White Engineering Corporation since 1913, has been appointed by the council of the Institution of Electrical Engineers, the British association as local honorary secretary of that institution for the United States. Mr. Dunn began his career with the Western Union Telegraph Company, with which he was connected from 1886 to 1891. From 1898 to 1911 he was vice-president and chief engineer of the Crocker-Wheeler Company, and then he became associated with J. G. White & Company, Inc., as vice-president in charge of engineering and construction, remaining in that capacity until 1913, when, upon the organization of the J. G. White Engineering Corporation to take over the engineering and construction department of J. G. White & Company, Inc., he was elected to its presidency. Mr. Dunn has held prominent positions in several important engineering organizations.

F. W. Lilley, associated with J. E. Aldred & Company, New York City, sailed for Italy on Dec. 7. While in Italy Mr. Lilley will inspect power projects which are under way in that country.

Ernest V. Pannell, who is associated with the British Aluminum Company as a consulting engineer for transmission-line construction, has returned to New York, after an extended trip in the Orient.

A. N. McI. Robertson of the Punjab, India, with the Indian service of the British Empire, spent a few days in Salt Lake City during the latter part of November studying irrigation works, methods and construction as applied to irrigation.

Le Roy M. Pharis, who had been assistant to the chief engineer of the Utah Power & Light Company for several years, has recently become associated with the Great Northern Power Company, with headquarters at Duluth, Minn. Mr. Pharis was graduated as an electrical engineer from Syracuse University in 1907. Immediately after his graduation he became associated with the Telluride Power Company, and he was actively connected with the early hydro-electric developments of that company in Utah, Idaho and Colorado. When the Utah Power & Light Company was organized, in 1912, he became a member of that organization, as a hydraulic engineer, and devoted considerable time to the company's hydro-electric development at Grace, Idaho. He had served in the capacity of assistant to the chief engineer for the past five years. Mr. Pharis' new duties will consist of investigating and developing hydro-electric possibilities.

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Dr. Langmuir Lectures on Electrons

Dr. Irving Langmuir, research physicist with the General Electric Company at Schenectady, gave a series of lectures at the Carnegie Institute of Technology on Nov. 27, 28 and 29 to students and executives in industrial and scientific fields in the Pittsburgh district. To the electrical industry at large Dr. Langmuir is probably best known as the inventor of the gas-filled incandescent tungsten lamp. The subjects of his lectures were "Electron Emission from Heated Metals," "Electron Emission from Thoriated Filaments" and "Methods of Controlling Electron Currents in High Vacuum."

Stone & Webster Increase Staff

Norman A. Lougee, for ten years with the General Electric Company, Schenectady, N. Y., has resigned to become associated with Stone & Webster, Inc., Boston, as engineer in the electrical division. In the consulting engineering laboratory of the General Electric Company Mr. Lougee developed the oxide-film lightning arrester and was intimately associated with Dr. Steinmetz in the development of high-voltage fuses, oil circuit breakers, air switches, contactors, high-voltage impulse phenomena and the fixation of atmospheric nitrogen by the electric arc process.

Robert J. Gordon, formerly with the Hercules Powder Company and E. I. du Pont & Company, has joined the organization of Stone & Webster, Inc., of Boston, as engineer in the betterment division. While with the companies just named Mr. Gordon conducted special power tests and investigations, and prior to his connection with the Boston firm he was in charge of the power engineering division for the Hercules company.

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J. H. Taylor President Central Division, E. C. A.

J. H. Taylor, recently elected president of the Electrical Credit Association, Central Division, has been credit manager for the Benjamin Electric Manufacturing Company, Chicago, since 1914. Mr. Taylor was born in Enniskillen, Ireland, in 1881 and came to America at the age of eleven years. From 1900 until his connection with the Benjamin organization in 1912 he was associated with accounting work in the sash-and-door business and the food-products line. In 1912 he took charge of the accounting department of the Benjamin company and became assistant treasurer of the Dean Auto Division, which later was absorbed into the Benjamin organization. His association work has been active. He is a director of the Electrical Protective League and was for two years a director of the Chicago Association of Credit Men.

J. H. TAYLOR

Thomas Duncan, president of the Duncan Electric Manufacturing Company, Lafayette, Ind., left this country for a trip to Africa about the middle of November.

W. S. Davis, formerly associated with the Aluminum Company of America as electrical superintendent, is now connected with the Tennessee Electric Power Company as construction engineer.

Verne Hansen, until recently local engineer of the Portland (Ore.) district of the General Electric Company, has resigned his position and returned to his old home at Everett, Wash., owing to urgent private business.

William V. Holick, formerly in the statistics department of the Stone & Webster organization in Boston, has been transferred to the Pawtucket division of the Blackstone Valley Gas & Electric Company.

Frank H. Fox, formerly electrical engineer with Burns & McDonnell of Kansas City, Mo., and E. M. Smith, formerly structural engineer with the Houston (Tex.) Light & Power Company and the Sinclair Refining Company, have joined the organization of Arthur L. Mullergren, consulting engineer, Kansas City, the former as principal assistant engineer and the latter as structural engineer.

F. J. Low recently resigned as vice-president of the agency with which he was associated for more than six years and has organized an advertising agency under the name of F. J. Low Company, Inc., New York City. Mr. Low is well known in the technical advertising field. He was for many years advertising manager of H. W. Johns-Manville Company and has been associated with the advertising of the Chicago Fuse Manufacturing Company, the American Steam Gauge & Valve Manufacturing Company and many other concerns in the technical field.

Herman Plaut, retiring president of the New York Section of the National Council of Lighting Fixture Manufacturers, was presented with a silver-inlaid chest at a luncheon of the local body held at the New York Club, Dec. 5. The chest, arranged for use as a humidor, was prepared by the craftsmen of the Caldwell Company from an original design by the late Edward F. Caldwell. Mr. Plaut is well known in the fixture field for his untiring efforts on behalf of the fixture business, especially during the three years he served as president of the council. E. T. Caldwell, son of the late Edward F. Caldwell, is the new president of the New York Section, succeeding Mr. Plaut.

William Saltmarsh, secretary of the McGraw Company, has recently been placed in charge of the company's jobbing house in St. Louis. Mr. Saltmarsh has had extensive experience in virtually all branches of the electrical power field. After finishing his work at the University of South Dakota, his native state, he entered the electrical contracting field in Lewistown. Mont., and later engaged in construction work for the Montana Power Company and the Great Falls Power Company. He was subsequently in charge of a municipal power plant in South Dakota, leaving it about five years ago to join the McGraw Company organization. He was in the main office of that company in Sioux City, Iowa, until his recent transfer to St. Louis.

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John L. Harrington President A. S. M. E.

John Lyle Harrington, senior partner of the firm of Harrington, Howard & Ash, consulting engineers of Kansas City, Mo., was elected president of the American Society of Mechanical Engineers at the meeting the organization held last week in New York City. Mr. Harrington, who succeeds Dean Dexter S. Kimball of Cornell University, has been a member of the society since 1902 and is now serving as vice-president and chairman of the committee on constitution and by-laws. In addition to his activity in the A. S. M. E., Mr. Harrington is also a member of the A. S. C. E., the Engineering Institute of Canada and many other engineering organizations.

J. L. HARRINGTON

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Clement J. Sheridan has joined Watts & Barry, Inc., 50 Church Street, New York City, to handle sales promotion work in connection with "Monarch" refillable fuses.

Col. William Kelly, the chief engineer of the Federal Power Commission, is visiting the water-power developments being made on the Coosa River. Before returning he will visit Muscle Shoals and the Gorgas steam plant.

Otis Gerke, who has been connected with the Eastern Wisconsin Electric Company, at Sheboygan, Wis., for four years as auditor, has been promoted to be assistant secretary of the North West Utilities Company, with headquarters at Madison.

George L. Duncan is now secretary of the Clarksburg Gas & Electric Company, Clarksburg, W. Va., replacing B. M. Despend.

J. E. Beyer, Jr., formerly connected with the general engineering department of the Southwestern Bell Telephon Company, is now in the distribution department of the Duquesne Light Company.

J. R. Wampler is engineer in charge of the power station of the Kentucky & West Virginia Power Company at Logan, replacing H. M. Zaunor.

Warren Stoutnor, member of the Public Utilities Commission of Utah, has returned to Salt Lake City from the recent convention of the National Association of Railway and Utilities Commissioners held at Detroit. Mr. Stoutnor, who is chairman of the accounting committee of the national association, reports that Salt Lake City is very likely to get the 1924 convention.

Obituary

Alfred E. Bent, a pioneer in the electric lighting business in Colorado and at one time State Auditor and State Treasurer, recently died. Mr. Bent was sixty years of age.

W. B. Everest, general traffic manager of the Westinghouse Electric & Manufacturing Company, died Dec. 5 at his home in Pittsburgh, where he had been confined for one week with pneumonia. Mr. Everest became associated with the Westinghouse company when it obtained control of the United States Electric Company at Newark, N. J., where he was employed. Later he was transferred to the East Pittsburgh works, and in 1914 he was made general traffic manager of the company.

William Jared Clark, advisory manager of the General Electric Company's railway department, died on Wednesday morning, Dec. 12. Mr. Clark, who was a pioneer in the commercial development of electric railways, originated the project for the first electric railway in the world intended for freight traffic and was instrumental in obtaining the legislative charter authorizing its construction at Derby—his native town—and Ansonia, Conn. He had been associated with the electrical industry since 1888, during which time he had been manager of both the railway and foreign departments of the Cincinnati and London offices of the General Electric Company, managing director of the British Thomson-Houston Electric Company and had held several other positions of importance. Mr. Clark was a member of a number of national electrical and railway engineering societies in which he took an active part. They include the American Institute of Electrical Engineers, National Electric Light Association, American Electrochemical Society, New York Electrical Society, American Electric Railway Association.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic
Problems of the Producer and Distributor, with Market Reports, Trade
Activities, Foreign and Construction News

Net Prices Versus List and Discount

Present Price Practice Takes Heavy Toll of the Jobber—A Net Price System Would Compensate for Slow Turnover—Views of Prominent Jobbers

THE electrical industry as a whole is profoundly interested in seeing to it that the cost of selling electrical supplies from manufacturer to consumer is minimized. In order that all elements in the chain of distribution shall function economically, it is right that each element should participate in financial return in just proportion to the service rendered. Present-day evils that tend toward an unbalanced differential for service rendered should be eradicated. The selling of many lines handled by present-day electrical supply jobbers at a list and a discount price is one of these evils in the electrical jobbing business.

Apparently the only advantage of this old-time system is that it lends itself readily to changes in prices. It has had a tendency to force the jobber to sell the items with a slow turnover on approximately the same margin of profit that he is compelled to sell the fast-moving, highly competitive items. The manufacturer takes care of this situation for himself in most cases in the prices he makes to the distributor. On items which are not made in large quantities and which have a slower turnover a much greater profit is added than on the highly competitive, fast-moving lines. This is accomplished by making a list price sufficiently high to carry slow turnover, small sales, obsolescence, etc., and still leave a substantial profit.

If the jobber in turn did the same in his own behalf, he could make a strictly competitive price on the fast-moving competitive items and have an opportunity to make up his profit on the other items which have a slower turnover and are not so competitive. However, when a discount is quoted from a list, this discount usually applies all the way through on a group of items or all items in a given line, with the result that to meet competition on the fast-moving lines the jobber is compelled to sell the items of slow turnover on a margin that is not adequate to cover his operating expenses and at the same time make up for the loss which he is obliged to sustain on fast-moving items.

Two Good Examples

On No. 14 wire, for instance, it is absolutely impossible to make more than a small gross profit owing to the highly competitive condition of the market. This wire will probably have to be sold at a gross profit of 5 per cent or less, while the operating expense is likely to be close to 20 per cent, or four times the gross profit. It follows that if a jobber is to make a profit he must be assured of a gross margin of more than 20 per cent on the other items which do not have so high a rate of turnover. Considering the fact that the highly competitive fast-moving items represent 75 to 80 per cent of the jobber's volume, it is plain why the other 20 or 25 per cent of his volume must bring a high rate of gross profit to maintain a proper balance. Compare another item, the push-button switch. A four-way switch of this class lists at more than eight times the price of a single-pole switch. It is evident the list price was made high on the four-pole switch because it has a slow turnover and is not competitive. The cost of production was probably little greater than on the single-pole switch, yet it is practically six times the list. The discount which the manufacturer allows the jobber takes care of his problem, but the jobber in making the resale on a list and discount basis must accept approximately the same ratio of profit on the slow-moving item as on the fast-moving highly competitive item.

It would seem that a list and discount basis of marketing electrical merchandise is not in the best interests of either the manufacturer or the jobber. If the manufacturers would universally adopt the practice of selling on a strictly net basis, the jobbers could base selling prices on the competition and the rate of turnover on each individual item. A profit might thus be shown at the end of the year that represented a fair earning on the full volume of the business and would make the effort of handling the business worth while. For until a system is established to put the jobbing on a basis where a fair return is made on the items of slow turnover and a much lower return on the fast-moving highly competitive items, the jobbing business of the country cannot hope to change from the hazardous undertaking it has been from the beginning.

EDITOR'S NOTE.—This article, based on interviews with a number of prominent jobbers, was submitted for comment to F. M. Bernardin, chairman the B-R Electric Company, Kansas City, Mo., and president of the Electrical Supply Jobbers' Association, Central Division, and also to H. F. Thomas, president Northwestern Electric Equipment Company, St. Paul, and chairman of the accounting and statistical committee of the Electrical Supply Jobbers' Association. Mr. Bernardin writes:

"The subject of your proposed article, 'Net Prices Versus List and Discount,' is without doubt one of national importance. It has been a subject of frequent discussion by jobbers at meetings throughout the country. Its publication, therefore, I am sure, will undoubtedly prove of interest to the entire trade. For the reasons you have so thoroughly covered in your article, I think most jobbers favor net prices and have applied them as far as practicable in their own business.

"The jobbers have met with some resistance to their request that manufacturers have net prices in place of list and discount, owing to the increased cost of publishing their prices because of frequent changes. For instance, at the request of their distributors, the General Electric Company changed from list and discount to net prices on wiring devices. This line, as you know, covers a large number of items, and it was an ideal line on which to apply this principle because of the fact that a very small percentage of the items could be termed fast movers. Owing to frequent changes necessary on account of market conditions, it was found very expensive and entailed considerable delay in getting out net prices. Notwithstanding the fact that distributors of lines other than General Electric were convinced that this change inaugurated by the General Electric Company was beneficial, it was impossible to obtain the support of the manufacturers for whom they were acting as distributors, and after a year's trial the plan was discarded.

"In order for a jobber to function economically there is no question that the maximum possible number of turnovers must be obtained. Each commodity therefore requires a careful analysis in order to determine the proper number of turnovers required to be profitable. As you have aptly pointed out, the manufacturer invariably takes care of himself in formulating his lists on the slow-moving and fast-moving articles, but where the discount is applied to this list it is extremely difficult for the jobber to reimburse himself properly in the matter of turnover. Surely in the case of ridged iron conduit, where the competition is very keen only on ½-in. and ¾-in. conduit, there is no reason why the jobber should sell 1-in. and larger sizes on the same margin of profit. This same principle applies to weatherproof and rubber-covered wire.

"Your article is very timely and I am sure will be of value to the trade."

Mr. Thomas writes:

"I am convinced that the subject of encouraging the use of net prices by the manufacturer and jobber in lieu of list and discount is of great importance. Your proposed article covers the subject thoroughly, but I believe that instead of the example cited, on No. 14 wire as compared with the other sizes, an example of conduit fittings—condulets, VV fittings, etc.—would be more appropriate. We find that most manufacturers while selling all sizes of rubber-covered wire except No. 14 use a discount from list, a special net price being quoted on No. 14.

"There is one clerical point that might be brought out if you considered it of sufficient moment. That is that the use of net prices would materially reduce the clerical work involved in pricing and figuring the sales. As an example, at a price change we would establish and bill the new net prices on a certain commodity and the work of billing the different sales of that commodity until the next price change would be materially reduced."

Separate Factory Costs and Salesmanship

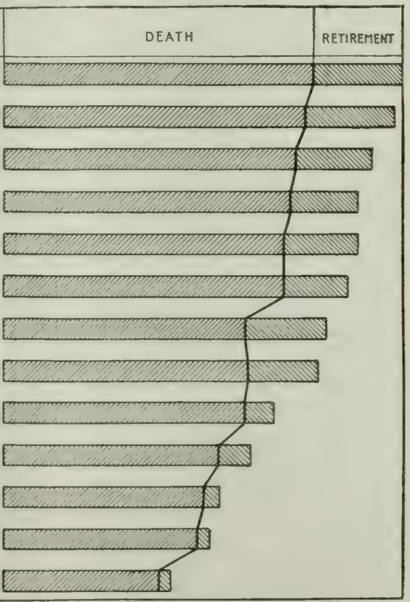
How Much Should the Salesman Know About the Cost of the Goods He Sells—Well-Grounded General Knowledge More Important

BY P. G. ALEXANDER
Sales Manager Tape Division,
Boston Woven Hose & Rubber Company, Cambridge, Mass.

THE question has been raised recently in private discussion whether it would be desirable for manufacturers of electrical products to adopt a policy of posting their sales representatives in the field upon factory costs in order to provide a broader base upon which such representatives might operate. There can be very little good from such a course, as I see it, and probably sales managers of manufacturing plants generally look at the matter in this way. There are several points in this connection which seem to me to dispose of the issue very quickly.

The Labor Turnover in the Building Trades

ARTISANS	DEATH	RETIREMENT	TOTAL
Brick and Stone Masons	17.6	5.0	22.6
Carpenters	17.4	4.8	22.2
Plasterers	16.6	4.3	20.9
Stone Cutters	16.4	3.6	20.0
Painters, Glaziers and Varnishers (Building)	16.2	3.8	20.0
Paper Hangers	16.2	3.4	19.6
Tinsmiths and Sheet Metal Workers	13.9	2.7	16.6
Roofers and Slaters	14.0	2.4	16.4
Cement Finishers	13.9	1.5	15.4
Coppersmiths	12.4	1.7	14.1
Plumbers and Gas and Steam Fitters	11.5	0.8	12.3
Structural Iron Workers (Building)	11.3	0.5	11.8
Electricians	9.3	0.4	9.7



From the *Contractor*.

A chart showing the number of men in the building trades that must be replaced each year to make up the loss through death or retirement. Figures are on the thousand basis and show the minimum turnover among electricians.

Factory costs are properly guarded by concerns subject to competition, no matter how liberal policies may be with respect to permitting visitors to go through plants. The market is concerned primarily with selling prices, and competition acts effectively in keeping these within reason, other things being equal. The disorganization which a general diffusion of specific manufacturers' cost data might achieve need not be elaborated. What the electrical industry needs is more cost stabilization rather than less, and conditions vary so widely between different plants that comparisons are difficult and apt to be misleading. Again costs are not the only factor in sales. Quality goods count heavily in selection, deliveries, service, previous relations—these are weighty influences between buyer and seller. The dissemination of cost data among field representatives might not spread further in numerous organizations, it is true; but fundamentally the responsibility for price setting rests upon the home office and only a limited range of price offerings can be handed over to the sales representative without danger of inadequate pricing under close competition.

If detailed cost data are at the disposal of the salesman, the temptation to take liberties with prices when competition is sharp is very keen. Manufacturers who are thoroughly informed upon their costs know the limits of pricing which can be permitted in the field better than the salesman can know them, and such concerns refuse business over and over again because the prices offered by the customer are below the safe margin above costs. In these days of change, overhead costs vary more or less from time to time, and only the home office is in close enough touch with the market for raw material, the cost of money and the vagaries of taxation to warrant price fixing. Losses through cancellation, transportation delays or difficulties, errors, spoilage, etc., require the exercise of immediate sound judgment in price establishment on the basis of information which the field sales force cannot possess, and in the interest of trying to stabilize prices for a fair profit above all costs borne by the manufacturer, it is better for the salesman to rely upon headquarters advices and to follow his price sheets without concerning himself in detail as to their make-up at home.

It may be well on occasion to inform sales representatives as to the underlying reasons for marked increases or decreases in prices, but a well-informed sales representative will himself follow the market conditions in raw material entering into his product. Rubber is 40 per cent higher than it was two years ago and sheeting 45 or 50 per cent higher. Hence, if tape advances in the near future, the basic reasons therefor are virtually a matter of general information, and that is as far as the salesman need go in this direction, as the writer sees it. The field representative has enough to think about without taking on the burdens of factory accounting analysis, and there is properly a division of responsibility between outside men and the inside branches of manufacturing organizations with respect to cost matters and business-getting.

Survey of Business Conditions

Railroad Troubles Affect Deliveries in Switch Market

In a survey of the switch market a leading manufacturer of rotary flush switches in Connecticut reports that present sales are about 50 per cent heavier than the sales of six months ago. He says that this is due very largely to the heavy building during the summer, of which switch manufacturers are just now getting the benefit. The sales manager of this company says:

"Deliveries are longer than normal, but if it were not for the conditions of railroads we feel that they would be very much improved during the next few months. The condition of the rolling stock of the railroads, however, is such as to offset any chance for improvement and we look forward to poor deliveries all during the winter months.

"Slight price advances have occurred this fall. This has also, of course, been a factor in stimulating sales, which are always better on a rising market. We feel that the price conditions are now pretty well stabilized and will continue so for the next few months without change.

"We feel that the sales in 1923 will exceed the sales in 1922 and that the first six months in 1923 will considerably exceed the sales of 1922 for the following reasons:

"Building has continued heavily during the last six months in 1922, which will have a favorable effect on the electrical business for the six months of 1923. The feeling still exists in the trade that we are on an advancing market rather than on a declining market, which will encourage buying. The feeling also exists that deliveries will be delayed and this will encourage stocking more heavily than normally."

An important manufacturer of surface switches states that its present sales compared to six months ago are fully 100 per cent greater. According to this manufacturer's sales manager, deliveries are slightly longer than usual owing to the difficulties of obtaining raw materials, although the present situation is not serious.

"Prices have been advanced recently, but we do not look for any further large advances unless events take place in the near future which cannot be foreseen today. The outlook for the next six months we believe to be favorable, and although we do not look for any big boom, we feel sure that business will be well maintained and we are looking forward to capacity operation."

Changes in Wiring Device Prices to Be Fractional

Frank V. Burton, sales manager of Henry D. Sears, general sales agent for wiring devices, 80 Boylston Street, Boston, says: "Except for the intervention of some terrible cataclysm, such as international war, the business in wiring devices for 1923 will show a substantial increase over the year 1922. Domestic conditions are most favorable to this result. Price changes, if any, will be fractional, with the probability of their going upward rather than downward."

Heater Cord Demand Shows Great Improvement

That the demand for heater cord has improved considerably during the past six months is consistently shown in a survey of the market throughout the country. One important manufacturer in the East has stated:

"Increased demand, in our opinion, is due to the elimination of the excessive stocks in the hands of fixture and utensil manufacturers, as well as the new sales outlet developed by reason of the large residential housing program which has been carried on since last spring.

"Prices have not changed recently, but it is quite possible that they will do so in the near future, as the trend of the wage scale is upward, and with unemployment disappearing it usually follows that all manufacturers have a larger labor turnover, which means increased production costs."

Delinquent Electrical Accounts Improve Slightly

Although delinquent accounts are still large, especially in the Central and New York divisions, reports from the National Electrical Credit Association indicate that for the Central division October, 1922, lowered the high stand of September, 1922, by ten accounts. For this division October, 1922, presented only 872 bad accounts, with a total value of $102,465.56, as against 1,006, valued at $127,769.08, in October, 1921.

The other divisions reported an increase in number of accounts for the same period, but with a lowered average amount. New York increased from 281 to 517 accounts, but reduced the total amount from $74,680 to $59,602. The New England territory jumped from thirty to eighty accounts and also raised the average amount to $140.29.

Electrical accounts on the Pacific Coast appear to be in good condition since only twenty-two accounts were in arrears for both October, 1921, and October, 1922. The valuation for October, 1922, was placed at $3,980.61, as against $1,266.80 for October, 1921, an increased average amount of $22.92. The official reports follow:

DELINQUENT ELECTRICAL ACCOUNTS

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
Sept., 1921	664	$95,962.87	$144.55
Sept., 1922	882	98,818.80	112.04
Oct., 1921	1,006	127,769.08	127.00
Oct., 1922	872	102,465.56	117.50
New York:			
Sept., 1921	431	56,571.00	131.00
Sept., 1922	530	78,739.00	149.00
Oct., 1921	281	74,680.00	265.00
Oct., 1922	517	59,602.00	115.00
Philadelphia:			
Sept., 1921	243	34,676.26	142.70
Sept., 1922	264	39,050.19	147.92
Oct., 1921	227	21,634.07	95.30
Oct., 1922	262	24,609.19	93.93
New England:			
Sept., 1921	98	12,688.69	129.47
Sept., 1922	124	13,045.43	105.20
Oct., 1921	30	3,096.23	103.21
Oct., 1922	80	11,223.14	140.29
Pacific Coast:			
Sept., 1921	30	2,488.63	82.95
Sept., 1922	19	3,002.57	157.95
Oct., 1921	22	1,266.80	57.58
Oct., 1922	22	3,980.61	180.50

Gradual Improvement in Control Devices

Promotion of Labor-Saving Machinery Helps the Ever-Increasing Demand—Simple Push-Button Lifting Electricity Out of Competition with Other Forms of Power

AN IMPORTANT manufacturer of controlling devices in the Eastern territory reports on his market as follows: "Our records show a gradual improvement in sales. The factors that have influenced developments are the gradual return of confidence and increased business activities in general. Construction plans that were laid aside during the depression period of 1920 and 1921 are being pushed to completion and a vast program is still to be completed. Careful and thoughtful management are seeing to it that their factories and mines are equipped with up-to-date automatic labor-saving machinery in which electricity enters very largely, and hence controls such as we manufacture are in ever increasing demand.

"Improvements in deliveries have been made by us from month to month for the past year in spite of the fact that our average sales each month show considerable gain. The outlook for the next six months is that we shall probably need longer time for deliveries.

"Prices have not been changed recently. They probably will not be changed in the near future—that is, in the next four to six months—but there will be a hardening of prices and very little concession.

"The outlook for the next six months appears promising. There can be only one decision in our opinion, and that is that the underlying trend of business in general in this country is upward, particularly with the electrical industry. This is based on the belief that we have a great and ever-expanding market and that we have only scratched the surface of the future electrical development. Because of its ease of application, its cleanliness, the simple-push button and automatic electric control, electricity is today where no other power can compete with it. The vast projects under way to generate electric power will tend to make it universally used for power, light and heat."

Range and Stove Prices to Be Advanced in January

It has been definitely stated by a leading electric stove and range manufacturer in the Middle West that prices will advance Jan. 1. According to other manufacturers, this increase is due to the higher cost of raw materials.

Sales in this field are better and the demand apparently is firm. Customers complain somewhat about delayed deliveries, but manufacturers are holding these orders for less time than orders for material are held up. One manufacturer says: "It is all a matter of atmosphere when speaking of sales possibilities. Rates per kilowatt-hour influence the sales, of course, but the successful performance of the article after sale is of more vital importance in increasing business."

Jobbers Submit Outlook for Freight Transportation

At the recent winter meeting of the Electrical Supply Jobbers' Association the committee on freight classification submitted the following opinion on the present outlook for freight transportation:

"The railroads have not been able to bring their equipment and motive power up to the standard maintained prior to the war because of the dilapidated condition in which they were returned by the government. During the shopmen's and coal miners' strikes the equipment further deteriorated, so that today we have the largest car shortage in the history of the country and the railroads have not sufficient motive power to move the large tonnage which is being offered for transportation. Further, the railroads generally are very badly congested, which retards the maintaining of freight schedules, and it is the consensus of opinion of the railway executives that the car shortage and the slow movement of freight will continue throughout the winter.

"No definite action has been taken by the committee relative to the application filed by the General Electric Company which was considered at Atlantic City last July, and we doubt very much if any material change—except minor ones—will be made in the articles listed in this application. The matter of packing was discussed, which may result in some changes in the commodity descriptions."

The following changes in classification were reported:

"*Storage Batteries.*—Effective Nov. 15, the carload rating on storage batteries, both with and without liquid, will be reduced in the classification in all territories from third to fourth class, with an increase in the minimum weight from 30,000 lb. to 40,000 lb.; also, reduction from first to second class on less carloads on storage batteries without chemicals between points in Eastern territory.

"*Dry Batteries.*—Reduction, effective Nov. 15, from fourth to fifth class in Southern classification territory.

"*Dishwashers.*—Effective Nov. 15, the carload rating will be reduced from third class in official classification territory and first class in Southern classification territory to fourth class in both territories; minimum carload weight increased from 16,000 lb. to 18,000 lb.

"*Sad Irons.*—Effective Dec. 15 next, electric sadirons, carloads, from fourth to fifth class between points in the Central States; also, from the Central States to Eastern destination."

Says Philadelphia Jobbers Enjoy Excellent Business

"During the last two months electrical jobbers have enjoyed excellent business. Sales of equipment used in wiring buildings have been large, and specialties such as washers, toasters and grills have been moving fairly well," according to a report just issued by the Federal Reserve Bank of Philadelphia.

"The one line which has been sluggish is radio equipment, sales of which have fallen off steadily since last spring. Dealers are at a loss to explain this decline, unless it be that radio is proving to be only a passing fad; but many of them hope that an improvement will occur during the weeks prior to the holidays. Electrical contractors, too, are busy, especially in Philadelphia, where many contracts have been let for wiring office buildings and residences. In spite of rather keen competition among contractors there seems to be sufficient work for all.

"The freight situation has offered considerable difficulty to both contractors and jobbers. In many cases it has been necessary to haul supplies long distances by motor truck, and in some lines stocks have become pretty well depleted. The latter condition applies especially to iron conduit pipe, which has been difficult to secure from Western producers.

"Both jobbers and contractors report rather slow collections."

The Metal Market

Copper Selling in Fair Volume—Prices Are Slightly Stronger—Some Premiums Obtained

Copper is selling in fair volume, but most of the other metals are more than usually quiet. Most metal consumers are looking forward to a particularly successful year in 1923, although the present slowness of recovery in the European markets is disappointing. Copper prices are slightly stronger this week, ranging from 13.87½ cents to 14 cents, delivered. Most of the business is for January and February, and the price has been generally 13.87½ cents, delivered, although premiums have been obtained above this price for certain convenient lots or in sections where the freight rate is unfavorable. Prices are as follows:

NEW YORK METAL MARKET PRICES

	Dec 6, 1922 Cents per Pound	Dec 13, 1922 Cents per Pound
Copper		
Prime Lake	13 87½	14 00
Electrolytic	14 00	14 00
Lead, Am. S. & R. price	7 00	7 10
Antimony	6 50	6 50
Nickel, ingot	36 00	36 00
Zinc, spot	7 25	8 25
Tin, Straits	36 25	37 00
Aluminum, 98 to 99 per cent	21 50	22 00

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

CHRISTMAS buying continues in good volume in most sections of the country. Some jobbers expect that appliance sales during the month of December will be the heaviest in several years. Fixtures are selling in a stronger market owing to an increased demand in the construction field. Shipments of steel pipe from Pennsylvania mills are becoming slower and several manufacturers in the Eastern territory report very low stocks of conduit. Several heavy orders for lamps are reported.

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New York

Appliances in Improving Demand—Fixture Stocks Ample—General Improvement in Motor Market

Improving demand for all sorts of appliances is seen in the market. Construction continues to take heavy stocks of armored cable, conduit and fixtures. Prices generally are firm.

Fixtures.—Commercial types are in greater demand and present stocks are ample to meet all requirements. Prices are firm.

Lamps.—Much replacement business and orders for recently constructed apartment houses and residences are features of the market. Many lamps of higher wattages are going to the sign manufacturers.

Motors.—A general improvement in the motor market is noted, all sizes selling in fair volume. Prices are firm and stocks are ample.

Washers and Cleaners.—Competition is most keen. Sales have increased noticeably, with recessions in prices. Stocks are heavy.

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Boston

Fixtures in Brisk Demand—Wire Deliveries Are Good—Acute Washing Machine Competition

Trade continues in good volume with firm prices and little large-scale buying to build up distributors' stocks. Central-station business is very active, though construction work is being conducted only upon a conservative basis. Contractor-dealers are very busy and jobbers are finding deliveries their chief immediate anxiety. No bad shortages were reported Monday, but smaller sizes of rigid conduit were hard to obtain and some grades of steel were being quoted on long deliveries to electrical manufacturers. Building and engineering contracts in New England for the week ended Dec. 5 totaled $6,130,100 against $4,447,000 for the corresponding week last year.

Fixtures.—A brisk demand is evident and stocks are well prepared to meet it. Both large and smaller dealers report good business.

Wire.—Not much change occurs from week to week in the demand for rubber-covered wire but owing to the expanding building program the tendency is toward larger volumes of business. Deliveries are in good shape. Owing to seasonal conditions, weatherproof is not in heavy demand and little is heard of bare copper wire as an active factor in wholesale business.

Lamps.—Industrial buying has increased materially of late, and enlarged stocks and manufacturing facilities are putting the lamp dealer into a strong position. A single mill ordered 21,000 lamps of various sizes and types from a Boston representative Monday. Domestic lamp consumption is at its height and the sign business is showing life. Prices are firm.

Rigid Conduit.—Deliveries are requiring close attention from distributors. Stocks are low, especially in the smaller sizes, and the outlook for early improvement in shipments is poor.

Flexible Armored Conductor.—Liberal-sized orders of this material are being placed and the supply seems equal to current requirements.

Washing Machines.—Some jobbers appear to be doing a better business in washers than a few weeks ago, but competition is acute and the demand as a whole is rather spotty.

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Chicago

Christmas Buying Active—Conduit Still Scarce—Lamp Sales Brisk —Wire Demand Strong

Reports from jobbers indicate that buying for the Christmas trade has had an active start. Most jobbers state that this buying has commenced rather early this year compared with former years. The call for wiring materials continues, with complications appearing in the low stocks of conduit. High-tension manufacturers report that the usual seasonal slump during this time of the year has failed to appear since orders are steadily coming in. Lamp sales are also very active.

Wire.—A continuing strong demand for wire was noted this week, with the rubber-covered No. 14 selling actively.

Conduit.—All jobbers report that an active demand with scanty stocks is troubling deliveries.

Schedule Material.—Prices remain the same as last listed, but the call for this material is lively owing to the fall continuation of building construction.

Lamps.—Seasonal sales have created a lively buying market. Jobbers report that both the industrials and railroads are building up thier stocks. This results in a steady flow of all sizes of lamps, but jobbers and dealers have good stocks.

Christmas-Tree Lighting Sets.—Action has started on this equipment, and jobbers fear that their supplies will be exhausted before Christmas, regardless of their present good stocks.

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St. Louis

Holiday Buying Active—Wire Prices Are Moving Upward—Transmission Equipment Prospects Excellent

Building construction is on a high level in St. Louis and surrounding territory. Permits issued in St. Louis during November amounted to $2,850,789 as compared with $975,125 during November last year. The total for the first eleven months of this year was $22,865,307, and for the same period last year $15,651,585, an increase of 46 per cent. Of prime interest to the electrical industry is the increase in industrial building, there being issued last month fifteen permits for new manufactories, amounting to $402,150—the largest amount since April, 1920.

Holiday Buying.—Holiday buying is exceptionally active. Extremely low stocks exist in toasters and waffle irons. Percolators are sufficiently stocked, but there is difficulty in getting creamers, sugars and trays to make percolator sets. Vacuum cleaners and grills are moving well with ample quantity on hand. Sales have been generally stimulated by colder weather, especially in air heaters, the rapid movement of which is resulting in low stocks.

Wire.—Prices are moving upward. No. 14 rubber-covered advanced about 8 per cent during the week, and the other sizes from 5 per cent to 8 per cent. No change was made in the base price of bare and weatherproof, but the cotton market has made weatherproof tend higher. Stocks are normal and demand is steady.

Conduit.—Scattered shipments have not substantially bettered conditions of stocks, which jobbers generally report as short. Steady demand and firm prices rule.

Transmission Equipment.—Improvement in high-tension business in Oklahoma is reported, though some decline is felt in the rest of the territory. Numerous projects are contemplated for next year, and prospects for good business are excellent. Consolidation and expansion of power companies will be an important contributing factor.

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Atlanta

Ranges Continue Strong—Portable Lamp Prices Lower Than Last Year—Poles Active

Trade in the Southeast is picking up from week to week, and all electrical dealers report the holiday buying as brisk and their stocks as ample to meet the demands. Business in general is good, as indicated by the fact that bank clearings in Atlanta for the month of

November were approximately $14,000,000 over the same month last year. Building activities continue, permits in Atlanta for November numbering 433, with a valuation of $1,705,588. Building throughout the territory is exceeding expectations, some cities reporting a shortage of building craftsmen. General conditions in the rural districts are considerably improved, and farmers are optimistic over the outlook for the new year.

Electric Ranges.—Ranges continue strong, good sales being reported by all jobbers. Sales efforts are being concentrated, and this is bringing good results. Ample stocks are on hand and deliveries satisfactory. Prices firm.

Portable Lamps.—Prices are well under those of last year, and this, together with the holiday demand, is resulting in a very satisfactory movement. Deliveries have slowed up a bit, but jobbers have sufficient stocks to get through the holidays.

Hollow-Ware.—Moving briskly with percolators in most demand. Jobbers are well stocked in all articles and prices are firm.

Vacuum Cleaners.—The holiday trade is responsible for a satisfactory movement. Manufacturers' advertising and sales campaigns are doing much to popularize this specialty, and the coming year should witness a healthy and general movement. Stocks in the territory are ample and prices are firm.

Storage Batteries.—The movement continues very active in both the vehicle and radio types. Prices are considerably lower than last year but generally are firm. Good stocks are the rule.

Poles.—A fair to good movement is reported, with the demand equally divided between central-stations and municipalities. Pole-yard stocks are sufficient and deliveries good. Prices are firm.

Cleveland

Washers, Ironers and Cleaners Active—Prompt Wire Deliveries—Fixture Sales Are Steady

Christmas shopping is well under way, with washers, ironers and cleaners active. The smaller appliances are in very good demand and much competition is evident. The fixture market is spotty, but careful buying has prevented overstocks. Central-station buying has diminished somewhat. Industrial equipment sales continue in fair volume. Although interest in radio is not so keen as last year, it has a greater number of devotees, and part sales have dominated the week. Prices generally are firm.

Wire.—A lessening demand has had a tendency to retard prices slightly and deliveries are accordingly prompt.

Conduit.—Stocks are sufficient to fill orders promptly, although demand is in comparative good strength.

Pole-Line Hardware.—The cessation of new line construction has affected this market, although some buying continues.

Meters.—Demand is in proportion to central-station activity. Stocks are not heavy, however, and prices are firm.

Fixtures.—Despite the near ending of the building season, fixture sales are steady and firm prices prevail. Stocks are good, however, and permit prompt deliveries. Building plans for next year indicate that an unusually active fixture market may be expected.

Heaters.—Jobbers and dealers report a better week in heater sales, but stocks are good and the weather has not been inclement.

Appliances.—Dealers seem to have concentrated most of their efforts in the merchandising of appliances to accelerate the holiday buying and to meet keen competition. In this they have enjoyed fruitful results. Washers and ironers are moving well, and it is expected the demand will hold up into the beginning of the new year. Cleaners are in very good season and hand irons, toasters, grills, percolators and the like are improving.

Salt Lake City

Holiday Trade Promises to Be Best of Several Years—Radio Stocks Are Ample

Construction work in Salt Lake City for the first eleven months of 1922 exceeded the cost of that begun in the same period of 1921 by half a million dollars. Permits issued to date during December indicate that some unusually large construction jobs are getting under way. Although building activity has been slowed by the arrival of winter, the electrical contractors are still going to capacity on inside wiring and installing. Holiday trade promises to be the best in several years. Electrical gifts, especially in the hollow-ware line, seem to be in favor. Many radio sets are being purchased for gifts, the less expensive apparatus leading in demand.

Portland–Seattle

Jobbers Report Active Christmas Buying—Contracting Work Active—Fixtures Steady—Radio Improving

For the first time in months lumber production is below normal. Stormy weather in the past week accompanied by several inches of snow in some sections of the Northwest interferred materially with Christmas shopping. Crowds are again, however, filling the stores and actual sales are improving. Electrical jobbers report active Christmas buying with stocks in some lines of heating devices running low. Hollow ware, including the usual line of small appliances, is proving very popular. Electrical dealers report business for November as being lower than had been predicted, but conditions are improving since that time. Contracting work is very active and fixtures are steady. Radio sales are improving.

Denver

Conduit Demand Is Lessened — Small Motors Active — Dealers' Stocks of Hollow Ware Are Moderate

Increased employment is reported throughout the Mountain region and in the mining districts, where improved conditions are believed to be due to the recently enacted tariff law. The car shortage is still acute and has prevented several coal mines from resuming normal schedules. About half of the beet-sugar factories have terminated campaigns and labor has been released to other industries. Farmers are depressed financially and little electrical business is coming from agricultural regions. Holiday buying here is well under way and is being aided by co-operative advertising, sponsored by the local electrical league.

Christmas-Tree Lamps.—Stocks of standard sets are practically exhausted. Chain stores are featuring cheap outfits, and it is reported that 1,500 sets of this kind are being expected daily for the Christmas trade.

Conduit.—Demand has lessened during the past week, but this is believed temporary. Although stocks are low, supply is thought ample.

Motors.—Inquiries for smaller sizes are increasing, but demand is below normal. Several good sales are reported.

Cookers.—Holiday demand, local and national, for those manufactured here has increased production.

Hollow Ware.—Dealers' stocks are moderate as a result of the careful buying. Department and miscellaneous stores have more extensive stocks.

San Francisco

Jobbers Continue to Maintain Heater Device Stocks on Normal Basis —Wire Advances

Heavy rainfall, in some localities totaling 50 per cent over normal, coupled with warmer weather, insures favorable conditions for early seeding and plowing. Building has slowed down slightly, although November figures are high.

Heating Devices.—Despite rumors of price decrease on account of the expiration of the Marsh patents next year, jobbers continue to maintain stocks on a normal sixty-day basis and not only will sell out present stocks for holidays but will apparently run short. Toasters and table grills are in particularly good demand.

Weatherproof Wire.—An advance of 50 cents per 100 lb. is reported.

Household Appliances.—Store business is showing a larger proportionate volume. Several dealers report overnight disintegration of selling crews because of weather conditions. Effort is being made this season to sell appliances for holidays through special concessions such as lower and deferred payments. The volume of business exceeds last year.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Electric Power Equipment Firm Plans Increased Production

The Electric Power Equipment Corporation, Thirteenth and Wood Streets, Philadelphia, manufacturer of high-tension electric switches for indoor and outdoor service, has acquired the former Darby Building, on Eighteenth Street near Callowhill Street, for a new plant. The structure will be remodeled and improved and is expected to be ready for occupancy early in 1923. It will provide for considerable increase in capacity. L. R. Lewis is president of the corporation.

Le Valley Vitae Carbon Brush Purchased by M. W. Robertson

Maxwell W. Robertson, who for fifteen years prior to 1920 was general manager of the Le Valley Vitae Carbon Brush Company, 521 West Twenty-third Street, New York City, announces that he has purchased its entire plant and business and right to the use of its corporate name. This company is a pioneer in the manufacture of carbon dynamo brushes and was established in 1897.

Monitor Controller Company Opens Southern Sales Office

The Monitor Controller Company, Baltimore, manufacturer of the "Just Press a Button" system of automatic control for all motor-driven apparatus, has recently established a branch sales office in the South at 1100 Elm Street, Birmingham. William H. Neville will be in charge.

Westinghouse Announces Changes in Purchasing Department

C. G. Taylor has been appointed director of purchases of the Westinghouse Electric & Manufacturing Company. He will have general supervision of the purchasing activities of all plants composing the electrical group. The company also announces that C. G. Bunnell has been appointed purchasing agent of the East Pittsburgh Works to succeed Mr. Taylor.

Pacific Electric Manufacturing Represented by J. E. Slimp

J. E. Slimp, for many years identified in the South and West with the high-voltage transmission field, has opened an office at 50 Church Street, New York City. This will be the Eastern agency of the Pacific Electric Manufacturing Company of San Francisco, maker of high-tension oil circuit breakers, air-break switches, choke coils, lightning arresters, fuse equipment, etc., for high-voltage transmission lines. Mr. Slimp later may take other lines of apparatus in the transmission field. For eighteen years he was connected with the Ohio Brass Company.

Chicago Metallic Manufacturing Purchases Chicago Plant

The Chicago Metallic Manufacturing Company, manufacturer of household metal ware, 544 West Thirty-fifth Street, Chicago, has purchased the plant at 3711 South Ashland Avenue, occupied by the Ever-Ready Company, a subsidiary of the National Carbon Company. The building contains 90,000 sq.ft. of floor space. The Ever-Ready Company, which manufactures electric novelties, will occupy the vacated plant of the Oxweld Acetylene Company at Thirty-sixth Street and Jasper Place.

McGraw Company Creates New Sales Departments

As a result of the resignation of F. D. Philips as vice-president and manager of the St. Louis house of the McGraw Company, electrical jobber, William Saltmarsh, secretary of the company, has been placed in charge of the St. Louis house with the title of manager. H. R. Edwards, formerly manager of the radio department in its Omaha (Neb.) office, has been transferred to St. Louis and made sales manager there.

Two new departments have been created in the sales division, one handling radio equipment, with H. A. Heimberger in charge, and the other merchandising goods, which will be under C. W. St. Denis. The McGraw Company makes a specialty of the Westinghouse line.

Alex. Macomber and John West Organize Engineering Firm

Alexander Macomber and John West, formerly of Carver, Macomber & West, Boston, have organized the firm of Macomber & West, with offices at 15 Exchange Street, Boston, to carry on an engineering business. Messrs. Macomber and West are widely known in New England electrical circles, the former having been for some time electrical engineer of Charles H. Tenney & Company, Boston, and the latter power engineer of the same organization. Mr. Macomber is vice-chairman of the Boston Section of the A. I. E. E.

Elltone Company, Inc., Will Manufacture Radio Parts

The Elltone Company, Inc., Shelton, Conn., recently incorporated with $50,000 capital stock, announces that it will engage in the manufacture of radio and other electrical apparatus parts. Officials of the company are John H. Elliott, Daniel J. Teevan, William J. Mahoney, Daniel A. Reilly, Matthew Kuziak and William E. Sullivan.

Coffield Washer Company Opens Sales Offices in Dallas, Tex.

The Coffield Washer Company of Dayton, Ohio, one of the largest manufacturers of electric washing machines, has opened a display room and district sales offices at 206 South Akard Street, Dallas, Tex. The distributing company for Texas has been organized as the Texas Coffield Washer Company, and it will sell directly to the users in the homes on small cash payments, the balance to be paid in small monthly payments. The Texas distributing agency will be in charge of J. R. Cutler as manager.

Stone & Webster, Inc., Opens Philadelphia Office

Stone & Webster, Inc., has opened a branch office at 307 Real Estate Trust Building, Philadelphia, under the management of George Chamberlain. The company has several million dollars' worth of work under way, including the foundation for a power house extension for the Philadelphia Electric Company.

Cornell-Mathews Will Represent Several Large Manufacturers

The Cornell-Mathews Company is the name of a new business recently established with headquarters in Orlando, Fla., in the Christ Building, by R. L. Cornell and G. W. Mathews. Mr. Cornell is an engineer of experience in construction and operation of public utility properties as well as in industrial management work and sales building, having recently completed a contract with the Holt Electric Company, Jacksonville, Fla., jobber, where he served in the capacity of general manager. Mr. Mathews recently resigned as district manager of the Holt Company, Tampa, Fla., to enter into the new association. The Cornell-Mathews Company will represent several large manufacturers of electrical and mechanical equipment.

Frank E. Wolcott Company Will Manufacture Appliances

The Frank E. Wolcott Manufacturing Company, Hartford, Conn., recently incorporated under the laws of Connecticut with capital stock of $50,000, has announced that it will engage in the manufacture of electrical appliances. The incorporators are F. E. Wolcott and G. H. Anthony of Hartford, Conn., and J. J. Wall of Providence, R. I.

Electric Storage Battery Stock Dividend Announced

The Electric Storage Battery Company, Allegheny Avenue and Nineteenth Street, Philadelphia, has announced that its directors have declared from the accumulated surplus of the company a dividend of one dollar per share, for the quarter ended Dec. 31, 1922, and an extra dividend of 75 cents per share on the new common stock without nominal or par value and the new preferred stock of $25 par value, payable Jan. 2, 1923, to stockholders of record of both of these classes of stock at the close of business, Dec. 15, 1922, and to those who subsequently become stockholders of record of these classes of stock by conversion of old stock of $100 par value into new stock. Walter G. Henderson is treasurer of the company.

Worthington Pump Makes Important Change in Sales Staff

The Worthington Pump & Machinery Corporation, 115 Broadway, New York City, announces that E. T. Fishwick, formerly sales manager, has been made vice-president in charge of sales to succeed F. H. Jones, resigned. J. E. Sague, former vice-president, has been succeeded by William Goodman, formerly assistant to Mr. Sague. James C. Barnaby, formerly plant engineer of the Staten Island Shipbuilding Company, is now in charge of certain engineering work in the Diesel-oil-engine division of the Worthington Corporation.

Burdick Cabinet Company Plans $100,000 Stock Issue

The Burdick Cabinet Company, Milton, Wis., manufacturer of electric bath cabinets and therapeutic equipment, is planning an issue of $100,000 in preferred stock, the proceeds of which will be used to erect a modern factory addition to take care of the steadily increasing demand for electrical hospital appliances.

Laundryette Company Appoints Kratz Chicago Distributor

The Laundryette Manufacturing Company, Cleveland, announces that it has appointed the A. W. Kratz organization, Chicago, as its distributor in that city. The Kratz organization now has six branch stores in Chicago for demonstrating washing machines.

Uehling Instrument Appoints Australian Sales Agent

The Uehling Instrument Company, Paterson, N. J., has recently appointed Robert Bryce & Company, 482 Collins Street, Melbourne, Australia, as its exclusive sales agents for Australia and New Zealand. Other appointments of sales agents include the Lebedoff Smith Company, Kirby Building, Cleveland, exclusive sales agent for the state of Ohio.

The Uehling company also announces that the territory of the Coon de Visser Company, who has been handling Uehling interests in the state of Michigan for many years, has been extended to include western Ontario.

Northern Supply Building to Be Ready Jan. 15

The Northern Supply Company, Chippewa Falls, Wis., a new corporation with $50,000 capital stock, organized to manufacture telephone, telegraph and power transmission-line supplies, has started work on the erection of a two-story brick factory, 40 ft. x 120 ft., to be ready Jan. 15.

Most of the operations will be for woodworking operations on poles, crossarms, brackets, pins, braces, etc. J. M. Bischell, formerly of Bloomer, Wis., but for several years engaged in similar business at Baltimore, Md., is president and general manager of the company.

Knox Porcelain Company Will Build $100,000 Plant

The Knox Porcelain Company, Knoxville, Tenn., organized a short time ago with capital stock of $370,000, will soon commence the erection of a new plant on five acres, recently purchased, which will consist of three individual units, to be equipped for the most part for the manufacture of electrical porcelain specialties. The plant will, it is estimated, cost in excess of $100,000. J. N. House is president of the company.

Magnus Electric Has Second Enlargement in Year

The Magnus Electric Company, Inc., 451 Greenwich Street, New York City, is enlarging its factory space by 11,000 sq.ft. to provide for increased output. This is the second enlargement within a year. Specifications are being prepared for bids on additional equipment and new machinery to provide added facilities in its electrical plug and radio accessories department.

Marconi Company of London Asks Peru to Cancel Contract

Owing to severe criticism in Peru and to numerous difficulties thrown in its way, the Marconi Company of London has requested the Peruvian government to cancel its contract. Under the terms of this contract, which went in effect May 1, 1921, the Marconi Company was to undertake the administration of the posts, telegraphs and wireless services of the Peruvian government for a period of twenty-five years, receiving as remuneration 5 per cent of the gross revenues plus 50 per cent of the annual surplus, if any.

General Electric Ships Two 66-Ton Locomotives to Japan

Shipment has been made from the Erie (Pa.) works of General Electric Company of two 66-ton, 1,500-volt direct-current locomotives for the Imperial Government Railways of Japan. These locomotives include all the latest improvements in high-voltage, direct-current design and will be tried out by the Japanese government pending selection of additional equipment for electrification of its main-line railroads. Initial operating tests will be made upon the Tokio-Yokohama line, electrified in 1915. The locomotives were subjected to exhaustive tests in presence of representatives of the Japanese government.

Anderson Electric Works, Inc., Leases Chicago Property

The Anderson Electric Works, Inc., 212 West Austin Avenue, Chicago, recently organized with $25,000 capital stock, announce that they will repair, buy and sell motors, generators and electrical equipment. This firm has leased 6,500 sq.ft. of floor space in a building at the address given and has purchased all necessary equipment and machinery.

Officers of the company are: A. C. G. Anderson, president; J. C. A. Anderson, vice-president; E. H. Johnson, secretary and treasurer, and Max V. Boreing, manager and superintendent.

Duluth Electrical Supplies Firm Appoints Sullivan Sales Manager

A. H. Sullivan has recently joined the organization of the Duluth Electrical Supplies Company, Duluth, Minn., in the capacity of sales manager and consulting engineer, going to Duluth directly from Chicago, where he was formerly connected with the Freeman-Sweet Company, electrical engineer and contractor, in the capacity of supervising engineer.

The general organization of the Duluth Electrical Supplies Company has been considerably enlarged during the last year in order to keep pace with better business throughout the Northwest territory, and the company has added a fully equipped engineering department for serving its customers in a consulting capacity.

The E. N. Riddle Company, Toledo, Ohio, manufacturer of lighting fixtures, will enlarge its plant by the erection of buildings to be used for foundry and other purposes.

The Wilson Welder & Metals Company, 132 King Street, New York City, is now represented exclusively in the States of Maryland and Virginia and the District of Columbia by the Alexander Milburn Company, Baltimore, where a complete demonstration plant is in operation.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Norway (No. 4,617) for insulators, copper cable, galvanized wire, etc.

An agency is desired in Canada (No. 4,623) for builders' hardware and tools for carpenters, machinists and electricians and small machinery, etc.

An agency is desired in Poland (No. 4,631) for electric motors and current-measuring apparatus.

An agency is desired in Poland (No. 4,637) for rubber for electrical and other purposes.

An agency is desired in Norway (No. 4,639) for electrically operated machinery for bakers and confectioners.

An agency is desired in Austria (No. 4,640) for electric automotive air compressors.

Purchase is desired in Italy (No. 4,644) for fifty wireless telephone receiving sets, 250-mile range, and accessories for same.

Agency is desired in France (No. 4,648) for small electrical equipment, milling and pulverizing machinery, etc.

An agency is desired in Belgium (No. 4,653) for all articles for interior lighting installations, electromechanic applications, measuring instruments, tables of electrical distribution, for industrial plants, central stations, mines, etc.

Purchase and agency is desired in Canary Islands (No. 4,654) for radiophones, broadcasting and receiving outfits and accessories.

BIDS ASKED FOR ELECTRIC CONCESSION IN BRAZIL.—Announcement of a call for a concession to furnish hydro-electric power to Porto Alegre and vicinity, *Commerce Reports* states, has been made by the government of the State of Rio Grande do Sul, Brazil. In order that foreign countries may participate a period of one year from October 10, 1922, is given for submitting bids for this franchise. The proposed site for the hydro-electric plant is on the Rio Jacuhy, in the municipality of Saledade, about 140 miles northwest of Porto Alegre. It is estimated that a minimum of 40,000 hp. can be developed. A translation of the announcement, together with a map showing the location of the proposed plant, is available to firms interested on application to the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., and district offices, by referring to No. 75,352.

CATALOGS OF TELEPHONE, TELEGRAPH AND WIRELESS APPARATUS REQUESTED BY THE POLISH GOVERNMENT.—Catalogs and other literature of telephone, telegraph and wireless apparatus manufactured in America, *Commerce Reports* states, are desired by the chief of technical section of the Ministry of War, Warsaw, Poland. General catalogs presenting the widest field are of greatest value. Firms interested are requested to send this information direct.

New Apparatus and Publications

RADIO APPARATUS.—The Electric Appliance Company, 408-416 Canal Street, New Orleans, jobber in electrical supplies and automotive equipment, has issued an eighty-page catalog covering the radio apparatus and equipment carried by the company.

ELECTRIC LANTERN.—The Excellight Company, a subsidiary of the National Marine Lamp Company, Forestville, Conn., is distributing a folder describing its "Excellight, electric hand lantern.

METER.—Publication No. 1,099 issued by the H. S. B. W.-Cochrane Corporation, Philadelphia, describes the "Cochrane" flow meter for steam or water in pipes.

MAGNET WIRE.—The Belden Manufacturing Company, Twenty-third Street and Western Avenue, Chicago, has issued in pamphlet form an article by its chemist on "Magnet Wire," which describes the coating of the wire, the baking and testing of the enamel and various uses of enamel wire.

AUTOMATIC STOP VALVE.—The Foster Engineering Company, Newark, N. J., is distributing a leaflet covering the "Foster" automatic non-return stop valve.

ELECTRIC MOTORS.—The Louis Allis Company, Milwaukee, successor to the Mechanical Appliance Company, is distributing a folder describing the Louis Allis "L-A." type H. D. heavy-duty motors.

STORAGE BATTERY TOOLS.—S. R. M. Orum, 503-505 North Eleventh Street, Philadelphia, is distributing two leaflets covering a double-action carboy pump, hot-rivet post-sealing mechanism and a combination plate press burning stand recently brought out by him.

GRAPHIC INSTRUMENTS. — Bulletin No. 1,022 issued by Esterline & Angus, engineers, Indianapolis, contains an article on "Graphic Instruments for Reporting Trouble" and also calls attention to a number of improvements made in the chart-driving mechanism of their instruments.

New Incorporations

THE WARREN POWER CORPORATION, Front Royal, Va., has been incorporated with a capital stock of $300,000 to distribute electricity in Front Royal, Riverton and Strasburg. B. J. Hullidge is president and C. W. Borden secretary.

THE KENTUCKY-TENNESSEE LIGHT & POWER COMPANY, Bowling Green, Ky., has been chartered with a capital stock of $200,000 by H. D. Fitch, Roland Fitch and J. A. Henderson, all of Bowling Green, Ky.

THE SPRING LAKE (UTAH) LIGHT & POWER COMPANY of Spring Lake Precinct, Utah County, has been incorporated with a capital stock of $5,000 to distribute electricity. The company may also generate electricity. The officers are Herman Tweede, president; Woodson Peery, vice-president, and Walter Menlove, secretary and treasurer.

THE VERNONIA (ORE.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $100,000 by George J. Burdick, Maurice W. Seitz and M. E. McDermott.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CONCORD, N. H.—The Concord Electric Railway Company plans to rebuild its power plant at West Concord, recently destroyed by fire.

MILFORD, N. H.—The sawmill, power plant and several small buildings of the White Mountain Freezer Company, Nashua, were recently destroyed by fire, causing a loss of about $12,000.

NEW BEDFORD, MASS.—The Pairpoint Corporation, Howland Street, will install additional power equipment at its glass-manufacturing plant.

WESTERLY, R. I.—The Columbia Granite Works plans to rebuild its power house, recently damaged by fire, with other structures, causing a loss of about $50,000.

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Middle Atlantic States

AMSTERDAM, N. Y.—Work will soon begin by the Adirondack Power & Light Corporation on a large development program, involving an expenditure of about $700,000, which will include the erection of a new distributing station near Rotterdam. The company also contemplates the construction of a new distributing station in South Amsterdam.

ELMHURST, N. Y. — Electric power equipment will be installed in the proposed two-story ice-manufacturing plant, 50 ft. x 120 ft., to be erected by the Elmhurst Ice Company, Renn Place, estimated to cost $150,000. William Vanfelde, 2188 Metropolitan Avenue, Middle Village, N. Y., is architect.

GLENS FALLS, N. Y.—An electrically operated pumping plant will be installed in connection with extensions and improvements to the sewerage system, to cost about $120,000. J. Meyer is city engineer.

LE ROY, N. Y.—The Union Explosives Company is planning to rebuild its power house, recently destroyed by fire.

NEWARK, N. Y.—The taxpayers have authorized the installation of an ornamental lighting system on the principal streets of the village, the cost not to exceed $18,000.

TUPPER LAKE, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 28 for construction of twelve new buildings complete at the United States Veterans' Hospital, Tupper Lake. Part IV includes lighting systems for each building, nurses' call system, power systems and telephone conduits in certain buildings, and outside electric distributing systems, including transformers, panelboards, fixtures, conduits, fiber ducts and wiring. Part III includes complete heating and steam-distributing systems, and Part V boiler-plant equipment, piping feed and water pumps, etc.

CLARKSBORO, N. J.—The Board of Freeholders, Woodbury, plans to install an electric lighting plant and system at the county farm.

CARLISLE, PA.—The Middlesex Electric Light, Heat & Power Company, recently organized, plans to install a system in this section, including substation. Robert C. Brenneman, Carlisle, is treasurer.

OIL CITY, PA.—The business men of the south side of the city have petitioned the City Council for the establishment of an ornamental lighting system in that section.

PHILADELPHIA, PA.—The Philadelphia Electric Company has acquired the Penn Electric Light Company and will make extensions and improvements in the system.

PHILADELPHIA, PA.—H. M. and C. B. Siner, Church and Tacony Streets, will build a power house at their local brick manufacturing plant.

PHILADELPHIA, PA.—Plans are under way for the installation of substations and transmission lines by the following companies, recently organized as affiliated concerns, the Metal Township Power, the Letterkenny Township Power, the Hope Township Power, the Lurgan Township Power, the Bratton Township Power, the Fannett Township Power and the Sannett Township Power companies. The companies will operate in Mifflin, Franklin, Huntingdon and other counties and are represented by James Collins Jones, Bullitt Building, Philadelphia.

CLAYTON, DEL.—Electric power equipment will be installed in the proposed one-story ice-manufacturing plant here, to be erected by the J. A. Spahn Company, Wilmington, Del., to cost about $80,000.

ANNAPOLIS, MD.—The installation of an ornamental lighting system on Main and West Streets is under consideration by the City Council.

CHESTERTOWN, MD.—The property of the Chestertown Electric Light & Power Company has been purchased by Thompson & Lathrop, Philadelphia. The new owners, it is understood, will make improvements, including the installation of new equipment.

HUNTINGTON, W. VA.—Bids will be received by the United States Engineer Office until Dec. 30 for the construction of a power house at Dam No. 30, Ohio River.

RUPERT, W. VA.—The Midland Smokeless Coal Company, Ronceverte, recently organized, will install electric power and operating equipment at its mines.

BRISTOL, VA.—Plans for the proposed local factory to be erected by the Lincoln Furniture Company include a power house. C. C. Lincoln, Sr., is president.

WINCHESTER, VA. — The Virginia Woolen Company will build a power plant in connection with its proposed local mill, to cost about $100,000. Lockwood, Greene & Company, Atlanta, Ga., are architects.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Dec. 19, for switchboard for the Puget Sound Navy Yord (Schedule 343); miscellaneous quantity of flashlights and batteries, for Eastern and Western yards (Schedule 344); 6,000 ft. No. 8 single-conductor cable, and 6,000 ft. three-conductor cable, for the Puget Sound yard (Schedule 347).

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Dec. 28, for telephone equipment and supplies. (Circular P.R. 12566—17 CP.)

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, until Dec. 21, for 200 compass light switches.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Dec. 20, for a quantity of electrical and mechanical equipment for Canal Zone service, including 15,000 ft. electric detonators, 20,000 ft. safety fuse, one air and oil pumping outfit, one centrifugal pump and other power equipment. (Circular 1503.)

North Central States

BAD AXE, MICH.—Bonds to the amount of $10,500 have been authorized for the purchase of the local electric light plant, to be owned and operated by the municipality.

ISHPEMING, MICH.—The Michigan Gas & Electric Company is preparing plans for a new generating plant on the St. Joseph River, to cost about $400,000.

JACKSON, MICH. — The Consumers' Power Company will begin preliminary work in connection with its proposed new power plant on the Manistee River, to have an initial capacity of 8,000 kw.

OAKWOOD, MICH.—The Michigan Steel Corporation, First National Bank Building, Detroit, will install a power plant in connection with its proposed local plant, to cost about $500,000.

PALMYRA, MICH.—The Simplex Paper Company will build a power house in connection with its proposed local paper mill, to cost about $100,000. The Austin Company, Euclid Avenue, Cleveland, is engineer and contractor.

SAULT STE. MARIE, MICH.—The Union Carbide Company, 30 East Forty-second Street, New York City, will install electric power equipment in connection with additions to its local plant, to cost about $500,000.

TERRE HAUTE, IND.—Contract has been awarded by the Central Indiana Power Company for the construction of its new power station on the Wabash River, near Terre Haute, to Stone & Webster, Inc., Boston. The proposed plant will have an output of 40,000 kw. and will cost about $12,000,000. The work will be done under the supervision of Kelsey, Brewer & Company, Grand Rapids, Mich.

CHICAGO, ILL. — The Commonwealth Edison Company has authorized the sale of additional stock for $12,000,000, a portion of the proceeds to be used for new power-plant construction and improvements. Plans are being prepared for a substation on Troy Street, to cost about $25,000.

EDWARDSVILLE, ILL. — The Madison County Light & Power Company has closed a new contract with the City Council for street lighting, under the terms of which the lighting system will be reorganized, which includes the installation of an ornamental lighting system in the business district and replacing the arc lamps in the residential section with high-candlepower nitrogen tungsten lamps.

GRANITE CITY, ILL. — The Madison County Light & Power Company is erecting a transmission line from Stallings to East Alton, via Poag, Hartford, Roxana, Woodriver, and also a line from Stallings to Edwardsville. The substation at Woodriver will be rebuilt and a new transformer installed.

MOLINE, ILL.—Extensions are contemplated by the People's Power Company, to cost about $1,250,000, within the next eighteen months. The work will include an addition to the local power station and the installation of a triple generator and a 35,000-hp. steam turbine, for which orders have been placed.

COON VALLEY, WIS.—The Coon Valley Electric Company has petitioned the State Railroad Commission for permission to issue $3,000 in capital stock, the proceeds to be used for extensions to its plant and to change the system from direct to alternating current.

HARTFORD, WIS.—A bond issue of $60,000 has been approved by the City Council of which part of the proceeds will be used for the installation of an ornamental lighting system.

MANAWA, WIS.—The Lindsay Light & Power Company is planning to construct a hydro-electric generating plant, to cost about $45,000. Contracts, it is understood, will be awarded about Jan. 1.

MILWAUKEE, WIS. — Electric power equipment will be installed in the one and two-story ice-manufacturing plant, 120 ft. x 135 ft., to be erected by the Wisconsin Ice & Coal Company, 216 West Water Street, estimated to cost $150,000.

RACINE, WIS.—The Racine Pure Milk Company, 1010 Thirteenth Street, will make extensions and improvements in its power house and plant to cost about $22,000.

DULUTH, MINN.—Arrangements are being made by the Universal Portland Cement Company, 210 South La Salle Street, Chicago, for an addition to its plant at Morgan Park, including extensions to grinding department, burner building and power plant.

RED LAKE FALLS, MINN.—The Red River Power Company has submitted proposals to the villages of Oklee, Plummer and Brooks relative to extending its lines to those places. The company also contemplates erecting transmission lines to Mentor, McIntosh, Erskine and Fosston.

LA PORTE, MO.—An electrically operated pumping plant will be installed in connection with extensions and improvements to the municipal waterworks, to cost about $190,000. Black & Veatch, Mutual Building, Kansas City, Mo., are engineers.

ST. LOUIS, MO.—Bids, it is understood, will soon be asked for the installation of 287 electric lamps mounted on concrete standards on a number of streets in the city, to cost about $53,000. R. Toensfeldt, City Hall, is engineer.

ST. LOUIS, MO.—At an election to be held Feb. 9 the proposal to issue $8,000,000 in bonds for the installation of a municipal electric lighting system will be submitted to the voters. W. W. Horner, City Hall, is engineer.

BRIDGEWATER, S. D.—At an election to be held Dec. 22 the proposal to issue $10,000 in bonds for the installation of an electric light and power plant will be submitted to the voters.

CENTER, NEB.—The local electric light plant was recently damaged by fire.

LIBERTY, NEB.—A special election will be held Dec. 23 to vote on the proposal to issue $7,000 in bonds for the purpose of erecting a high-tension transmission line to connect with the plant of the Beatrice Power Company, near Barnston.

Southern States

NEWBERN, N. C.—The Roper Lumber Company plans to rebuild its mill and power house, recently destroyed by fire, causing a loss of about $300,000.

DILLON, S. C.—The Palmetto Power & Light Company plans for extensions in the municipal power plants at Dillon and Latta, S. C., recently acquired. New transmission lines will be constructed.

ATLANTA, GA.—Plans are under way by the Georgia Railway & Power Company for the erection of high-tension transmission lines from Tallulah to Atlanta, connecting Hartwell, Royston, Lavonia, Canon and Bowersville.

CHATTANOOGA, TENN.—Plans are under consideration to install an ornamental lighting system on several streets of the city.

NASHVILLE, TENN.—Plans have been prepared by the Nashville Railway & Light Company for extensive improvements, including the erection of high-tension transmission lines, installation of a new turbo-generator set, switchboard, stoker equipment for power plant, construction of five substations and track improvements, etc., to cost about $500,000.

UNION CITY, TENN.—The Brown Shoe Company, Washington Avenue, St. Louis, will build a power house in connection with its proposed local factory, to cost about $250,000.

DADEVILLE, ALA.—The municipal electric light plant has been purchased by the Alabama Power Company, Birmingham. Work will begin at once on the reconstruction of the electric lines and the erection of a substation.

FLORENCE, ALA.—The Council has engaged Evans & Meade, engineers, to prepare plans for a municipal hydro-electric plant on Cypress Creek, to cost, with equipment, about $250,000.

LUCEDALE, MISS.—The Council is considering taking over the local electric light plant and waterworks system, to be owned and operated by the city.

BATON ROUGE, LA.—Bids will be received by R. L. Himes, secretary building committee, Louisiana State University, Baton Rouge, until Dec. 19 for construction of an engineering shop and power house. Theodore C. Link, Baton Rouge, is architect.

MONROE, LA.—An election will soon be held to submit to the voters the proposal to issue $200,000 in bonds for public improvements, of which $100,000 will be used for the construction of a new municipal electric light and water plant.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company has purchased a site near Harrah Lake, about 20 miles from Oklahoma City, on which it proposes to erect an electric generating plant, to cost about $3,000,000, work on which will begin at once. The initial installation will have an output of 15,000 kw. The plans provide for an ultimate capacity of 50,000 kw.

PAULS VALLEY, OKLA.—Bonds have been voted for an ornamental street-lighting system.

CAMERON, TEX. — The Texas Central Power Company has taken an option on the electric plant of the Cameron Water, Power & Light Company. The Texas Company, it is reported, contemplates the construction of a large electric generating plant on the Brazos River in this section.

CORPUS CHRISTI, TEX.—Estimates of the cost of the installation of a municipal electric light plant are being prepared by the city engineer.

CORSICANA, TEX.—The Corsicana Ice Company is planning to double the capacity of its power house on South Fourteenth Street.

McALLEN, TEX.—The property of the Rio Grande Public Service Corporation, consisting of an electric light plant and waterworks system, has been acquired by the Morrison & McCall syndicate, St. Louis, and San Antonio, Tex. The new owners, it is understood, will make extensive improvements to the systems. The Morrison & McCall syndicate own public utility systems in eighteen towns in Texas and at this time is making improvements in thirteen of these towns, at a cost of about $500,000. One of the most important of these is the construction of a hydro-electric plant on the Guadalupe River, near Yorktown. Transmission lines will be erected from the new power station to a number of towns. Improvements are now being made to plants in McAllen, Corpus Christi, Beeville, Yorktown, Victoria, Cuero, Kingsville, Del Rio, Center, Carthage, Childress, Memphis and San Benito.

ORANGE, TEX.—The Texas Gas & Electric Company will install additional equipment at its power plant for service at Tenaha, Gary and Carthage. Transmission lines will be built and distributing systems installed.

RICHLAND, TEX.—B. M. Fluker, operating a power plant for local commercial service, will install additional equipment. Line extensions will also be made.

Pacific and Mountain States

CHELAN, WASH.—The Commissioners of Chelan County have granted the Washington Water Power Company, Spokane, a franchise to extend its transmission lines into Chelan County at Chelan Falls and thence north to the county line.

TACOMA, WASH.—Bids will be received by the Director of the United States Veterans' Bureau, office of the Quartermaster General, 2306 Munitions Building, Washington, D. C., until Jan. 16 for construction of a Neuro-Psychiatric Hospital at American Lake, Tacoma, for the Veterans' Bureau. The work will include the construction of twenty-eight buildings, with water, lighting, heating and sewer systems, etc.

ALBANY, ORE.—Almond A. White and associates have applied to the State Water Department for permission to construct a hydro-electric plant on the Santiam River. The cost is estimated at about $250,000.

FRESNO, CAL.—The San Joaquin Light & Power Corporation contemplates extensions and improvements to its system in the vicinity of McKittrick and Santa Maria.

LOS ANGELES, CAL.—The Blue Tank Pipe Line & Refinery Company, Long Beach, will build an electric substation in connection with its proposed refining plant here, to cost about $900,000.

MURRAY, UTAH.—Application has been made by the City Council to the state engineer for authority to divert 15 cu.ft. of water from Little Cottonwood Creek in Salt Lake County, the power to be used to increase the output of the municipal electric plant. The plans call for a development of 420 hp.

PROVO, UTAH. — The Council is considering the installation of an ornamental lighting system, to cost about $11,600.

CHANDLER, ARIZ.—The Town Council is considering calling an election to submit the proposal to issue bonds for the installation of electric light, water and sewer systems to the voters.

GREAT FALLS, MONT.—Plans are being considered for a lighting system on Central Avenue. An appropriation of $10,000 will be made.

EUREKA, NEV. — Electric power equipment will be installed by the Eureka Smelting & Mining Company in connection with its proposed smelting plant to cost about $1,200,000.

Canada

COLEMAN, ALTA.—The power house of the International Coal & Coke Company was recently destroyed by fire.

WINNIPEG, MAN. — The City Council has authorized the manager of the Winnipeg Hydro-Electric System to prepare plans for a steam auxiliary steam-power plant with an initial capacity of 15,000 hp.

ST, JOHN, N. B.—The New Brunswick Power Company, which operates the electric light and power system, street-car lines and gas system in St. John, has rejected the offer of the city to purchase its system at $2.577.655, the valuation of its property fixed by the Supreme Court in 1920. The City Council has appointed a permanent hydro-commission of seven members, with power to erect and operate an electrical distribution system. The Council has entered into a contract with the New Brunswick Electric Power Commission for electricity from the Musquash hydro-electric project.

ELK LAKE, ONT. — The Matachewan Power Company has contracted to furnish electricity to the Night Hawk, Peninsula, Davidson Clifton-Porcupine and Premier Paymaster mines, all located in the Porcupine district. The company also plans to supply energy to the Matachewan gold mines.

PORT ARTHUR, ONT.—The Port Arthur Public Utilities Commission has petitioned the Hydro-Electric Power Commission of Ontario to begin work on the construction of an additional unit to the Nipigon power development.

TORONTO, ONT.—Plans are being prepared by the Canadian National Railways for the electrification of the former Canadian Northern Railway and the Toronto Eastern Railway so as to give an electric radial service from Toronto to Port Hope, a distance of 75 miles. The cost is estimated at about $3,000,000. A. F. Stewart is chief engineer.

ESTEVAN, SASK.—The Town Council has petitioned the local Government Board for authority to install a turbine in the municipal electric plant.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 21, 1922)

1,436,247. HEATING METAL POT; G. J. Hagan, Pittsburgh, Pa. App. filed Sept. 29, 1921. Applicable to tinning or galvanizing sheet metal.

1,436,251. OZONE GENERATOR; H. B. Hartman, Scottdale, Pa. App. filed Oct. 11, 1921. Air filter placed betwteen air inlet and generator.

1,436.252. SYSTEM FOR PRODUCING MODULATED WAVES; R. A. Heising, East Orange, N. J. App. filed Dec. 27, 1918. High-frequency electromagnetic waves produced by varying current supplied to arc generator.

1,436,261. AUTOMATIC TELEPHONE SYSTEM; Emil Jacobson, Port Washington, N. J. App. filed Aug. 6, 1920. Automatic rotary connector switch of improved type.

1,436,264. AURICULAR APPARATUS; Gustaf L. Jonason, Stockholm, Sweden. App. filed Feb. 28, 1920. Apparatus for transmission of articulate sounds.

1,436,280. AUTOMATIC STEERING DEVICE; Nicolai Minorsky, New York. N. Y. App. filed Nov. 2, 1918. Device automatically controls action of rudder whereby accurate steering is obtained.

1,436,299. ELECTRIC CIGAR LIGHTER; M. H. Speilman, New York, N. Y. App. filed Dec. 10, 1920.

1,436,327. ELECTROMAGNET; F. E. Ward, East Orange, N. J. App. filed June 1, 1921. Signal to detect dangerous currents in wires or machines.

1,436,329. MOTOR-STARTING SWITCH; S. S. Wheeler, Bernardsville, N. J. App. filed June 7, 1921. Switches for starting three-phase and two-phase motors.

1,436,335. ELECTROMAGNETIC MOTOR; W. W. Billings, Lakewood, Ohio. App. filed July 5, 1919. For actuating record tables of phonographs.

1,436,341. DEVICE FOR CONNECTING ELECTRIC CABLES OR CONDUCTORS WITH OTHER PARTS; G. Giovannoni, Turin, Italy. App. filed Dec. 20, 1918. Slip-on connector for spark plugs.

1,436,381. ELECTRICAL PAD AND THE LIKE; W. F. Craddick and C. M. Uhlig, Chicago, Ill. App. filed April 7, 1922. Conductors woven into body of fabrics.

1,436,395. ELECTRIC WELDING AND THE LIKE; Le Roy H. Hoffer, Nyack, N. Y. App. filed Feb. 18, 1921. Method for controlling energy used to heat and soften parts welded.

1,436,467. MAGNETO STARTER; J. F. Adye, Cheshire, Eng. App. filed Dec. 17, 1920. Arrangement of clutch.

1,436,497. ELECTRODE FURNACE; J. H. Gray, New York, N. Y. App. filed July 31, 1920. Motor that controls electrodes mounted independent of furnace.

1,436,541. TELEGRAPH INSTRUMENT; G. I. Shelton, Fort Worth, Tex. App. filed May 31, 1921. Contact for sending device of "autodot type."

1,436,557. PROCESS OF AND DEVICE FOR REMOVING RIVET HEADS; B. C. Wysong, Huntington, W. Va. App. filed Sept. 28, 1920. By melting rivet with electric arc and blowing material away with compressed air.

1,436,570. APPARATUS FOR OPENING TELEPHONE CIRCUITS AT A DISTANCE; L. S. Bohac; Cedar Rapids, Iowa. App. filed Jan. 12, 1921. Distant line opened for testing from the central station.

1,436,575. AIR-SPEED INDICATOR; C. R. Colt, Washington, D. C. App. filed June 16, 1920. Employs propeller-driven generator.

1,436,616. SECONDARY OR STORAGE BATTERY; R. L. Walsh, Washington, D. C. App. filed March 6, 1920. Utilizes circular electrodes.

(Issued Nov. 28, 1922)

1,436,639. DEVICE FOR OPERATING ADDING MACHINES AND THE LIKE; T. S. Bindschedler, Detroit, Mich. App. filed Oct. 19, 1917. Solenoid apparatus for operating adding machines.

1.436,657. ELECTRICAL HEATING DEVICE; C. B. Ingersoll, Chicago, Ill. App. filed Nov. 26, 1921. Portable heating device inserted in receptacle to be heated.

1,436,676. SYSTEM FOR WIRELESS TRANSMISSION OF WRITING, PICTURES AND THE LIKE; M. H. Peterson, Christiania, Norway. App. filed Oct. 21, 1921. By receiving oscillating current and combining it with separate auxiliary current of slightly different frequency.

1.436,683. BATTERY SUPPLY CIRCUITS FOR REPEATERS; A. F. Rose, New Brighton, N. Y. App. filed Feb. 28, 1918. Installations involving several vacuum-tube repeaters.

1,436,685. SWIVEL CONNECTION; D. L. Sauerhering, Wausau, Wis. App. filed March 10, 1920. Swivel connection for electric cords to obviate twisting and tangling.

1,436,697. CAR-LIGHTING SYSTEM; B. M. Coffee, Jersey City, N. J. App. filed Dec. 20, 1919. Control of variable-speed generators employed to charge storage batteries.

1,436,709. ANODE FOR ELECTROLYTIC RECTIFIERS; G. H. Groce, Chicago, Ill. App. filed Aug. 17, 1920. Electrode composed of alloy of lead and antimony.

1,436,716. DUPLEX ELECTRIC WELDING MACHINE; J. Ledwinka, Philadelphia, Pa. App. filed April 17, 1919. Simultaneously forms several welds.

1,436,717. FILAMENT FOR INCANDESCENT ELECTRIC LAMPS AND THE LIKE; F. S. Goucher, Hammersmith, London, England. App. filed Nov. 25, 1921. Annealed wire passed through steep temperature gradient to withstand high temperatures.

1,436,723. ELECTRIC FURNACE PLATFORM; H. F. Priwer, Springfield, Ohio. App. filed June 15, 1920. Swinging platform to allow work on electrodes without standing on furnace top.

1,436,807. METALLIC-FILAMENT LAMP; H. J. Jaeger, Weehawken, N. J. App. filed Sept. 22, 1920. Has high and low candle-power filament.

1,436,867. ELECTRIC HEATER; H. H. C. Dun-Woody, Washington, D. C. App. filed Feb. 17. 1922. Resistor plate immersed in receptacle to be heated.

1,436,873. REVERSIBLE BATTERY; V. C. Goodridge, Chicago, Ill. App. filed July 3, 1922. Negative electrode of porous lead and positive electrode of lead-oxygen composition.

1,436,889. THERMOELECTRIC APPARATUS FOR HEATING FLOWING LIQUIDS; R. C. Masseroni, Milan, Italy. App. filed Feb. 16, 1921. Electrodes arranged in pairs in liquid.

1,436,891. ELECTRIC HEATING APPARATUS; W. S. Moody, Pittsfield, Mass. App. filed Jan. 3, 1922. For heating pipes.

1,436,901. ELECTRICAL APPARATUS; J. W. Patch, Fort Wayne, Ind. App. filed Jan. 15, 1921. Means for retaining windings, transformers, reactors, etc., in predetermined spaced relations.

1,436,926. ELECTRIC PROTECTION SYSTEM; J. P. Williams, New York, N. Y. App. filed May 21, 1921. High-tension spark coil or transformer to protect vaults, etc.

1,436,936. AUTOMATIC TROLLEY RETRIEVER FOR ELECTRIC TRAMCARS; A. Bowen, Santiago, Chile. App. filed May 18, 1922.

1,436,957. ELECTRIC HAIRBRUSH; B. Harvey, Dallas, Tex. App. filed Sept. 2, 1921. Electrically heated.

1,436,968. STATIONARY INDUCTION APPARATUS; J. S. Lennox, Norwich, Conn. App. filed Dec. 22, 1920. Reactance coils in which conductors support one another without special radial supports.

1,437,003. ELECTROPLATING APPARATUS AND PROCESS; J. J. Mueller, Ottawa, Ill. App. filed Oct. 8. 1921. Machine for continuously electroplating metal strips.

1,437,005. ELECTRICALLY HEATED COOKING DEVICE; J. F. Newsom, Palo Alta, Cal. App. filed Sept. 20, 1921. Subjects material being cooked to desired temperature for selected time.

1,437,018. MOTOR CONTROLLER; T. H. Rodman, New York, N. Y. App. filed Feb. 21, 1921. Controller for printing press.

1,437,021. ELECTRON-DISCHARGE-DEVICE CIRCUITS; J. C. Schelleng, East Orange, N. J. App. filed May 11, 1921. Prevents vacuum-tube systems from generating undesired oscillations.

1,437,023. PORTABLE CONTAINER; I. Schneider, New York, N. Y. App. filed Jan. 12, 1922. Flashlight for portable cases and bags.

1,437,046. ELECTRICAL WATER HEATER; M. D. Dominguez, New Orleans, La. App. filed Sept. 21, 1921. Automatically controlled by flow of water in pipe.

1,437,047. CIRCUIT CONTROLLER; C. L. DuBois and Claudius Reynold, Lausanna, Switzerland. App. filed Dec. 16, 1920. Prevents customer from using more than predetermined amount of power.

1,437,061. STARTING MECHANISM FOR AUTOMOBILES; B. D. Kunkle, Wilkinsburg, Pa. App. filed April 6, 1915. Shiftable pinion between starter and engine.

1,437,068. CONTROL SYSTEM; H. D. Murdock, Wilkinsburg, Pa. App. filed May 23, 1919. Systems for accelerating and decelerating electric machines.

1,437,074. ELECTRICAL PROTECTIVE DEVICE; J. H. Procter, Wilkinsburg, Pa. App. filed May 7, 1917. Overload time-limit relay.

1,437,075. MOTOR-CONTROL SYSTEM; L. G. Riley, Wilkinsburg, and Samuel B. Schenck, Edgewood Park, Pa. App. filed March 14, 1921. Series-parallel control of railway cars.

1,437,076. APPARATUS FOR KEEPING POLICE OFFICERS' RECORDS; W. H. Rooney, New York, N. Y. App. filed Oct. 11, 1918. Central recorder at headquarters.

1,437,086. ELECTRICALLY OPERATED SIGNAL FOR AUTOMOBILES; M. R. Bater, N. P. Svendsen, D. T. Trump and R. M. Mahoney, Calgary, Alberta, Canada. App. filed Oct. 7, 1918.

1,437,087. VOLTAGE-REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed June 18, 1919. For governing regenerative-control voltage of electric locomotives.

1,437,103. TERMINALS; P. M. Hengstenberg, Wilkinsburg, Pa. App. filed Aug. 10, 1918. Adapted for electrical measuring instruments.

1,437,104. SYSTEM OF CONTROL; D. C. Hershberger, Turtle Creek, Pa. App. filed Jan. 30, 1920. Protection of auxiliary apparatus on locomotives.

1,437,107. CONTROL SYSTEM AND APPARATUS; H. M. Johnston, Edgewood Park, Pa. App. filed May 23, 1919. Series-parallel control of railway cars.

1,437,111. ELECTRICALLY HEATED SADIRON; J. F. Lamb, New Britain, Conn. App. filed July 23, 1921. Sole plate of less thickness at toe than at heel.

1,437,119. ELECTRICALLY OPERATED HEATING APPARATUS; C. P. Speck, Evansville, Ind. App. filed Dec. 7, 1921. Heating system of radiator type with heating element in vacuum.

1,437,122. ELECTRICAL COOKING UTENSIL; G. F. Wells, San Francisco, Cal. App. filed Sept. 22, 1921. Portable domestic cooking device.

1,437,132. ELECTRIC REGULATION; J. L. Creveling, Tucson, Ariz. App. filed Dec. 1, 1919. Applicable to generator used to charge storage batteries.

1,437,142. REGULATOR SYSTEM; A. Heckman, Wilkinsburg, Pa. App. filed Jan. 16, 1920. Regulator automatically controls temperature of solder pot.

1.437,166. SUBMERSIBLE ELECTRIC HEATER; G. S. Campbell and Oscar A. Sommermeyer, Passaic, N. J. App. filed Sept. 2, 1921. Adapted to be placed in liquid.

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The Power Behind All Plans

A PROMINENT utility man in an address before a group of central-station people the other day stressed again the oft-told truth that it is money that makes the mare go—likewise the boiler, the turbine and the generator. Engineers may plan, he said, with all the vision and the skill that trained minds are capable of, and yet if capital is not available to finance these plans, the greater stations, the heavier transmission lines and the further extension of the service cannot be realized.

All true it is—but there is something even beyond this that is, after all, the real power behind the plans. There must be good repute and public confidence.

THERE are many brave plans now in suspension—waiting the unfolding of the new year. Manufacturers and jobbers look to 1923 for improved business conditions that will bring opportunity to put into effect long-formed desires. Central-station executives have ready many engineering projects that they are eager to get into operation and programs for market development that will sell the new output which will be made available. Contractors are counting on the acceleration of home building and other construction to provide a greater business for them too. Dealers are feeling the influence of increased public demand for electrical appliances and look for steady gains in sales as prosperity advances.

The entire industry is full of expectation and every man is thinking plans for 1923. But the very keystone of the whole structure rests on the interest and confidence of the public, on its desire to buy and use electric service, appliances and accessories, its willingness to support the electrical industry by investing its money in light and power company securities and in those of other electrical business enterprises.

Of all the plans that are now forming there are none more fundamental, therefore, than the plans for the extension of customer ownership of utility securities, with all it means not only in enlarged financial resources but in the supporting public interest, confidence and sympathy that always follow. For here only is there a practical and appropriate opportunity to approach and sell to average households a living piece of the electrical industry and to bind them in as partners in our great enterprise.

ALL this is more than a mere matter of central-station interest and concern. Out of central-station prosperity and growth come growth and prosperity for all those who make and sell things to the growing central station and to its customers. Experience has proved that utility stock ownership has universally sharpened the consumer's desire to do more things electrically and stimulated the market for both electrical energy and merchandise. The whole industry believes this now. There could be no better industry plan for 1923, therefore, than for electrical men of every class to get solidly behind this power behind all plans.

George Francis Morrison

An engineering executive who has developed the lamp industry and influenced the standardization of lamp equipment.

THE incandescent lamp is largely responsible for the coming into being of the electrical industry and still retains its place as one of the leading assets of that industry. Foresight and intelligent development have brought about the great lamp industry of today, and in this achievement no man has been more instrumental than George Francis Morrison, vice-president of the General Electric Company and a director of both the General Electric Company and the International General Electric Company.

Born in Wellsville, N. Y., Mr. Morrison was first employed at the Edison Lamp Works at Harrison, N. J., where, in 1882, at about sixteen years of age, he did a boy's work for a dollar a week. Quickly rising in the ranks, he learned the lamp business in all its phases and won rapid recognition of his executive ability. He served as general foreman, superintendent and works manager and became a vice-president in 1916.

While Mr. Morrison was works manager the great expansion of the company's lamp business took place and friendly relations were established among lamp manufacturers, with a resulting stabilization of the industry. The great number of bases then used were discarded in favor of the Edison base, which became the standard not only in the United States but also in most other countries. In all negotiations of this sort Mr. Morrison took a leading part. His attractive personality and sound reasoning helped immeasurably to effect the harmonious understanding which was brought about. In the same way Mr. Morrison has been instrumental in establishing closer contact with lamp manufacturers abroad. His work in Japan along these lines was so beneficial to the lamp industry that the Emperor of that country bestowed upon him the Order of the Rising Sun.

Mr. Morrison has a keen judgment of men and affairs, possessing that type of mind which sees all sides of a problem and arrives at accurate conclusions. This ability was developed in the school of actual experience. The ever-increasing responsibilities which he so successfully assumed constituted his technical and business training for further achievement. In the many years which Mr. Morrison spent at the Edison Lamp Works it is said that he never made an enemy. He won the esteem of all his associates and now numbers them among his intimate business and personal friends.

As vice-president of the General Electric Company Mr. Morrison has continued his direction of the lamp business, while his ability has also been of great value in promoting the many other interests of the company.

Editorial Comment

Electrical World, December 23, 1922

Volume 80 Number 26

The Eighteenth Amendment and the Public Utility

HIS speeches in defense of the liberty and Constitution of his country were among the most eloquent of all of Daniel Webster's utterances. It was he who sketched for future generations the broad national grounds upon which our Constitution rests, and in view of the belligerent (or shall we say antagonistic?) attitude now being manifested toward the Constitution in some quarters, it is refreshing to recall that all similar onslaughts against that American citadel have come to naught.

Now, the Eighteenth Amendment has nothing to do with engineering, but it has everything to do with American institutions, and our duty as citizens is above our duty as engineers. Therefore, as heirs to the precious inheritance of liberty secured by law, we ought not lightly to regard infractions of the Constitution which if persisted in will threaten the very foundation of the government. For a democracy that will not respect and obey its own laws is no democracy at all. We urge all readers, and particularly those engaged in public utility work, to refrain from indulging in spirituous liquors in public and from making light of a law which is as legal as any other law. Disregarding for the moment the effect on the human system, we are more solicitous of the moral effect on the community. How can we expect men in the street to accept decisions of the commission or decrees of the courts at their true value, how can we even claim the protection of the laws of the land, if we ourselves flout them?

The electric light and power business is a semi-public business, and of all men in the community those engaged in public business should be most scrupulous in the observance of law and in demanding compliance therewith on the part of others.

Transportation Advantages of Railroad Electrification

THE chief element in considering railroad electrification should be its value in increasing transportation facilities. Too frequently the discussions of the question degenerate into choice of systems, designs of locomotives, costs of operation and other controversial details that have their place, but not to such an extent that they obscure the major premises that electrification speeds up and makes more flexible the transportation of goods and men.

An outstanding fact is that every electrification system is a success; they are all working and none has been discontinued. In every case the transportation advantages are increased. Why, therefore, should debates about direct current versus single-phase or polyphase alternating current, side-rod locomotives versus geared or quill-drive locomotives, relative direct costs of locomotive energy consumption in terms of fuel, and the merits of overhead versus third-rail distribution be permitted to hold first place in convention discussions on the subject?

It is to be hoped that the papers to be presented before the American Institute of Electrical Engineers at the June convention next year will be a summation of the transportation efficiency of electrification and not develop entirely into a discussion of equipment design, cost and economy.

A national convention of an engineering organization affords opportunity for working out in co-operation with the transportation executives an agreement of opinion on the subject along broad lines which will have a world-wide influence on electrification progress. The problems of application and design are largely determined by the specific case and cannot afford details from which to generalize, but consideration of the existing systems from the standpoint of transportation should permit the presentation of papers of merit which will co-ordinate and record the current knowledge and opinion on the subject.

New Activity in Education

AN ENCOURAGING, vigorous and original type of thinking has developed recently in connection with engineering and industrial education. Much food for reflection as well as some decidedly helpful action has resulted from the thorough discussions on this topic that have characterized recent programs of many engineering and educational organizations.

Education may be divided into several classifications in so far as its industrial relations are concerned—the engineering colleges, the trade schools and others of like character within an industrial organization, and finally the correspondence schools and university extension departments. Each class makes valuable contributions to industry, and, while as regards the technique of education each is in a field for intense activity on the part of specialized educators, at the same time some broad, fundamental thoughts have been developed from many sources which should receive consideration.

One plan brought forward and acted upon is a practical scheme for co-operation between the educators and the industrial leaders in studying the problem. Largely through the activities of the Society for the Promotion of Engineering Education and the National Industrial Conference Board a joint committee has been formed. This committee is now actively at work and has the personnel and funds to accomplish definite results. One beneficial effect of this development will be brought about by the personal interest of influential industrial men in college engineering activities, whereby the university executives will be forced to realize in greater degree the importance of adequately equipping the engineering schools and furnishing them with competent and well-paid staffs.

Another idea expressed and well worth consideration was in brief that a functional separation of students was more meritorious than the traditional college classifications. For example, the students might be divided into research, operating, construction and sales engineers, rather than into civil, electrical, mechanical and chemical engineers. This idea was based on a division in conformity with the aptitudes of the individuals and their future functions in the industrial organizations with which they may be connected.

A very favorable opinion was expressed as to the value of the trade, correspondence, apprentice and other secondary industrial schools. As one central-station executive has said: "A sound educational policy is fundamental in a central-station organization. The rank and file of the personnel must know how to do their jobs and also why they do them in one particular way. The college men rapidly advance in position and the secondary executives also shift. A permanent operating code accompanied by proper interpretation renders the organization immune from bad effects from these changes and also secures permanency in operating methods. In addition, every man becomes interested in his job and the next one above on the ladder of progress and increases his personal activity. This enhances the esprit de corps of the whole organization."

The results from the thought and action we have referred to will be beneficial. They show a more complete realization of the vital economic asset possessed by the organization with an interested and educated personnel, and they have caused a more nearly unanimous agreement that educational investments pay dividends continuously.

Insulator Life Will Be Lengthened

THE electric light and power industry has been going through a rapid cycle of changes necessitating the replacement of much equipment because of obsolescence rather than natural wear. Pressure of immediate problems has prevented much consideration of how to attain longer life for material not directly affected by obsolescence. It is now necessary to give attention to insuring greater permanence for many materials used in building generating and transmitting systems. With greater stabilization in the development of the industry it is fair to assume that there will be an increasing amount of equipment in the plant that will have a longer life and that means to lengthen life will be found. Among the objects now receiving intensive study are wooden poles. Had more been known of preservative methods twenty years ago, the pole problem might not have been so acute as it is today and will be for the next few years.

In a little more than twenty years of high-tension development American insulator manufacturers have produced an insulator that, despite some faults, is a creditable piece of work, particularly when it is remembered that the ceramic industry has existed almost as long as human history is known and that there have been many traditions to overcome. Faced with the demand for higher standards of service, the central-station operator is inclined to lose faith at times in insulators—particularly if a line goes down and service cannot be restored promptly because of insulator trouble. He forgets that there are thousands of miles of transmission circuit in service and that good service is being given as the result of real accomplishment on the part of the insulator designer and manufacturer. Greater things can and will be done in the future, the life of insulators will be increased, and the present troubles will become a thing of the past. That much is certain, and a little patience and co-operation between the producer and user will be the biggest factor in bringing about such results.

Hunting for Electrical Data

ONE of the most serious difficulties which the student or engineer has to encounter is the finding of necessary data known or suspected to have been published and needed for reference. The same difficulty exists in every branch of science, increasing in complexity and exasperating quality according to the extent of the particular science concerned, the number of possible places for publication, and the array of languages in which such publication is likely to take place. Suppose that one attempts to run down the literature of some problem, let us say, in lightning-arrester theory and practice. The subject may be incidentally touched upon, to the extent of a chapter or less, in twenty books, published all the way from two to twenty years ago. There is a long array of papers stretching over many years and half a dozen languages scattered through scientific journals, class journals, house journals, bulletins or other publications of a score of societies, and theses from many institutions. Broadly speaking, the only refuge is to dig and keep on digging until driven from the quest by lack of time or sheer brain fag.

A very informing paper by Professor Karapetoff in the current issue gives some idea of the line of attack to be followed, and at least a few of the sources of information to be unearthed. We particularly agree with his view of the usual faults of indices. To be sure, an index cross-referenced as it should be for easy finding of details involves almost as much labor as the book itself, and there are several famous examples of indices which, having referred (following Professor Karapetoff's example) to "Sparkover," "Discharge," "Corona," each duly accredited to "See Dielectric strength," have wound up by "Strength, dielectric, see Corona." Many sciences have yearbooks of great ultimate value, but unfortunately several years behind the game. We quite agree with Professor Karapetoff that monthly *Science Abstracts* is a very valuable source in starting a hunt on a large scale. If the branch of science or technology has a good yearbook, this furnishes the quickest summary of work to within the past two or three years. Then the *Science Abstracts* come into extremely useful play, and in addition to these use should be made of the principal electrical journals, foreign and American, which Professor Karapetoff lists. These, if well edited, as most of them are and all of them ought to be, should give at least a clew to all publications bearing directly on progress of the electrical arts. The most troublesome feature of the whole quest is the tendency of technical and scientific writers to bury important data in a great mass of somewhat irrelevant matter to which the thing really vital is entirely collateral, so collateral indeed as to escape even the scrutiny of the compilers of *Science Abstracts*. Sometimes, through the help of one of our great national institutions, a conspective index of technical literature will make its appearance. Until then one can hardly do better than to advise the student to follow Professor Karapetoff's general suggestions and keep digging.

Alternating Current for Congested Districts

ALTERNATING-CURRENT distribution for districts in large cities where the load is congested is making very rapid progress. Virtually all companies with direct-current systems are hard at work on the best methods of bringing about the eventual changeover to alternating current, and it may not be long till we shall see the elimination of direct current except for elevator, printing-press or other special service.

Some of the many advantages which the alternating-current system possesses over the direct-current system are outlined in the article by M. T. Crawford in this issue. The use of interconnected stations and the development of automatic substations and protective equipment have largely solved the question of reliability of service. Thus only certain features of application now make direct-current service necessary, and the improved operation of rotary converters combined with automatic control of their actions makes it entirely feasible to use them when a direct-current supply is imperative for special reasons. The reduced losses, the employment of higher voltages, the operation of the simpler and more stable substation apparatus and the elimination of much underground construction all help in effecting the striking economies obtained by the use of alternating current. In his study of conditions at Seattle Mr. Crawford points out that alternating-current substations can be located at intervals of two miles, with a rating of 35,000 kw., as compared with the use of four direct-current 10,000-kw. substations at one-mile intervals. Moreover, he estimates a loss of only 6 to 8 per cent for alternating current as against 20 to 25 per cent for direct current.

The entirely alternating-current system is the ideal type to build toward in central-station practice. Improvements are to be expected in secondary network connections and also in obtaining alternating-current motors of proper characteristics so that finally it shall be possible to meet the few remaining advantages possessed for special services by the direct-current system.

Executive Contacts with the Public

THOSE of us who are privileged to stand behind the scenes in the great drama of public utility management know that it is the earnest intent of the vast majority of executives to play fairly and squarely with the people. Unfortunately the growth of utilities has inevitably tended to lengthen the distance between managers and customers, and it has come to pass that the impression the public gets of its local company depends very largely upon the bearing and work of subordinate employees. There seems no escape from this, if escape were desirable, and efforts expended upon inculcating policies of courtesy and good will are today of fundamental importance in the field of public relations. Gradually, we believe, there is being built up a new type of utility employee who constantly recognizes his or her obligations to the public, so that the outlook is on the whole very encouraging. But some provision for executive contact with the people down to the most humble customer is of continuing importance.

With the best of intentions, it is sometimes impossible for the subordinate employee, and even for the department head, to satisfy a customer that the company is trying to do right. Before the case is given up for lost, therefore, a higher executive should take a hand in it. In at least one progressive company of which the *Electrical World* has knowledge no customer is finally allowed to depart unsatisfied without having an opportunity to talk with the vice-president, and often a courteous hearing and sympathetic explanation of company practices in the quiet of the executive office, with full opportunity for the customer to ask questions about the reasons for policies and regulations, has cleared up the trouble. If the department head is at fault, as may happen once in a while, the situation can be rectified, while if the company's position is sound, its explanation by an executive unhurried with routine and for the time being free from interruptions may work much good. With a well-conducted utility cases where the customer requires the personal attention of a higher executive should not be sufficiently numerous to cause serious inconvenience. The existence of such an opportunity has the further merit of bringing to higher official attention the views held upon company matters by the unsatisfied public.

The Intimate Performance of Storage Batteries

THE general theory of the storage battery has of course been known for many years. The battery itself has been worked down to an approximation of a standard condition, so that its general characteristics of operation are familiar. It has always, however, shown an occasional inclination to evil ways, sometimes of an unknown character. For instance, certain impurities are well understood to make very serious trouble in a battery and certain methods of treatment are known to be damaging. The exact reason for trouble arising from such sources is not always clear, and it is therefore an exceedingly good thing that the Bureau of Standards has taken up the study of the performance of battery plates from a strictly scientific standpoint. Messrs. Vinal and Ritchie, in a paper which we publish this week, give the preliminary results of a study of battery performance by a new and apparently very sensible method. Heretofore many tests have been made on small cells, well or ill treated or poisoned with various impurities, but always with the disadvantage that much time was required and that many undesirable factors crept into the case.

Starting from the principle that the performance of the battery from the chemical and electrochemical standpoint can be well judged by observation of the actual rate at which sulphation of the plates takes place, the present experimenters broke away from the conventional tests and directed their study immediately at the actual rate day by day, or hour by hour if necessary, of sulphation occurring in battery plates immersed in electrolytes of various strengths, temperatures and degrees of purity. Two varieties of plates closely alike in size were actually used, and one of the rather striking results of the preliminary experiments was to find a very considerable difference in the performance of these two makes of plates, a much larger difference than would at first sight appear probable, due doubtless to slight differences of structures or composition which were actually significant although apparently insignificant. The paper before us is merely preliminary to the extension of the work to the analysis of the effect of impurities, which will be taken up in a subsequent publication.

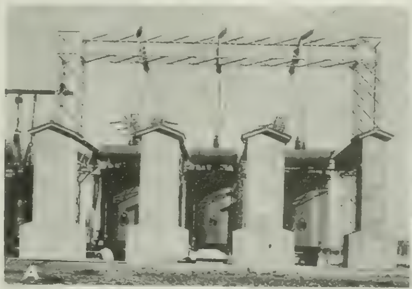
Outdoor Receiving Station for 220,000-Volt Energy

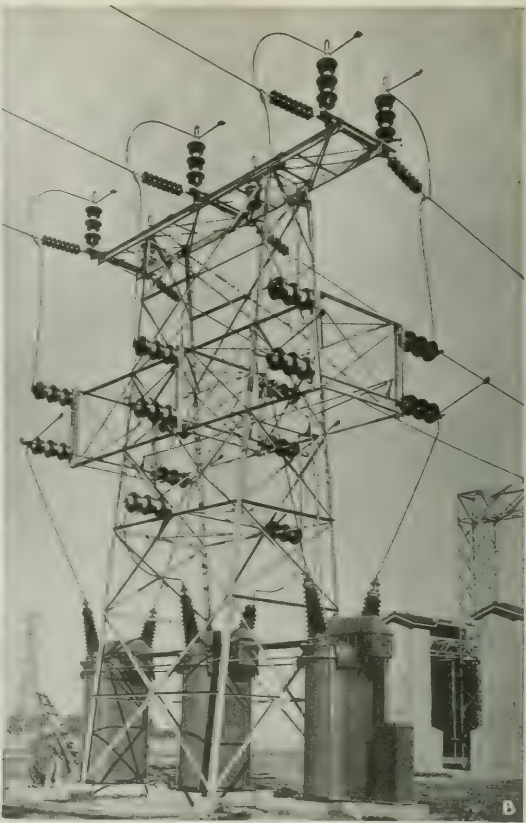
NO FINER example of engineering design and construction in outdoor substations is to be found than in the Vaca substation of the Pacific Gas & Electric Company, the terminus of the 220,000-volt circuits from the new Pit River No. 1 plant. This is the first substation ever built to receive 220,000 volts and is among the largest substations in terms of transformer capacity and synchronous condenser capacity. There are installed here two banks of 220,000-volt transformers with a combined capacity of 100,000-kva. and two 20,000-kva. synchronous condenser units.

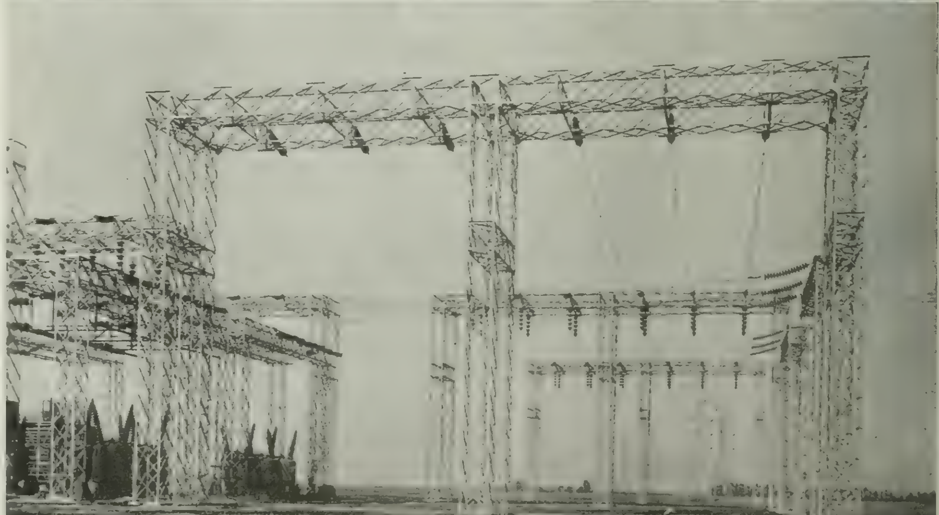
A — One of the two 50,000-kva., 220,000-volt transformer banks, with oil conservators and oil-filled terminal bushings, each unit being rated at 16,667 kva. Like the transformers at the Pit River plant, they are of the single high-tension terminal type, with the other end of the high-tension winding permanently grounded. These are the first 220,000-volt transformers to be built for use of the high-tension windings as auto-transformers. A 110,000-volt tap is provided in the high-tension winding for stepping down the incoming voltage for nearby transmission. The transformers also contain an 11,000-volt tertiary winding for the operation of the synchronous condensers and a 3,300-volt starting winding for the condensers. The four upright compartments in the foreground of the picture contain the 11,000 and 3,300-volt buses.

B—One of the 110,000-volt switching units. Disconnecting switches have been provided so that the oil switches may be cut out for repairs or inspection. Extensive use has been made of pillar-type insulators.

C—High-tension bus for the incoming 220,000-volt lines. A noteworthy feature is the comparative simplicity of the high-voltage arrangement.



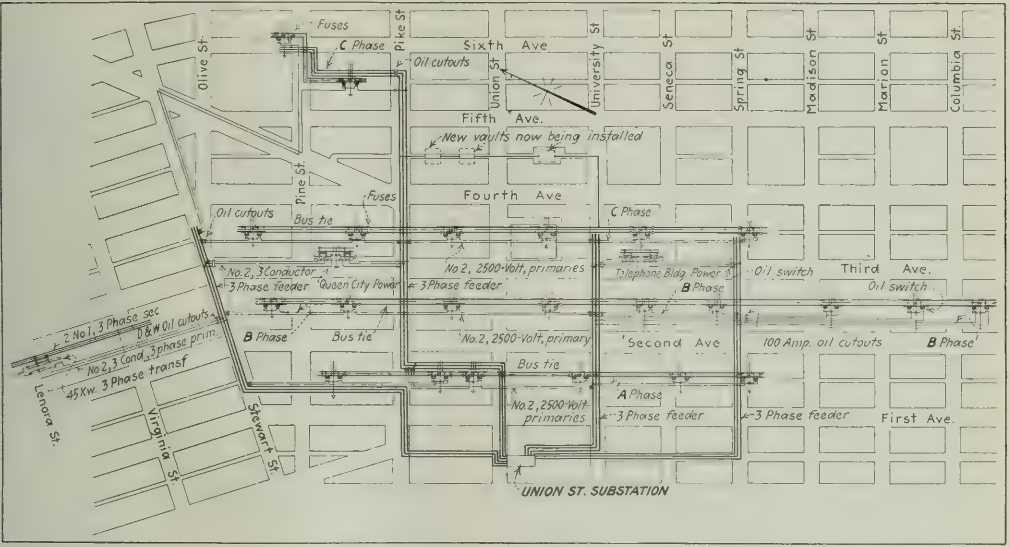




Merits of A. C. Underground Distribution

Outline of Conditions Affecting Underground Distribution in Seattle and Description of System Installed—Discussion of the Relative Merits and the Costs of Various Systems

By M. T. CRAWFORD
Superintendent of Distribution Puget Sound Power & Light Company



LAYOUT OF FEEDERS, VAULTS AND OTHER EQUIPMENT ON THE 4,500-VOLT ALTERNATING-CURRENT UNDERGROUND SYSTEM

IN CONNECTION with the distribution of electrical energy in the business center of a large city an alternating-current underground system deserves consideration in planning future extension policies, even where direct current is already in use, as decided economies may be effected and the service reliability of an alternating-current system may be enhanced by the use of automatic selective protection. The elements to be considered can best be treated by dealing with the specific problems encountered in connection with extensions to the underground system of the Puget Sound Power & Light Company in Seattle.

Starting in 1903 with one station, a 250/125-volt, three-wire Edison direct-current distributing system was built in the underground district of Seattle for supplying commercial light and power. In 1920 this system consisted of two main substations complete with battery protection and one small booster station, with a total load of about 11,000 kw., together with a distribution system of conduits, feeder cables and mains serving a downtown business district area about half a mile wide and one mile long. The remainder of the underground district, built up principally with smaller hotels and business establishments whose service requirements had not yet made the Edison system necessary, was served by an ordinary alternating-current underground system of 2,200-volt feeders, transformers and services.

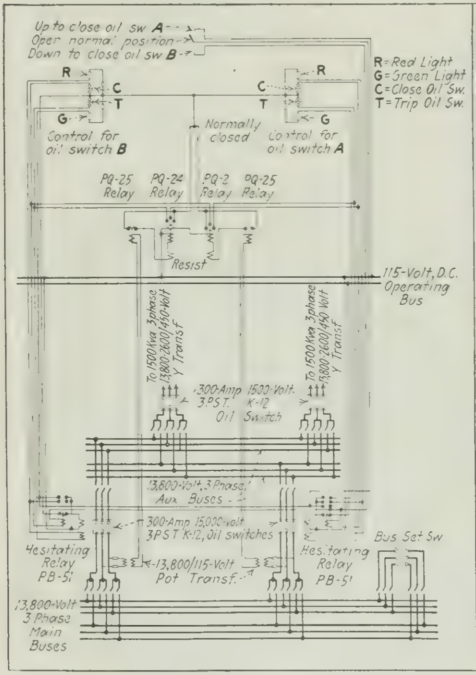
In 1920 the growth of load and the development of a new high-class business district a little beyond the economic range of the existing Edison system made it necessary to plan additional facilities. The high costs then in effect made it advisable to reconsider the established policy of extending the direct-current system, although service requirements were so exacting that no sacrifice could be made in reliability.

In the present state of the art there is a demand for a certain amount of direct current in cities, principally for office building elevators where high speed and accurate control are necessary. Large newspaper presses and a few other special loads prefer direct current. On the other hand, there are X-ray machines and other power requirements for which alternating current is most satisfactory and economical to the consumer, and we had found it necessary to parallel our direct-current system with a skeleton alternating-current system, or this business would have gone to our competitor.

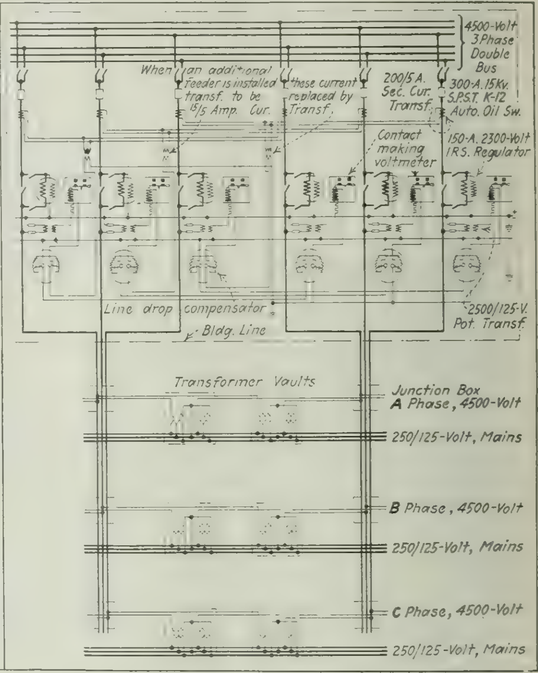
There is also a need for an emergency lighting service in theaters for instant use in case of any difficulty with the regular service wiring or supply, some cities requiring it by ordinance. A similar requirement is found in the new automatic telephone exchanges of the Bell companies. To be most effective this emergency service should come from a distinct distributing system, so that it seems clear there are advantages in having both alternating-current and direct-current service mains, although only one need be the principal supply.

It is a fundamental fact that the requirements of the public will sooner or later be met in this free country, and if we do not meet them, the isolated plant or other competitor will come in. In a metropolitan center the public requires both economical and adequate service which embraces continuity, good regulation and the supply of the kind of current adapted to the consumers' needs.

On account of low rates and good service, isolated plants were almost unknown in Seattle, but competition from a municipal system was present, and with identical rates the company had been able to get and keep the larger portion of the better-class downtown load only by giving service of superior reliability. For this reason care was necessary in planning changes, and an investigation was made which included an inspection trip to many of the principal cities of the country, with particular attention to those having alternating-current underground systems.



SELECTOR SWITCH FOR AUTOMATIC TRANSFER OF LOAD FROM A FAULTY TO A GOOD LINE


4500-Volt 3 Phase Double Bus
When an additional feeder is installed transf. to be 15/5 Amp. Cur.
these current replaced by Transf.
200/5 A. Sec. Cur. Transf.
300-A. 15 Kv. S.P.S.T. K-12 Auto. Oil Sw.
Contact making voltmeter
150-A. 2300-Volt I.R.S. Regulator
Line drop compensator
Bldg. Line
2500/125-V. Pot. Transf.
Transformer Vaults
Junction Box A Phase, 4500-Volt
250/125-Volt, Mains
B Phase, 4500-Volt
250/125-Volt, Mains
C Phase, 4500-Volt
250/125-Volt, Mains

METHOD FOR GETTING AUTOMATIC VOLTAGE REGULATION ON TWO TYPICAL FEEDERS

Although the majority of metropolitan cities were found with battery-protected direct-current distributing systems for their downtown service, a noticeable tendency toward the use of alternating current for extensions was found in about fifteen cities, and even the dyed-in-the-wool direct-current engineers were interested in knowing of alternating-current possibilities. One large system on Manhattan Island and one in the Bronx, one in San Francisco and the principal systems in Newark, Louisville, Omaha and San Diego were found using alternating-current underground distribution for their most important downtown load. In San Francisco, Los Angeles, Portland and several other cities no major extensions were being made to the direct-current systems, and some first-class lighting load growth was being served by alternating current, use being made in some cases of automatic throw-over switches and two supply feeders to enhance continuity. In Chicago, Boston, Philadelphia and some of the other cities still committed to direct-current extensions a considerable amount of alternating-current underground distribution was being employed in outlying districts and for power service.

The continuity of service from some of these alternating-current systems was not always of the best, although usually better than that from overhead lines. Where service was only fair and rates high the isolated plants were frequent. On the other hand, many of the systems gave excellent service, particularly where they were carefully installed and where the feeders were supplied direct from large central stations with reliable primary supply. In several cities the subway transformers were paralleled by a system of secondary mains and fuses relied on to segregate defective apparatus. The United Electric Light & Power system on Manhattan Island employed carefully worked out interconnection and fusing schemes with network protectors on transformers, with in some cases automatic selective switches on two sources of primary supply, and a study of further automatic selective switch equipment was being made by the company's engineers, with particular reference to power directional control. On the other hand, a number of systems were found with no paralleling or fusing whatever, as their experience indicated more trouble than benefit resulted and they preferred to have an outage on an entire feeder when the trouble could not be burned clear.

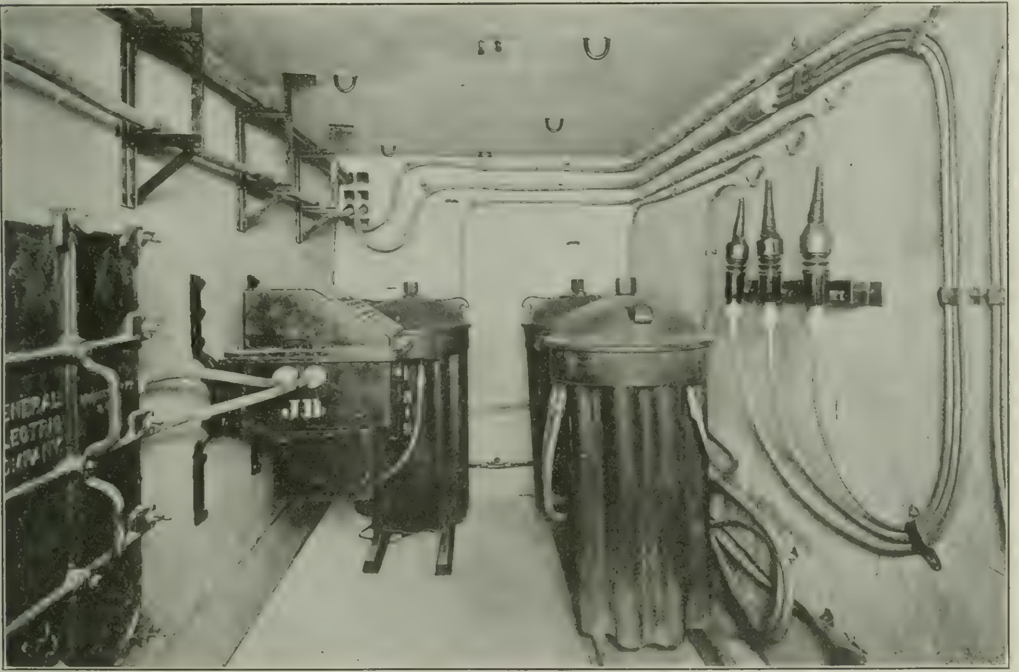
In general, it seemed apparent from this investigation of other systems that direct current was still considered necessary for highest reliability by many engineers in the largest cities. In such cases, however, the load density was high, the operations were on a large scale, and the rates earned did not always compel extreme economy, so that facilities for safeguarding the service could be afforded. Nevertheless, many of the best-operated Edison systems were subject to serious distribution troubles at times, as was brought out in the symposium on system troubles contained in the Association of Edison Illuminating Companies committee report of 1920.

The importance to us of service reliability made it necessary to consider this phase very carefully. Although our direct-current system is protected with batteries having a one-hour rating of 35 per cent of peak demand and feeder cables are conservatively loaded, a certain amount of trouble involving limited areas is inevitable, especially where franchise requirements compel sharing congested manholes with railway and municipal utilities. These troubles are from occasional manhole fires and failures of substation equipment, and with careful operation they should affect the average consumer rarely, but nevertheless they are inherent in direct-current systems.

The inability to provide battery protection on the supply is an inherent disadvantage in alternating-current distribution, and to give as reliable service as direct current this must be offset by a reduction of all other sources of trouble. The somewhat greater risks of cable operation at higher voltages must also be kept from affecting service. On the other hand, the greater simplicity and stability of substation equipment and the higher economy and efficiency are inherent advantages.

With quite reliable prime supply, the problem in this case was one of providing such facilities in the design of the alternating-current system as would prevent cable or apparatus failures from affecting service. The system designed by our organization was intended to match our Edison direct current in service reliability and improve on its economy. Ten years from now we shall be able to speak definitely in regard to this. In order to meet fully the service requirements, we planned to retain the existing direct-current system, eventually to be loaded entirely with elevator and special loads. The alternating-current system was installed in the growing district and sufficient lighting load transferred thereto to relieve the direct-current system of the growth in business. New territory is being served entirely with alternating current and only a skeleton direct-current system installed for special loads.

The supply facilities can only briefly be outlined here. The number of hydro-electric and steam generating stations on our system and interconnections with other systems is such that a complete failure of generation is practically impossible and service is largely a transmission problem. From different sections of the transmission network four 55-kv. lines enter Seattle via different routes and supply a 13-kv. secondary transmission system through two separate receiving substations. Downtown distributing substations have two 13-kv. buses, each supplied by parallel lines from sepa-



INTERIOR OF POWER VAULT, SHOWING ONE END VIEWED FROM CENTER. THE VAULT CONTAINS SIX 50-KW. TRANSFORMERS. IN LARGER SIZES TWO THREE-PHASE UNITS ARE USED rate receiving substations, and part of the Edison machines are put on each bus. The two 13-kv. buses in the distributing substations thus have separate and duplicate supply facilities, which are only paralleled at generating-station 55-kv. buses. The city 13-kv. system can also be supplied direct from a steam generating station. A relay committee and a modern load-dispatching office have steadily improved reliability of operation, and we are now in our sixth consecutive year without having had an outage on all four incoming transmission lines at the same time. The downtown load is only 10 per cent of the system load and has full priority of service.

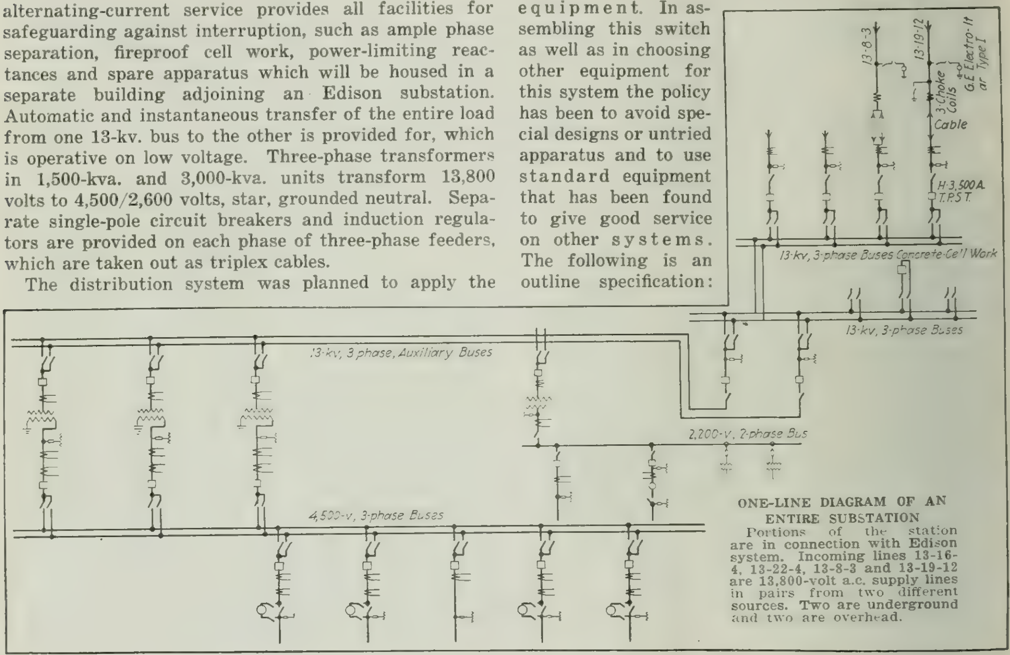
The design of the distributing substation for the alternating-current service provides all facilities for safeguarding against interruption, such as ample phase separation, fireproof cell work, power-limiting reactances and spare apparatus which will be housed in a separate building adjoining an Edison substation. Automatic and instantaneous transfer of the entire load from one 13-kv. bus to the other is provided for, which is operative on low voltage. Three-phase transformers in 1,500-kva. and 3,000-kva. units transform 13,800 volts to 4,500/2,600 volts, star, grounded neutral. Separate single-pole circuit breakers and induction regulators are provided on each phase of three-phase feeders, which are taken out as triplex cables.

The distribution system was planned to apply the well-known and tried scheme of transmission with radial parallel lines where relays for overload release are installed at the supply station and directional relays operative on reverse power at the receiving station. The 250/125-volt, three-wire distributing mains are considered as the receiving bus, and the subway transformers are connected thereto through a special circuit breaker operative on reverse power only. Alternate transformers on this bus are supplied from different 2,600-volt feeders from the substation, so that transformer or feeder trouble will act only to disconnect every other subway transformer from the bus in a limited area. This is shown more clearly in accompanying illustrations.

It will be seen from the diagrams that primary feeders extend along streets and branch off at right angles, the branch primary feeders overlapping. The branch feeders in each alley all tap off of the same phase of the main feeders at the street intersections, so that transformers connected thereto can be multiplied on the secondary side. Every vault contains two similar transformers each supplied from a separate primary feeder and feeding into the same secondary junction box.

The secondary junction boxes of all vaults in the same alley are connected together with a 500,000-circ.mil duplex-cable tie bus which equalizes loads. Services are not connected to this tie bus, but are taken out separately from the junction boxes.

The special feature for enhancing continuity is the parallel operation of feeders through subway transformers, which is made possible by a standard type of circuit breaker. This is a switch from the manufacturers' standard line embodying the development of years of service, with a special aluminum cover to permit the inclosure of standard power-directional relay equipment. In assembling this switch as well as in choosing other equipment for this system the policy has been to avoid special designs or untried apparatus and to use standard equipment that has been found to give good service on other systems. The following is an outline specification:



ONE-LINE DIAGRAM OF AN ENTIRE SUBSTATION

Portions of the station are in connection with Edison system. Incoming lines 13-16-4, 13-22-4, 13-8-3 and 13-19-12 are 13,800-volt a.c. supply lines in pairs from two different sources. Two are underground and two are overhead.

Nominal Voltages.—Primary, 4,500-volt, three-phase, star, grounded neutral; secondary, 250/125-volt, single-phase, three-wire grounded neutral for lighting, 250-volt, three-phase delta, with one phase wire grounded for power.

Main Feeders.—350,000 circ.mil, triplex, 4/32-in. x 3/32-in., paper-insulated, lead-covered cable from station to primary junction boxes.

Branch Feeders.—No. 2, single-conductor, 7/32-in., paper-insulated, lead-covered cable from primary junction boxes to transformer vaults for single-phase lighting; No. 2, triplex, 4/32-in. x 3/32-in., paper-insulated, lead-covered cable from primary junction boxes to three-phase transformers in separate transformer vaults for power service.

250-Volt Tie Bus.—500 000 circ.mil, duplex, 3/32-in., paper-insulated, lead-covered cables as tie bus between transformer vaults for cross-feed only; fused heavily at each end.

Service Mains.—500,000-circ.mil, single-conductor, 3/32-in., rubber-insulated, lead-covered cables fused and run out as service mains from secondary junction boxes in transformer vaults to handholes in each direction, where small services are spliced on and radiate to consumers near by; large services taken direct to junction box and fused.

Neutral.—Existing direct-current neutral supplemented by cables where needed; grounded at every opportunity and to two ground cones underneath each transformer vault.

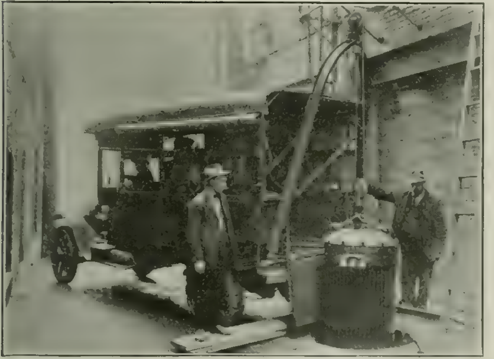
Junction Boxes.—Primary boxes: G. & W. Electric Specialty Company, type C, 4,500-volt, six-way, three-wire, for four three-phase and six single-phase outlets, fitted with disconnecting links for each outlet; all jaw clip contacts are bolted, and phases are separated by barriers. Secondary boxes: General Electric, type MD-16-B4, 300-volt, two-wire, for fuses or links.

Transformers. — General Electric and Westinghouse, standard subway type, 2,500/250-125-volt, 50-kw., 100-kw. and 150-kw. units; all provisions are made for 200-kw. units if needed; two transformers of same size installed in every vault and connected to different primary feeders.

Fuses and Cut-outs.—Branch primary feeders fused at four times full-load transformer current, with D. & W. heavy-duty subway-type oil fuses at primary junction box; G. & W. disconnecting potheads on each transformer in vault. Standard copper fuses in secondary boxes except on incoming transformer leads, which are linked in solid.

Subway Oil Circuit Breakers. — Westinghouse, type F, 250-volt, 800-amp., two-pole subway oil circuit breakers, with special cover inclosing type CR directional power relays; operate on reverse power only, clearing secondary system of any primary or transformer trouble. Switch handles are equipped with targets, showing whether open or closed, which are visible from street surface through ventilating holes in cover.

Conduit System.—Existing subway system of manholes and tile ducts used, and enlarged where necessary. At street intersections with alleys, where branch primary feeders leave main feeders, existing 6-ft. x 6-ft. manholes were enlarged one way to 6 ft. x 12 ft. to accommodate 4,500-volt junction boxes and oil cut-outs; existing service handholes used; new 8-ft. x 20-ft. transformer vaults built into existing duct runs in alleys midway the block; manholes and vaults equipped with electric lights, controlled by tumbler switch within reach of street through ventilating holes in manhole cover, facilitating rapid inspection of subway system to locate open switches or trouble.



POWER SUPPLIED BY ENGINE-DRIVEN WINCH RAPIDLY HANDLES SUBWAY TRANSFORMERS

Three-Phase Power Service.—Separate transformer vaults for power service are installed where required and when close enough together joined by secondary bus tie; with one side of three-phase, 250-volt, delta, grounded, the standard two-pole equipment is used for secondary system; three-phase transformer units used, two to each vault, and supplied from separate feeders as is done on lighting service.

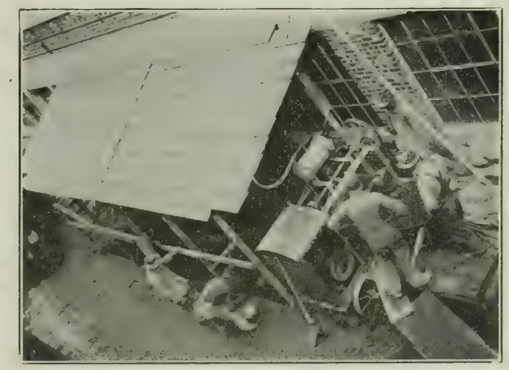
Operation During Trouble.—(1) Trouble on consumers' services or on service mains is to be cleared by fuse in secondary junction boxes; 500,000-circ.mil service mains normally fused, 650 amp. (2) Trouble on 250-volt tie bus to be cleared by fuses in secondary junction box, normally 1,200 amp. (3) Trouble in secondary boxes or leads from subway switches to boxes will have to be burned clear unless it draws current enough to open 2,500-volt fuses at primary junction box. (4) Trouble in transformers or branch 2,500-volt feeders to be cleared by reverse power tripping of subway circuit breakers and by D. & W. oil fuses at primary junction box; circuit breakers to be set at 150 per cent full-load transformer current, 0.75-second reverse energy. Fuses to be normally four times full-load transformer current. (5) Trouble in main 4,500-volt feeders to be cleared by station circuit breaker and reverse tripping of subway circuit breakers on all transformers supplied therefrom; station circuit breakers to be set with two seconds definite time delay.

Future Growth.—As load increases additional feeders and transformer vaults may be installed in between those existing; new territory may be served by similar installations.

The operation of this system requires systematic and regular inspection with rigid standards. A testing outfit on wheels with artificial load, cycle counter, etc., facilitates the frequent and regular checking of subway circuit breaker and relay operation which is necessary for reliability. Graphic charts are taken of transformer loads at periodic intervals. These charts afford data upon which to maintain adequate transformer capacity.

Every precaution has been taken to protect the cables from the effects of manhole fires or arcing, such as cement coverings and barricades. Important cables are shielded by asbestos board barriers in addition to covering. Alternate feeders are taken out separate duct runs, and where proximity to other cables cannot be avoided they are inclosed with firebrick and mortar.

It is possible to open any feeder or to cut out any section of this system during off-peak hours, avoiding live cable work. The disconnecting links in junction boxes facilitate this as well as the quick segregation of defective equipment. As the automatic tripping out of defective equipment throws additional load on adjacent parts of the system until repairs can be made, transformers and cables are normally loaded to a somewhat conservative rating.



VAULT CONSTRUCTION UNDER WAY WHILE TRAFFIC CONTINUES. A TEMPORARY SHED PERMITS WORK IN WET WEATHER

Repeated and successive tests have been made in applying water-barrel short circuits to various points on the secondary and primary system, and the fuses and circuit breakers have operated uniformly to clear the service mains under all conditions of load. The only serious case of trouble we have had in the first year's operation was on a feeder under construction and was due to the accidental short-circuiting of a 4,500-volt junction box by an employee while he had the cover removed. The box was burned up, but the subway switches functioned as planned and cleared the trouble from all secondary mains. An interruption occurred, however, from damaged substation equipment, due to the installation not having been entirely completed as planned.

The installation which has so far been completed consists of four three-phase feeders and twenty-five transformer vaults, with a proportionate amount of the substation equipment.

With a distributing voltage of 4,500 volts substations could be spaced about two miles apart. With a load density of 400 kw. for a city block of 300 ft. x 400 ft.

this would give a maximum of about 35,000 kw. per substation. With 250-volt direct current at least four 10,000-kw. substations, one mile apart, would be required. Good practice would probably call for more substations in each case.

With 350,000-circ.mil, triplex, 4,500-volt feeder cables, each feeder duct will carry 1,500 kw., whereas with 1,500,000-circ.mil, single-conductor, 250-volt, two-wire feeders 350 kw. for two ducts, or 175 kw. per duct. would be the maximum. This is somewhat offset by the space requirements of at least one transformer vault per block with alternating current.

A study was made of the relative efficiencies and comparative economy of the direct-current and the alternating-current systems of distribution for supplying the same load at consumers' premises. In general, it was found that under conditions obtaining on the Seattle system the losses in substation transformation and the distribution system were on the order of 6 to 8 per cent of substation input with the alternating-current system, as compared with 20 to 25 per cent with direct-current distribution. The principal sources of increased efficiency are the use of static transformers instead of rotating converters, the higher feeder voltage and the higher accuracy of consumers' load measurement possible with the induction type of meter used on alternating current.

An analysis was made of the comparative net earnings obtainable by serving the same total load and area with alternating current for the principal service as compared with direct-current service. It was found that an increase on the order of 10 per cent of the gross revenues might be looked for owing to the higher efficiencies and lower costs applying to alternating-current service.

These conclusions and figures do not necessarily apply to any other systems or conditions, but seem to indicate a decided economy in favor of alternating current. This would warrant careful study of the facilities which may be provided for enhancing the reliability of service from alternating-current underground distribution in order to make it equally serviceable.

Finding Published Electrical Information

Advice on How to Consult Books and Periodicals Pertaining to the Art, with List of Important Magazines and Organs of Electrical Associations in Various Countries—Indexes and Note Making

By VLADIMIR KARAPETOFF
Professor of Electrical Engineering, Cornell University, Ithaca, N. Y.

FREQUENTLY I receive requests from strangers and friends for references to literature on this or that electrical topic, and in my own work I often have to get posted on some special topic within a comparatively short time. The following advice as to how to do this is based on more than twenty years of experience in handling dusty volumes of engineering periodicals in big libraries and is given in the hope that it may be of assistance to younger investigators.

BOOKS ARE OF LITTLE USE FOR CURRENT TOPICS

As a rule, books are of comparatively little use for obtaining information on special or recent topics in electrical theory or practice, but are indispensable for references on elementary subjects, standardized practice, physical laws, mathematical relationships, etc. In looking up a new subject it is sometimes necessary first to peruse a book or two in order to get familiar with the fundamental relationships and be able to follow articles and papers in periodicals.

As far as I know, there is no authoritative classified topical list of electrical books. One has to consult a library catalog, publishers' lists or special bibliographies found in various books. For new books the principal electrical periodicals may be consulted under "Book Reviews" and "Books Received"; also "Accessions to the United Engineering Library," published in the *Journal* of the American Institute of Electrical Engineers. A library catalog usually has entries under authors' names and also under subjects and sub-topics of a subject. It is hardly possible to mention all the electrical sub-topics in a library catalog, and some judgment on the part of the reader is required as to where to look for a desired topic.

It is rather difficult to recommend a suitable book to a stranger without knowing his preparation, his reading habits and the exact nature of his problem. For my own needs I usually get a preliminary orientation by looking over several books which have something on the desired topic. Then I make up my mind as to the character of each book, such as general, specific, elementary, advanced, up-to-date, old, theoretical, practical, compilation, etc., and study more in detail whatever I need for the particular problem on hand.

It would be a great help to readers and to researchers if some impartial organization, such as the American Institute of Electrical Engineers or the United Engineering Library, would publish a classified list of electrical books, revised every few years. Such a list should give a few details about each book, such as the number of pages, the year of the last edition, the publisher's name, and also whether the book is advanced or elementary, theoretical or practical, etc.

It would also help greatly if book writers would exercise more care in the preparation of indexes, keeping in mind an occasional user of the book who does not know anything about the general arrangement or plan of the work and merely looks for a key word. An inexperienced reader, after having looked in vain under "Spark-over," "Discharge," "Corona," and half a dozen other entries, may decide that the book has nothing on the subject of high-tension testing, while there may be a considerable amount of valuable information indexed under "Dielectric Strength," which, of course, means nearly the same thing. The fault is not with the book itself, but with an insufficient index. The index maker should have listed "Corona," "Spark-over," "Discharge," etc., separately and added after each: "See Dielectric Strength." This so-called "cross-indexing" is very important in books intended for reference purposes.

The same warning applies to electrical periodicals. For example, in a search for polyphase commutator motors I found that in the index of a certain leading German periodical one had to look under "Elektromotoren," while in another weekly the same information was found under "Kollektor," "Kommutator" and "Mehrphasen."

By far the most useful single help in a search for information on electrical subjects is a non-commercial monthly magazine called *Science Abstracts*, available in most of the large technical libraries. It is published in two separate sections, Part A, "Physics," and Part B, "Electrical Engineering."* This magazine gives brief abstracts of the most important original articles and papers which appear in the electrical and scientific periodicals throughout the civilized world. These abstracts are prepared either by experts or by the authors themselves, and in many cases are sufficient for the information wanted, or at least give an idea as to whether the original article need be consulted or not.

USE OF SCIENCE ABSTRACTS, INDEXES AND CATALOGS

In starting on a new investigation my first step usually is to look over the volumes of the *Science Abstracts* for a sufficient number of years back to satisfy myself that I have a general idea and perspective of the subject in its recent phases. Any items of interest I carefully note on slips or sheets of paper, never trusting my memory, no matter how insignificant or self-evident an item may be. I remember weary hours spent in trying to locate a bit of information not recorded at the proper time.

I most earnestly urge younger investigators in electrical engineering to become familiar with the *Science Abstracts* and even to follow this magazine regularly month after month in at least some topics of interest. Every graduate student working under my direction gets from me a lesson in the use of this periodical, and to most inquiries from outsiders my reply is: First look up the *Science Abstracts*.

The thing that impresses a habitual user of this magazine is the tremendous amount of labor performed by many prominent investigators in various parts of the world and the long time necessary to bring out a reliable piece of apparatus, a good method, a useful relationship or anything else of lasting value to the profession. It is enough to discourage a wild-eyed inventor or discoverer of the "revolutionizing" type and at the same time is a good tonic to encourage an honest and patient worker ready to do his bit "in Reih' und Glied."

The "Engineering Index" published by the American Society of Mechanical Engineers in connection with its monthly *Journal* contains titles of important electrical articles and may also be profitably consulted.

For patent search the publications of the patent offices of various countries have to be consulted. Such a search is preferably conducted by a patent attorney familiar with the classification and the technical terms, sometimes incomprehensible to an ordinary engineer.

For a thorough historical search into the beginnings of the electrical science and art consult the "Catalogue of Scientific Papers," 1800-1900, compiled by the Royal Society of London. There is a separate index volume on electricity and magnetism to facilitate the search. This catalog was continued until 1914 under the title of "International Catalogue of Scientific Literature" and then was discontinued for lack of funds. It has several volumes on physics and chemistry.

PUBLICATIONS OF ELECTRICAL ASSOCIATIONS OFFER MATERIAL

Each national electrical society publishes a magazine of its own, with the exception of the German association, which uses a leading German electrical weekly as its organ. The principal electrical associations and their publications are as follows:

United States of America:
American Institute of Electrical Engineers, monthly *Journal* and annual *Transactions*.
National Electric Light Association, monthly *Bulletin* and annual *Proceedings*.
American Electric Railway Association, monthly *Aera* and annual *Proceedings*.
Institute of Radio Engineers, bi-weekly *Proceedings*.
Illuminating Engineering Society, monthly *Transactions*.
Franklin Institute, Philadelphia, monthly *Journal*.
England:
Institution of Electrical Engineers, monthly *Journal*.
France:
Association Française des Electriciens, monthly *Bulletin*.
Switzerland:
Association Française dès Electriciens, monthly *Bulletin*. with articles both in French and German.
Germany:
Deutscher Elektrotechnischer Verein and Verband Deutscher Elektrotechniker. Their organ is *Elektrotechnische Zeitschrift*, a weekly.
Italy:
L'Associazione Elettrotecnica Italiana; *Elettrotecnica*, published three times a month.

Each annual volume of these publications is provided with an index to facilitate search for information. While most of the articles will also be found in the *Science Abstracts*, it is sometimes advisable to look over the indexes of the publications themselves, because of a somewhat different grouping of papérs, and also when information is desired on some practice limited to one country or to a particular group of writers.

Now and then "high-brow" publications, like the *Comptes Rendus* of the Académie des Sciences of France and the *Proceedings* of the Royal Society of London contain articles on engineering subjects.

When consulting a library catalog for a publication of a society, always look under the society's name, not under that of the publication. For example, look under *American Institute of Electrical Engineers* and you will find its various publications, such as *Transactions, Proceedings, Journal, Standards, Yearbook*, etc.

LEADING ELECTRICAL PERIODICALS SHOULD BE READ

It is somewhat difficult to name certain good electrical periodicals without incurring the criticism of having undeservedly omitted other worthy publications. So let it be stated at the outset that the following list is incomplete and represents only my personal experience in bibliographic searches. In other words, only those periodicals are mentioned which I am in the habit of consulting in the particular range of

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*Science Abstracts is issued by the Institution of Electrical Engineers (British), Savoy Place, Victoria Embankment, W. C. 2, London, England, in association with the Physical Society of London, with the co-operation of the American Physical Society, the American Institute of Electrical Engineers and the Associazione Elettrotecnica Italiana. Any one interested can subscribe to the *Abstracts* by writing to the Institute of Electrical Engineers.

electrical problems in which I am interested. These are:

Electrical World, weekly, New York.
The Electrician, weekly, London.
La Revue Generale de l'Electricite, weekly, Paris.
Elektrotechnische Zeitschrift, weekly, Berlin.
Archiv für Elektrotechnik, monthly, Berlin.
Elektrotechnik und Maschinenbau, weekly, Vienna.

These periodicals publish first-class original technical and scientific articles and also contain editorials and news items which indicate the general trend of the industry. Moreover, they abstract or even reprint noteworthy articles from one another, publish papers and discussions presented before electrical societies, review new books and contain accounts of the most important patents.

Monthly engineering magazines are published by students in several American colleges of engineering. Occasionally these periodicals contain useful articles contributed by members of the faculties or by alumni.

Among special research issues should be mentioned numerous publications of the United States Bureau of Standards, Washington, which appear in different series, denominated as "bulletins," "scientific papers," "technological papers," "technical news bulletins" (mimeographed), "safety rules," etc. These contributions are mostly of quite a high order, impartial, carefully written and edited and provided with detailed references to literature. If for no other reason, young authors should consult them as high standards in the art of technical writing. A complete list of these publications may be obtained free from the Superintendent of Documents, Washington, D. C.

Several prominent American universities and state experiment stations publish bulletins containing accounts of their investigations, and these sources of information should not be overlooked.

House Organs Contain Valuable Articles

Large electric manufacturing companies in this country and abroad publish magazines (usually monthly), mainly devoted to their own products and to cognate problems in manufacture, operation, theory and research. While of necessity some of the information issued has to be taken with a grain of salt, yet some of these periodicals contain many valuable articles written by engineers and scientists of high standing The best known among such "house organs" are:

General Electric Review, Schenectady, N. Y.
Electric Journal (Westinghouse organ), Pittsburgh, Pa.
Bell System Technical Journal, quarterly, American Telephone & Telegraph Company, New York.
Beama (British Electrical and Allied Manufacturers' Association), London.
A. E. G. Mitteilungen, Berlin.
Siemens Zeitschrift, Berlin.
B. B. C. Mitteilungen (Brown, Boveri & Company), Baden, Switzerland.

Large operating organizations also have their house organs, but so far most of the information published in these has been of non-technical or popular nature. The best among these periodicals are perhaps the monthly *Bulletin* published by the Hydro-Electric Commission of Ontario, Toronto, Canada, and the Stone & Webster *Journal*.

It goes without saying that technical bulletins, catalogs, instruction booklets, monographs, reprints, etc., issued by numerous manufacturers of electrical equipment should also be considered as legitimate sources of information, provided that one uses them with due discrimination for a possible commercial bias. Many of these publications are not nearly so misleading and biased as some papers and articles in regular periodicals that are seemingly written *bona fide* but in reality are inspired by insidious commercial considerations.

In many electrical research problems it is necessary to look up information on physics, chemistry, mathematics, mechanics, thermodynamics, strength of materials, etc. Each of these sciences has a vast literature of its own, and it is well to get advice from a specialist in each particular science as to the principal sources of information. The general method of conducting a library search is about the same in all the sciences that border on engineering.

How To Make Notes

Many a young investigator, after having made copious notes in the library, wishes that he could start the whole literature search over again and make an entirely different set of notes. The principal rules that I have found useful in the preparation of notes in my own work are as follows:

1. Make your notes as complete as if you had no memory at all; in other words, on the assumption that later you could not add anything to the information already on a card. Standard 3-in. x 5-in. cards will be found most convenient. Each card should have some title on top, and groups of cards should be separated by colored tab or index cards. Sketches, curves, tables, etc., may be put on larger cards or sheets of paper, filed separately, but a reference card for each should be included in the main 3-in. x 5-in. file.

2. Always begin a search with the latest issue or the last volume of a periodical and go back (counterclockwise search). This has the following advantages: (a) Your first impression and the first information will be up-to-date, and the earlier articles will merely supplement it; (b) you will know where to stop, because as you follow the earlier articles you finally come to a volume previous to which you find no new information.

3. Put only one small and distinct item on each card or sheet of paper and add an exact bibliographic reference, so that in case you later decide to quote this particular note you will not have to make another trip to the library. For example, "Johnson, A. F., *Amer. Inst. Electr. Engrs., Trans.*, 1920, Vol. 53, p. 472." I am of the opinion that the exact title of the article in many cases is not of sufficient importance to be quoted. I have often got valuable information from papers in which the particular statement was merely an incidental remark or even a literature reference.

4. As much as possible, make the detailed plan or outline of your article or investigation as a result of the literature search. In other words, do not make out a preconceived plan and then try to fit the found information into it. Modify your outline as you study the subject, and for this purpose keep your notes on separate cards which can be arranged and rearranged.

Conclusion

There is a well-tried method of obtaining published information on an electrical topic in a systematic way. It will pay a young engineer to become familiar with this method, and to be fluent in its use, early in his professional career. Then, when a rush problem comes he will be able to obtain the desired information within a comparatively short time and with the assurance that no important source has been overlooked.

Rate of Sulphation of Battery Plates*

A Speedy and Accurate Method for Measuring Effect of Concentration in Storage-Battery Electrolyte Has Been Developed—Fundamental Theory —Rate of Sulphation in Pure Solutions of Different Concentration Given

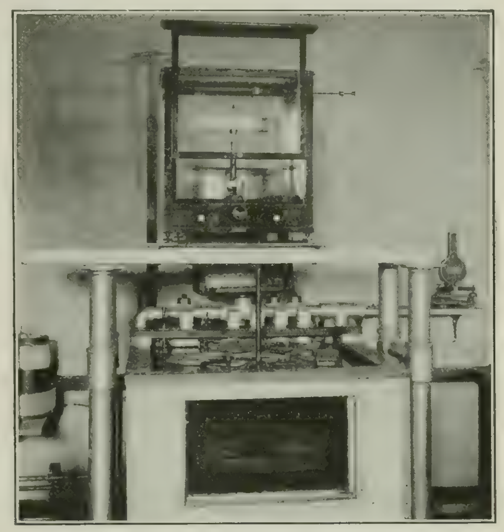
By G. W. VINAL and L. M. RITCHIE
Bureau of Standards, Washington, D. C.

KNOWLEDGE of the effect of impurities in storage-battery electrolytes has always been desired, but experiments in which small cells were "poisoned" by the addition of the substances to be studied have shown that accurate and consistent results were difficult to obtain. The capacity of the negative plates is ordinarily greater than that of the positives, and the effect of such impurities as affect the negative plate is therefore masked, in part at least, when determinations of the capacity are made. It is difficult also to insulate the small cells so perfectly that leakage current during the periods of standing will not affect the measured capacity. It is often necessary to allow several weeks to elapse in order to determine the loss in capacity resulting from the impurities which are added. Because of the inaccuracies of this method and the time required, it was decided by the Bureau of Standards to determine the effect of the impurities in terms of the rate of the reactions taking place at the plates. This may be accurately determined in a short time by successive weighings of the plates immersed in solutions which are maintained at a constant temperature.

The fundamental theory of the method and the results which have been obtained for the rate of sulphation[1] of positive and negative plates in solutions of pure sulphuric acid of various concentrations will be given in this paper. The effects of impurities will be discussed in a later paper. The method here described affords a simple and accurate means of obtaining this information.

TEST APPARATUS USED

To make this test twenty-four plates were suspended by glass hooks and entirely immersed in the electrolytes which were contained in six rectangular glass jars, four plates to each jar. These jars were carried on a revolving frame in the thermostat bath which permitted the plates in any jar to be brought to a point directly underneath the left-hand arm of the balance. The balance was mounted on a marble slab over the thermostat tank as shown in the illustration. By this arrangement it was possible to weigh each plate while immersed and without exposing it to the air. The thermostat tank was filled with water to within one inch of the top of the jars. The temperature of the water could be controlled by a thermoregulator at any desired point within the range 20 deg. to 40 deg. C. The variation of the temperature of the water from a fixed point was within 0.01 deg. The water was stirred continuously. Each jar was provided with a wooden cover impregnated with paraffin.



ARRANGEMENT OF APPARATUS FOR MAKING SULPHATION TESTS

The plates selected for the experiments were those made for starting and lighting batteries by two manufacturers. Small sizes of plates were selected to avoid overloading the balance, which was of high quality, having a nominal capacity of 200 grams. The plates of maker A were $5\frac{5}{8}$ in. x $4\frac{1}{8}$ in. x $\frac{3}{32}$ in.; those of maker B were approximately $5\frac{5}{8}$ in. x $4\frac{3}{4}$ in. x $\frac{3}{32}$ in.

To adapt these plates to the conditions of the experiments, each lug was cut off and burned on again in the middle of the top edge in order to balance the plate when suspended in the liquid. Two holes were drilled in the lug. One of these was used for the glass hook which suspended the plate from the balance during weighings and the other for a second glass hook which supported the plates when weighings were not in progress.

PLATES WEIGHED REGULARLY TO MEASURE REACTION

Weighings of the plates were made daily and the results computed as the increase of weight per hour. Three sets of weighings extending over a period of forty-eight hours were sufficient to give two determinations of the rate of change in weight of the plates. These two determinations in nearly all cases were in good agreement. Four weighings at 25 deg. C. were made, giving three determinations of the change in weight. The mean of these is given in Table I.

Since the weighings were made in the electrolyte, a buoyancy correction was necessary. This correction has been calculated on the assumption that the materials have the following densities:[2] Lead, 11.3; lead sulphate, 6.3; lead peroxide, A plates, 8.7; lead peroxide, B plates, 8.8.

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*Published by permission of the Director of the Bureau of Standards.

[1] "Theory of the Lead Accumulator," Dolezalek, page 139.

Analysis of the active materials[3] showed 97 per cent lead peroxide in the positives of each manufacturer, 97 per cent lead in the negatives of manufacturer A and 91.5 per cent lead in the negatives of manufacturer B. The expanders in the negatives were carbon in each case. Buoyancy corrections were applied to a small difference of two weighings, and hence a slight error in the density of either the solutions or the active materials produces a negligible error in the final result.

The densities of the solutions were determined directly by the use of calibrated hydrometers.

The chemical reactions during discharge at the plates are generally assumed to be represented by the equations:

$$Pb + SO_4 = PbSO_4 \qquad \text{(negative plate)}$$

$$PbO_2 + H_2 + H_2SO_4 = PbSO_4 + 2H_2O \qquad \text{(positive plate)}$$

Since the molecular weight of lead is 207.20 and of lead sulphate 303.26, the gain in weight during the transformation of one molecule of lead to lead sulphate is 96.06 grams; hence the relative gain in weight is 96.06 ÷ 207.20 times the weight of lead acted upon. There is, of course, a large amount of lead which does not take part in the reaction and decreases the sensibility of the weighings, but in spite of this fact and the heavy damping resulting from the viscosity of the electrolytes, the balance was sufficiently sensitive to permit an accuracy of a few tenths of a milligram to be obtained.

From the rate of change in weight of the plates the equivalent loss in ampere-hour capacity can be computed. The valence is 2, and hence a gain in weight of the negative plate of 96.06 grams is equivalent to 2 × 96,500 coulombs. From this the change in weight is computed to be 1.79 grams per ampere-hour.

CHEMICAL REACTION PREDOMINANT DURING SELF-DISCHARGE

Both chemical and electrochemical reactions are possible at the negative plate, but the former are probably predominant over the latter during self-discharge. This is indicated by the results for the A plates in acid having a specific gravity of 1.150 to 1.400. The gain in weight per hour in the stronger acid is twenty-three times that in the more dilute. The change in potential of a lead plate, as the concentration of the electrolyte is changed from 1.150 to 1.400 specific gravity, is less than 0.1 volt according to the measurements of Gladstone and Hibbert.[4] The resistivity of the more concentrated electrolyte is higher than for the 1.150-specific gravity electrolyte. On the basis of Ohm's law, therefore, this marked increase in the extent of the reaction cannot be readily accounted for as an electrochemical reaction.

The measurements on the negative plates at 25 deg. C. are given in Table I. Each figure is the mean of six observations (three measurements on each of two plates). Buoyancy corrections have been made.

These results show that the rate of sulphation is decreased appreciably in the saturated solutions of concentrations corresponding to those ordinarily used in storage batteries. In the unsaturated experiments the ratio of the mass of acid to the mass of the plates was so large that saturation could not occur in as short a time as is ordinarily the case. Each jar contained 4.5 liters of solution and four negative plates.

TABLE I—GAIN IN WEIGHT OF NEGATIVE PLATES IN SOLUTIONS AT 25 DEG. C. SATURATED[5] AND UNSATURATED WITH LEAD SULPHATE

	Gain in Weight (Grams per Hour) for Plates of			
	Manufacturer A		Manufacturer B	
Specific Gravity at 25 Deg. C.	Saturated Solution	Unsaturated Solution	Saturated Solution	Unsaturated Solution
1.150	0.0022	0.0031	0.0048	0.0058
1.200	0.0026	0.0071	0.0118	0.0120
1.250	0.0036	0.0098	0.0178	0.0290
1.300	0.0060	0.0115	0.0283	0.0394
1.350	0.0151	0.0270	0.0385	0.0558
1.400	0.0460	0.0480	0.0906	0.0960

The question has been asked why it is injurious to allow a discharged cell with low gravity of electrolyte to stand when the results of this paper show that the rate of sulphation is less in the solutions of low gravities. The answer is that the low gravity of electrolyte in the discharged cell is merely incidental and the state of charge of the plates is the controlling factor. The plates for these experiments were initially fully charged.

The rate of sulphation decreased as time progressed. This is especially noticeable in the case of the plates of manufacturer B in the unsaturated solutions of higher concentration, as is shown in Table II.

It can easily be computed that the capacity of the plates would be exhausted in a relatively short time if the initial rate of sulphation were to continue indefinitely. The decrease in the rate of sulphation is probably attributable to the protection which the lead sulphate affords to the underlying active material and also to the increasing amount of lead sulphate present in the solutions which were initially unsaturated. The effect of the presence of lead sulphate in decreasing the rate of sulphation of the plates has been shown in Table I, but the effect of saturating the solution in holding the rate of sulphation constant for a few days during which measurements of the effect of impurities can be made is of fundamental importance in establishing the validity of this method. This is made clear in Table III, in which comparative results for the plates of manufacturer A are given for a period of three days for both the saturated and unsaturated solutions. Inconsistent results are to be observed for the solutions of 1.150 and 1.200 specific gravity, but this is not surprising since these solutions are in the region of the minimum solubility for lead sulphate according to the curve given by Dolezalek.[6] In this region there can

TABLE II—DECREASE IN RATE OF SULPHATION WITH TIME, NEGATIVE PLATES IN UNSATURATED SOLUTION
(Measurements on Plates of Manufacturer B)

	Gain in Weight (Grams per Hour) for Each of Six Concentrations					
Date	1.150	1.200	1.250	1.300	1.350	1.400
Feb. 19	0.0059	0.0132	0.0304	0.0416	0.0574	0.0976
Feb. 20	0.0053	0.0110	0.0289	0.0414	0.0560	0.0964
Feb. 21	0.0061	0.0121	0.0275	0.0352	0.0535	0.0942
Feb. 22	0.0050	0.0118	0.0260	0.0369	0.0484	0.0818
Feb. 25	0.0052	0.0110	0.0247	0.0359	0.0498	0.0819
Feb. 27	0.0053	0.0113	0.0236	0.0332	0.0470	0.0769

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[2] Determinations of the density of the active materials of the positive plates in the fully charged condition were made by Mr. Peffer at the Bureau of Standards.

[3] Made by Mr. Altrup of the Bureau of Standards.

[4] *Journal I. E. E.* (British), Vol. 21, page 430, 1892.

[5] The solutions were saturated with chemically pure lead sulphate when hot and were allowed to cool before the plates were immersed. The electrolyte in a lead storage battery is ordinarily saturated with lead sulphate, although the electrolyte is initially a solution of pure sulphuric acid.

[6] "Theory of the Lead Accumulator," page 145.

TABLE III—EFFECT OF SATURATING THE ELECTROLYTE WITH LEAD SULPHATE ON THE CONSTANCY OF THE RATE OF SULPHATION OF PLATES OF MANUFACTURER A OVER A PERIOD OF THREE DAYS

(The minus signs indicate a decrease in the rate and plus signs an increase.)

	Change in the Rate of Sulphation (Grams per Hour) in Solutions at 25 Deg. C.					
Solution	1.150	1.200	1.250	1.300	1.350	1.400
Unsaturated......	+0.0017	+0.0013	—0.0031	—0.0045	—0.0029	—0.0037
Saturated........	0.0000	+0.0005	0.0000	0.0000	—0.0009	—0.0014

TABLE V—GAIN IN WEIGHT (GRAMS PER HOUR) OF POSITIVE PLATES IN SOLUTIONS AT 25 DEG. C, SATURATED AND UNSATURATED WITH LEAD SULPHATE

Specific Gravity at 25 Deg. C.	Plates of Manufacturer A		Plates of Manufacturer B	
	Saturated Solution	Unsaturated Solution	Saturated Solution	Unsaturated Solution
1.150	0.0128	0.0111	0.0077	0.0138
1.200	0.0121	0.0096	0.0077	0.0090
1.250	0.0069	0.0060	0.0047	0.0051
1.300	0.0053	0.0022	0.0050	0.0061
1.350	0.0050	0.0019	0.0048	0.0062
1.400	0.0047	0.0031	0.0049	0.0088

be but little distinction drawn between saturated and unsaturated solutions. The measurements made on the plates of manufacturer B were not so consistent as those for manufacturer A because of a tendency for the active material to scale off, which produced an error in the results.

TEMPERATURE EFFECT IS IMPORTANT

The effect of temperature on the rate of sulphation is important. In Table IV are given the measurements made on the negative plates of both manufacturers when the solutions were maintained at constant temperatures of 22 deg., 25 deg., and 30 deg. C. The increase in the rate of sulphation from 22 deg. to 25 deg. is proportionately greater than from 25 deg. to 30 deg.

Local action at the positive plate is essentially electrochemical, resulting from the difference in potential between the oxide and the lead-antimony alloy of the grid. Metallic impurities are not precipitated by the oxide, and Dolezalek and Finckh[7] have stated that no solubility of the peroxide in solutions of the specific gravities ordinarily used in storage batteries can be detected. The reaction at the positive plate in these experiments is therefore to be regarded as the general expression for the discharge of a cell, with the qualification that the negative electrode may be lead or lead-antimony alloy, depending on the construction of the plate.

$$PbO_2 + Pb + 2H_2SO_4 = 2PbSO_4 + 2H_2O.$$

The lead sulphate formed appears on both the peroxide and the grid.

SULPHATION OF POSITIVE PLATES

The gain in weight of the positive plates is not so simply related to the total amount of sulphate formed as in the case of the negatives. The sulphate which forms on the grid or the underlying lead is equal to 96.06 grams for 2 × 96,500 coulombs, but the change in weight of the positive plates because of the formation of sulphate on the peroxide is 64.06 grams for the same quantity of electricity. The difference is accounted for by the formation of 2 molecules of water at the peroxide. This means that 160.12 grams of sulphate would be formed on the positive plate if the quantity of electricity flowing were 2 × 96,500 coulombs. The ampere-hour equivalent for the gain in weight resulting from local action is, therefore, 2.99 grams for each ampere-hour. The experimental results for the positive plates in solutions of varying concentration at 25 deg. C. are given in Table V for solutions saturated and unsaturated with lead sulphate.

TABLE IV—EFFECT OF TEMPERATURE ON THE RATE OF SULPHATION OF NEGATIVE PLATES

Specific Gravity at 25 Deg.C.	Gain in Weight (Grams per Hour) of Saturated Solutions for Plates of					
	Manufacturer B			Manufacturer A		
	22 Deg.	25 Deg.	30 Deg.	22 Deg.	25 Deg.	30 Deg.
1.150	0.0031	0.0048	0.0056	0.0012	0.0022	0.0022
1.200	0.0073	0.0118	0.0118	0.0016	0.0026	0.0027
1.250	0.0111	0.0178	0.0196	0.0028	0.0036	0.0051
1.300	0.0183	0.0283	0.0325	0.0046	0.0060	0.0082
1.350	0.0270	0.0385	0.0420	0.0122	0.0151	0.0196
1.400	0.0614	0.0906	0.1027	0.0350	0.0460	0.0544

It will be observed from the results given in Table V that the gain in weight of the positive plates decreases as the concentration of the solution increases. This suggests that the plates contained some soluble constituent the solubility of which increased as the concentration increased, but the data which are available on the solubility of lead peroxide and lead oxide fail to offer an explanation. In the solutions which were saturated the gain in weight of the plates was more for manufacturer A but less for manufacturer B than in the unsaturated solutions. The differences in behavior may be attributed to the different methods used in preparing the paste for these plates, but no exact explanation can be given now.

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Dividing Load Between Units

Must Plot the Total Steam Consumption of the Various Combinations of Turbines at Different Loads to Establish Operating Schedules

BY GEORGE R. DAVISON
Superintendent Technical Division Generating Department, Edison Electric Illuminating Company of Boston

TURBINE water-rate curves are familiar to all central-station operators and yet they are seldom used in making a proper division of load between the various units. They are none the less essential to selecting the proper combination of turbines to carry the load at any part of the day and to proportioning the loading of each machine so as to obtain the greatest plant efficiency. Failure to follow a definite plan of operation laid out in accordance with the water rate characteristics of the various turbines may result in large losses.

When a number of machines are in service the total no-load loss is a factor which cannot be altered except by taking machines out, and under these conditions it becomes evident that as much of the load as possible should be carried on machines whose Willans lines have the least slope.

For example, suppose that curve 1 (Fig. 1) represents a 15,000-kw. turbo-generator and curve 2 a 30,000-kw. unit. If both of the machines are in operation and with the total load on machine No. 2, while machine No. 1 is runing idle, then the combined Willans line will be represented by curve 3, which is parallel to curve 2 and separated from it by a distance equivalent to the idle loss on machine No. 1. Similarly, curve 4 represents the combined Willans line when both units are in service, but with reversed condition—that is, with all the load on machine No. 1 while machine No. 2 is running idle. It will now be seen that curves Nos. 3 and

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[7] *Zeitschrift für Anorg. Chem.*, vol. 51, page 320, 1906.

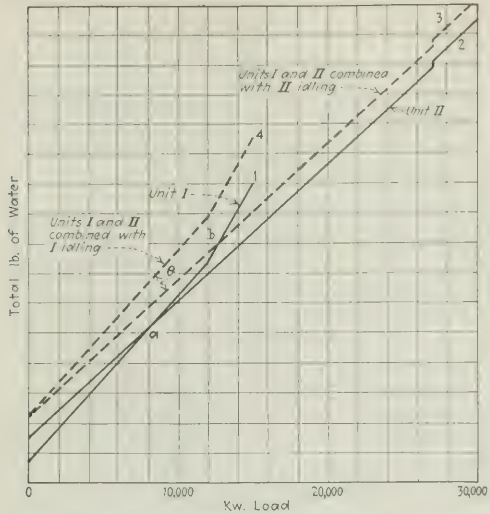

FIG. 1—WILLANS LINES FOR TWO UNITS AND COMBINED OPERATION THEREOF

For the turbine of usual design the Willans line is straight from zero load up to a point of load where some change takes place in the method of flow of steam through the turbine, such as happens, for instance, when a secondary valve is opened to admit steam to an intermediate stage. The curvature of a water-rate curve shows the influence of the no-load or idle running losses upon the water rate at different points of loading. If there were no such losses, the water-rate line would be a straight line between the same points of load where the Willans line is straight.

4 represent the limiting conditions of combined operation of the two units, and all other methods of loading them than those described above, such as proportional percentage loading and other methods, will be represented by lines which lie in the angle θ between curve 4 and curve 3.

Therefore, when the two machines are in operation the method of loading represented by curve 3 will prove the most economical at all points of the combined load. That is, machine No. 1 should be run as near no load as operation permits until No. 2 is fully loaded, at which point increased load will have to be built up on No. 1.

Keeping two machines in service when there is load only for one would be poor policy if plant efficiency were the only consideration. However, there are other important considerations, such as providing continuity of service in case of trouble and preparation for rapidly changing load, which usually make it necessary to carry considerable extra capacity upon the bus.

In this case, if both machines are not required in service, it may be seen that machine No. 1 would prove most economical up to 8,000 kw., where line 1 crosses line 2 at *a*. For loads beyond this point No. 2 machine should be brought up and the load transferred to it, taking machine No. 1 out of service. On the other hand, if the load is rising rapidly, it would be poor policy to take out machine No. 1 only to put it in service again in a short period. Under this condition it will pay to continue with machine No. 1 before bringing in No. 2 to the point *b*, where curve 1 crosses curve 3. At this point the load should then be transferred to machine No. 2 and machine No. 1 operated at as low a point of loading as will give stable conditions until the capacity of No. 2 is reached.

When it becomes necessary to put in a third machine two considerations present themselves. It must be decided whether to choose a machine with the smallest idle losses or one with a Willans line of the least slope. If the increase of load is not expected to load up the extra machine for a long period, low idle losses might be a feature.

Usually, however, the greatest gain will be made by putting in service a machine which has a line of least slope. Then, if one of the machines already in service has a line of steep slope, all of its load may be shifted to the incoming machine.

The same considerations that apply to putting in the first three machines apply to putting in all other additional machines. The problem is simply one of extending the method.

So far only turbine losses have been considered. However, in many stations different parts of the plant operate at different efficiencies due to other factors than the turbines. It may be necessary to add the boiler losses to the turbine losses for a proper survey. Such items as the percentage of make-up water which has to be evaporated in different parts of the plant must be considered. The power used by auxiliaries also enters into the problem, and it is only in plants where these factors are of equal weight upon all machines that the question may be decided alone on the merits of turbine steam-consumption curves.

However, it is not always possible to operate with an eye to efficiency alone. As mentioned before, providing for continuity of service and fluctuating load is also essential. Again, there may be separate bus sections that make it imperative to operate a machine on one bus section, which is not the most efficient, and usually there

SCHEDULE OF MACHINES TO OPERATE AT DIFFERENT LOADS INDICATING DIVISION OF LOAD, CAPACITY AVAILABLE, PERCENTAGE OF LOADING AND COMBINED WATER RATE

COMPANY SYSTEMS TIED TOGETHER

Turbine No.	3–4	1–2–5	6–7–8	9–10	Average Load of Machines (in 1,000 Kw.)				Total Rating (1,000 Kw.)	Per Cent Loading	Combined Water Rate at Given Load (Lb./Kw.-Hr.)
Actual rating	7,500	12,000	15,000	25,000							
Maximum rating	8,000	13,000	15,000	30,000							
Scheduled load (in 1,000 Kw.)....					3–4	1–2–5	6–7–8	9–10			
	Number of Above Units in Operation										
25				1				25	30	83.4	11.56
33				2				16.5	60	55.1	12 42
46		1		2		3		21 5	73	63 1	12.42
48			1	2			3	22 5	75	64 0	12.44
49	2			2	3			21 5	76	64.5	12 69
54	1	1		2	3	3		24	81	66.7	12.54
56	1		1	2	3		3	25	83	67.5	12.54
59		2		2		4 5		25	86	68.7	12.67
61		1	1	2		5	6	25	88	69.3	12.67
62	2	1		2	3 5	5		25	89	69.7	12.83
63			2	2			6.5	25	90	70.0	12.72
64	2		1	2	3 5		7	25	91	70.4	12.87
67	1	2		2	4	6 5		25	94	71 3	13.05
69	1	1	1	2	4	7	8	25	96	71 9	12.93
71	1		2	2	5		8	25	98	72.5	12.90
72		3		2		7 33		25	99	72 7	13.15
74		2	1	2		7 5	9	25	101	73 3	13 10
75	2	2		2	5	7.5		25	102	73 5	13.22
76		1	2	2		8	9	25	103	73.7	13.04
77	2	1	1	2	5	8	9	25	104	74.0	13.17
78			3	2			9 33	25	105	74.2	13.08
79	2		2	2	5		9.5	25	106	74 5	13.15
80	1	3		2	5	8.33		25	107	74 8	13.28
82	1	2	1	2	5	8 5	10	25	109	75.2	13.27
84	1	1	2	2	5 5	8.5	10	25	111	75.6	13.24
87		3	1	2		9	10	25	114	76.3	13.39
88	2	3		2	5 5	9		25	115	76.6	13.55

are one or two other upsetting factors which cannot be ignored.

Nevertheless, with all such factors in mind, a schedule should be drawn up fixing upon a combination of machines and a point of loading on each machine for every different zone of loading on the station. This schedule would then definitely fix the method of operation to give the best efficiency at all times which is possible under the existing conditions of policy.

Such a schedule was devised several years ago for the Edison Electric Illuminating Company of Boston. This has been in effect continually with occasional revision from time to time as conditions required. This schedule, which is shown in the accompanying tables, indicates what machines to carry, the loading on each machine for different station loads and the combined water rate.

The water rates of the various combinations laid out in the schedule are given in Fig. 2. It must be noted that the highest possible efficiency is not attained in the combinations represented, for the reason that it has been necessary to sacrifice efficiency somewhat for conditions of policy and operation. Attention is also called to the peculiar flattened shape of the curves at the higher loads. These curves clearly show the point at which it is necessary to begin loading the poorer units after reaching the limit of loading on the better ones.

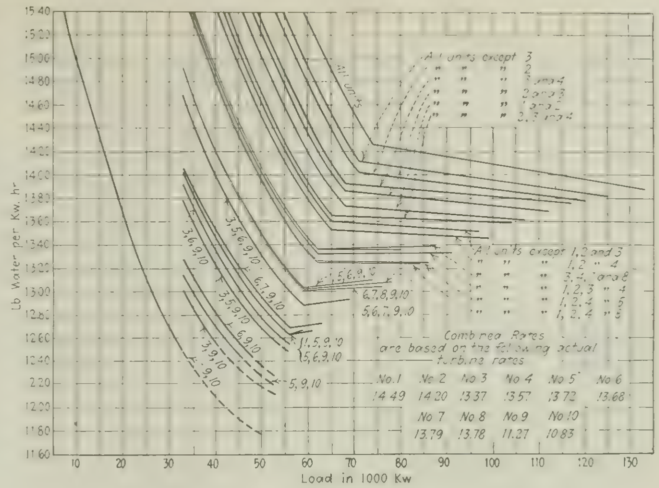

FIG. 2—COMBINED WATER RATES OF VARIOUS COMBINATIONS OF TURBINES AT DIFFERENT LOADS

These results include auxiliaries and leakage figured with average rates and conditions. Although the actual rates change with seasons, their relation to one another is nearly constant. Numbers on curves indicate units operated.

MUST CHOOSE CAREFULLY BETWEEN COMBINATIONS

Among these combinations are some which have considerably different combined water rates without much difference in combined capacity. The mistake of putting in combined service the wrong combination may be brought out by noting a particular cast. For example, there is little capacity difference in the combinations represented by the seventh and ninth curves from the top of the family of curves shown in Fig. 2. Nevertheless, with a 98,000-kw. load for a period of eight hours per day the loss per day, using the poorer combination, is equivalent to 8 tons of coal. At $7 per ton this amounts to about $15,000 per year.

COMPANY SYSTEMS SEPARATED—6,900-VOLT SYSTEM

Turbine No.... Actual rating... Maximum rating	3–4 7,500 8,000	1 2 5 12,000 13,000	Average Load on Machines (in 1,000 Kw.)		Total Rating (1,000 Kw.)	Per Cent Loading	Combined Water Rate at Given Load (Lb. Kw.-Hr.)
Scheduled Load (in 1,000 Kw.)	Number of Above Units in Operation		3–4	1 2 5			
16		2		8	26	61.5	15.63
24	1	2	6	9	34	70.6	15.58
33	2	2	6.5	10	42	78.5	15.66
37	1	3	7	10	47	78.7	15.33
45	2	3	6.6	10.6	55	81.9	15.39

COMPANY SYSTEMS SEPARATED—13,800-VOLT SYSTEM

Turbine No. ... Actual rating... Maximum rating	6–7–8 15,000 15,000	9–10 25,000 30,000	Average Load on Machines (in 1,000 Kw.)		Total Rating (1,000 Kw.)	Per Cent Loading	Combined Water Rate at Given Load (Lb. Kw.-Hr.)
Scheduled Load (in 1,000 Kw.)	Number of Above Units in Operation		6–7–8	9–10			
33		2		16.5	60	55.1	12.42
48	1	2	3	22.5	75	64	12.44
63	2	2	6.5	25	90	70	12.72
78	3	2	9.33	25	105	74.2	13.08

In both cases compared above the loading was in accordance with correct methods, and the substitution of machines in the two combinations considered was between two smaller units which had individual water-rate curves comparatively not far apart. Hence it is conceivable that the loss would be very high between two machines of distinctly different characteristics.

It must be evident, therefore, that inconsiderate methods of loading may lead into losses of a very appreciable figure.

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Saxony's Electricity Supply

THE power plant at Hirschfelde, near Zittau, Saxony, is starting up a third large turbine, through which the capacity of the plant will be increased to 85,500 kw., reports C. T. Steger, United States Vice-Consul in Charge at Dresden. This plant is now supplying the greater part of eastern Saxony and western Silesia with electricity and is also supplying the city of Dresden with very considerable quantities by means of the 100,000-volt transmission system. In 1921 the three largest power plants of the Saxon district of Niederlausitz were connected with the power plant at Hirschfelde. The high-tension system thereby established, connecting Hirschfelde, Dresden, Lauta, Spremberg, Berlin, Zcheornewitz and Leipzig, already has a length of 525 km. Recently the 100,000-volt system covering Dresden, Chemnitz, Silberstrasse and Herlasgrün has been tested, so that the power plants at Hirschfelde and Lauta will be in a position to supply electricity to the distant Saxon districts of Erzgebirge and Vogtland.

The erection of the second long-distance state power plant at Döhlen, near Leipzig, will be begun this autumn, and it is estimated that the territory covered by it will be considerably larger than that of the power plant at Hirschfelde. A 100,000-volt line from Leipzig to Silberstrasse will connect this new plant with the long-distance line from Hirschfelde to Dresden, thereby completing the extensive network.

Keep Public Contacts from Sparking—I

A Close-up Analysis of Some of the Points of Contact Between the Central-Station Organization and the Community, with a Few Suggestions for Preventing Them from Heating Up

By E. L. MILLIKEN
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ON THOSE occasions when friction develops between some member of a public utility organization and some citizen whom it serves it is encouraging to call to mind the rather striking similarity which can be drawn between central-station public relations and the brushes on a generator. Let us look back for a moment at some of the old types of direct-current machines with which, for some inherent reason, we always had commutating trouble, in spite of everything we did. The machines sparked at the brushes, particularly where the nature of the load was fluctuating.

As years went by, however, new types of brushes came into existence which, when applied to these old machines, materially alleviated, if they did not entirely eliminate, sparking. The seemingly impossible was accomplished, owing to advance in the art of producing brushes of higher conductivity or, as we technically termed it, greater amperage per square inch of brush contact. Sparking was perhaps the earliest contact problem in the industry.

The question of public contact today presents a psychological parallel to the technical problem of reducing sparking of commutators in direct-current machines. The company's service may be likened unto the flow of current, and the public to the commutator, while the brush cross-section may be represented by the number of contact employees and the conductivity per square inch finds its parallel in the state of mind of the contact employees. No matter how well the service may be maintained by those directing the company's policy, it cannot flow to the consumer with the least resistance and without undue loss and sparking unless there are sufficient contact employees to render the service, and unless the conductivity through these employees is high; that is, unless they are imbued with the spirit of service.

Continuing the analogy, the direction of rotation must be such as not to cause sparking at the toe of the brush. The consumer's relations with the company and the company's relations with the consumer must be such that the brush will lie flat on the commutator, and all contact employees must function satisfactorily in their respective duties.

The reader may well say that this parallel is more or less a stretch of the imagination. This is admitted. The entire question of improving public relations calls for a very vivid play of the imagination.

Those in any organization responsible for directing its public relations must not only observe but must also anticipate the effect of the company's policies on the consumer and the effect of the probable errors of certain contact employees in handling the public. Yet to secure the most satisfactory results observation and imagination must go hand in hand. It is possible to go too far in imagining features of a company's service which rub the consumer the wrong way. Closer observation and analysis reveals seemingly unimportant elements in our dealings with the public which may have a marked effect in molding public opinion concerning a company and its service. Such a study will, among other opportunities for service improvement, offer the following very practical suggestions:

Inaccurate Meters and Errors in Billing.—There is no more prolific source of strained relations with consumers than conditions arising out of inaccurate—and particularly fast—meters and out of errors in billing. This is an old story, but there are yet many chapters to be written before "finis" can be placed after any one of them.

COMPANY SHOULD ADOPT BROAD POLICY

The public as a whole has yet to be convinced that the electric meter does not "knock down fares" for the company's benefit. There are still consumers who believe that some iniquitous official raises and lowers bills as best suits his whim and the company's interests. To improve these conditions the management may well decide on a broad policy intended to engender in the public a faith in the meter and in the company's practice in using it as a measure of energy sold.

To do this, first and foremost it is necessary to make rebates voluntarily to all consumers whose meters, either on complaint or periodic test, are found fast. The percentage of such meters is small, and the amount rebated is correspondingly negligible when compared with the favorable effect on the mind of the consumer. Whatever loss in revenue (actually never earned) results from this rebating practice will to no small degree be offset by payments from consumers whose meters have been running slow or failing to register. These payments will become gradually easier to obtain when the public are convinced that the company's practice works both ways impartially.

Let the practice of justly rebating apply to errors in constants as well as in meter accuracy. To the same extent acknowledge errors in reading and billing and rebate or collect as the case may require. These acknowledgments should come freely and willingly. If they are not made promptly and with a good grace, much of their effect will be lost.

Above all, let concerted effort be directed toward eliminating the causes. Instill in the meter readers the importance of accuracy in their work. Let meter installers understand the consequences to the company of errors in constants or in connections. Educate billing clerks to a knowledge of the trouble arising from sending out inaccurate bills. Develop team work between all of those departments and employees whose combined efforts result in the finished bill to the consumer.

Bill Forms.—The evolution of non-confusing, non-irritating, non-threatening, non-inflammatory, understandable and computable bill forms began long before our problems of public contact were crystallized under the term "public relations." Nevertheless, the ideal bill form has probably yet to be devised, although "soothing syrup" has been administered to most forms. The old type of bill for residential consumers, with its—to the customer—cryptic figures and carefully and legally worded threats to penalize through loss of discount, has gradually been replaced by a simple, open-faced form so designed as to make it possible for the recipient to understand how the amount due is computed.

SHOW HOW BILLS ARE COMPUTED

When we come to bills for power or industrial service under the more or less complicated rate forms in use, some progress has yet to be made. It is to the credit of the utilities issuing bills under these rates that the customers pay them usually without monthly protests. This shows a certain degree of confidence in the integrity of the utilities. But this confidence would be enhanced by an actual and a plain statement on the face of the bill as to how the total amount due is derived.

Making up such a bill will entail somewhat more labor and expense. Yet the customer who pays the utility hundreds or thousands of dollars a month is entitled to a detailed bill. The utility official who received a bill from his grocer for, say, merely "vegetables," "canned goods" and "groceries" would insist that the grocer should furnish details of these three items. If he were told that it entailed too much work so to detail them, he would hardly be content. Similarly, a bill for merely "demand charge" or "service charge," plus so many kilowatt-hours, cannot satisfy a utility customer, even if the rate is printed on the back of the bill. Let's give unto others what we expect from them.

ORDER CLERK AN IMPORTANT LINK

The Order Clerk.—In any electric company the order clerk or the employee who receives orders for service from customers and in turn issues necessary instructions to the operating department regarding cut-ins and cut-outs is a most, if not *the* most, important link in the company's chain of relations with its customers. In some organizations this clerk handles complaints as well and gives general information to all inquirers. When his or her duties are thus amplified, the position becomes doubly or trebly important. Upon the order clerk to no small degree depends the speedy execution of customer's requests and orders.

Not infrequently this clerk is the first point of contact with the customer. It naturally follows that the selection of this employee should be made in a most discriminating manner. A person of pleasing personality, affable, of even temper, having a thorough knowledge of the business and of the company's routine, is not found at every turn, neither are such made in a day. Then, too, he or she must be a student of human nature and must like and sincerely enjoy meeting people. Ordinarily the person who enjoys meeting people other people enjoy meeting.

Moreover, this clerk must be imbued with the spirit of service. He or she must be entirely in accord with the management's policies directed toward pleasing the public. All of these other qualities must, also, go hand in hand with the faculty of getting along with all of the other departments of the company. For the order clerk is the pivot around which swing the activities of the sales, meter, service, accounting and collection departments. The ideal order clerk will have the respect and liking of all of these departments. For the proper performance of such a job there should be given to him or her every reasonable and requisite authority. When so vested, this vital employee can do much toward attending to those little niceties of service which give rise to ever-widening ripples of public good will. The right kind of an order clerk may be considered the master key which will open many of the doors to public good-will that otherwise would be closed.

Cut-in and Cut-out Orders.—The rapid execution of cut-ins and cut-outs by the operating departments is a prime essential in creating public good will. The public expects expeditious treatment. The longer a family has deferred using electric service the more insistent it is to have connections made promptly.

The average householder who is about to have service connected for the first time is in much the same frame of mind as a child with a new toy. He is eager to see the toy come out of the box at home, which in the case of electric or gas service means to see light and heat coming from the fixtures or appliances. Hence it is up to the operating department to see that new customers are enabled to play with their new toy at the earliest possible moment.

QUICK CONNECTIONS ARE DESIRABLE

Quick connections always make a good impression. Undue delay has the reverse effect, particularly considering the eager anticipation of the new user of service. It therefore behooves any organization giving consideration to improving public relations to cast about and take stock of those things in its existing routine which facilitate or hinder the rapid connection of new customers. The practice of leaving meters in a house from which tenants move, and having service disconnected, does much to render this possible. Service to the incoming tenants can be given more quickly—particularly where entrance boxes are used—than where the meter is taken out and must be put back. The tagging of these locked meters, showing the incoming tenants where to telephone or apply for service, is a further step in the same direction.

ELIMINATE RED TAPE

There has been in the past altogether too much red tape in the way of a prospective customer securing service. In one instance with which the writer is familiar it was found that there were twenty-eight items of routine to be undergone before a cut-in order would be issued for a new customer. After careful consideration all of these were dispensed with, and it was made possible for a prospective customer to call the office by telephone and ask to have service connected, whereupon it would be done. No application card is now required and no deposit, unless, as happened in some isolated cases, it is found necessary to have a deposit after the meter has been put in. In such cases a personal call is made on the customer and the deposit is obtained, or, as rarely has been necessary, the service is discontinued. All of this red tape has been cut out on the theory that the customer should not be an applicant for service, but that the company, on the contrary, should seek the business.

The prompt reading of meters and rendering of final bills to customers moving from one location to another in a company's territory, or moving out of the territory, should not be overlooked. This not only has a favorable effect on collections, but prompt service of this kind is appreciated by the customer. We never know when customers leaving our territory may come back, and their last impression of our service is bound to hold over. Our service should be prompt and efficient from beginning to end; that is, from the time they are first connected until the final bill is rendered.

Care for Those Who Move Away

Then, too, there is another aspect of the situation The industry as a whole should make sure that the impressions brought by customers moving from the territory of one company to that of another are favorable. The good work being done by some one company, resulting in general public good will, will be somewhat negatived if there are constantly coming into its territory customers bringing grievances which they have nursed against the companies serving the territories in which they formerly lived. This is another instance of the value of concerted action in the working of one for the good of all and all for the good of one.

Handling Complaints.—Very little remains to be said on this point, regarding which so much has been said and written. One point sometimes overlooked is the giving of sufficient consideration to the person handling particularly "difficult" customers and "chronic kickers." Don't send a man on a boy's job or a cook to repair a fine clock. Consider each case and pick the man to handle it.

In general, a special representative can best be employed by larger companies to do such work. Salesmen, operating men and collectors each have a certain viewpoint which unfits them for handling important or difficult complaints. An unprejudiced mind is essential, and the possessor should as well know the various angles of the business sufficiently to judge each case on its merits. Such a representative should have full authority to settle, without having to keep the matter in the fire for an extended period, which is always irritating to the consumer and militates against a final satisfactory settlement.

Manager Personally Responsible

In smaller companies the manager is obviously the man to do this work. If he is not capable of doing it well, he probably should not be a manager. The handling of complaints or trouble should not be left to subordinates without a most careful oversight from the manager. The policy of following up trouble calls or complaints by telephone, or by writing to ask the consumer if the matter has been handled to his satisfaction, will serve as a check on the complaint and trouble man, and at the same time it impresses upon the consumer the company's desire to serve thoroughly.

Handling Credits.—The handling of credits, particularly those which are doubtful, is always a ticklish problem. The accounting department is always charged with the responsibility of passing on the credit of prospective customers. This department naturally feels that it should in every possible manner safeguard the company's present as well as future income. Yet to establish a hard and fixed rule in the matter of collection of accounts or the extension of credit to any customer would be very detrimental to public relations. Here again is an opportunity for a careful study of human nature.

Sometimes the householder who has always met his obligations promptly, but through illness in his family becomes hard put for cash, finds it necessary to allow his bills for lighting service to go unpaid. Thereupon arises a great opportunity for the company furnishing these services to demonstrate to him that it is human by recognizing his difficulties and sympathizing with him in the most practical way possible—that is, giving him a reasonable extension of time in which to pay his bills.

Similarly, if some mercantile or manufacturing concern of formerly unquestionable integrity becomes short of cash through a fire or through economic conditions beyond its control, consideration should be shown it through an extension of credit. Of course, all of the considerations entering into each case must be taken into account, but in many instances we shall win the good will of those who will in the future be good customers, not only from the standpoint of use of service but of prompt payment. People appreciate assistance most when they need it the most, and remembrance of such assistance will extend into the future in more or less proportion to the assistance rendered at the time.

Size May Affect Relations

In general, the writer believes that most companies, and particularly the smaller ones, follow some such practice as above suggested. The point is brought out, however, in the fear that as companies grow and the more intimate contact with customers which existed under their smaller organization in the bygone days becomes less possible these little humanizing acts may not be performed by those down the line in charge of credits and collections.

Atmosphere in Company Offices.—Considerable attention has been directed in recent years to improving the general atmosphere prevailing in our offices. In passing, one suggestion may not be amiss.

Frequently when a consumer is paying a bill at a cashier's window employees of the company may for some reason or another have business with the cashier. All too often the cashier will leave the consumer standing at the window and make change or otherwise transact the particular business which his fellow employee may wish done. This has a most unfortunate effect on the mind of the consumer. Any one who has stood in line at the box office of a theater or before a ticket window in a railroad station and had some attendant or railroad employee taken care of ahead of the whole line of standing patrons will realize the force of this argument.

A Correction

In the article in the issue of Nov. 11, page 1033, entitled, "Simplification of Paper Mill Drive Control," it was stated that Timken roller bearings were used on the paper machine, while as a matter of fact Gurney ball bearings were used throughout. The statement was an editorial error brought about by using an incorrect drawing of a paper machine similar to the machine at Tyrone.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Selling Plug Fuses to the Public

To the Editors of the Electrical World:

In recent issues of the *Electrical World* and elsewhere I have observed a good deal of controversy in regard to fuses. Here and there I have seen discussion as to whether or not the householder should be permitted to replace his own plug fuses.

About a year and a half ago one of the five-and-ten-cent-store companies advertised somewhat extensively in the *Saturday Evening Post.* The illustration showed, if I remember rightly, a man with his son as helper fixing electrical wires. Now, it so happened that in going through these stores I found plug fuses rated as high as 30 amp. It did not seem right to me for these stores to solicit patrons to purchase electrical supplies which would endanger their homes. So I wrote to the company pointing out clearly the danger of the public use of fuses rated at more than 10 amp. or 15 amp. It was a long letter but clearly and simply explained.

The result was an extremely courteous reply from headquarters, explaining that those in authority were unaware that such a danger existed. To them a fuse was a fuse whatever its amperage. They promised to rectify their error and not keep anything in their stores for sale to the general public with an amperage higher than 15.

This was a year and a half ago. Since then I have made a practice of looking at fuses whenever I go into such stores. They have kept their promise, and I do not think you will find in any of the five-and-ten-cent stores throughout the country a fuse that will be a source of danger to the average householder.

R. VAN RAALTE,
Advertising Department.
B. F. Sturtevant Company,
Boston, Mass.

Testing Transformers for Characteristics

To the Editors of the Electrical World:

On page 982 of the *Electrical World* for Nov. 4 is an article by R. F. Gooding entitled "Testing Transformers for Characteristics." In this article several statements are made which are rather confusing and which we should like to call to your attention. In the fourth paragraph the first sentence reads: "After connections are made, close switch in circuit No. 1 and adjust to full-load current through ammeter with rated voltage across transformer terminals." After connections are made, as shown in Fig. 2A, the ammeter can show only the exciting current of one transformer at full voltage. After circuit No. 2 is closed and adjusted the ammeter will then show, accurately enough for this purpose, full-load current. Theoretically, of course, full-load current at quadrature with the exciting current should be held.

In Fig. 2B the low-tension windings are shown connected in series, whereas the text calls for them to be connected in parallel, which, of course, they must be if the voltage of circuit No. 1 is equal to the rated voltage of the low-tension winding.

W. S. MOODY,
Engineer Transformer Engineering Department.
General Electric Company,
Pittsfield, Mass.

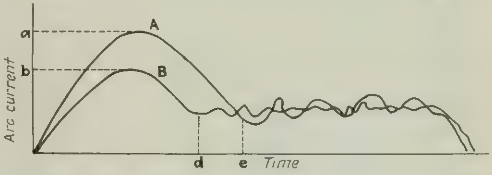
Laminated-Frame Arc-Welding Generators

To the Editors of the Electrical World:

In your issue of Oct. 28 it was interesting to note a letter from K. L. Hansen of Milwaukee, in which he still persists in denying the truth of the statement that "laminated-frame arc-welding generators permit a very rapid change of flux density, which in turn makes it possible for the arc current to adjust itself almost instantly to any demand."

As stated in my previous communication of Oct. 7, in a differential compound-wound generator for arc-welding service flux changes in the magnetic circuit take place quite rapidly, so that by using a completely laminated magnetic circuit the damping effect of induced eddy currents in the field iron is eliminated to a large extent, thus allowing the change in terminal voltage to take place more rapidly than it does in case of cast-steel frame. Therefore, with the differential type of generator, on a sudden shortening of arc length there is an inrush of current, the rate of which depends upon the time constant of the arc circuit, and the amount of which depends upon the rate of change of magnetic flux density in the fields. Likewise, with a sudden lengthening of the arc, the rate and amount of current decrease depends on these two factors.

Your readers can perhaps best understand this particular phenomenon by assuming, first, the condition encountered when starting the arc, then sketching a curve of the current characteristics in the arc circuit under this condition, with current as ordinate and time as abscissa, thus:



In the above sketch it is assumed for sake of comparison that the time constant (L/R) of the arc circuit (including reactance coil, etc.), also the average welding arc amperes, are the same in both cases. Curve *A* represents current-time characteristic of a cast-steel-yoke welding generator, and curve *B* represents current-time characteristic of a laminated-yoke generator. It will be noted that the maximum current peaks represented by *a* and *b* and the time required, *d* and *e* respectively, for the arc current to adjust itself to normal welding conditions are much greater on the cast-frame than on the laminated-frame generator. It is, of course, universally known that in interlinked electromagnetic circuits an electrical change will take place many times quicker than will a magnetic change even under the most favorable conditions, e.g., where the magnetic circuit is made up of the thinnest of laminations. Hence, upon starting the arc with a differential compound-wound welding generator, with a normal approximate open-circuit voltage of 60, the current tends to approach a value equal to $60/R$ amp., where R is the resistance of the entire arc circuit in ohms, but owing to the reacting flux set up by the differential field the maximum current inrush is reduced to a much lower value, depending on how quickly the differential field is built up. It has already been agreed by Mr. Hansen that a laminated yoke, by preventing eddy currents, will cause a quicker change in flux density than a cast yoke;

so, applying this fact with the above facts, it is apparent that the amount and duration of the inrush current on starting the arc, and also the variations in arc voltage and current during the actual welding operation, are greatly improved by the use of an entirely laminated magnetic circuit. As stated in my previous communication, even with the best design of laminated frame it has not been possible entirely to eliminate a reactance in the arc circuit, though it has been materially reduced in amount. This reduction in reactance means a reduction in the actual resistance or inductance of the reactor —generally both—hence a certain power saving.

By no means do I claim that the damping effects of eddy currents are beneficial in stabilizing the arc, as was suggested in the second paragraph of Mr. Hansen's recent letter, and if the wording of my first letter was such as to be misunderstood in that connection, I am sincerely sorry. It was my idea in the first letter to point out other advantages of the laminated-frame generator, such as reduction of eddy current and hysteresis losses, besides the advantage gained by a quicker adjustment of generator voltage.

It is apparent from your contributor's letter in the issue of Oct. 28 that he has failed to go beyond the fact that the reactor is put in the arc circuit to slow up the rate of change of current in that circuit. The point he has not grasped is this: That the reactor is used for stabilizing the arc and not the generator. The cause of any change in arc current is at the arc entirely —namely, lengthening or shortening the arc—while the effect is that the generator tends to readjust itself to the new condition; and since no generator, even with the thinnest laminations in the magnetic circuit, has been designed to take care of this rapid change in arc conditions, the reactor in the circuit has the effect of slowing up the changes at the arc, thus allowing the generator time to adjust itself. In order to get equivalent results on a cast-frame generator, it is necessary, then, to use a larger reactor to the detriment of good operating arc characteristics.

In regard to the high hysteretic coefficient which the writer used in his previous letter, I should like to state that this value was obtained from the Franklin and Esty textbook on "Elements of Electrical Engineering," Volume I, third section, page 380, and is evidently higher than that given in other textbooks. It is believed, however, that the pulsation in flux density in the frame is nearer 2,000 lines per square centimeter under commercial hand-operating conditions, which would increase the loss in proportion to the 1.6 power, or about three times that calculated already in your contributor's letter. Of course, the maximum change in flux density also will be greater with the cast frame, as explained above, and this should be noted when working out the formula. It is conservatively estimated that the cast frame has about 200 watts more core loss than the laminated frame, which represents approximately 10 per cent of the total loss in the generator when operated at a rated load of 200 amp. at 20 volts. In addition to this it is possible to use a smaller reactor with a laminated frame, hence a reduction in reactor copper and iron loss.

I agree perfectly that the next step in the developing of arc-welding generators should be such as to eliminate entirely the reactor in the arc circuit, thus reducing the cost and increasing the efficiency of the unit, if this is possible. In approaching this condition, of course, it would be necessary to build the entire magnetic circuit of the thinnest laminated sheets of the highest permeability and increase the time constant of the arc circuit by increasing the inductance of the generator.

New York, N. Y. P. P. PIPES.

Extremely High-Tension Transformers

To the Editors of the Electrical World:

Some time ago reference was made in the *Electrical World* to the transformers built for very high voltages by the Koch & Sterzel Company of Dresden, Germany. Swiss papers of recent date direct attention to the fact that in 1921 a 1,000,000-volt test transformer, built after the patent of Professor Dessauer of Frankfort-on-Main, was installed in the laboratories of the Haefely Company, Ltd., of Basle. It is contended that transformers of this kind, which are also being used in the construction of modern Röntgen therapeutic apparatus, have a great future and that the further augmentation of voltage is merely a question of construction and finance.

HENRY L. GEISSEL.
Beaurivage, Thoune, Switzerland.

Oregon Commission's Rural-Service Regulations

To the Editors of the Electrical World:

On page 1103 of the Nov. 18 issue of the *Electrical World* you give the Oregon Public Service Commission's rules regarding rural extensions. I wish to call your attention to the fact that your caption and preamble are slightly misleading as they do not convey the exact meaning of the rules, in that, instead of the utility being required to invest $4 for each $1 annual revenue, you will note that under Rule 4 the annual revenue mentioned is the *minimum* annual revenue. In other words, if the minimum charge of the rural rate is $1 per month, or $12 per year, then the amount to be spent by the utility would be $48. The *average* annual revenue from this rural business is more nearly in the neighborhood of $20 per year. It should be made clear that this four-to-one ratio applies to the minimum annual revenue only.

This matter will no doubt be called to your attention by others, but I am writing you to make sure that the point is not overlooked, because a bad precedent might be established by allowing the wording in your article to stand uncorrected.

M. M. HAMILTON,
Division Manager.
Portland Railway, Light & Power Company,
Salem, Ore.

Automatic Operation for Small Plants

To the Editors of the Electrical World:

The subject of automatically controlled electrical equipment is an interesting one to me, and I found much of value in the article in the *Electrical World* for Nov. 4 on "Automatic Plant Replaces Cable Drive." In reading it over a question arose as to why it was necessary to install two units. Usually installations of this nature are much more simple if there is but one unit.

Looking into the future, I can see here in the West the trend toward the development of small automatic hydro-electric plants incidental to the large central generating stations along the Sierra Nevada Mountains. Many of these plants are physically possible and economically desirable at the present time, and whenever the financial policy has been formulated they will be realized.

G. H. BRAGG,
Engineer of Maintenance.
Pacific Gas & Electric Company,
San Francisco, Cal.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Maintenance Schedules for Oil Circuit Breakers

FROM the discussion in an article appearing in the *Electrical World* for Nov. 11, page 1050, on the above subject it is very evident that opinions differ considerably as to the frequency and importance of these maintenance duties. It is true that while endeavoring to create a permanent schedule for this work one must consider the class of service, type of breaker, capacity involved, and the records of past experiences, lest any result obtained should overlook economy in station expense. Somewhere then between this undue expense of maintenance and successive or prolonged disturbances to service as the result of the neglect of this work lies the medium schedule by which this maintenance should be timed.

The combination schedule for successive overhaulings of oil-circuit-breaker equipment, as adopted and practiced by the Consolidated Gas, Electric Light & Power Company of Baltimore, on 13,000-volt and 26,000-volt, 25-cycle distribution systems is as follows:

(1) *Weekly Inspection of Oil Level in Oil Switch Tanks.*—This inspection to detect leaky tanks is made by station operators without additional expense.

(2) *Monthly Test: Tripping Breakers at 90 per cent of normal control voltage.*—Made by station operators.

(3) *Inspection of Breakers Following Severe Shocks.*—This inspection, which is made by the maintenance department immediately after the breaker has cleared a short circuit, consists of lowering the tanks and making all necessary repairs to put the switch in the proper operating condition.

(4) *Semi-Annual Inspection of Oil Switches.*—Operating conditions permitting, the maintenance department makes a thorough examination of all breakers semi-annually. At this time the breaker receives a general overhauling. The tanks are lowered and contacts renewed. The tripping mechanism is then adjusted to respond as quickly as possible to the controller and relay. Insulators are cleaned and oil is renewed if necessary.

The oil circuit breakers of the Baltimore system to which the above schedule of maintenance is applied are chiefly of the older designs of one manufacturer. For the following reason additional precautions may be taken with these breakers, to enable them better to withstand the severe shocks to which they may be subjected:

It has been our experience that under short-circuit conditions these breakers behave in a peculiar manner. When a breaker is tripped by its relay, the main contacts are required to separate under oil, thereby breaking a heavy current. This separation forms a volume of gas which raises the pressure in the oil tank. The design of the switch is such that the pressure created does not act in a balanced manner on the moving parts, consequently the effect is to reclose the switch. By this time there has been an appreciable reduction in voltage, so that the next opening of the switch is under a lower voltage. The automatic opening and closing of the switch proceeds until the unbalanced pressure tending to close the contacts is insufficient to reclose the switch. This peculiar action accounts for the apparent ability of the switch to open short circuits of magnitudes which seem to be in excess of its actual rupturing capacity.

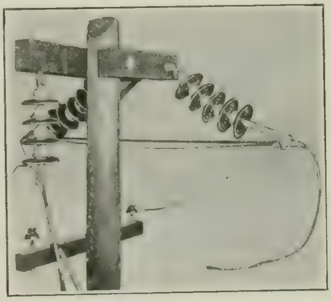
In the opinion of the writer all modern high-powered oil circuit breakers will no doubt be equipped with mufflers, to relieve the switch tanks of gas. An outlet pipe from the switch tank conducts the gases to a muffler, containing baffles, which resembles that of an automobile. This serves to cool the gases and reduce the pressure. An outlet pipe from the muffler liberates the gases above the mechanism of the breaker, while any oil forced to the muffler is left to return to the switch tank by gravity.

In order that the life of the tanks and tank castings of this type of switch may be prolonged, this company has had in force the practice of securely cradling each switch tank on the system from the floor of the building.

R. H. LANG,
Chief Operator.
Consolidated Gas, Electric Light & Power Company,
Baltimore, Md.

Sample Pole Top Shows New Line Construction

THE specimen pole top shown in the accompanying illustration proved very useful in acquainting draftsmen, the purchasing department and others of the California-Oregon Power Company with the details of design and the various material used in the construction of a 123-mile, 110,000-volt transmission line recently completed by this company. This pole top was set up in the offices of the company and was built to show single-pole, straight-line construction for the top conductor only, with suspension construction on one end of the arm and semi-strain construction on the other. It was typical in all respects, except that only a short section of the standard cross-arm used in the field was employed. The iron rod shown between the semi-strain insulators was used simply to hold the insulators in place. A standard telephone arm with insulators and a section of the wire used was bolted below the transmission exhibits.

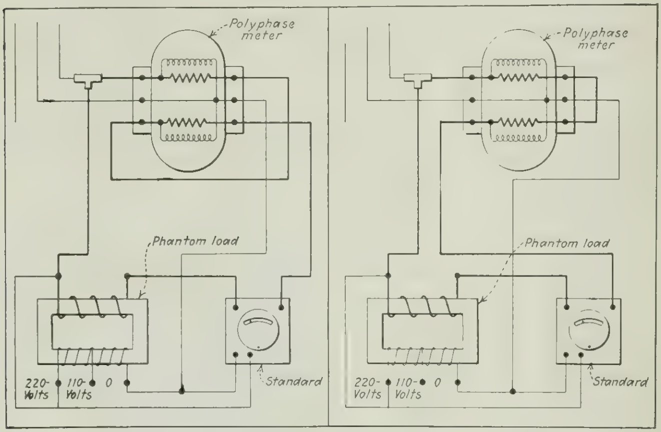

SAMPLE POLE TOP AIDS DRAFTSMEN IN MAKING DRAWINGS

This specimen pole top was useful in explaining to officials of the company the general type of construction of the line, and incidentally it was later used as an exhibit at several fairs where the company maintained a booth.

P. O. CRAWFORD,
Chief Engineer.
California-Oregon Power Company.
Medford, Ore.

Testing of Polyphase Type Watt-Hour Meters

Most metermen prefer testing a polyphase meter for balance of torques between elements and then connecting the current coils in series and testing as a single-phase meter. Some men prefer testing each element separately, but if the elements are not balanced, the meter will not register correctly on low power factor or unbalanced load conditions.



TORQUE BALANCE OF POLYPHASE METER TESTED BY REVERSING CURRENT FLOW IN ONE ELEMENT

The polyphase meter to be tested is "jumpered" out of service if loaded, and if not, all wires are removed except the potential tap. The correct "hook-up" when the meter is to be tested as a single-phase meter is shown at the left in the accompanying illustration, but if the meter is first to be tested for balance of torques, it is connected as shown at the right. The only difference is that the current is flowing through the lower-element current coil in the wrong direction, so that it tends to make the meter rotate backward. Full-load current is allowed to flow through the meter, and as it is the same in both elements, the disk should stand perfectly still. If the disk rotates backward, the lower element is the stronger, and vice versa. The torques should then be balanced until the disk does stand still. The different makes of meters have different methods of adjusting for torque, but in most cases it is done by changing the air gap between the series magnets and the disk. The light or heavy load adjustments should never be used to balance the torques.

After the torques are properly adjusted, the current in the lower element is reversed so that the meter will run forward full speed. The meter is then tested on full-load current. A polyphase meter thus connected will always register twice as many watt-hours as the standard, because the same current is measured twice. Therefore only half the disk constant must be used in calculating the accuracy. The percentage of accuracy of the service meter is then found by the formula: (100 × revolutions service meter × half its disk constant) ÷ (revolutions standard meter × its disk constant) = percentage of accuracy. If the result is greater than 100 per cent, the service meter is fast, and if less than 100 per cent, the service meter is slow.

The full-load adjustment must not be moved if an "as found" test record of the service meter is desired, because moving the heavy-load adjustment will also change the light-load speed. After the full-load test is made, the meter is tested on light load, usually between 5 per cent and 10 per cent of full load. Then the meter is adjusted and checked on full load, and then later adjusted for light load, if necessary. Usually the light-load error is removed when the heavy-load adjustment is made, hence the heavy-load adjustment is made first. After any adjustments a final check should be made on both light and full load.

The above tests and adjustments are made at approximately 100 per cent power factor. The current in the current coil is supposed to be exactly 90 deg. out of phase with the current in the voltage coil. If this phase relation is not maintained, the meter will not register correctly on low power factor. Thus it is usually desirable to test a meter on about 50 per cent power factor to determine its accuracy on inductive load. This is very easily done with a phantom load by merely connecting the primary of the transformer on the third phase of the three-phase circuit, being careful to leave the potential coils of both meters on the original phase. Then the current in the current coils is 30 deg. out of phase with the current in the voltage coils, resulting in a power factor of approximately 50 per cent or a little more. Both full-load and light-load tests are then made as before.

Changing Phase Angle

The phase angle between the voltage coil and the current coil is changed in most meters of older make by changing the resistance of a small coil of wire wound around the pole piece of the voltage coil. The ends of the coil are brought out and a short length of resistance wire is soldered across them. By changing the length of this resistance wire a place will be found where the meter will be accurate on 50 per cent power factor. The connection is then soldered. This last test does not always have to be made, except in cases where the meter has been damaged or a coil replaced, for the meters are adjusted before they leave the factory and will not change easily.

The phantom loading device used above is only a simple transformer that can easily be made in spare time. The core need not be more than 5 in. x 6 in. outside dimensions, and the cross-section should be at least 1 sq.in. The primary is wound for 110 and 220 volts. Each 110-volt coil consists of between 385 and 550 turns of wire, depending on the cross-section of the core, making a total of 770 or 1,100 turns in primary. The wire used may be any size between No. 18 and No. 24 B. & S. The secondary voltage is about 2.5 volts. Wind on ten turns of large wire, about No. 8 or No. 10, which will give approximately this voltage. This coil is short-circuited right through the current coils of the two meters while testing and furnishes enough current for full load for a 50-amp. meter for a short time. In order to regulate the current it will be necessary to insert a small rheostat in the primary circuit. A sewing-machine motor rheostat will answer the purpose. The current will usually adjust itself to the different sizes of meters on account of the different impedance of the respective current coils. When test- the rotating standard is used, which ing on light load the 1-amp. coil of has sufficient impedance to cut the current down to about 10 per cent of full load. Always use the 5-amp. coil when testing a 5-amp. meter, the 10-amp. coil for a 10-amp. meter, etc., and the small rheostat will take care of the small variations in current.

Dan C. Hoffmann,
Meter Tester.
Power & Light Department,
City of Austin, Tex.

Radiophone Insures Service to Customers

Western Hydro-Electric System Develops Reliable Emergency Communication—Rugged, Timbered Country Requires High-Powered Apparatus

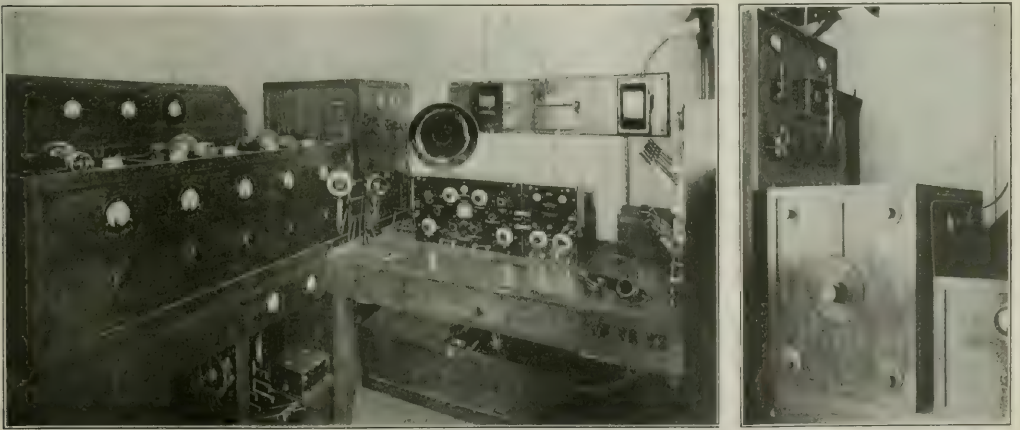
The use of radio to supplement other means of communication between isolated hydro-electric plants and the system load dispatcher under adverse conditions is viewed with great favor among power companies of the West. A complete high-power experimental radiophone set has just been installed by the Northwestern Electric Company at its main office in the Pittock Block, Portland, Ore. This company was a pioneer on the Pacific Coast in the use of radio for emergency communication between its power plants. For several years prior to 1917 it maintained spark-type transmitting stations at its Albina substation in Portland and its Condit hydro-electric plant on the White Salmon River in Washington, 64 miles from Portland. These stations were described in an issue of the *Electrical World* several years ago.* In addition to its hydro-electric plant, the company operates two steam plants in Portland. The transmission line from the hydro-electric plant passes through a section subject to severe sleet storms in the winter with consequent isolation of the plant and the severing of all lines of communication. This demoralization of all wired telephone and telegraph service creates a potential menace to customers' service and causes a most expensive delay in locating the trouble and dispatching men and material to repair damage.

The experimental radiophone set was installed to determine the feasibility of radiophone emergency communication, as well as to experiment with the transmission of radio speech with the aid of the company's transmission system as a guide for the high-frequency current.

Tests made so far indicate that reliable radiophone communication can be carried on day and night between the company's main office in Portland and its hydro-electric plant. Because of the character of the intervening country, which is rugged and heavily timbered, the use of low-power sets is not possible.

OFFICES OF THE COMPANY, SHOWING ANTENNA INSTALLED ON THE ROOF

On two occasions radiophone conversations were successfully carried on with the Colin B. Kennedy station at Los Altos, near San Francisco, a distance of approximately 700 miles. During various tests conversation was clearly heard at Vancouver, B. C.; Edmonton, Alberta; Reno, Nev.; Denver, Col., and Orange near Los Angeles, Cal. In addition Mr. Dow, at Wailuku, Maui, Hawaiian Islands, reported being able to hear voice and music distinctly at a distance of 40 ft. from a loud speaker, using a detector and two-stage audio amplifier. Maui is approximately 2,300 miles distant from Portland.



LEFT—A MODEL INSTRUMENT ROOM FOR A CENTRAL-STATION RADIO-TELEPHONE SET. RIGHT—OSCILLATION TRANSFORMER, 2,000-VOLT DIRECT-CURRENT GENERATOR PANEL, AND PORTION OF TUBE CABINET

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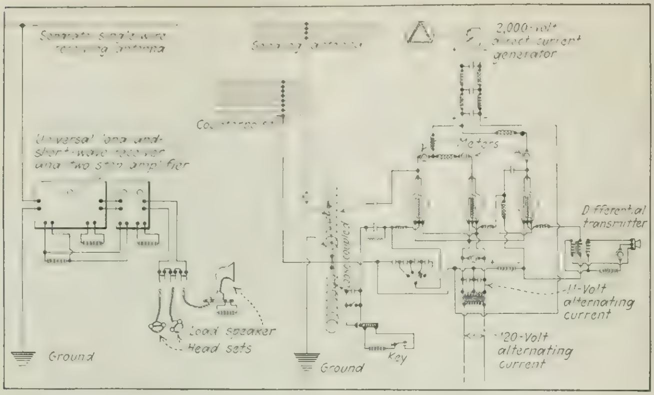
*"Good Dispatching by Wireless on the Pacific Coast," by L. T. Merwin, *Electrical World*, Jan. 1, 1916, page 41.


Separate single-wire receiving antenna
Sending antenna
2,000-volt direct current generator
Counterpoise
Universal long- and short-wave receiver and two-step amplifier
Meters
Loose coupled
Differential transmitter
11-Volt alternating current
Loud speaker
Head sets
Ground
Ground
Key
120-Volt alternating current

WIRING DIAGRAM FOR SENDING AND RECEIVING APPARATUS OF RADIO SET

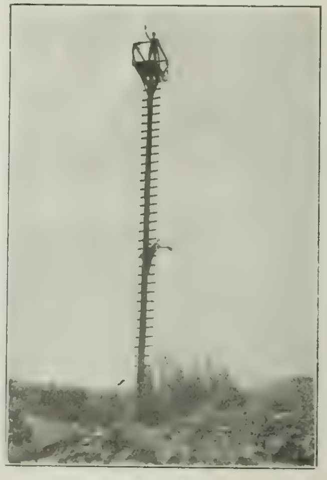
Three 250-watt pliotron tubes are used, one for the oscillator, one for the modulator and one for the voice amplifier, connected for constant-current system of modulation. The plate circuit is supplied at 2,000 volts direct current from a double commutator generator and the filaments are lighted with alternating current at 11 volts. At a wave length of 450 m., and with the tubes operating at rated voltage on both plate filament circuits, a normal antenna current of 9½ amp. is obtained. A four-wire "T" antenna, 70 ft. in length, is installed on the roof of the building in which the company maintains offices, 197 ft. above the ground. One end is supported from a steel smokestack and the other from a wooden mast. An eight-wire counterpoise is stretched just above the roof and 70 ft. directly below the antenna. A separate single-wire antenna is used for receiving. The apparatus is remote controlled through relays from a single push-button switch which simultaneously starts motor-generator sets, closes the transmitter circuit and opens the receiving circuit—and vice versa. The set was designed by the author and assembled and mounted by the company.

E. F. Pearson,
Electrical Engineer.
Northwestern Electric Company.
Portland, Ore.

◆

Taking Photographs During Plant Construction

PICTURES showing the construction of a power plant are always of interest and are particularly useful in making up progress reports and for publicity purposes after the plant has been completed. A good general view of a power house under construction, particularly on some of the Western hydro-electric projects, is difficult to procure because the character of the country is such that from a photographic standpoint there is no point of vantage. The Pit River No. 1 plant of the Pacific Gas & Electric Company in the mountains of northern California proved no exception. During the construction job the engineer in charge saw possibilities in a tall pine tree about 300 yd. from the power house and slightly to one side of the center of the building. This tree was stripped of all its branches and the top cut off, leaving about 60 ft. of the trunk standing. It was then stepped and guyed and a platform with railing placed on top, as shown in the accompanying illustration. This formed an excellent photographic tower, commanding an unobstructed view of the power house, penstocks and surge-chamber construction, and was utilized to great advantage all during the time construction work was in progress and after the plant had been completed.



PLATFORM ON TALL TREE USED FOR TAKING PICTURES OF POWER-PLANT CONSTRUCTION

O. W. Peterson,
Engineer in Charge of Construction.
Pacific Gas & Electric Company,
San Francisco, Calif.

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Cost of Transformer for 13,200-Volt Service

THE following tabulation, prepared in connection with an inventory of transmission equipment running back about ten years, covers the cost of transformers for five customers of an Eastern hydro-electric system. These costs do not purport to represent current quotations, but do represent actual field outlays by the company in question during the period:

Customer	No. of Transformers	Size of Transformer, Kva.	Voltage Rating	Cost of Transformers
A	3	1,250	13,200 6,600-2,200-600	$9,435.00*
B	3	75	13,200/550	1,200.46
C	2	5	13,200 608	420.00
D	3	125	13,200/608	1,772.82
D	3	75	13,200/550	1,248.54
D	3	125	13,200 608	1,772.82†
D	2	75	13,200 2,300	905.64
E	2	25	13,200/550	620.00

* Additional cost of installation in this case, $7,500.14.

† Cost of supporting structure as follows: Model D steel structure, $680; H. & S. air-break switches, $168; 13,200-volt compression arresters, $114.75; cost of installing transformers and above equipment, $108.21; total for supporting structure, $1,070.96.

Field Editor Electrical World.
Boston, Mass.

◆

Calculating Line Loss Due to Low Power Factor

THE effect of operating an alternating-current system at low power factor is now receiving some of the attention from operating engineers that it should have had in the past. Many operating engineers even today do not realize the magnitude of the losses on the city distribution lines due to operating them at the generally prevailing power factors of from 50 per cent to 70 per cent.

One of the easiest ways to make a quick estimate of a line which is built and whose characteristics are all fixed is to figure the power losses at 100 per cent power factor as follows: Current squared times the ohmic resistance of total length of all wires in the circuit (neglecting capacity and skin effects, etc.) gives the watts loss at unity power factor.

The losses at any lower power factor can then be determined by multiplying the loss at 100 per cent power factor by the square of the secant of the angle corresponding to the power factor of the circuit.

This method of making a quick estimate of the increased losses due to low power factor has been used by the writer for a number of years, and has proved to be a great time saver. **GEORGE B. LELAND,**

General Manager.
Stamford Gas & Electric Company,
Stamford, Conn.

Specific Data for Street-Lighting Practice

VIRTUALLY the first attempt to assign specific, quantitative values of lamp size, spacings, etc., for the various classes of street lighting was undertaken by the committee on street lighting of the Society for Municipal Improvements. As a result of this work the accompanying table has been formulated. This table is based upon the observation and experience of illuminating engineers and is influenced by the results of a number of surveys made to determine the relation of street lighting to traffic accidents and crime.

In the past there has been in different municipalities a wide diversity in practice as to the illumination of streets of the same character and importance. These variations have been due in part to differences in local opinion as to the requirements to be fulfilled, but in many cases the extent of available funds has been the governing factor.

Varying types of ornamental equipment are suited for the different classes of streets. For business streets the upright column with a single lamp is most common, though ornamental trolley-pole brackets are often used. For intensive or "white way" lighting with 3,000 cp. to 5,000 cp. per standard two-light or three-light units have been adopted. For thoroughfares, boulevards, parks and residential streets both ornamental bracket standards and upright standards are common. In some instances ornamental brackets are attached to trolley poles or to other poles already in place. The preference is for underground wiring, though some ornamental poles can be successfully adapted to use overhead wiring. For outlying districts, alleys and highways underground wiring is seldom practical. It is recognized that 100-cp. lamps have a place in residential sections, on narrow streets, curbed parkways, in parks, in alleys and in certain outlying streets.

There is a very noticeable trend toward the use of larger lamp sizes. Engineers who have studied comparative costs and illuminating efficiences are in agreement that 100-cp. is the minimum lamp size which it is economical to use for street lighting. The lamps of less than 100 cp. which are in use under the terms of some of the older street-lighting contracts not only operate at a lower efficiency but are uneconomical because too great a proportion of the annual street-lighting cost to the city (sometimes as much as three-fourths of the total expenditure) is made up of fixed charges on the installation and only a relatively small part of the expenditure goes for the production of light. Particularly where ornamental equipment is installed and where the investment cost is therefore fairly high per lamp, there is a growing conviction that the 250-cp. lamp is the minimum economical size to be used in designing a new installation. However, very effective systems using lamps of lower candlepower are being installed.

C. W. KOINER,*

General Manager.
Electric Utility, City of Pasadena,
Pasadena, Cal.

DESIRABLE RANGE OF STREET-LIGHTING PRACTICE UNDER PRESENT CONDITIONS

Population of City	Class of Street	Candlepower of Lamp per Post	Mounting Height, Ft.	Lamp Spacing, Ft.	Arrangement of Lamps	Candlepower per Foot Length of Street
100,000 or larger	Principal business	1,000–5,000	14–25	80–150	Parallel	20–100
	Secondary business	1,000–2,500	14–18	80–125	Parallel	10–50
	Principal thoroughfares	600–1,500	20–25	125–250	Parallel	3–10
	Secondary thoroughfares, wholesale and manufacturing district	400–1,000	20–25	125–250	Staggered	2–5
	Boulevards and parks	250–1,000	14–20	125–250	Parallel or one side	1–5
	Residential	250–600	14–20	125–250	Staggered	1–4
	Alleys, business section	250–600	16–20	125–250	One side	2–5
	Outlying streets and alleys	100–250	16–20	200–400	One side	¼–1
20,000 to 100,000	Business	1,000–2,500	14–18	80–125	Parallel	10–50
	Thoroughfares	400–1,000	20–25	125–250	Staggered	2–5
	Boulevards and parks	250–1,000	14–20	125–250	Parallel or one side	1–5
	Residential	250–600	14–20	125–250	Staggered	1–3
	Outlying streets and alleys	100–250	15–20	200–400	One side	½–1
5,000 to 20,000	Business	600–1,500	14–18	80–125	Parallel	5–30
	Thoroughfares	400–1,000	20–25	125–250	Staggered or one side	2–5
	Boulevards and parks	250–600	14–20	125–250	Parallel or one side	1–3
	Residential	250–400	14–20	125–250	Staggered or one side	1–3
	Outlying streets and alleys	100–250	16–20	200–400	One side	¼–1
5,000 or smaller	Business	250–600	12–16	80–125	Parallel or staggered	2–10
	Thoroughfares	250–600	16–20	125–250	Staggered or one side	1–3
	Residential	250	14–20	125–250	Staggered or one side	1–2
	Alleys	100	16–20	200–400	One side	¼–½
	Highways	250–400	25–35	300–600	One side	½–1

Cost of Equipment for Generating Plant

VARIOUS costs of central-station generating-plant apparatus filed with one of the Eastern public service commissions by a large operating company are printed below. The data apply to a period of rapidly changing prices and costs, running back about seven years, and are presented for their value as actual field costs rather than for their reflection of current quotations:

Building work in connection with installation of three 2,500-kva. A.B. compensators, 60 cycles, 8,100/14,000 volts Y or 4,050/7,000 volts Y, air pressure 1¾ oz., for use in connection with 15,000-kw. turbine	$2,152
Purchase and installation of three 2,500-kva. compensators referred to above	13.732
Four 1,200-hp. water-tube boilers for use with 30,000-kw. turbine	198,044
Completing installation of above four boilers, including economizers, fans, steam exhaust and feed-water piping heaters and miscellaneous	593,993
One 30,000-kw. horizontal turbine	316,975
Twenty steel lockers 18 in. x 18 in. x 60 in., fitted with three-point locking devices, doors with louvers in groups of three lockers each, operated with flat key and master key locks	127
One 30,000-kw. turbine, purchased later than above-mentioned unit	373.347
Auxiliaries for this 30,000-kw. unit	211,124
Switching and control equipment for a No. 4/0, 15,000-volt split-conductor cable	5,677
Two master clocks for regulating station frequency	1,248
Three 5,000-kva., 14,000/24,220-volt, three-phase outdoor-type transformers installed with switching equipment for two 25,000-volt lines	79,055
Two type I, Class 12, 100-600 form B, 100 hp., 60-cycle 2,080-volt, three-phase induction motors	2,280
Installation of one 500 watt multiple incandescent lamp on each of six reserve operating units	492
Installation of complete switching instrument and wiring equipment for two 25,000-volt, 300,000-circ.mil tie lines	26,770
One 2-ton storage-battery truck equipped with a 1,500-lb. self-compensating crane	2,628

FIELD EDITOR ELECTRICAL WORLD.

Boston, Mass.

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*Chairman of the committee on street lighting, Society for Municipal Improvements.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Does Residence Business Pay? *

Some Figures on the Cost of Service and the Value of Domestic Customers, Indicating Where the Turning Point May Be —Need for Education to Increase Load Factor

By George H. Davis
Idaho Power Company, Boise, Idaho

ANY answer to this question must be obtained by a liberal application of the law of averages. We are all aware that the actual cost of delivering service is probably a little different for each individual customer and that in every system there are some customers who, strictly speaking, are paying a part of the cost of delivering service to others. There is no way of avoiding this condition. It is impossible to analyze the costs down to the individual, and the results would be of no practical value even if it were possible. No practical system of charges could be based on the results of such an analysis.

The only practical system of charges yet devised is that of fixing a uniform rate for all customers using the same class of service, and in this system of charges the greatest good to the greatest number is secured by dividing the total cost of all service among the different classes in proportion to the value of the service to the consumer. The value of residence service to the consumer is such that the cost of production is relatively unimportant, and, in general, the service would sell for several times its cost before substitution would become serious.

Residence Business Must Pay

The electric utility companies furnish no other class of service where the value to the consumer is higher than is that of residence lighting, and the value of cooking and appliance service is becoming increasingly valuable as fuel prices increase and as the efficiency and convenience of the service become known and appreciated by the public. From this viewpoint there is but one answer. Residence business must pay! It is merely a question of proper rates.

No other class of service is more stable and dependable through the economic ups and downs of the country than is the residence business. Industrial power and commercial lighting are bought by consumers for commercial purposes, and the increase, curtailment or complete discontinuance of their use is a strictly economic question. The revenue from these classes of business is quickly and seriously affected by business depression, while the residence customer, buying for personal use and bound by the habits of that use, responds but slowly and to a much less degree, and the revenue can be depended on through thick and thin.

Cost of Service

The following investments and costs are assumed as fair averages for hydro-electric properties:

Total investment per kw. of demand	$500.00
Distribution system investment from low-tension substation bus to customer's premises is 25 per cent of above or	125.00
Generation, transmission and transformation	$375.00
Taxes, depreciation and interest per kw.-year on the above, at 12 per cent per annum, equal	$45.00
Annual operating costs of same per kw.-year	12.00
Total annual costs of above per kw.-year	$57.00
Annual fixed charges on distribution system investment of $125.00, at 12 per cent, equal	$15.00
Annual operation costs of same	6.00
Total annual distribution costs per kw.	$21.00
Customer costs, including commercial and general expense, per customer-year	$7.50

On some systems of the Northwest approximately 20 per cent of the residence customers are using electric ranges and approximately 15 per cent are using electric water heaters. Various group tests on some of these systems have shown that the average residence contributes from 0.2 kw. to 0.47 kw. to the simultaneous maximum demand on the distribution system. The tests represent groups of from 150 to 650 customers to the group, selected in various-sized towns and in rural districts, and the demands stated are the average for customers in individual groups.

These figures, therefore, show no effect of diversity which exists between groups, nor of the diversity between residences and other classes of business, and thus they seem to be conservative on the high side. In fact, it would seem perfectly reasonable to consider them as maximum. This is not, of course, the last word in the answer to the question of residence demand, but it furnishes definite points within the range of possibility and should be a fair indication of where the general average is to be found. Tests on groups of purely cooking customers showed an average demand of 1.22 kw. per customer, and 0.25 kw. may be taken as fairly representative of the average lighting customer.

	Lighting	Cooking
Average kw. of demand	0.24	1.22
Annual generation, transmission and transformation costs	$14.25	$69.54
Annual distribution costs	5.25	25.62
Annual customer costs	7.50	7.50
Total annual costs	$27.00	$102.66
Average per month	2.25	8.56

Therefore the costs given in table above will prevail for the two types of customers.

Residence lighting customers use on the average 258 kw.-hr. per year, and cooking customers 1,758 kw.-hr. per year, and to be profitable these customers must pay on the average 10.5 cents and 4.5 cents per kilowatt-hour respectively for lighting and cooking service.

It will be noted that in this cost discussion the residence customers only have been considered and the total annual cost of capacity required at the substation has been charged against them. If residence service was the only class furnished, then

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*Paper presented before the Northwest Electric Light and Power Association, Boise, Idaho, June 7-10, 1922.

approximately 75 per cent of the possible kilowatt-hours would remain unsold, and the price per kilowatt-hour for the 25 per cent that is sold must be high enough to pay the total cost, which fact brings into the limelight the one big opportunity for increasing profits—increase the load factor! With hydro-electric generation the rate per kilowatt-hour goes down nearly in proportion to the increase in load factor.

The average electric utility company has a complex load, and other classes of business use more or less of the unsold kilowatt-hours represented in the capacity of the residence demand. These other classes of business may be given full benefit for this use and charged only for the additional capacity which they demand, or the total plant cost may be divided equally betwen them, thus reducing the price to the residence consumer as the total load factor is increased. The residence business has, in fact, reaped the benefit of such a division of cost, and in some cases the benefit has been more than it was entitled to receive.

In general, the utility company should go after the classes of business with the high value to the consumer without restraint, and the rates can be made to take care of the cost. Then look at the daily and annual load curve and endeavor to dispose of the unsold kilowatt-hours at the best price possible; but here, as some of us know to our sorrow, is chance for the use of fine discretion. Residence business, with a reservation as to flat-rate heating, is one of the leaders in the high-value service class and is worth more than its cost, even though that cost be a maximum, as it is when residence business stands alone to bear the total cost of the necessary plant to serve it.

DETERMINING BASIC LOAD

Attempts have been made to pick the main class of business, the basic load which justifies the development of a system to serve it alone, and charge it with the total cost of capacity required, and then to build a system of charges for other classes of business on the basis of excess cost only. In one system one class of business is considered basic, and in another system some other class, and this plan succeeds only in so far as the value of each class of service is recognized and due consideration is given to it. The total cost of all service divided among the various classes in proportion to the value of each class makes possible the greatest development of the utility company's business as a whole and gives it its maximum effect in the development of the community which it serves, and, in fact, realizes the greatest good to the greatest number.

Residence business, particularly lighting, has been considered one of the household necessities for so long that a maximum price has become firmly fixed in the public mind, and no matter how much the cost increases, it is difficult to break over this price. Increased use of the service, which increases the load factor, will accomplish the same purpose for the utility company as an increase in the price, and here is the field for our best sales effort.

When we can educate our average residence lighting customer, with a demand on our stations of from 0.25 kw. to 0.3 kw., to such an appreciation of the value of electric appliances that he will use 25 kw.-hr. per month, then we can profitably serve him with 9-cent energy. And when our average cooking customer, with a demand on our stations of from 1 kw. to 1.5 kw., feels that he can't afford to use less than 160 kw.-hr. per month, then we can profitably serve him with 3.5-cent energy. Here is the turning point.

Educational Courses for Central-Station Men

THE value of educational courses for central-station employees is well illustrated in the work of the Chicago Central Station Institute,

Getting Out the Crowds for Electrical Homes

THIS group of pictures is of particular interest to the electrical industry as it shows the keen interest of the public in the electrical equipment of the home. The views were taken at the California Complete Homes Exposition in Oakland, where ten model homes were fully provided with electrical conveniences. It was necessary to have traffic officers handle the crowds when 900 automobiles visited the exposition one Sunday afternoon.

which, under the leadership of Fred R. Jenkins as manager and Frederic A. De Lay as head lecturer, is providing instruction for more than six hundred employees of the Commonwealth Edison Company, Public Service Company of Northern Illinois, Middle West Utilities and Federal Electric Company. The institute is organized for the sole purpose of providing instruction for employees of these companies, no tuition fees being charged.

The work for the year 1922-23 embraces eighteen courses, including two engineering and operating courses, the first of which covers elementary engineering involved in central-station work and takes the student through a study of various kinds of apparatus. The second course deals with transmission, a comparison of direct-current and alternating-current systems and the various types of substations, ending with industrial power applications. Two construction courses of the same type are provided covering power-plant and substation construction, transmission and distribution systems, including a study of the Commonwealth Edison power plants. A street department course covers street distribution.

Commercial features are covered in a course for the employees in the Electric Shop maintained by the Commonwealth Edison Company, and there are a lighting sales course, a course in appliance sales and a special course for the men engaged in the sale of securities. New employees received a course of special training. Meter department employees are offered an elementary course. A general radio course, together with one in advanced radio and a radio salesmen's course, covers this subject, in which the Commonwealth Edison Company has become deeply interested.

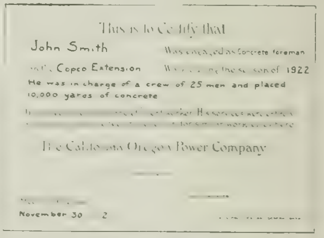
A course in practical effective speaking is conducted under the direction of a recognized authority, and two utility business courses, one on the general features of the utility business and organization and a special course on organization and financing of the utility business, with Dean Ralph E. Heilman of the Northwestern University School of Commerce as lecturer, afford an opportunity for studying these phases of the business.

For the past ten years the institute has been conducting a course for college graduates to enable them to get practical experience in the engineering, operating and commercial branches of the company.

Except in the college graduate course the aim is to take employees who have had limited educational advantages and give them a thorough grounding in the practical problems they must meet in their work. Enough of the elementary technical facts are included to make this foundation secure, but no effort is made to develop advanced technical training. The correspondence course work of the National Electric Light Association is also conducted from the headquarters of the institute, in the Edison Building in Chicago.

Recommendations for Temporary Employees

TO THOSE deserving men who have been engaged in construction work or other work of a temporary nature and cannot be retained permanently on the payroll the California-Oregon Power Company presents the engraved card shown in the accompanying illustration, instead of the usual letter of recommendation. It was felt by the officials of the company that such a letter carries little weight unless the writer and the man to whom the bearer presents it are personally acquainted. Furthermore, these letters usually follow a stereotyped form and when solicited by an employee leaving the company they are sometimes given to him grudgingly.


This is to Certify that

John Smith Was engaged as Concrete foreman

on the Copco Extension during the season of 1922

He was in charge of a crew of 25 men and placed 10,000 yards of concrete

[illegible]

The California Oregon Power Company

November 30 2

CARD OF RECOMMENDATION GIVEN TO TEMPORARY EMPLOYEES

The card was purposely made as formal as possible so that it would carry an air of dignity and be prized by the recipient. Each one is signed by three officials of the company, the construction superintendent, the chief engineer and the vice-president and general manager, to make sure that the man who receives a card merits it. These cards are not given on solicitation, but handed out at the discretion of the company.

It is interesting to note that all of the 250 men, including the floaters, engaged on construction work purchased some of the company's preferred stock, and nearly all of them have proved themselves deserving of receiving one of these cards as a tribute to their faithful service.

Course in Electric Transportation Proposed by N. E. L. A.

TO OVERCOME the lack of detailed information among many central-station power engineers as to the economic and service capabilities of electric vehicles and industrial electric trucks and tractors, the Electric Vehicle Bureau of the Commercial Section of the National Electric Light Association is planning an intensive course somewhat along the lines of the recent successful courses in industrial electric heating which have been conducted under association auspices with the co-operation of manufacturing plants and organizations. At a recent meeting of the bureau in New York it was brought out that many power-sales engineers have little real knowledge of the field of service of this class of equipment.

In the proposed course it is planned to conduct probably a ten days' or two weeks' period of instruction at one or more factories building this class of equipment, selecting a central point for the sake of convenience. Free instruction will be given in the construction, use and care of electric vehicles and tractors, in the principles of industrial transportation, details of equipment and battery design and application, charging outfits, control and economic records. Sales practice will also be included in the curriculum. As the passenger electric vehicle is in a different class from the truck and tractor type, emphasis will be laid chiefly upon business vehicle problems. At the close of the course an examination will be held to test the results of instruction. The only expense attached will be the traveling and hotel expenses of the students, apart from their regular compensation from their home companies.

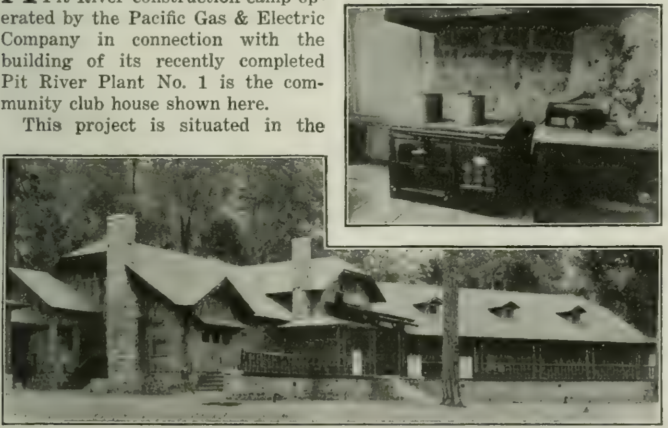
Manufacturers of commercial electric vehicle equipment will be invited to send types of their products for study, and representatives of competing establishments will have the opportunity to lecture upon their own designs as was done in the industrial heating courses. E. S.

Mansfield of the Edison Electric Illuminating Company of Boston has been made chairman of the tentative committee of arrangements for the course, and already a number of central-station organizations have signified their desire to send power sales engineers for instruction in case the program goes through as planned. The date of the course has not yet been assigned, but it is probable that it will begin soon after the first of the year.

Camp Community House Sells the Electrical Idea

AN INTERESTING feature of the Pit River construction camp operated by the Pacific Gas & Electric Company in connection with the building of its recently completed Pit River Plant No. 1 is the community club house shown here.

This project is situated in the mountains at an elevation of 3,324 ft., about 250 miles from San Francisco, and requires a journey of a day and a half to reach it. During construction and since its opening it has been the policy of the company to take up parties of guests for an inspection of the plant. Almost five hundred were present at the opening celebration, and nearly two thousand visitors have been cared for at the camp up to the present time.



COMMUNITY CLUB HOUSE AND ELECTRIC KITCHEN AT PIT RIVER PLANT NO. 1

One of the far-sighted policies of the management which has made many friends for the company was the construction of the community center as the first of the permanent buildings which are later to make up the plant. The building is attractively designed and provided with billiard room, lounging room and other recreational features, as well as with bedrooms and baths for the convenience of guests. A special host was provided to care for their comfort and pleasure.

Along with the feeling of general good will went also an immediate initiation into the electrical idea. Electric heaters are provided in every room, and the guest who finds the mountain evening chilly can taste the comfort of an electric heater. Instantaneous hot water is provided by electric heaters at the turn of the faucet—a luxury appreciated by those acquainted with roughing it in the mountains. The lighting is carefully designed along modern lines, and the kitchen is completely equipped with a hotel-type electric range and an electric grill.

At present this installation serves as a sales argument for electrical convenience to the hundreds of visitors who are witnessing the operation of the new plant. Later it will serve to teach employees of the company the advantages of electrical comfort, at the same time providing an attractive community center for the men and their families in this spot so far removed from city life.

What Other Companies Are Doing

Houston, Tex. — The Houston Lighting & Power Company recently offered 7,500 shares of its 7 per cent cumulative preferred stock in Houston and sold the entire amount there in just eight days. During the last twelve months this company has sold $1,250,000 of its preferred stock to its customers, who are now receiving $87,500 a year in dividends.

Louisville, Ky. — The Kentucky Utilities Company has just closed the most successful stock-selling campaign of its experience in the promotion of customer ownership. A survey of the campaign reveals that it ran for thirty days, resulting in the sale of 1,856 shares, and that the stock was sold by 23 per cent of the regular employees to residents of 63 per cent of the communities served. The campaign was marked by a keen spirit of competition between teams for weekly prizes and for a "bag of silver," containing 5 cents for each share sold, which was offered as a grand prize to any employee selling 100 shares. Four bags of silver were awarded to a like number of employees.

Boston, Mass.—Interest in the merchandise sales cup contest which has been running since Jan. 1 in the gas and electric utilities managed by Charles H. Tenney & Company is rising to fever heat as the race draws toward its conclusion. Last year the cup was won by the Fitchburg (Mass.) Gas & Electric Light Company. Appliance sales of five of these utilities for the week ended Nov. 25 totaled $9,229, the leading organization for the week totaling $3,331.

Mattoon, Ill.—The Central Illinois Public Service Company during the first nine months of 1922 made a net gain of 4,926 electric light and power customers. In September the company broke previous records for adding new customers, the net gain during that month being 999. Many power contracts were obtained by the company during the summer. One recently closed involves supplying energy for operation of a coal mine near Elkville, Ill. The estimated annual revenue from this customer will amount to $35,000. Another contract with a colliery company will earn an annual revenue of $15,000. The company already serves a number of coal mines in central and southern Illinois.

Plymouth, Wis.—Agitation has been started by citizens here for the city to discontinue operating its municipal power plant and purchase energy from some large manufacturing plant or private utility company in or near Plymouth inasmuch as the municipally owned plant is too expensive and is not yet paid for. A member of the local electric commission is visiting nearby city-owned plants in an effort to learn of methods whereby this transferral can be avoided and the present power plant continued.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

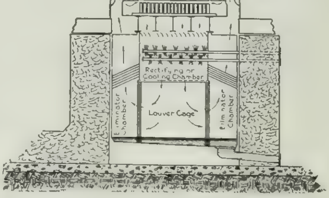
General Possibilities of Electric Steam Boilers.—K. MARKAU.—Basing his research upon data from actual operating experiences with electro-steam boilers, the author investigates the future possibilities of this type of steam generation. It is shown that the economy of an electrically heated steam boiler does not depend solely upon the comparative cost of the kilowatt-hours and the coal, but that a number of other factors have to be considered which will result in higher economy even in the case of an apparently high cost for electrical energy. The paper contains copious statistical data on electro-steam boilers in operation, together with comparative figures on the efficiency of coal-fired boilers. The author also deals with practical experiences with steam accumulators.—*A. E. G. Mitteilungen,* October, 1922.

Boiler Efficiency Under Test and Working Conditions.—DAVID WILSON.—The substance of this paper concerns a heat balance which is suggested as typical of a modern steam boiler under test conditions. The author states from his own experience that in a modern boiler plant using coal of a calorific value of 13,000 B.t.u. per pound 85 per cent of the heat of the coal could be transferred to the water in the boiler and economizer. In this case the chimney losses would be 9 per cent, the losses of ash and clinker 1 per cent and radiation 4 per cent, leaving 1 per cent unaccounted for. A similar plant using coal of 10,000 B.t.u. per pound could transmit 79 per cent of the heat to the water. Ten per cent would go up the chimney, the ash and clinker would account for 6 per cent, and the radiation and unaccounted-for losses would be as before. In each case the final flue-gas temperature would be 380 deg. F.—*Paper presented before the Electrical Power Engineers' Association (England),* Oct. 6, 1922.

A 12,000-Kw. Industrial Power Plant.—A modern power plant comprising three turbine units of 4,000 kw. each has replaced a combined gas-engine and steam plant, both of which were very uneconomical in fuel consumption and labor, at the Kokomo (Ind.) plant of the Pittsburgh Plate Glass Company. The main equipment of this new plant consists of six 6,650-sq.ft. B. & W. boilers, equipped with three-ram extra-long type underfeed stokers, three horizontal 3,600-r.p.m. steam turbines connected to three-phase, 60-cycle, 2,300-volt generators rated at 4,000 kw. at 80 per cent power factor, and three three-pass surface condensers containing 9,000 sq.ft. of cooling surface. A short description is given of the switchboard equipment.—*Power,* Oct. 31, 1922.

Generation, Control and Switching

Closed-Air-Circuit System of Ventilation.—J. C. MONSON.—The article describes in detail the closed-air-circuit system of generator ventilation that, in the opinion of the author, is superior in many ways to the duct system. This system has been tried out in the General Electric Company's power station on a 40-cycle, two-pole, 10,000-kw., 2,400-r.p.m., 10,000-volt steam-turbine generator and has operated very satisfactorily. As may be seen from the accompanying illustration, the exhaust air from the generator passes through a row of baffle plates which prevent water from being forced into the generator. The air then enters the washing chamber, in which are the spray nozzles. Here the heated air comes in contact with the spray films and thoroughly mixes with the water vapors, thus reducing the air temperature to within a few degrees of the water temperature. It then flows through the eliminator chamber to generator.—*General Electric Review,* December, 1922.



EXPENSE OF CLEANING GENERATORS GREATLY REDUCED BY CLOSED VENTILATING SYSTEM

Rheostatic Type of Voltage Regulator.—J. H. ASHBAUGH.—The rheostat type of alternating-current generator voltage regulator maintains a constant alternating-current voltage by means of the generator field rheostat, keeping the excitation voltage at a constant value, whereas in the vibrating regulator the exciter voltage is varied in order to give the proper excitation current to the generator for a given load condition. The author gives a general discussion on the principles of operation of this regulator, its construction and design, anti-hunting and general operating features.—*Central Station,* November, 1922.

Direct-Connected Generators for Reciprocating Engines.—M. GAZE.—If a generator is directly coupled with a reciprocating steam engine, a gas or a Diesel motor, certain rules have to be observed to insure the required flywheel effect of the set. The necessary amount of flywheel energy may be either built into the armature of the generator or a special flywheel may be keyed to the shaft. Depending upon the character of the engine or the requirements of a satisfactory parallel operation of several generators, a certain maximum amount of unsteadiness is permissible in the run of the machine. If the unsteadiness of the prime mover is more than this critical value, the armature weight has to be increased, or a flywheel must be used. The paper contains data on the unsteadiness found with different types and sizes of engines and describes and illustrates proper methods to equip these machines with the required momentum.—*A. E. G. Mitteilungen,* November, 1922.

Transmission, Substations and Distribution

Modern Applications of Compressed Air.—F. A. MCLEAN.—In the first part of the article, appearing in the Nov. 7 issue, the author described at length various pneumatic tools used in contracting and construction work, including diggers for tunnel and trench work, pavement breakers and tools for rock excavation. In this issue he discusses the relative merits of pneumatic versus hand calking and reaming, pneumatic hoists and the use of air tools in connection with the installation of service pipes.—*Canadian Engineer,* Nov. 14, 1922.

Short-Circuit Currents in Large Three-Phase Networks.—T. PANZERBEITER.—A mathematical paper showing by a number of examples the method of calculating the possible short-circuit currents which may occur on certain points of large networks with assumed generator capacities and cable and transformer characteristics. The beneficial influence of sectionalizing a system over reactance coils and their use in feeder circuits are enlarged upon. Further examples are given to show how to calculate currents and mechanical forces on the buses for the case of two interconnected stations.—*Siemens Zeitschrift,* November, 1922.

Units, Measurements and Instruments

Calibration Data on Polyphase Wattmeters.—V. H. TODD.—The author demonstrates the relation between the secondary or calibration watts and the primary or indicated watts of a polyphase indicating wattmeter. Data are given for two-phase circuits, three-phase, three-wire circuits and three-phase, four-wire circuits.—*Electric Journal,* November, 1922.

A New Highest-Demand Meter.—K. SINGER and P. PASCHEN.—The known types of highest-demand meters contain a tension mechanism which is actuated by either a spring or a weight. Both are affected strongly by temperature variations, and a spring has in addition in many cases a considerable starting error. An induction disk-type meter of the Ferraris class containing an adjustable spring-tension mechanism is described in this paper. A full temperature compensation has been reached by using a running disk made out of a special low-temperature coefficient alloy. The starting error was avoided by an eccentric arrangement of the spring adjuster.—*Elektrotechnische Zeitschrift*, Nov. 16, 1922.

Illumination

Amount of Light for Rooms.—Newton Harrison.—The problem of adequately lighting various types of rooms depends upon the brightness of light or intensity desired in the room under consideration, the quantity of light necessary to apply this intensity of light in the room and the number and location of the lamps necessary. Among the important items discussed are indirect and semi-indirect lighting, glass for bowls, spacing and mounting height, intensity of illumination and the total amount of light required.—*Central Station*, November, 1922.

Lighting of the Food Industries.—W. H. Rademacher.—In dealing with his subject the author covers the following points: General character of building, analysis of the processes of manufacture, present lighting practice, recommended practice as to intensity, type of equipment, method of lighting, and special or peculiar lighting requirements. The discussion following the reading of this paper at the Swampscott convention is given in full.—*Transactions of the I. E. S.*, October, 1922.

Motors and Control

Design of Electrical Machines.—J. T. Takeuchi.—A method for the design of electrical machines is given and a mechanical design for determining distribution of loadings described. A new formula is given to determine magnetic and electric loading. Several numerical examples demonstrate the application of this formula.—*Journal of the Institute of Electrical Engineers of Japan*, October, 1922.

Electrical Safety Orders.—Proposed revised forms as issued by the Industrial Accident Commission of the State of California are divided into three parts, the first covering the electrical utilization safety orders, the second general lighting safety orders, and the third being an appendix. The first part includes material contained in recent editions of the National Electrical Code, the National Electrical Safety Code, publications of the National Safety Conference and other publications relating to electrical safety standards, together with the original work of the general committee appointed to revise the electrical utilization safety orders. The object of these orders is to provide a minimum standard for electrical installations in places of employment throughout the State of California. The material includes: Conductor and cable specifications, grounding requirements, requirements for opening wiring, specifications for substations and transformers, services, submains and metering equipment, feeders, branch circuits and distribution centers, motors, motor-control equipment and motor wiring, lighting fixtures, appliances and installations, domestic and industrial heating devices, cranes, elevator conveyors, rectifiers and storage batteries, radio installations, X-ray and high-frequency operation, signaling and communication systems, etc.—*Order of the Industrial Accident Commission of California.*

Heat Applications and Material Handling

Electric Arc Welding of Cast Iron.—W. H. Namack.—The sub-committee of the Northern New York Section of the American Welding Society on the arc welding of cast iron has completed a summary covering arc welding of cast iron as it exists today, outlining the difficulties that have been encountered and the degree of success which has been achieved. The paper describes the research work which the committee has carried out and offers suggestions for further research. Descriptions are given of typical cast-iron arc welding operations by various methods. The report is fifty pages long and contains numerous illustrations and tables. —*Journal of the American Welding Society*, August-November, 1922.

Electrophysics, Electrochemistry and Batteries

Characteristics of the Tungar Rectifier.—Yasusi Watanabe.—The irregularity of the static characteristic curve is due to the fact that the arc stream changes its position suddenly or gradually between the anode of graphite and the heated filament as cathode, with the result that the arc length varies. When the arc stream of negative ions converges on the anode an oscillating current is produced in the condenser circuit connected across the terminals of the electrodes. This phenomenon seems to be related to the fact that the negative ions oscillate in the arc vapor simply owing to mechanical causes. Some remarks on the dynamic characteristics of the rectifying arc are made, particularly with regard to the effect of the condition of the filament.—*Journal of the Institute of Electrical Engineers of Japan*, October, 1922.

Development in Insulating Materials and Processes in Great Britain.—A. P. M. Fleming.—This article, presented at the Niagara Falls convention, shows the lines along which the manufacturers of electrical apparatus in Great Britain are dealing with their insulation problems. A 500-word abstract may be found in the convention report in the July 8, 1922, issue of the *Electrical World* on page 72.—*Journal of the A. I. E. E.*, December, 1922.

Telegraphy, Telephony, Radio and Signals

Oscillograph Investigation of a Telegraph Relay.—S. S. Richardson.—The paper deals with an examination by means of the oscillograph of the details of the current changes in the auxiliary and line circuits of the Gulstad high-speed vibrating relay. The results include: (a) Effect of variation of the current in the two branches of the auxiliary circuit; (b) resultant of the auxiliary currents determining the magnetization of the relay cores; (c) influence of leak circuits; (d) effect of a closed-line circuit and operation of the line currents. The circuit connections used in the tests are given and a new type of frequency meter devised by the author is described.—*Institution of (British) Electrical Engineers*, Vol. 60, No. 312.

Electron Tube Detector Unit for Radio Reception.—A circular giving a description of a simple electron-tube detector receiving set with method for operating it. Most of the parts for the set should be purchased, although some can be made at home. The cost may be expected to be from $23 to $37. A complete description of the method of assembling and wiring the detector is given, with illustrations showing the arrangements of the various parts.—*Circular No.* 133 *of the Bureau of Standards.*

Developments in Telephotography.—D. W. Isakson.—Modern developments in telephotography are brought out by the author in this paper, presented at the Vancouver convention of the A. I. E. E. A short abstract will be found in the convention report, page 432, of the Aug. 26 issue of the *Electrical World.*—*Journal of the A. I. E. E.*, November, 1922.

Miscellaneous

Education of Engineers in France.—A. E. Kennelly.—According to the author, the French system of training in engineering professions is usually superior to the American system in its systematic qualities and especially in its thorough grounding on the fundamental sciences. It is inferior to the American system on the practical side of manual training, laboratory equipment, economic training and relations with industry. A rather complete comparison between these two systems is made. The French student life is more methodical and more laborious intellectually, but is less developed socially and athletically. In technical research and post-graduate studies of investigation the American facilities and opportunities in our best technical colleges are superior. Each country has, according to the author, certain advantageous features in technical training to offer and an exchange of graduate students should be an advantage.—*Engineering Education*, November, 1922.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

How the New Motor Ratings Were Decided

Official Report of I. E. C. Committee Meetings at Geneva Indicates that British Commercial Situation Was Important Factor—Entire Meeting Generally Successful

IN THE Dec. 2 issue of the *Electrical World* (page 1230) an advance radio report of the meeting of the advisory committees of the International Electrotechnical Commission was given. C. O. Mailloux, president of the commission and chairman of the American committee, returned on Wednesday of this week and has supplied the *Electrical World* with a full official statement of the meetings. As indicated in an item accompanying the report which came by radio, the British position on ratings was strongly and ably presented and finally the other delegates acceded to the British proposals.

The meetings were held in close proximity to the Council of the League of Nations in a hall of immense historical interest and in the "Alabama room," where the famous Alabama claims case was settled more than fifty years ago.

E. Huber, president of the Swiss committee, was elected to preside over the technical sessions of the rating committee. Arrangements were made for the meetings of the other committees—graphical symbols, standard pressures, regulations for overhead transmission, and screw lamps, caps and holders—to be held during the week.

Rating Committee's Work

The official report gives the following résumé of the work of the rating committee:

"The main object of the meetings of the advisory committee on rating, which was convened principally at the request of the British national committee, was to consider the difficulties which have arisen in the attempt to introduce into practice the method recommended by the I. E. C. of rating electrical machinery on the maximum continuous load.

"The British delegation stated that it had been found possible to adopt the I. E. C. 50-deg. rating without overload for certain classes of machines, but for the ordinary type of industrial motor and generator the established British practice had for many years past been to rate these machines on a 40-deg. temperature rise with an overload of 25 per cent for two hours. The British committee had found itself in a difficult position in its efforts to be loyal to its industry and to the I. E. C. as well, and this was the reason why it appealed to the I. E. C. for assistance in finding a solution of the problem confronting it. The British were most anxious that an overload rating of this nature should be recognized by the I. E. C. and were, moreover, desirous that temperature rise alone should be specified and that the rating be based on the temperature rise at full load and not on the overload. In Great Britain it should be noted that the cooling air temperature does not exceed 30 deg. C. and indeed is more nearly 20 deg. C. and this overload therefore does not produce maximum temperatures in excess of those laid down by the I. E. C.

"The British also felt that while established British practice in regard to industrial motors gives a more substantial machine than the 50-deg. rating of the I. E. C. without overload, unless the I. E. C. agreed to adopt an overload rating for this class of machine the rating the British desired to standardize in their own country would not actually be in accordance with the I. E. C. rules, although it might be within them.

"Some misunderstanding arose in regard to the question of the temperatures produced on the overload, as an overload rating, if adopted by the I. E. C., would have to be applicable to all countries where the ambient temperature does not exceed 40 deg. C.

"The British delegation, while emphasizing the fact that the ultimate temperature limits of the I. E. C. had been based on laboratory experiments carried out many years ago and that experience with the use of the modern materials and methods of measurement might justify a review of the I. E. C. maximum temperature limits, was yet at present most desirous of putting forward only such proposals as would be entirely within the I. E. C. limits.

"Some discussion then took place as to the necessity of the I. E. C. introducing overloads, seeing that any national committee is perfectly at liberty to specify overloads in its national rules so long as this does not involve temperatures beyond the I. E. C. figures. In view, however, of the commercial importance attached to this question by the British committee, the other delegations, desiring to give satisfaction to the British, after further discussion, agreed to consider the question of recommending the introduction within the I. E. C. limits of a nominal rating with an overload as an international standard.

"In deference therefore to the British views, the advisory committee, with the help especially of M. Boucherot (France) and Signor Semenza (Italy), endeavored to find a solution satisfactory to their British colleagues.

"The American delegates, while they had not come with any preconceived ideas or definite proposals, were at the same time inclined to favor the British suggestion, although they pointed out that there was a tendency in the United States toward a 40-deg. single rating without overload, which would imply a liberally designed machine capable of carrying both the mechanical and electrical overloads that such machines have to meet in ordinary service. They urged most strongly that one rating only should be adopted.

Proposals Agreed To

"In an international meeting of such a nature much time has of necessity to be taken up with explanations, for in the discussions terms not fully comprehended by everybody are often used—and also with translations into different languages—and much patience has to be exercised in dealing with the various points as they arise, and in some instances time was allowed through adjournment of the official sittings for the members of each delegation to discuss details among themselves. It was not until Thursday that, with the help of M. Boucherot, a generally acceptable proposal embodying the wishes of the British delegates was agreed to for submission to the national committees to the effect that *overload ratings within the I. E. C. maximum continuous rating be recognized, and that for general industrial machines (the class to be defined later) where overloads have to be provided a machine having a 40 deg. C. temperature rise and capable of carrying 25 per cent overload for two hours applied at the end of the full-load run, be recommended, the overload only to be applied under such conditions of air temperature as will not cause the limits of maximum temperature laid down by the I. E. C. to be exceeded.**

"It will be remembered that the main object of the international rating of electrical machinery is to establish an equitable basis of comparison of tenders, and much discussion took place as to the method of indicating the relation between the proposed British nominal rating and the I. E. C. single rating. To carry this into effect Signor Semenza suggested, and it was ultimately agreed to recommend, that *the rating plate of the machine indicate in addition to the other information the output under the ordinary I. E. C. continuous rating* (50 *deg. C. rise*).

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*See footnote on page 1230, Dec. 2 issue of *Electrical World*, for details of I. E. C. temperature limitations.

"With this decision the meetings of the advisory committee were adjourned, and the British delegates expressed their thanks for and appreciation of the manner in which their proposals had been received. They had fulfilled their obligation to consult the advisory committee before introducing into their national rules recommendations at variance with those of the I. E. C., and in view of the agreement now arrived at they felt, and the members agreed, that they would be at liberty to proceed with the urgently required revision of their national rules, introducing into the new British rules a lower temperature rise and an overload rating conforming as to ultimate temperatures with the I. E. C. limits and indicating at the same time on the rating plate the relation between their 40-deg. rating with overload and the I. E. C. 50-deg. single rating.

"The German representatives at the close of the meeting expressed their appreciation of the manner in which they had been received and said their desire was to resuscitate the German national committee and its work and, in so far as is possible, to bring the German rules entirely into harmony with the rules of the I. E. C."

As reported in the Dec. 2 issue, other committees took action on graphical symbols, added standard pressures and lamp sockets, the principal point in the last-named subject being an agreement to standardize first on the socket and later on the base. Further reports on action of other committees, together with some additional notes of interest and a photograph and list of delegates present, will be printed in an early issue.

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Program of Engineering Section, American Association

The Engineering Section of the American Association for the Advancement of Science will, in the course of the annual meeting of that association, to be held from Tuesday to Saturday next week at the Massachusetts Institute of Technology, Cambridge, Mass., hold three sessions on Friday, Dec. 29.

In the morning there will be a joint meeting with the Section on Social and Economic Sciences, of which Dr. Henry S. Graves, School of Forestry, Yale University, is chairman. The general theme of the meeting will be the engineer's relation to the conservation of national resources. Dr. Graves will preside, and John T. Black, State Health Commissioner of Connecticut, will speak on "Conservation and Industrial Waste"; O. C. Merrill, executive secretary Federal Power Commission, on "The Federal Water-Power Policy and Its Results"; William S. Murray, New York, on "Conservation of Power," and Gen. Harry Taylor on "Problems of Flood Control."

At the afternoon session of the Engineering Section the speakers will be Dr. J. B. Tyrrell, Toronto; Dr. Ira N. Hollis, president of the Worcester (Mass.) Polytechnic Institute, who will have for his topic "Progress and the Engineer"; Prof. C. F. Scott of Yale, on "New Phases of Engineering Education," and Harrington Emerson on "Prevention of Waste in Industry."

A second joint session with the Section on Social and Economic Sciences will be held in the evening, arranged by Dr. Graves and F. M. Feiker, vice-president McGraw-Hill Company, who is the chairman of the Engineering Section. At this meeting Calvin W. Rice will give an illustrated lecture on "Engineering in South America."

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Municipal Ownership Defeat at Cambridge, Mass.

Failure to obtain the necessary two-thirds vote in the Cambridge (Mass.) City Council last week killed a movement to take over the plant of the Cambridge Electric Light Company and will prevent further agitation of consequence on this question for at least two years. Little public discussion of the proposal had been had, and there was no widespread sentiment in favor of the city's embarking upon municipal ownership. It was shown at the Council meeting that the city would gain little if anything by seeking lower rates through municipal ownership and that the rates in Cambridge compare favorably with those in other Massachusetts cities and towns. It was pointed out by Councilor Griswold, chief spokesman against the project, that the enterprise would cost the city at the outset from $2,600,000 to $4,000,000 and that there would be little chance of surplus earnings being turned over to the city from a municipal plant.

Street-Lighting Tables for 1923

FOLLOWING its practice for thirty-four consecutive years, the *Electrical World* has prepared tables showing the proper time for lighting and extinguishing street lamps. The 1923 tables will be ready in a few days, and a copy will be sent free to any subscriber upon request to *Electrical World*, Tenth Avenue and Thirty-sixth Street, New York. For more than one copy a charge of 25 cents each is made to cover a portion of the postage, printing and compilation costs.

Quarrel Over Valuation

Alabama Commissioners Split and State Press Differs Widely on Rate-Base Figures

A VALUATION of the property of the Alabama Power Company for rate-making purposes, accomplished last week by the Alabama Public Service Commission, has caused a quarrel in the commission itself and divided the press of the state into two camps, some newspapers bitterly attacking the power company while others assert that the valuation is fair.

The value as established by the commission is $33,843,252, this being a reduction of $11,000,000 from the sum fixed by Hagenah & Erickson, expert appraisal engineers. The valuation was made by a majority vote of the three commissioners, two of whom, S. P. Gaillard and B. H. Cooper, overrode the vigorous protest of A. G. Patterson, president of the commission, who left the room when he saw he could not restrain his fellow members from acting.

Mr. Patterson has published the charge that the other commissioners made the valuation without considering all the facts required by law, in order that they might definitely fix the service rates before leaving office on Jan. 16. They were defeated in the last election while President Patterson was re-elected. The associate commissioners, in a counter statement, charge that President Patterson is trying to bait the public utilities of the state for political purposes. Under the law the company has thirty days in which to enter a protest. If it does not do so, the valuation becomes final and the company is allowed to establish such rates as will allow a fair return on its investment.

ESTIMATES OF ORIGINAL COST RECEIVE LITTLE CONSIDERATION

The appraisal made by Hagenah & Erickson was the outcome of more than ten months' work. I. F. McDonnell, engineer for the Public Service Commission, made a report after checking the estimates of Hagenah & Erickson, as did M. W. Aldridge, accountant of the commission. Hagenah & Erickson placed the original cost of the company's properties at $36,807,513.76. Mr. McDonnell placed it at $36,029,457.81. M. W. Aldridge showed the cost to be $37,645,741.26 and the working capital to be $2,297,457.63, making a total of $39,943,198.89. The Alabama Power Company filed a sworn statement that the original cost was $40,125,952.60. The commissioners declined to give consideration to the original-cost figures beyond the amount which would cover the reproduction cost of the property.

The part the Alabama Power Company has played in the bidding for Muscle Shoals and the support given in Alabama to Henry Ford's offer helped to stir up a hornets' nest when the valuation question came up before the commission.

New Radio-Detector Tube

Non-Interfering Contrivance Based on Ionization of Metallic Atoms Shown in New York

A RADICALLY new type of radio-detector tube which depends upon the ionization of metallic atoms for its operation was announced before a meeting of the Institute of Radio Engineers in New York City on Wednesday of this week by H. P. Donle, chief engineer of the Connecticut Telephone & Electric Company, Meriden, Conn. According to the demonstration and research data presented, the tube is remarkably sensitive, readily controllable and stable, unproductive of interference, free from signal distortion and powerful in its action. The tube consists essentially of a filament, a semi-cylindrical electrode called a collector and a metal anode (sodium or the like) that can be readily ionized by heating with a resistor in series with the filament. The features of the tube are shown in the accompanying illustrations, which also outline a simple two-circuit tuner connection for a radio reception.

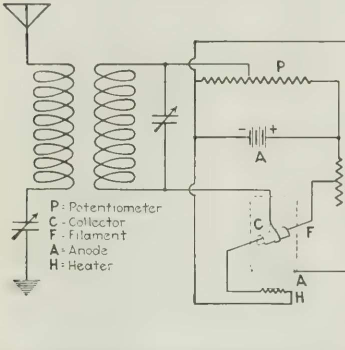

Fig. 1—Elements of New Radio Detector Tube and Application to Two-Circuit Tuning Connections

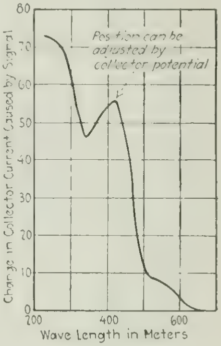

Fig. 3—Tubes Can Be Made Selective by Adjustment of the Collector Potential

Adjustment of the collector potential is the only operation necessary for effective action other than the usual variations of the capacity and coupling of the tuning circuit. The anode potential is not at all critical. The response secured with this tube in a plain circuit is said to equal in magnitude that of a regenerative set using maximum non-oscillating regeneration. The collector potential necessary for maximum sensitivity with the tube shown was —1.4 volts. An interesting feature is the fact that the collector current is considerably larger than the anode current —twofold to fourfold. Large changes can be made in the collector current by small changes of the collector potential. No amplifier action is produced, although the tube has high voltage amplification, sometimes as high as four hundred to one. Practically as good reception is obtained by connecting receivers in the input side of the tube by means of transformers.

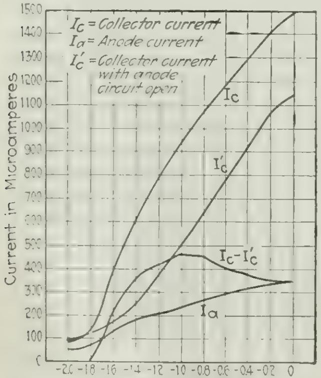

Fig. 2—Characteristics of One Sample of New Detector Which Are Readily Reproducible and Permanent

Another remarkable feature of the tube characteristics is the marked difference in collector current at different wave lengths, the current changing from about 40 to zero between 250 m. and 1,100 m. wave length. Furthermore, it is possible to change this curve radically by changing the collector potential, thus enabling unusual selectivity. Despite the fact that the metallic anode has to be heated, the operation of the tube becomes fairly stable within a few seconds after the filament is lighted, although slight readjustment of the collector potential is required later to obtain maximum sensitivity.

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Plans of Pacific Power & Light Company

A construction program representing an expenditure of about $6,500,000 is, it is understood, soon to be undertaken by the Pacific Power & Light Company of Portland, Ore. Included in the program is the construction of a 10,000-hp. hydro-electric plant at the reclamation site on the Deschutes River, 15 miles from the mouth of the river.

Sixty miles of high-tension line will be constructed this winter from Kennewyck across the lower Horse Heaven district, and during the following summer extensions will be continued to the power site. Eighty-five miles of further extension will be made during the summer from the company's proposed plant at the reclamation site to the new Oak Grove hydro-electric plant of the Portland Railway, Light & Power Company 60 miles southeast of Portland, on the headwaters of the Clackamas River.

The transmission lines will cost $1,500,000 and will serve to link the systems of the Montana Power Company, the Washington Water Power Company and the Puget Sound Power & Light Company with those of the Pacific Power & Light Company and other companies to the south.

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Los Angeles Injunction Suit Still Pending

The injunction suit brought by the Los Angeles Gas & Electric Corporation against the city of Los Angeles and the California Railroad Commission to prevent the city from taking steps to acquire the company's electrical distribution system within the city limits is still pending in the courts. The suit was filed on the ground that the motion before the City Council to have the commission make an appraisal of the utility's property did not pass by the required two-thirds majority, the right to vote of one of the Councilmen who was temporarily acting as head of the city government being disputed.

The Los Angeles Gas & Electric Corporation claims that its system is worth $17,000,000, while city officials value it at only $7,000,000. The company now has many extensions under way and, according to its officials, the property will be worth $20,000,000 within another year.

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Possibility of Transmitting Niagara Power to Hornell

The city of Hornell, N. Y., which is now paying from 15 cents down to 6 cents a kilowatt-hour for electrical energy, has received an offer from the Niagara, Lockport & Ontario Power Company to build a transmission line to Hornell and deliver power there at about half of the present rate, provided that a consumption of 5,000 kw. on a 50 per cent load basis could be guaranteed. This is equal to 20,000,000 kw.-hr. a year, or more than five times Hornell's present consumption.

To supply Niagara power to Hornell would mean building a transmission line from Franklinville, 45 miles away, which would cost $12,000 a mile. It is considered unlikely that the demand by towns through which the line would pass could be great enough to enable Hornell to meet the stipulation. The condition, however, may be waived if a promising opportunity to continue such a line through to Corning, Elmira and Binghamton should arise.

Power Board Activities

Applications Granted and Denied—Falls of Ohio and Ouachita Cases to Be Heard

AT ITS last meeting the Federal Power Commission approved issuance of a preliminary permit to the Southern California Edison Company covering an extensive project on the headwaters of the San Joaquin River.

The application of the Smith-Sanders Power Company of Rogersville, Tenn., for a preliminary permit to cover a development on the Holston River was denied. The commission is of the opinion that the applicants are not in a position to make the best use of the power resources of the stream.

A license of indeterminate length was granted to the Hydraulic Race Company of New York and the Newsane Mill Owners' Association, involving a diversion of 500 second-feet through the State Barge Canal. The license will be revoked automatically in case the State of New York should revoke the permit allowing the use of the Barge Canal for the transportation of the water used in connection with the project.

A license issued to the Western States Gas & Electric Company was amended so that it could be transferred to the El Dorado Power Company, a subsidiary.

The chief engineer reported to the commission that the Arkansas River is non-navigable at the point where C. P. Chenault of Hugo, Okla., desires to develop a power project. He also reported that the Pemigewasset River near Bristol, N. H., is non-navigable at the point where the Utilities Power Company of New Hampshire desires to construct a power project.

COMING CONTESTS

The Secretary of War will on Jan. 22 hear arguments on the power which will become available with the completion of Dam No. 41 in the Ohio River at Louisville. The rival contenders for this power are the city of Louisville and H. M. Byllesby & Company. Both the War Department and the Federal Power Commission are anxious to expedite the construction of the dam, for which the necessary appropriation is available to the Chief of Engineers. It is felt that the successful applicant should co-operate with the district engineer in the preparation of the designs for the dam so that the maximum utilization may be made of the 35-ft. head which will be developed.

It is very evident that the city of Louisville cannot make full utilization of the power unless it is prepared to take over the steam plant and distribution system of the Louisville Gas & Electric Company. Furthermore, Louisville probably cannot secure rights to own property and do business in Indiana. Indiana has the right to utilize one-half of the power which the dam will make available. For these reasons it is anticipated that the commission will decide the case in favor of the Louisville Hydro-Electric Company, the Byllesby subsidiary which is the actual applicant.

An acrimonious contest probably will be staged before the commission in regard to rights on the Ouachita River. The Caddo River Power & Irrigation Company, which is affiliated with the Arkansas Light & Power Company, holds a license authorizing the development of two sites, including a large storage reservoir, but the Caddo company is anxious to develop first a small site lower down on the Ouachita. It develops that the Electric Bond & Share Company many years ago bought up property rights along this stream, expecting to develop power when the demand for it should justify the expenditure. Each side is known to be preparing to fight for the site in controversy. The date for the hearing before the Federal Power Commission has not been fixed as yet, but it probably will be early in February.

* * *

Charge Waste in State Work at Vischers Ferry, N. Y.

Charges of waste and inefficiency in the work carried on by the State of New York to develop hydro-electric power at Vischers Ferry and Crescent, N. Y., where there are Barge Canal dams on the Mohawk River, have been made at Albany. It is claimed that Charles L. Cadle, State Superintendent of Public Works, in letting contracts for the construction of the two power houses under a cost-plus arrangement has not alone brought about a condition which in the end will cost the state more money than it would have done had the work been let under competitive bidding, but also that time and state money have been wasted on the construction of unessential and temporary works in connection with the two developments. It is also asserted that when the current is finally turned on its frequency will be such as to make it useful to only one company and that there will for this reason be no competitive bidding.

Another claim made by the critics of Mr. Cadle's construction activities is that his plan calls for the development of only half of the potential electrical energy that could be harnessed at the two dams and that the cost in the end will exceed the figure set by State Engineer Frank M. Williams, who had submitted a report stating that 16,000 hp. could be developed at each of the sites at a total estimated expenditure of $2,000,000. Private engineering corporations had previously estimated that this power would cost to develop $5,000,000. Mr. Cadle's plans, it is said, contemplated the development of only 8,000 hp. at each site at a total cost of $1,000,000. This sum has already been expended, and the Superintendent of Public Works is now said to believe that $400,000 more will be necessary in order to bring about the completion of the work as planned by his department.

Fear of Commission Upset

Governor Smith of New York to Demand Entirely New Body and "Home Rule"

NEWS articles in the New York press, evidently inspired, foreshadow the recommendation to the State Legislature by Alfred E. Smith, who will become Governor on Jan. 1, of drastic changes in the state's policy regarding the regulation of public utilities. These recommendations will, it is said, be made in his first message and embodied in a bill to be introduced early in the session.

Features of this bill, in its provisions or effect, will be the abolition of the Transit Commission, the substitution of a new Public Service Commission with greatly circumscribed powers for the present Public Service Commission, and the transfer to the Board of Estimate in New York City and to the governing bodies of other municipalities of regulatory power over all public utilities within the limits of each city, excluding telephone companies but including gas and electric companies as well as transit companies.

Another policy to be urged by the incoming Governor will be the development of the state's water powers through state ownership and control. Both these declarations of policy would be in accord with the platform adopted by the Democratic party at the convention which nominated Mr. Smith.

EFFECT OF "HOME RULE"

The most radical change proposed is in the transfer to the cities of power to regulate transit, gas and electric companies within their municipal limits. This, it is said, would give each municipality, acting through its board of estimate or common council, power to hold hearings and fix rates, within limits fixed by the courts, and to prescribe standards of service.

The new Public Service Commission, if these plans are consummated, will have general powers only over telephone companies, the business of which is not considered so localized as that of other public utilities, and over intercity traffic and business of these other public utilities, as well as their traffic and business outside any city.

It may be significant in this connection that nine of the thirty-three Republican members of the House of Representatives from New York State are endeavoring to have party pressure brought to bear on Republican members of the Legislature to support, among other things, "a genuine home rule amendment to the State Constitution for all cities and villages, particularly in transit matters," and "state control of water power and regulation of power now being developed by private companies under existing grants." The Democratic party will have a majority in the new State Senate, but the Republicans are still in control of the Assembly, though by a greatly reduced majority, which might conceivably be overturned on specific issues.

Quebec Project Under Way

Duke and Price Finance Water-Power Development with a Potential Output of 1,200,000 Hp.

ANNOUNCEMENT is made that the long-contemplated development of the power resources of Lake St. John and the Saguenay River in the Province of Quebec, Canada, has taken practical shape through the incorporation at Ottawa of the Quebec Development Company, composed of United States and Canadian financiers.

Heading the company is James B. Duke, president of the Southern Power Company. Associated with him in the enterprise is Sir William Price of Price Brothers & Company, Ltd., one of the largest print-paper manufacturing firms in the Dominion of Canada, who is vice-president. The engineering part of the development has been placed in charge of W. S. Lee, chief engineer of the Southern Power Company, who has also become a vice-president of the new company. The other vice-presidents are H. L. Brown and J. M. McCarthy, the latter a Canadian. The capital stock of the company is $25,000,000, which has been subscribed entirely by Mr. Duke and Sir William Price.

The first development will be made where the river flows from the lake, and here 400,000 hp. can be produced. Twelve generating units of 35,000 hp. each are contemplated. Eventually, it is stated, a second development, 22 miles from the lake, where the river drops directly into tidewater, will provide 800,000 hp. more. The work already started at the first site includes the sinking of the cofferdams for the power-plant foundations, the construction of the connecting railway over which materials will be hauled, and preliminary steps to raise the level of the lake 20 ft., permitting continuous flow to the turbines in the coldest weather. Specifications for electrical equipment are being drawn.

As a part of the plan it is announced that Price Brothers, Ltd., have entered into a contract with the new company for 200,000 hp. to be used in their paper mills, which will be connected to the plant by high-tension transmission lines.

The site is less than 100 miles from the city of Quebec, and the intervening country affords numerous opportunities for industrial plants.

Delaware River Projects

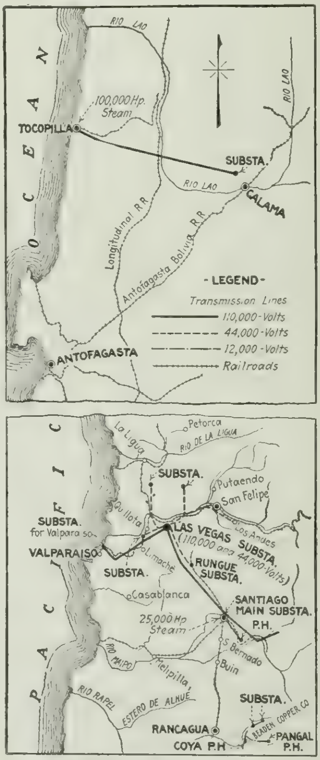
One of the more powerful companies in the public utility field is understood to be flirting with a power development scheme for the Delaware River. The project is a particularly attractive one because 450,000 hp. can be developed on the Delaware in the very heart of the country's greatest industrial section. Any development of the power resources of that river, however, must contend with unusual obstacles.

The principal difficulty is in the number and character of vested rights along the stream. The flowage rights involved are such that they may render the whole project unfeasible when it is investigated in detail. Another difficulty is with the extremely low flow of the river at certain periods of the year. There are no less than eight excellent storage sites on the river, but the feasibility of their utilization will depend on the flowage damages involved. It is a fact, however, that seasonal power can be used to a greater advantage in the vicinity of New York and Philadelphia than in any other area, because the connected load bears such a large ratio to the potential power.

Electrical Progress in Chile

Water-Power Development in the Region of Santiago and Valparaiso Is Assuming Large Dimensions—Plan to Electrify 75 Miles of State Railways from Five Substations

FROM Percy H. Thomas, consulting electrical engineer, New York City, come, at the request of the *Electrical World*, the accompanying interesting details of the recent progress in generating and distributing energy in the Republic of Chile, which is, he says, with the aid of British capital, now making a long step in advance. The principal factor in the extension of power facilities is the Compañia Chilena de Electricidad, Ltda., of Santiago, which is a consolidation of the Chilean Light & Tramway Company, Ltd., of Santiago, and the Compañia Nacional de Fuerza Electrica, a power company organized in Chile during the war.



Electrical Transmission Systems in Central Chile

The Compañia Chilena de Electricidad, Ltda., is installing a very comprehensive power generating and transmission system to serve the central district of Chile, lying around the cities of Santiago and Valparaiso. This company has just completed the installation of a 34,000-hp. plant on the Colorado River, a branch of the Maipo River, this plant being about 25 miles directly east of the city of Santiago. This, with the 20,000-hp. hydro-electric plant at La Florida near Santiago and the 25,000-hp. steam plant in that city, gives an installed capacity of nearly 80,000 hp. A large block of this power will be used in the city of Santiago, which already has quite an industrial development, and the rest will be distributed in the large territory north and south of Santiago and between Santiago and Valparaiso. The main transmission is at 110,000 volts over double-circuit lines. Already a number of industries in the Aconcagua Valley are preparing to use electric power. The electrification of the Chilean State Railways will be supplied with power from this company, which will feed five substations distributed over about 75 miles of road. Forty-four thousand volts will be used for feeding the railway substations and for general distribution and for supplying the various mines and irrigating plants which are expected to take power from the company.

Present Installation Inadequate

The Compañia Chilena purposes to develop another large plant to the east of Santiago to supply power for the further development of the country, for the capacity of the present installation is likely to be soon exhausted. As ample opportunity for further development of power exists, it is expected that before many years Chile will have one of the largest power systems in South America. With her relatively expensive coal the value of this development to that country is very great. The company, while controlled by the Lord Cowdray interests, has associated with it a number of representative business men of Chile.

In addition to the plant of the Compañia Chilena de Electricidad, Ltda., Chile has the well-known plants of the Chile Exploration Company, now with a rated capacity of nearly 100,000 hp. at its steam-electric power plant at Tocopilla, and of the Braden Copper Company, with approximately 35,000 hp. rated capacity in hydro-electric installations. There are a number of other smaller installations, including one of the Bethlehem Steel Company at Cruz Grande and that of the Andes Exploration Company near Chaneral.

The location of the principal power plants in Chile is shown in the sectional maps of the central portion of the country reproduced.

Revised Classification of Accounts to Be Issued

The committee on statistics and accounts of the National Association of Railway and Utilities Commissioners having given very full and technical consideration to the "Uniform Classification of Accounts for Electric Corporations," adopted by the association in November, 1920, found it advisable to recommend to the convention held in Detroit in November, 1922, certain amendments to the original classification issued in 1920. Some of the amendments were made to clarify the text and avoid possible confusion in its interpretation and more nearly to fit the text to the language of the electrical industry.

It was found that the conversion and storage group of accounts under electric fixed capital and the appropriate departmental accounts under operation were inapplicable to the industry. These accounts have now been eliminated and spread over the appropriate accounts of transmission and distribution.

It was also suggested by companies having long transmission lines that to properly reflect their costs and operation a functional set-up of fixed-capital accounts would be preferable to one based upon the physical characteristics of the property, and this suggestion was met by making it optional on the part of the companies which way the fixed-capital accounts should be grouped.

Changes were also made to provide for the inclusion of all minor rents in operating expenses, and a change was made in the tax accounts so as to provide for a single account for taxes.

There were certain other minor changes made which, in the judgment of the committee, more nearly meet the requirements of the operating companies and the regulatory commissions. The committee feels that it now has a complete system of accounts through which there may be set down historically and in an orderly manner a detailed statement of the operation and condition of the utility and which is sufficiently elastic to meet the requirements of the regulatory bodies and the industry.

The amendments are so numerous and so important, including changes in account numbers and in practice under classification definitions, that a revised edition of the classification will be issued in printed form at as early a date as possible.

Brief News Notes

Georgetown (Ky.) Power House Destroyed.—By a fire believed to have been caused by a defective flue the power house of the Georgetown (Ky.) Water, Gas, Electric & Power Company was burned to the ground on Dec. 14, causing a loss of between $75,000 and $100,000. It is estimated that complete service cannot be restored for a month despite energetic efforts by the company.

Tokyo Electrical Company to Float Bonds Here.—Negotiations for a loan of $30,000,000 to the Tokyo Electrical Company, largely for the purchase of electrical equipment, are, according to information in New York banking circles, under way in Wall Street. It is understood, however, that there is European competition for this issue. Details are lacking.

Kern River Turbines Operate with 810-Ft. Head.—In the "News of the Industry" for Dec. 2 the head on the turbines at the Kern River No. 3 plant of the Southern California Edison Company was incorrectly printed as 610 ft., instead of 810 ft. As is well known, there are a number of reaction turbines operating at heads exceeding 610 ft., so that that figure could not have been the present world's record, as stated in the item.

Radio Amateurs Heard in Europe.—In the course of tests recently held by the American Radio Relay League twenty-five American amateur operators made themselves heard in England and thirteen in France. This was the first time that the French had succeeded in picking up amateur messages from America. Dispatches from private senders in the United States have also been received in Switzerland.

San Joaquin Company to Have New Home. — Construction plans are virtually finished for a ten-story office building at Fresno, Cal., to house the San Joaquin Light & Power Corporation's executive staff. The company will occupy eight stories of the building as soon as it is completed, leaving only two for rental. The new building, it is said, will be ready by the beginning of next fall.

Boise Offices to Move.—The Boise division and Boise City offices of the Idaho Power company will be moved on Feb. 1 from their present location at Seventh and Bannock Streets to 807 Idaho Street, and the space now occupied by these two divisions of the company will be transformed into general offices. The new offices will house the merchandising business and the electric shop. Expanding business has forced the change.

Detroit Edison's Load Over 255,000 Kw.—On Dec. 7 the load on the Detroit Edison system registered over 255,000 kw. This is the highest total since the industrial boom in 1920. The new plant at Marysville is carrying 17,000 kw. and will supply 35,000 kw. on the completion of the transmission lines. The engineering department will during the winter complete the Trenton channel, 16 miles south of Detroit, after finishing the Marysville plant.

Two Wisconsin Plants to Be Taken Over by Municipalities.—The property and plant of the Wisconsin-Minnesota Light & Power Company at Rice Lake is to be purchased and operated as a municipal public utility. The Wisconsin Railroad Commission has valued it at $233,000. The McGowan Power, Light & Water Company's plants at Milton, valued at $33,500, are also to be taken over by the municipality, provided that the company does not appeal from the commission's decision.

Uniform Accounting Ordered in Wisconsin.—Beginning with 1923, the entire bookkeeping system of electric and gas companies in Wisconsin will be changed by order of the Railroad Commission, and all companies will have to keep their accounts in a uniform manner and in accordance with a definite procedure laid down by the commission. The uniform classification of accounts to be installed is in conformity with the accounting plan adopted by the National Association of Railway and Utilities Commissioners.

Water-Power Development in the Iron Range Country.—Construction of the dam and water-power project begun last June on the Kawiskjwa River, a short distance from Winton, Minn., and just south of the Canadian border, is progressing rapidly, according to engineers for the Minnesota Utilities Company. Approximately 300 men are employed on the work and the plant may be ready for operation by midsummer of 1923. The plans call for double coffer dams with reinforced-concrete retaining walls. The power plant will be built at the base of a hill near the river. The estimated cost of the enterprise is $1,500,000.

Power Project on International Border.—The development of the power possibilities of the Pigeon and Rainy Rivers, boundary streams between Minnesota and Canada, is being considered. The Pigeon River Lumber Company has applied to the Federal Power Commission for the privilege of developing five sites on that stream. While the Pigeon River is a small stream, it has a fall of 250 ft. in 15 miles above its mouth in Lake Superior. It is reported that a large public utility company also is interested in that stream and in the power possibilities of the Rainy River.

Electricity on Board Atlantic Passenger Boat.—Fifteen thousand electric lamps, exclusive of those used for decorative festoons, are to be employed in lighting the *Leviathan*, now being reconditioned at Newport News, Va., for North Atlantic passenger service, and many artistic effects will be achieved in some of its rooms and saloons by indirect-lighting devices. The ship will be ventilated by motor-driven fans, and electrically driven passenger elevators will serve the five principal decks. Ranges, ovens and miscellaneous culinary apparatus are operated by the turn of a switch. There are 600 telephones, an elaborate annunciator system, electric clocks, automatic fire alarms, and generally every electric appliance that would be found in a great hotel.

Another International Parley on Cable Communication.—Plans for a general international conference on electrical communications to be held in Paris next spring for the purpose of revising treaties and establishing new agreements among the countries of the world with respect to cables, signaling, codes and other matters are being worked out jointly by the Departments of State and Commerce and the embassies of France, Great Britain, Italy and Japan. This conference will take up the work where it was left by the preliminary international conference on the subject held in Washington in 1920.

Commonwealth Edison Installs Electrical Kitchen. — The Commonwealth Edison Company, Chicago, has completed an electrically equipped cafeteria on the eighteenth floor of the Edison Building. This dining room, which seats 300 persons, is the outgrowth of a small lunchroom started in 1921. The electrical apparatus consists of two hotel ranges, two 30-gal. kettles, one bake oven, a dough mixer and various small motor-driven equipment. This installation is completely electrified and will be used as an exhibit for prospective buyers of cooking equipment. It was laid out by the company's engineering department, under the supervision of H. R. Wahl and J. J. Kirk.

New Zealand's Method of Radio Control.—Proposed broadcasting regulations for the government of New Zealand will assign to each locality in the island a definite wave length and a definite power of transmission. The wave lengths run from 180 meters to 400 meters. Several of the larger cities will use a $\frac{1}{2}$-kw. station, while the smaller towns must use a $\frac{1}{4}$-kw. station. At each of these centers time tables will be arranged by the government to insure that only one broadcasting station shall be operating at any one center at the same time. In this way it is thought to avoid chaotic conditions.

Projected Municipal Plant at Florence, Ala.—An election is to be held at Florence, Ala., for the purpose of determining whether the city shall develop water power at Cypress Creek, near Muscle Shoals. Advocates of the plan say that if it is followed the citizens of Florence will enjoy a rate of 5 cents a kilowatt-hour or less and that this fund will pay for the work necessary, allow a depreciation and maintenance fund and furnish enough in addition to pave all the principal streets of the city within the next three years. Plans drawn up by the city engineers contemplate a minimum of 200 hp. and a maximum of 500 hp. Florence has a population of 10,500.

More Oklahoma Extensions. — The Eastern Oklahoma Light & Power Company has connected the towns of Vera, Ramona and Ochelata to its transmission line running from Skiatook to Vera, thence to Ramona and then on to Ochelata. The connection will bring energy for power purposes to the places named, which were previously dependent on small lighting plants.

How Not to Do It.—The *O. B. Bulletin,* house organ of the Ohio Brass Company, prints two pictures of "horrible examples" of line construction discovered by a correspondent "somewhere east of 'Frisco," one of which is reproduced here. "It is useless," says the *O. B. Bulletin,* "to make any attempt at classifying the various materials used or the methods followed in assembling them into the finished work so clearly brought out by our excellent engraving. Suffice it to say that materials were selected after very careful deliberation and much thought by a bonding foreman of a Western railroad and proved so good that a quantity of them were made up for use."

Class in Electric Truck Maintenance Quadruples Expectations. — So great has been the interest on the part of users of motor trucks in New York City in the course of instruction in the care and maintenance of electric trucks inaugurated by the Electric Motor Truck Association that it has been necessary to schedule double courses and to limit the number of enrollments. When this course was first discussed it was hoped that forty enrollments could be secured. Within two weeks after the announcement more than two hundred applications had been received, some firms asking to enroll twenty of their delivery force. The course is given under the direction of F. C. Henderschott, manager of the bureau of education of the New York Edison Company, and Charles R. Skinner, Jr., chairman of the Electric Vehicle Bureau of the N. E. L. A.

Associations and Societies

Iowa Engineering Society.—The annual meeting of the Iowa Engineering Society will be held at the Chamberlain Hotel in Des Moines on Jan. 23 to 26, 1923. There will be a mechanical-electrical session on the second afternoon.

American Physical Society.—At the annual meeting of this society, to be held at Boston on Dec. 26-30, seventy-two papers will be presented. Those of chief electrical interest are: "The Percentage Bridge in the Measurement of Low Electrical Resistances," by A. C. Longden; "Some Mechanical Effects of a Sliding Electric Contact," by K. S. Van Dyke; "Effect of an Intermittent Direct Current Under Varying Conditions of the Emf. Associated with a Metal Plate in a Solution," by R. D. Kleeman and W. F. Winter; "A Thermoelectric Effect," by A. S. Eve; "Effect of Frequency on Permeability," by Leigh Page; "Power Loss in Condensers with Liquid Dielectrics," by Louis S. McDowell, and "Piezo-Electrically Driven Tuning Forks and Rods," by W. G. Cady. This meeting will be held simultaneously with that of the American Association for the Advancement of Science, which will bring three thousand scientific men to Boston and Cambridge.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

American Physical Society—Boston, Dec. 26-30; New York, Feb. 24. D. C. Miller, Case School of Applied Science, Cleveland.

Federated American Engineering Societies—Washington, Jan. 11-12.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Western Association of Electrical Inspectors—Chicago. Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Wisconsin State Association of Electragists—Milwaukee, Jan. 24-26. H. M. Northrup, 23 Erie St., Milwaukee.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Atlantic Division, New York, Feb. 14; executive committee, Atlantic City, Jan. 15-16. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Institute of Electrical Engineers—New York. Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

American Institute of Mining and Metallurgical Engineers—New York, Feb. 19-21.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City.

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 16-17. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Recent Court Decisions

Confiscatory Rates.—That there is no distinction between the enforcement of a confiscatory rate which has become confiscatory because of changing conditions and the enforcement of a reduced rate which results in confiscation, since it is not the fixing but the enforcement of a confiscatory rate that invades constitutional rights, was a pronouncement of the United States Circuit Court in South Carolina in Augusta-Aiken Railway & Electric Corporation vs. the State Railroad Commission. (281 Fed. 977.)*

Navigability a Question of Local Law.—Declaring that a state vested by the act of admission to the Union with plenary jurisdiction and power over the beds of navigable streams within its borders may establish such rules as it deems proper for the government of riparian rights along such streams, the United States District Court in Kansas (in Jackson-Walker Coal & Material Company vs. Hodges) went on to say that whether a stream is navigable for the purpose of determining riparian rights thereon is not a question of present navigability in fact, to be determined by a jury in each case, but one of local law, which may give the stream a permanent status. The Arkansas River in Kansas is, under the law of the state, a navigable stream throughout its course, regardless of its navigability at any particular place, the court declared, and title to the bed of the stream is in the state and not in riparian owners. (283 Fed. 457.)

Boston Must Pay Traction Deficit.—The United States Supreme Court has decided against the city of Boston in its suit against State Treasurer Jackson and the trustees of the Boston Elevated Railway System to test the legality of an assessment under a special act to meet a deficit of $4,000,000 in the operation of the system, including the city-owned subways. The court held: "We assume, as did the Supreme Judicial Court, that the state may confer on one of its subdivisions like a city or town the private priority capacity by which it may acquire contract or property rights protected by the federal Constitution against subsequent impairment by its creator, the state. All we now decide is that even if the city of Boston may invoke the contract clause of the federal Constitution to protect its rights under the lease as against infringing legislation by the Commonwealth, the act of 1918 does not infringe." Boston, under legislative acts of 1902 and 1911, received power to construct subways and tunnels at a cost of $31,000,000 and leased these and others already built to the Boston Elevated Railway Company for a fixed rental until July 1, 1936. The railway got into financial difficulties during the war period, and the Massachusetts General Assembly passed a special act in 1918 to relieve the situation by placing the railway properties under control of a board of five trustees, the state to pay any operation deficit and assess it against the communities served by the railway lines.

Electric Light Poles Erected Without Landowner's Permission Abatable as Nuisance.—Action was brought by the Roxbury Light & Power Company against Perry Dimmick to recover damages for the alleged unlawful destruction of three lighting poles erected on defendant's premises without his consent but, it was alleged, with the consent of defendant's son, who was a tenant on the premises in question. The Delaware County Court in New York State granted a motion for nonsuit and dismissal, pointing out that if a landowner in cutting down poles erected on his land without his permission acted in defense of his ownership or possession and for the sole purpose of preserving and protecting his own rights and property from the acts of a trespasser, he was not liable criminally or for damages. The erection and maintenance of poles on his premises without his consent constituted a nuisance, and defendant was legally authorized to abate the nuisance if he did so in such manner as not to disturb the public peace or put in peril innocent third persons or their property. (196 N. Y. S. 320.)

Is Electric Supply Company Responsible for Destruction by Fire Which Migh Have Been Extinguished Had Pumping Service Not Failed?—An unusual question was raised in Highway Trailer Company vs. Janesville Electric Company. The plaintiff's plant at Edgerton, Wis., was destroyed by fire with a loss of $295,000. This destruction, the plaintiff claimed, would have been in large part averted had not the city's pumping plant broken down because of a sudden cessation of the electrical energy furnished by the defendant, this cessation being caused, it was alleged, by the negligent and unnecessary cutting of a primary wire, notwithstanding that the manager of the Edgerton electric plant had been informed that the city's auxiliary steam pumping plant was not ready or adequate for service in extinguishing the fire. Moreover, it was charged, after electric service was finally restored no notice of this fact was given to the city employees, who therefore failed to resort again to electric drive for the pumps used in fighting the fire. Suit was brought for $250,000. The trial court sustained a demurrer to the complaint on the ground that the plaintiff's cause of action lay against the city, to which alone the company could be held responsible for breach of contract; but the Supreme Court of Wisconsin has reversed this finding and ordered the case tried. (190 N. W. 110.)

Commission Rulings

Service Charge Not Allowed Because Not Understood by Customers.—Admitting that a service charge is both logical and equitable, the California Railroad Commission nevertheless refused to permit the Willets Water & Power Company to apply it to its water customers on the ground that such a charge is not generally understood and has in some instances resulted in distrust and discord.

Discrimination in the Matter of Extensions Prohibited. — An ordinance passed by the City Council of Madison to compel the Madison Gas & Electric Company to make free extensions of its gas service to prospective customers residing in a certain block has been declared by the Wisconsin Railroad Commission to be discriminatory as against those desiring service on streets not covered by the ordinance, in view of the existence of a rule requiring prospective customers to bear a part of the burden of paying for such extensions.

No-Par-Value Stock.—Authorizing an issue of no-par-value stock by the Utilities Power Company, the New Hampshire Public Service Commission said: "We can see no objection to the issuance of such securities by public utilities for proper corporate purposes, provided a record is made showing just what there is back of the no-par-value stock and a reasonable value placed upon it. In this way the book value of the company will not only indicate the fair value of the corporate property but will be in no way affected by the fact that the company has outstanding stock of no par value."

Paying for Rural Extensions.—The Missouri Public Service Commission in adjudicating a complaint brought against the Springfield Gas & Electric Company by a would-be rural customer who refused to comply with the conditions imposed on existing customers held that although as an abstract principle of law a public utility serving a certain community or neighborhood may be required within reasonable limitations to serve all in such territory who may apply, it would be inequitable to require this extension unless applicant should take service under the same conditions as the others. "If the law stands for anything," the commission declared, "it stands for equality, and we fail to see either equality or justice in allowing the progressive and enterprising men of a rural community to bring a transmission line to their own doors for service at a great expense and then allowing other men similarly situated who had refused to assist in this service to come in and obtain the fruit thereof without sharing any of its burdens."

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*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Augustus H. Siegfried has resigned as chief electrician of Los Angeles County, Cal., to enter the consulting engineering field in Mexico.

Lloyd N. Robinson, recently chief electrical engineer for the Merced (Cal.) Irrigation District, is now electrical engineer for Stone & Webster, Inc., at Seattle, Wash.

Arthur C. Ray, formerly assistant treasurer, has been elected treasurer of the Electric Bond & Share Company, and Alexander Simpson has been elected as assistant treasurer.

J. R. Werth, formerly commercial service manager of the West Penn Power Company of Pittsburgh, is now with the Oklahoma Gas & Electric Company as commercial agent at Poteau, Okla.

Dean W. Taylor, formerly power salesman with the Public Service Company of Northern Illinois, is now business engineer for the Wisconsin-Minnesota Light & Power Company, Eau Claire, Wis.

J. A. Adamson, formerly district engineer in the New York office of Lockwood, Greene & Company, engineers, has been appointed manager for the New York office of the John W. Ferguson Company, Paterson, N. J.

Col. John H. Trumbull, president of the Trumbull Electric Company, Plainville, Conn., has been appointed chief of ordnance on the staff of Governor-elect Charles A. Templeton of Connecticut.

S. E. Doane, of the engineering department of the National Lamp Works of the General Electric Company, has just returned to this country on the Baltic after a three months' sojourn in Europe. Mr. Doane sailed in September with M. D. Cooper to investigate the lighting industry on the Continent and in England.

C. G. Brown, professor of electrical engineering in the collegiate department of the School of Engineering at Milwaukee, is now with the General Electric Company in the general engineering laboratory. His work will be in connection with instruments, meters and measurements. Mr. Brown was graduated in 1906 from the Texas Agricultural and Mechanical College with the degree of B.S. in electrical engineering. Previous to his work in Milwaukee he had experience as a commercial engineer for the Bell Telephone Company, as instructor in electrical engineering at Cornell University and in charge of the research and testing laboratory of the Rochester Railway & Light Company. Mr. Brown is a member of the American Institute of Electrical Engineers, the Society for Promotion of Electrical Engineering and the American Association of Engineers.

W. W. Briggs Leaves Westinghouse Lamp Company

Wallace W. Briggs, who has been associated with the New York division of the Westinghouse Lamp Company for the past four years, was recently made vice-president of the United States Gasoline Manufacturing Corporation. Mr. Briggs, who was connected with the Great Western Power Company at San Francisco from 1913 to 1918, has been affiliated with the electrical industry since 1886, when as a boy he entered the arc-lamp department of the California Electric Light Company. Later he became electrician for an Idaho mining company and then joined the sales force of the Fort Wayne Electric Company. In 1899 he entered the sales department of the Westinghouse Electric & Manufacturing Company and six years later became Pacific Coast manager. In 1911 he was appointed assistant sales manager of the Westinghouse company, with headquarters at San Francisco.

W. W. BRIGGS

George I. Wright, until recently associated with the Duluth Edison Electric Company, is now connected with the Illinois Central Railroad at Chicago.

H. M. Short, representative of Marconi in the International Marine Communication Company of New York, has been selected to succeed Arthur H. Morse as general manager of the Canadian Marconi Company. Mr. Morse recently resigned.

G. Stanley Phelan has resigned his position with the Lord Electric Company, Boston, and is now with the E. L. Phillips Company, New York City.

Alexander E. Bauhan, formerly associated with the Pennsylvania Water & Power Company as superintendent of stations, is now in the service engineering department of the Public Service Electric Company, Newark, N. J.

Charles M. McCardle, who has been manager of the Dinuba office of the San Joaquin Light & Power Company for more than ten years, will be transferred to the Fresno office on the first of January, where he will have charge of rights-of-way.

Frederick G. Cottrell of Washington, D. C., has recently taken over the directorship of the nitrogen research laboratory of the Department of Agriculture, formerly under the direction of R. C. Tolman, who has gone to the California Institute of Technology as professor of physical chemistry and mathematical physics.

W. H. Rudisill, who has been for the last eight years connected with the Richmond Light & Railroad Company, Staten Island, New York City, in the capacity of chief engineer, has joined the engineering staff of the J. G. White Company and will sail for Manila, Philippine Islands, in the early part of January to do there work similar to that in which he has been engaged.

M. H. Aylesworth, executive manager of the National Electric Light Association, was the guest of honor at a dinner given by the officials of the Hartford Electric Light Company at the Bond Hotel on Monday evening, Dec. 11. After the dinner Mr. Aylesworth delivered an address to the Connecticut Section of the American Institute of Electrical Engineers on "Electrifying America."

R. P. Schwerin, president of the Federal Telegraph Company, R. R. Beal, chief engineer of the same company, and three assistant engineers recently sailed from San Francisco for Shanghai to commence construction on three powerful radio stations which will enable China to communicate directly with the Pacific Coast. Mr. Schwerin will remain in the Orient about three months. The others in the party will not return until May, 1924.

H. C. Couch, president of the Arkansas Light & Power Company and of the Pine Bluff Company, operating public utilities in forty-five cities and towns in Arkansas, has been elected "potentate" of Sahara Temple, Ancient Arabic Order of the Mystic Shrine. Sahara is one of two temples in Arkansas and has a membership of 1,536. Mr. Couch is president of the Chamber of Commerce of Pine Bluff and a member of the Bankers' Trust Company of Little Rock. He is secretary of the Caddo River Power & Irrigation Company, which will develop hydro-electric power on the Ouachita and Caddo Rivers in Arkansas.

J. L. Kilpatrick Manager Western Electric Installation Department

James L. Kilpatrick, until recently assistant vice-president and assistant general manager of the Bell Telephone Company of Pennsylvania, has been appointed general manager of the newly organized installation department of the Western Electric Company.

Mr. Kilpatrick entered the service of the Bell Telephone Company in Philadelphia when he was nineteen years old and three years later received the position of test operator in the Filbert Street office. Soon afterward he was made special inspector in charge of station inspection. After serving as chief wireman and superintendent of equipment he left the plant department to become engineer of buildings and equipment, a post he held until 1915. When the Philadelphia and Eastern divisions of the plant department were consolidated Mr. Kilpatrick was placed in charge of the larger organization, and in 1916 he was picked to succeed Mr. Hayward as engineer. It was in September, 1919, that Mr. Kilpatrick was made assistant general manager, and in the following year his title was changed to assistant vice-president and general manager.

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M. R. Franklin has accepted a position as electrical engineer with the Gulf Refining Company at Port Arthur, Tex.

Lewis B. Walker has severed his connection with the General Electric Company and is now with the Texas Power Company, Waco, Tex.

R. B. Morton, formerly an electrical engineer with Toltz, King & Day, has joined the engineering department of the St. Paul Gas Light Company.

H. W. Janzen has resigned from the electrification department of the Chicago, Milwaukee & St. Paul Railway to accept a position as sales engineer in the Seattle offices of the Pacific States Electric Company.

E. E. Nash, treasurer of the Peerless Lamp Division of the General Electric Company, has gone to Los Angeles to spend the winter. Mr. Nash is one of the pioneer lamp salesmen of the country and now divides his time between Warren, Ohio, and Los Angeles.

Alfred B. Carhart has resigned his position as vice-president and sales manager of the Crosby Steam Gage & Valve Company to become president and general manager of the Precision Instrument Company, Inc. Mr. Carhart was for more than ten years works manager of the Crosby factory and has had a large practical experience in manufacturing as well as in sales. He is a mechanical and electrical engineer, a graduate of Princeton, and before going to Boston was connected with several successful manufacturing companies in New York. The Precision Instrument Company, Inc., has acquired control of the Precision Instrument Company of Newark, N. J. The company's New York office will be in the Engineering Building, New York. Mr. Carhart will assume his new duties at once.

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E. C. Brandt Made Works Manager of New Westinghouse Plant

E. C. Brandt, works manager of the Westinghouse-Krantz Works, has been appointed works manager of the plant being erected by the Westinghouse Electric & Manufacturing Company in Homewood, Pittsburgh. Mr. Brandt was born in Tarrs, Pa., in 1887 and received apprenticeship training from 1902 to 1904 with the Kelley & Jones Company of Greensburg. In 1905 he entered upon the mechanical training course of the Westinghouse Electric Company and in 1907 began work for the company as a general mechanic and small-tool designer. Since then he has held a number of important positions. He was works manager of the Krantz Manufacturing Company from 1921 until his recent appointment.

Mr. Brandt is a member of the Western Pennsylvania Engineering Society and has written articles for engineering magazines and read papers before engineering societies.

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E. S. Obersdorf, formerly connected with the electrical engineering department of the Foundation Company, New York City, has become associated as electrical engineer with the firm of G. Drechsler & Company, Inc., New York City, engaged in general electrical contracting.

G. A. Sawin, assistant to the manager of the supply department of the Westinghouse Electric & Manufacturing Company, has been elected chairman of the committee on instruments and measurements of the American Institute of Electrical Engineers. He has been a member of the committee since 1920.

R. H. George has acquired **J. E.** Greenwood's interest in the George Construction Company, Inc., together with the equipment of the Greenwood Engineering Company. The business of constructing underground conduits and cables, substations, ornamental street lighting and heavy electrical construction will be continued by the George Construction Company, which will have its headquarters in Philadelphia after Jan. 1.

Omer Brasher, Southeastern manager for ten years of the Federal Electric Company and secretary of the Federal Sign System (Electric), has resigned and will become head of the Omer Brasher Sign Company, with headquarters in Birmingham, Ala.

Allen McR. Harrelson has severed his connection as vice-president of the Galvin Electric Manufacturing Company, St. Louis, and has associated himself with the Dayton Fan & Motor Company, Dayton, Ohio, as chief engineer. He has taken charge of the Dayton company's development program in the small-motor field.

O. D. Street, for some years general manager of distribution of the Western Electric Company, has severed his connection with this company. Mr. Street joined the Western Electric Company twenty-two years ago on leaving college. After a period of training which carried him through all departments, he was placed in charge of telephone sales on the Pacific Coast. Later he became assistant to the president, then general telephone sales manager, then general manager of distribution. Under his administration the Western Electric system has been expanded by the creation of twenty-two additional branch houses, and his very extensive experience with a jobbing business of national scope has gained him recognition as one of the leading authorities on distribution in the electrical industry. Mr. Street plans to remain in New York, where he will organize a company of consulting specialists to deal with questions of management and distribution.

Obituary

Christian Louis Berger, senior member of the firm of C. L. Berger & Sons, makers of engineering and scientific instruments, Boston, died recently. Mr. Berger had long been prominent as an inventor in the scientific instrument field.

C. W. Torrey, superintendent of the Perry (N. Y.) Electric Light Company for ten years, was recently killed by a fall from a transmission tower at Silver Springs. Mr. Torrey was repairing a switch on the tower when he lost his balance and fell.

C. C. Miller of Clermont, Iowa, vice-president, treasurer and general manager of the Northeastern Iowa Power Company, died on Dec. 6 at the age of forty-six years. Mr. Miller started business in 1910 with an old gristmill and a water-power site in a town of five hundred people. At the time of his death he was the active head of an electrical business that covers ten counties in Iowa and Minnesota, serving about 40,000 people in sixty towns.

Thomas L. Small, local manager of the Baton Rouge (La.) Electric Company, died on Dec. 14 after an illness of two months. Mr. Small was very highly regarded throughout the Stone & Webster organization, with which he had been connected since leaving college. He was born at Cambridge, Mass., in 1886, and was graduated from Harvard University in 1910. Starting in the Boston office of Stone & Webster, he later served in the field with the Dallas (Tex.) Electric Light & Power Company and the Savannah (Ga.) Electric Company. In 1919 he was appointed assistant treasurer of the Edison Electric Illuminating Company of Brockton, Mass., and later in the same year became manager of the Baton Rouge company.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic
Problems of the Producer and Distributor, with Market Reports, Trade
Activities, Foreign and Construction News

Competition—Big vs. Small Manufacturers

Price as a Factor in It—The Many Profits of the Large Producer and the Distinct Advantages that the Small Company Enjoys

By J. C. Belden
President Belden Manufacturing Company, Chicago

As in every period of deflation and falling values when business men are forced to readjust their prices and their costs to meet changing conditions, there have been much distress and discussion in the last year over the common effort to maintain established prices and, not being successful, to meet losses by tightening the belt. In many minds price seems to be looked upon as a matter of right or justice, whereas in truth price is in the end but an expression of economic facts and is not influenced by consideration of anybody's personal or corporate interests. Moreover, it seems to be human nature to fashion prices to opportunity rather than to make them a direct reflection of market value.

I am somewhat pessimistic about the possibility of persuading people to be intelligent in figuring prices and courageous in holding to a proper price level. Companies experienced in business will persistently sell their products below a legitimate cost even when their financial situation is such as to make profits extremely urgent. I know, too, that there are new companies just coming into the insulated-wire business today at a time when most of the older manufacturers, having excessive capacity stimulated into existence by war and after-war conditions, are unable to absorb their overhead expenses owing to so much of their equipment being idle. These people are not usually seeking instruction as to how to figure costs or advice regarding their sales policy, but, of course, there always comes a day when they are no longer able to demoralize a market or when they have acquired better policies in the school of experience.

We should regard sound cost making as the fundamental of good price making, and the electrical industry is particularly fortunate in that there is available a uniform system of cost accounting embodying the most advanced ideas in accounting for those electrical manufacturers who want to use it. Prices cannot be made solely with reference to costs, as supply and demand usually dominate the price situation, but the consideration of price should always start with an accurate knowledge of the cost.

J. C. BELDEN

In hard times a manufacturer often faces the problem of how his business can be conducted to lose the least money for a certain period of time. He may elect to sell his output at slightly below cost, thereby earning most of his overhead expenses as against not running at all and carrying overhead expense as a total loss. Such conditions do not last permanently, and the time comes when a legitimate profit can again be obtained.

The large corporations which handle every stage of manufacturing from the basic raw materials to the highly finished product can be the cause of much price demoralization. Such a company performs a sequence of manufacturing operations, each resulting in what may be the finished product of smaller competing companies, and in a poor market it throws off several or all profits until a price level is reached that will get the business. Sometimes the smaller company can only meet this competition by selling at a loss. Such a practice is for the temporary benefit of the consumer, but if the result is the elimination of the smaller companies the consumer usually finds that he has to pay a higher price later.

During every boom in business the little companies multiply and prosper until there is more capital invested than is needed, and duplication of sales, administration and so forth loads on the industry a burden of overhead not needed for the volume of goods produced. This situation in the end will solve itself by fierce competition until the weaker concerns drop out and the balance between supply and demand is restored.

Trend Toward Consolidation

A better solution is by consolidation in the interest of lower cost of production, distribution and superior service to the consumer. When the first large consolidations were effected thirty or more years ago the underlying motive was to control the market and incidentally the price.

Whether the public knows it or not, the man of big business today has given up this idea of controlling prices and most of the big consolidations are in the public interest, because their success is planned on economies in manufacturing, selling and distributing, of which the consumer is the chief beneficiary.

The big companies are not without their handicaps. Often a ponderous routine is necessary to prevent costly mistakes. Inertia grows and imagination deadens in spite of the most aggressive management. Some of the largest corporations with expensive engineering departments have had to depend upon struggling outside inventors for the best development of their own lines.

A SMALL COMPANY'S OPPORTUNITY

There has never been a time in this country when a small business could not be started or operated successfully, given the requisite ingenious and resourceful manager. The small manufacturer has the advantage of quicker initiative and more personal service. He has an exceptional opportunity to specialize on a staple line, concentrating on this one specialty and developing mass production that will enable him to sell below competitors, and the profits of this one department will carry on the business profitably, though other lines may be selling at a loss. For mass production of this kind brings a simpler buying problem, low engineering expense and smaller selling costs. Problems are solved once for all, and though ultimately such a line is forced to branch out, new opportunities for concentrated effort in the mass production of some other line present themselves. The opportunity of the small manufacturer of any line is therefore to specialize in order that less duplication and greater volume of production shall be developed.

If the small manufacturer would prosper, he must (1) excel in personal service, (2) be quick in initiative, (3) know his costs continually and respond promptly to cost facts, and (4) maintain a direct stimulus in his organization to do things right and to work hard.

Price is not all there is in competition by a long way, but it is a factor which must have a basis of fact in knowledge of cost and be regulated with confidence and common sense. If I were to make one suggestion about price making it would be that a manufacturer, after considering the factors of cost, competition and market prices, should determine a price level that, in his judgment, would secure to him his share of business. Then deviation from this price level should not be made on account of the loss of any particular order or particular customer, but only after a general falling off of business proves that the manufacturer's initial judgment was at fault.

Austrian Manufacturer Pictures Lamp Business in Europe

AMERICAN manufacturers who have been disturbed over the unsettled economic conditions in this country can congratulate themselves that they need not battle with the difficulties now being encountered in the manufacture and sale of electrical products in central Europe as described by Josef Kremenezky of Vienna, Austria, to a representative of the *Electrical World* last week. Mr. Kremenezky is of the firm of Joh. Kremenezky, with factories in Vienna and Budapest. The firm is the largest manufacturer of incandescent lamps in Europe, producing an exceedingly extensive line of "Mazda" lamps, including miniature lamps and decorative tree lights as well as the larger commercial units. He has been visiting at Nela Park, Cleveland.

Owing to the present socialistic tendencies of the Austrian government, according to Mr. Kremenezky, it is impossible to enjoy a profit on domestic sales of manufactures which are also exported to other countries. For the privilege of exporting beyond the frontier, lamps sold within Austria must be priced at varying degrees below cost. As a result before the manufacturer can begin to enjoy a profit, it becomes necessary to sell at export a sufficient quantity of lamps to repay the enforced loss on domestic consumption. The Joh. Kremenezky factories market the larger part of their output in Italy, Switzerland, the Balkan states and Turkey, and they are now making extensive shipments to Russia. Owing to the instability of the Austrian currency it is impossible to price goods in Austrian values, and all export and domestic business is being done in some foreign money that is dependably stable. Business with Italy and the Balkans is figured in Swiss francs. Sales to Russia or Germany are commonly reckoned in guilders of the Netherlands. "Russia," Mr. Kremenezky says, "appears to have no lack of ready money and buys in cash on delivery at the frontier." Shipments to other unstable countries are all made on the same terms.

It has become impossible for Austrian manufacturers to carry any stock of manufactured goods, because of the doubtfulness of future values. It is necessary to have on hand about three months' stock of raw materials, because the sources of supply are unreliable under existing conditions, some of it being brought in from Germany and other European countries. Labor supply is adequate because the needs of the laboring people are great. As an inducement for the starting of new factories, the Austrian government has made it practically impossible for any manufacturer to protect his patent rights. Small concerns may engage in the manufacture or the refilling of incandescent lamps, for example, without regard to the patents held by Joh. Kremenezky, and the government takes the position that work must be provided and does not consider the fact that this kind of wildcat competition reduces the ability of the established manufacturer to provide work for his force. The only way to exercise any control or guidance over the upstart factories is to issue them licenses under the governing patents and endeavor to assist them to higher standards of product.

"No building is being done in Central Europe," Mr. Kremenezky says, "and the lamp business is being restricted entirely to the providing of replacements." Business is extremely difficult, but by making their calculations in terms of selected currencies that have a stable value, manufacturers are carrying on the work of supplying the commodities which industry needs and believe that gradual economic restoration must eventually come.

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Electrical Jobbers Adopt a Code of Ethics

"BELIEVING that the complications arising in modern business competition from differences of talent, character or custom can be to a considerable extent overcome if those who are engaged in the same line of business will publicly acknowledge and then endeavor to live up to a system of basic principles of right action," the Electrical Supply Jobbers' Association, at its convention in Cleveland, adopted the following "code of ethics" "as a guide to those who are now or may hereafter become engaged in the business of jobbers and distributors of electrical materials":

SECTION 1. It is the function of a jobber to provide the most efficient yet most economical means for offsetting the natural obstacles which oppose direct communication between the producer and the consumer of electrical materials.

SECTION 2. Realizing that the function of a jobber is entirely that of service in one form of other, we recognize also that the measure of our success will be determined by the degree to which the service rendered by us affects favorably the safety, convenience and contentment of the public, to whom, in the final analysis, it is addressed.

SECTION 3. Second in importance only to our duty to the public we acknowledge our duty to the electrical industry, of which we must hold ourselves worthy representatives.

SECTION 4. In accepting recognition as an important and inseparable branch of a great industry, we acknowledge the resulting responsibility that we must by careful study attain a sympathetic understanding of (a) the functions performed by all other branches of the electrical industry, (b) the problems with which such other branches find themselves confronted, to the end that we may intelligently and effectively support any effort which has for its object to increase the ability of the entire industry to serve the public more efficiently and economically.

SECTION 5. Bearing in mind that only through use of the highest quality of electrical materials can the public be properly safeguarded, and consistent with our desire to be representative of the highest type of business enterprise, we shall purchase and sell only materials which we believe are representative of the safest and most widely approved practices in the industry.

SECTION 6. Knowing that permanent success in any line of human effort comes only to those who develop their talents, character and business in accordance with the laws of honor and fairness, we shall endeavor to be guided by those standards, always recognizing that a simple but infallible guide to right action is found in the practice of measuring all our own words and actions by what we would wish others to say or do if positions were reversed.

Survey of Business Conditions

Miniature Lamp Sales 83,000,000 in 1922

Estimated sales of tungsten-filament lamps, excluding the miniature type, in the United States during the year 1922 total 205,000,000, 3,000,000 more than in 1920, the record year, and 45,000,000 more than in 1921, according to the General Electric Company. Sales of carbon filament lamps are estimated to have been 4,000,000, as compared with 63,000,000 in 1907, the year in which they reached their maximum sales and in which the tungsten type first began to be marketed.

Approximately 83,000,000 miniature lamps were used during 1922. Of these 58,000,000 were of distinctly automobile type, while the consumption of flashlight lamps was about sixteen million. Eight million were used for Christmas-tree lighting outfits and the other million represented those used for miscellaneous purposes. There was also a considerable increase in the application of the small incandescent electric lamps operated by storage battery.

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Heavy Buying of Radio Helping Rectifier Market

The resumption of heavy buying in the radio market has acted as a tonic on rectifier sales. Present sales of rectifiers are approximately three times greater than they were six months ago, according to a leading manufacturer in the field. He says that the slump in the radio market which occurred six months ago lasted until the first days of August. After that date his products began to move in larger volume.

Deliveries are prompt and they promise to remain so because of the large stocks left over and accrued during the recent depression in the market. The outlook for the rectifier market for the next six months is exceedingly promising, says this manufacturer, and December sales sheets are much larger than those for April, in which month sales were more than double those of the entire year of 1921.

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"Specialty" Transformer Business Very Active

Aside from the present active demand for power and distribution transformers, business is thriving in smaller and varied outfits for bell ringing, night lighting, instrumental service, radio work, street lighting and auto-transformers for balancing three-wire circuits and other applications.

Some manufacturing concerns devote themselves almost entirely to these specialties, and the general trend of business is upward in harmony with improved conditions the country over. There appears to be little difficulty in obtaining wire and insulation for manufacturing specialty transformers in localities not handicapped by distance from sources of raw material; but the steel situation is causing some trouble. In case material other than that specified is shipped to a small transformer manufacturer, for instance, it is difficult to obtain anything like prompt correction. Railroad deliveries are slow, but express shipments are being utilized under pressure to get out orders, and the comparative lightness of these specialty units makes this less burdensome than would be the case with large transformer equipments.

Labor is very actively employed in the transformer manufacturing field, and the incentive to utilize modern machinery was never stronger. Barring deliveries in the steel industry, the situation is favorable to further expansion of trade.

Attachment Plug Sales Are in Great Volume

Present sales of attachment plugs are in great volume, the month of November running far ahead of the month of July, the peak month of the summer of 1922.

In speaking of prices one manufacturer says that the general trend of prices during the past year has been downward. During the summer some of the better grades have been reduced from 15 to 20 cents. No increases in present quotations are looked for for some time to come, unless, as one manufacturer states, there is a decided stiffening in price of raw materials. Although some advances have recently been made in the raw-material market, manufacturers are trying to take care of this added cost by bringing the efficiency of production to the maximum possible.

In giving an outlook for the 1923 market a manufacturer states: "I look for a fairly good market for the next six months. I base my prediction on the fact that Christmas sales of appliances are selling very actively, and also on the fact that the better grades of plugs which are now holding the market are becoming more widely known and used. There is, however, going to be some very stiff competition. The manufacturer who has the best article, the best sales organization, together with attractive prices, will be the one to get his rightful share of the sales. I might call attention to one regrettable point; that is, the fact that both jobbers and dealers are buying plugs on price alone. They seem to care nothing for quality, but only for a cheap article which will sell rapidly and in which their salesmen can interest their customers, leading the way to the sale of more profitable merchandise."

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Sales of Inclosed Switches 50 per Cent Over June

Sales of inclosed switches are running about 50 per cent higher than they were six months ago and are constantly increasing. Manufacturers attribute this to the increased industrial activity and larger purchases by jobbers in view of expectant price increases. In spite of greatly increased production by some manufacturers, there are reports that they are forced to quote on longer deliveries, and the prospect for shorter deliveries is not very favorable. Raw materials are increasingly hard to secure, making it impossible for manufacturers to increase their production schedules quickly.

Prices have not advanced recently, although there are tendencies for stronger quotations in view of the higher prices for labor and raw materials and because of the increased demand.

Present sales of safety switches are approximately 30 per cent higher than they were six months ago. The main factor which has influenced this increase is the standardized entrance-switch business which has recently been created owing to central-station companies in Chicago and other large cities requiring the installation of these devices on their lines.

Deliveries are running about thirty days. A leading manufacturer says that this situation is not very good, but cannot see any improvement unless deliveries of raw material become unexpectedly better. Business in safety switches is expected to improve during the next six months owing to the increased use of standardized switches and because of the contemplated increase in building activity which has been reported in recent weeks. There have been no changes in prices recently and manufacturers state that they do not anticipate either advances or declines.

Outlook for Transformer Business

Thinks Demand for Step-Down Units Will Exceed Business in "Step-Ups"—Supply of Materials Seems to Be Reasonably Satisfactory

BY M. O. TROY
Manager Transformer Sales General Electric Company

THE transformer business of the United States, and in fact of the world, is of such magnitude and so diversified that it is difficult to generalize upon it, and to make comments that have much significance requires that we deal with the manufacture, production and statistics by classes.

Broadly, transformers are divided into two classes—large power transformers—that is, transformers above 500 kva.—and small power and distribution transformers—that is, transformers of 500 kva. and less. This is the division established by the manufacturers and the apparatus committee of the National Electric Light Association. But a more general classification commonly made in every-day discussions of the business is to divide the sales and product into three general groups—namely, first, large power transformers used distinctly for transmission purposes—that is, the large step-up and step-down units; second, intermediate capacity, used for the smaller substation and step-down work, particularly for industrial undertakings; third, distribution transformers, used chiefly for lighting and small power purposes.

Last year was marked by a tremendous volume of business in large, chiefly high-voltage, transformers for transmission purposes, the average size and voltage being high. The intermediate class, which finds its application largely in industrial undertakings, developed only a moderate business. This, however, was as might be expected, because our industrial business has not, generally speaking, developed far beyond the capacities created and set up by the 1919 expansion.

SALES LOWEST IN JUNE, 1921

The distribution transformer business of 1921, while not so large as that of 1919, made a favorable showing in many respects. The low point of the sales curve in this business was reached in June of 1921; business bumped on the bottom for a few months, but in October it began to show unmistakably an upward trend, and the growth has been persistently upward ever since, with the usual saw-tooth effect. This gradual building up of the business has given manufacturers an opportunity to handle it efficiently—to man their factories, procure their supplies of materials and in a large measure to build up their stocks to meet a growing business of more or less uniformly sustained demand; whereas the irregular demand for large power transformers resulted in very difficult manufacturing conditions. Some months would show comparatively little business, and then possibly two months would show a veritable avalanche of orders.

MANUFACTURING SITUATION IS WELL IN HAND

The manufacturing situation on the whole is good, though some stress has been experienced in taking care of the irregular demand for large power transformers.

The generator business booked for 1922 has been large. While to some extent the transformer complement of this generator equipment has been purchased, it is not generally true that the step-up units for generators have been bought. It is reasonable to expect, therefore, a sustained demand for large step-up units in 1923. What is true of the large step-up units is more strikingly true of the large step-down units. Just where and how the step-down units will be installed in many instances is undecided, and the demand for transformers of this class should in 1923 be even greater than the demand for step-up units.

The industrial business, so far as transformers are concerned, has been comparatively small. Before the large turbines sold in 1922—the large step-up and step-down units, either installed or to be installed—take their loads we must have an expansion of our industrial business. I look for a very substantial expansion of business in transformers for industrial application in 1923. These take in the upper range of so-called distribution transformers, 100 kva. to 200 kva., and extend through the range of small power transformers, 1,000 kva. to 1,500 kva.—sometimes 2,000-kva. units, which give a 6,000-kva. bank.

SHOWED WHOLESOME GROWTH

The distribution-transformer business, while not large in 1922, showed a very wholesome growth, and this expansion will undoubtedly continue in 1923. While distribution-transformer business is to some extent affected by the industrial situation, it is more particularly influenced by building programs or by the wiring of unwired buildings. Building operations showed a large expansion in 1922, but what seems to be a still more important factor to the electrical industry is that house-wiring programs are being taken up in real earnest in many communities where the percentage of wired homes is still lamentably small.

The new building programs for 1923, the wiring of unwired buildings and the expansion in industrial business all foretell a very substantial volume of distribution-transformer business for the forthcoming year.

To summarize, I expect in 1923 a moderate increase in large and high-voltage transformers over the business of 1922, a very substantial increase in the moderate-capacity transformers used for industrial undertakings and a sustained and increasing business in distribution transformers. The manufacturing facilities of the country on the whole seem adequate to meet this situation, though deliveries may be somewhat slow on the larger sizes. The supply of materials seems to be reasonably satisfactory, though delays and difficulties are experienced in transportation. Unless some factor in our domestic or international affairs not at present in evidence changes the general trend of business, we can confidently look forward to a good transformer business for 1923.

The Metal Market

Domestic and Foreign Demand Unusually Good—Brass and Wire Mills Buying Heavily

Domestic and foreign demand for copper is unusually good. Brass and wire mills have been buying heavily during the last few days and are still willing to take large tonnages at 14¼ cents, although as yet reluctant to pay 14⅜ cents. Producers are in general unwilling to sell at under 14½ cents delivered. Producers feel confident of 14½-cent copper early this week in the domestic trade.

NEW YORK METAL MARKET PRICES

	Dec. 13, 1922 Cents per Pound	Dec. 20, 1922 Cents per Pound
Copper		
Prime Lake	14.00	14.25
Electrolytic	14.00	14.00
Lead, Am. S. & R. price	7.10	7.10
Antimony	6.50	6.40
Nickel, ingot	36.00	36.00
Zinc, spot	7.25	8.25
Tin, Straits	37.00	37.25
Aluminum, 98 to 99 per cent	22.00	22.50

High-Tension Equipment Reported Brisk

High-tension equipment manufacturers in the Chicago territory are reporting very good orders on a rising market. One firm sold one 66,000-volt, 6,000-kva. substation to an Eastern utility and three 33,000-volt, 600-kva. substations for the Far West during the last week. Another company reports that it has received a steady volume of high-tension fuse orders, while still another firm is filling an order for switchboard fittings for a utility on the Pacific Coast.

New England Collections Are Slightly Better

Improved conditions are reported in New England collections this month, although gains are not remarkable. Jobbers state that the railroads serving the more populous section of New England are settling their accounts more promptly; central stations and large industrial plants are handling accounts well, and some improvement can be seen among smaller industrial plants. Contractor-dealer collections are about the same, and business is so active that some of the delays are due to oversight. Representative houses report that from sixty to seventy-five days is being required to settle many accounts. Money is much easier to obtain than earlier in the year, and underlying confidence in the business outlook is widespread.

Steel Deliveries Affecting Welding Machine Schedules

Manufacturers of electric welding machines are having some trouble in keeping up with their production schedules because of short deliveries of steel, says one leading maker in this line in the eastern territory. Although the volume of present sales is approximately that of six months ago the deliveries of welding machines are no longer than normal.

Prices have not changed. Of course it is true that some refinements in production have been accomplished, and these refinements would allow certain reductions in prices, other things being equal. But the increased efficiency in production has been offset by the arbitrary rise in some factors entering into the manufacture, so that price levels for welding machines remain the same.

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

SALES of appliances are usually heavy, and in some sections manufacturers and jobbers report very low stocks. Our Denver correspondent states that appliance sales in his territory are higher than for the corresponding period of 1921. It is reported in some sections of the Central States that conduit stocks are much improved, mills making better deliveries. Several heavy orders for weather proof wire are reported for the week, one jobber being asked to bid on 100 miles of this material. Sluggishness is reported in the loom market. Stocks of loom are very heavy in New England. Switches and fuses are showing considerable life.

New York

Wiring Supplies Improved—Lamps Are Selling Actively—Motor Prices Generally Are Firm

Both jobbers and manufacturers report very heavy sales of appliances, particularly in washers, cleaners, toasters, percolators and irons. Other holiday goods are moving in heavy volume. Smaller motors are improving, and there is some pick-up in the larger sizes. Construction is progressing, and heavier orders are proceeding to the industrials.

Wiring Supplies.—Fuses and switches are moving better. Porcelain is receiving better attention. Stocks generally are ample. Prices are firm.

Lamps.—Some increase in lamp sales is reported by three jobbers in the metropolitan area. Some replacement business of importance is noted, and a good amount of the better grades is going to the recently constructed homes in Long Island and Brooklyn. Lamps for signs are slow.

Motors. — Improvement is reported for the fractional-horsepower sizes. Prices generally are firm. Second-hand dealers' activities are causing little worry.

Chicago

Cold Weather Slows up the Demand for Wiring Material—Christmas Appliance Call Active

A week of intense cold has dulled the building construction pace set up during the fall, and jobbers report a falling off in the demand for wiring materials. This slump is counteracted by the active Christmas buying of electrical merchandise. All types of appliances are moving briskly, and jobbers are pleased with the movement but state that surplus stocks by Christmas time will be scanty. Pole dealers declare that November was an active month but that the seasonal drop in demand is starting.

Conduit.—Although the demand has eased off slightly, the supply is still low with firm prices.

Flexible Armored Conductor.—The movement of this conductor has remained quiet for some time. Stocks are good.

High-Tension Equipment.—Active sales are again reported by manufacturers. One firm sold three 37,000-volt steel-tower outdoor substations, rated at from 600 kva. to 1,200 kva., to a Middle Western utility. Another company reports a sale of thirty-six lightning arresters rated at 70,000 volts to a utility in California. A Pennsylvania utility placed an order for 22,000-volt indoor sub-station equipment with another concern.

Poles.—The pole market remains unchanged, with a tendency toward a seasonal slump. Prices are firm and stocks are ample for winter requirements.

Cross-Arms.—Seasonal variations are causing a decreased demand for this material, but prices remain firm.

Heating Appliances.—Call for these appliances is developing and stocks are moving rapidly. Although stocks were good, jobbers report that should the present rate of buying continue the appliance carry-over will be small.

Boston

Smaller Sizes of Motors Moving Well—Conduit Stocks Low—Appliance Business Improved

Business is steadily improving in New England. Jobbers' stocks are greatly reduced in many lines. and buying is held down on account of the desire to show low inventories on Jan. 1. Deliveries are irregular on supplies from outside New England, but very good from local electrical manufacturing plants. Building operations are running far ahead of last year and the usual winter slump has not been in evidence. Prices are firm. Inquiries are developing in both industrial and public utility fields, and there is fair buying of line material even at this season.

Motors.—Good business is reported in fractional-horsepower motors for use in oil-heating installations. Sales are on the whole improving in integral-horsepower motors. Motor stocks are in very fair shape, and at present the second-hand market is not causing much disturbance. Stocks of used motors have been pretty well liquidated of late. Prices are firm.

Wire. — Inquiries are active for weatherproof this week. One jobber being asked to bid on 100 miles of this material. Sales of rubber-covered wire are holding up in excellent volume. Bare is dull.

Loom.—The market has fallen flat for this material compared with metallic conduit. Stocks are more than ample and price movement sluggish. Some up-country orders filter in now and then.

Rigid Conduit.—Jobbers' stocks, if plotted from day to day, would show severe fluctuations. Carload arrivals are quickly absorbed by building operations, and broken lines are widely prevalent. The demand is healthy, and if deliveries were reliable, there would be little cause for anxiety with the present volume of business.

Vacuum Cleaners.—Sales are improving and deliveries are on a very satisfactory basis. Six medium-sized central-station companies sold forty-eight cleaners last week in their appliance departments, indicating a steady demand considerably ahead of the demand for other larger appliances.

Wiring Supplies.—Knobs and tubes are dull this week. Sockets are active and in good supply. Switches are moving better and fuses are showing considerable life, with large stocks. Manufacturing facilities are readily meeting current requirements, and there is not much buying to build up jobbers' stocks.

Pole-Line Hardware.—Deliveries are giving trouble, notwithstanding a demand of moderate size. Stocks are spotty and shortages frequently reported. The situation is not serious but is a bit burdensome. Cross-arms are in good demand.

Atlanta

Holiday Trade Holding Up Well—Cold Weather Helping Heaters—Conduit Prices Steady

The holiday trade continues to hold up well, despite inclement weather conditions which have served to slow down retail sales. There is a noticeable number of inquiries by manufacturing establishments regarding the location of new plants throughout the section which, if they develop, will mean considerable heavy construction in the early spring months. The school building program in Atlanta is well under way and employment is at a high ebb, thus serving materially to stimulate retail trade through the additional buying power of the general public. Stocks of electrical holiday goods are considered adequate to meet the demands, but little carry-over is expected.

Air Heaters.—A recent cold snap has caused a slight pick-up in the movement of air heaters, though there had been but few sales up to that time on account of unusually warm weather for this season. Jobbers are well stocked and have no fears regarding the movement. There is a tendency toward price cutting in this line.

Heating Devices.—Heating devices in general show a good volume of sales, with flatirons and waffle irons leading in popularity. Jobbers' and retailers' stocks are ample to take care of the holiday demand. Prices are steady.

Porcelain.—A fair but steady demand is reported, with sufficient stocks in the territory to meet requirements in sight.

Christmas-Tree Outfits.—Sales are beginning to pick up and dealers are anticipating a satisfactory movement from now until Christmas. Jobbers have allowed stocks to run low to prevent carry-over, but no shortage is expected.

Rigid Conduit.—Building activities continue to hold up the volume of sales in this line and there is little prospect of the movement slowing up for some time. The general shortage that existed for some time has been overcome, and prompt shipments are responsible for stocks being in fair to good shape. Prices are steady.

Sewing Machines.—This line continues slow, with a tendency on the part of electrical jobbers to discontinue the handling of this class of merchandise.

St. Louis

Wiring Supplies Moving Slower—Good Sales of Substation Equipment—Lamps Selling Actively

As a result of the conservative stocks of merchandise carried by dealers and the very active holiday demand, jobbers' sales of holiday goods are in greater volume for this time of the year than usual. Retail sales are said to be considerably in advance of last year. General wiring supplies are moving somewhat slower, but power apparatus and high-tension substation equipment are in active demand. Prices show generally increasing tendencies, but stocks are kept down to a conservative basis. There is little disposition to buy to take advantage of the price advances, the preference being to make large turnovers.

Merchandise.—Shipments during the week have restored stocks in those items which were short, and stocks are now good in virtually all lines except portable lamps, sales of which have been especially good. Retail sales are said to be from 25 per cent to 100 per cent better than last year, notwithstanding lower price levels. Washing machines are moving slowly, but vacuum cleaners are enjoying a full share of the business. All classes of hollow ware are much in demand. It is expected that the season's carry-over will be very nominal.

Substation Equipment.—Good sales for the week were reported, and there is much work in prospect. Prices are firm and stocks, with the exception of oil switches, are satisfactory.

Industrial Heating.—A large installation is to be made by the local plant of the American Car & Foundry Company, consisting of sixty 15-kw. rivet heaters to replace oil heaters. Several other concerns are investigating the same proposition and also the proposition of rod heating, for forging purposes. Interest is very keen in all kinds of industrial heating.

Sockets.—Prices are higher by about 10 per cent. Demand, which would normally be falling off this time of the year, continues steady because of the maintained volume of construction work. Stocks are in excellent condition.

Lamps.—The seasonal increase in sales obtains, and prices have been slightly lowered. There is a gradual shift in demand toward the nitrogen-filled types. The new mill-type lamp is finding considerable favor. No difficulty is reported in maintaining satisfactory stocks.

Radio.—The Christmas demand is on in full swing and the total volume of sales for the season will be heavy. No actual shortage of stocks yet exists, but replenishment will be necessary after the holidays.

Cleveland

Wire Demand Continues Fair—Conduit Stocks Recovered Appreciably—Washers and Ironers Active

There has been very little variation in the market other than increasing activity in appliances. Motors are strong and industrial equipment is steady. Firm prices prevail.

Wire.—Demand continues in fair strength, stocks are good and deliveries prompt. No price increases reported.

Conduit.—While stocks have recovered appreciably, demand continues to absorb the supply easily. Prices are firm.

Lamps.—Fair activity continues. Receipts are lower than last week. Stocks are high and prices firm.

Motors.—The smaller sizes have been in good demand. Jobbers report stocks normal and prices unchanged.

Radio.—With the resumption of activity sales have continued to increase each week. Parts of the better grades have been most in demand. Stocks are good.

Heaters.—A sudden change in weather has accelerated heater sales and dealers report stocks decreasing noticeably, although no shortage is apparent. Prices are firm.

Washers.—Both washers and ironers have had a fair week. Dealers have attracted a great deal of the holiday buyers' trade through keen merchandising. Competition is evident, but prices are stable.

Salt Lake City

Vacuum Cleaners in Excellent Demand—Radio Shows Improvement—Bare Copper Wire Advances

Vacuum cleaners are in excellent demand. Electrical toys are also going well. Prcolators and other devices in the hollow-ware line are not moving satisfactorily for the holiday season. The construction program for 1923 includes many large business and industrial buildings. In 1922 building was confined almost exclusively to residences. Beet growers have recently been paid a substantial bonus by the sugar-manufacturing companies. This is having the effect of stimulating business in all lines.

Radio—There has been a sharp pick-up in consumer demand during the holiday period. Dealers are well stocked with sets at a good range of prices. The less expensive apparatus is favored by the trade.

Bare Copper Wire—Stiffening of the copper market has been reflected in a ⅝-cent advance in the price of bare copper wire in the past two weeks. Stocks are ample, with the exception of No. 14, which has lately been called for in excess of supply.

Denver

Appliance Warehouse Stocks Are Low—Christmas-Tree Lighting Outfits Are Selling Better

One manufacturer reports local warehouse stocks of small appliances practically exhausted. Percolators, table stoves, curling irons and vacuum cleaners lead in popularity, although considerable interest is being expressed in washing machines. Christmas-tree lighting outfits are more in demand than last year with stocks of standard sets running low. Although holiday buying has overshadowed the regular business of jobbers, staple lines are moving well. Wire, armored cable conduit and loom stocks are in good shape.

San Francisco

Collections Slower—Lamp Demand Is Very Heavy—Panel Switches Active—Motors Are Slow

Stocks are in fair shape except for conduit and certain schedule material. Collections are slower, averaging nearly sixty days. Credits are tighter and will continue so. Many established firms have been warned to make their own collecting more efficient, and 1922 has been generally signalized by the gradual closing out of firms financially inefficient. The recent government budget provided nearly $2,000,000 for the Mare Island and San Diego navy yards.

Lamps. — Demand is very heavy. Stocks are good. Christmas-tree lamp sales are excellent, far exceeding last year.

Motors.—Demand is rather slack now. Prices are firm and stocks are good. Competition is increasingly keen.

Schedule Material.—Several shortages are reported in staple items. A heavy demand for panel switches for apartment-house buildings is reported.

Conduit.—Stocks are kept low by the increasing demands of the building industry. Prices are stronger.

Portland-Seattle

Jobbers Expect Business to Be 40 to 50 per Cent Heavier Than a Year Ago —Christmas Buying Active

Lumber production for the past week was only 1 per cent below normal, and both new business and shipments were better than the preceding week. Production is being carried forward on a large scale at a time when ordinarily it would be curtailed. Building continues reasonably active for this time of the year in spite of the almost unprecedented cold wave for the past week. Christmas buying is very active. Jobbers report that business will run from 40 to 50 per cent better than a year ago. Stocks in some lines are in poor shape owing to heavy demand and to the fact that large orders are being shipped only in parcel lots. In many cases farm-lighting plants have been very sluggish this sason.

Porcelain.—Knobs, tubes and cleats are only fairly active and prices remain unchanged.

Radio Business—Receiving sets have been quite active recently. This is attributed to some extent to the powerful broadcasting station of the Portland *Oregonian*, the effect on the business caused by this new station bing noticeable both in Seattle and Portland.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Ajax Electrothermic Receives Large European Orders

During the past few months, the Ajax Electrothermic Corporation, Trenton, N. J., has sold through its agents, Cambell, Gifford & Company, London, three 25-kva. high-frequency converters and seven small high-frequency induction furnaces to the following institutions: The National Physical Laboratory, Johnson Matthey & Company, Ltd., refiners of precious metals and the Gutta Percha Company, a firm interested in the making of submarine cable.

The following high-frequency induction furnaces have been sold recently in this country: One 35-kva. equipment to the Silica Products Company, Lowville, N. Y.; two 75-kva. converters and three 100-lb. steel-melting furnaces to the Western Electric Company, Chicago; one 25-kva. converter and two furnaces to the DeBats Metals Company, Bloomfield, N. J.; one 25-kva. converter and two small furnaces to the Bureau of Mines station at Columbus, Ohio; one 18-kva. converter and one furnace to the Mellon Institute of Industrial Research, Pittsburgh, and one 15-kva. converter and one small laboratory furnace to the Lynn Works of the General Electric Company.

Hart & Hegeman Takes Title to Plant of Auto Parts Firm

The Hart & Hegeman Manufacturing Company, Hartford, Conn., manufacturer of wiring equipment and other electrical apparatus, is taking title to the former plant of the Hartford Auto Parts Corporation, Russ and Lawrence Streets, and will use the structure for extensions.

Ingersoll-Rand and Cameron Pump Open Buffalo Office

The Ingersoll-Rand Company, 11 Broadway, New York City, and the A. S. Cameron Steam Pump Works announce the opening of a branch office at 718 Ellicott Square Building, Buffalo, N. Y. This new office is equipped to render full service to those interested in air, gas and ammonia compressors, condensers, oil and gas engines, pneumatic tools, rock drills, centrifugal and direct-acting pumps and other of the numerous products manufactured by these companies.

Frasse Steel Works Appointed Distributor for Sizer Firm

The Frasse Steel Works, Inc., Hartford, Conn., announces that it has been appointed the exclusive New England distributor for the Sizer Steel Corporation, with plants at Solvay (Syracuse) and Buffalo, N. Y., manufacturer of electric carbon, alloy and tool steels, bars, billets and forgings and die blocks.

Cuno Engineering Company Increases Capital Stock

The Cuno Engineering Company, Meriden, Conn., announces that it has increased its capital stock from $50,000 to $250,000.

Federal Storage Battery Leases Alexandria (Va.) Building

The Federal Storage Battery Company, P. O. box 111, Alexandria, Va., has leased a local building and plans the immediate installation of equipment to manufacture electric storage batteries. George W. Carroll is general manager.

J. & B. Manufacturing Absorbs Berkshire Magneto Firm

The J. & B. Manufacturing Company, Pittsfield, Mass., manufacturer of ignition coils and timers, has absorbed the Berkshire Magneto Company, manufacturer of magnetos. The merger became effective Dec. 15 under the name of the Berkshire Products Company.

This consolidation brings together two companies that arose from the Pittsfield Spark Coil Company. The Berkshire Magneto plant will be discontinued and machinery and equipment moved to the former J. & B. plant, which will be enlarged and remodeled to suit requirements.

Colonial Sign & Insulator Firm Changes Name

Owing to the fact that it has entirely discontinued the manufacture of electric signs and sign letters, the Colonial Sign & Insulator Company has recently received authority from the Secretary of State of Ohio to change its incorporated name to the Colonial Insulator Company.

Westinghouse Electric New Plant Will Cost $900,000

The Westinghouse Electric & Manufacturing Company, First National Bank Building, San Francisco, is completing plans for the initial units of its new plant at Emeryville, Calif., to cost $900,000, including equipment. The company engineering department, Union Building, Pittsburgh, Pa., is in charge.

Spencer Turbine Company Increases Capital Stock

The Spencer Turbine Company, Hartford, Conn., has increased its authorized capital stock from $300,000 to $600,000, issuing 6,000 shares of common stock at $50 par value each.

General Electric Has Heavy Orders for Locomotives

The electric locomotive department of the General Electric Company has just completed a survey which shows that the company at the present time has more orders for electric locomotives on its books than at any other time since the beginning of the world war. These orders, it is said, come from all parts of the world and indicate that many electrification projects are under way. The opinion is expressed that the "interest in steam-railroad electrification has been greatly stimulated by the high prices of fuel, labor and commodities."

Domestic orders call for new engines of various types. The Baltimore & Ohio Belt Line, which was electrified by the General Electric in 1895, has ordered two 120-ton electric locomotives, while another order was received from the Sacramento Northern Railway in California for two freight locomotives to be used in heavy interurban freight service.

"Among foreign orders," says a statement issued by the company, "are contracts for locomotives to be installed in Spain, France, Chile, Japan and Mexico. A Mexican order including ten 150-ton 3,000-volt direct current locomotives is the first electrification in that country. The equipment will be installed for the Mexican Railway on the Mexico City-Vera Cruz line and is expected to effect sufficient economies to pay for itself in five years."

Post Glover Electric Company to Rebuild Destroyed Plant

The Post Glover Electric Company, Ludlow, Ky., is planning to rebuild the portion of its electric power plant recently destroyed by fire with loss of $35,000, including equipment. Frank V. Van Winkle is president.

Electric Service Engineering Will Sell Fixtures

The Electric Service Engineering Company, 4337 West Washington Boulevard, Chicago, recently incorporated for $10,000, will deal in electrical lighting fixtures. David M. Charles, Frank E. Starkweather and Alice Murphy are incorporators.

Phelps Electric Company Moves to Larger Quarters

The Phelps Electric Company, Chicago, manufacturer of electric flashing devices and other equipment, has arranged for the removal of its plant from 163 North Curtis Street to 227 West Randolph Street, in order to get increased facilities. The new location will provide approximately 5,000 sq.ft. of floor space.

Walworth Manufacturing Company Business Gaining

Substantial improvement in business during the last half of 1922 has been experienced by the Walworth Manufacturing Company, Boston, according to a statement recently made public by President Howard Coonley. Gross orders are coming at a rate approximating that of 1919 and 1920, and the outlook for 1923 is excellent. At present the company manufactures more than 23,000 separate items. About 25 per cent of the output goes to the building trade, 50 per cent to industrial corporations, and the balance largely to railroad and oil fields. Repair business has been active of late, especially in power-plant supply service.

The company's production, including the Kewanee (Ill.) plant, has now reached about 80 per cent of capacity. Average prices for the products run about 40 per cent below the 1920 level. No expansion in plant capacity is contemplated at present other than the installation of equipment which will permit the introduction of operating economies.

About 10 per cent of the total business is for the export trade, compared with a normal of about 15 per cent. This trade is handled through the Walworth International Company, which also sells on a commission basis the products of six non-competing American manufacturers. The profit from this business materially reduces the sales costs of the Walworth export lines. South America and the Far East are the principal foreign markets for the company at this time.

California Radio Manufacturer Establishes St. Louis Plant

The Radio Shop, Inc., Sunnyvale, Calif., manufacturer of radio equipment, has arranged for the establishment of a branch plant at St. Louis and will be affiliated with the Echo Radio Corporation, 315 International Life Building, St. Louis, recently organized. A. B. Dorman will be manager in charge at this point.

Berchtold Grimm Corporation Will Manufacture Appliances

The Berchtold Grimm Corporation, 209 South State Street, Chicago, recently incorporated by O. E. Brumbaugh, F. E. Grimm and J. F. D. Berchtold, for $70,000, announces that it will manufacture electrical and mechanical appliances and machines.

Terry Steam Turbine Increases Stock to $800,000

The Terry Steam Turbine Company, Hartford, Conn., has filed a certificate with the Secretary of the State of Connecticut, increasing its capital stock from $700,000 to $800,000.

Henry Maurer & Son, Perth Amboy, N. J., manufacturers of firebrick, refractories, etc., have acquired about 10½ acres in East Brunswick Township, to be used in connection with their local works.

The United Lead Company, Perth Amboy, N. J., has work in progress on an addition, 300 ft. x 300 ft., and plans to commence the installation of equipment at an early date.

The Sundh Electric Company, Newark, N. J., has been organized under states laws with a capital of $204,000 to take over the company of the same name prominent in the electrical contracting field, with headquarters at 209 Parkhurst Street. The new organization will specialize in the production of electrical equipment for various service. It is headed by William Deans, W. F. Jeffreys and Louis Larsen.

The Electric Porcelain Company, New York Avenue, Trenton, N. J., will commence the immediate construction of a one-story addition.

The C. J. Litscher Company, Grand Rapids, Mich., manufacturers of electric storage-battery equipment, etc., has tentative plans under consideration for the rebuilding of the portion of its plant, destroyed by fire Dec. 7, with loss estimated at about $200,000, including equipment and stock.

The Fuller Engineering Company, with offices in New York and Chicago, announces that it has moved its main offices from Allentown, Pa., to Fullertown, Pa.

The Electric Vehicle Company, 118 East Tenth Street, Los Angeles, announces the opening of its salesroom at the same address. Several well known models are on display.

Foreign Trade Notes

WATERFALLS IN THE TRANSYLVANIA MOUNTAINS TO BE UTILIZED TO GENERATE ELECTRICITY.—A company, to be known as the Karpathenwerke, has been organized in Hermannstad to utilize the waterfalls in the Carpathian Mountains. It is proposed to develop 125,000 hp.

DEMAND FOR ELECTRICAL EQUIPMENT IN BRITISH INDIA. — Important hydro-electric plants recently placed in operation and others soon to be completed, *Commerce Reports* states, will furnish electricity for the mills in Bombay as well as for street railways and electric lighting systems of the city. These new power facilities should result in an increasing demand for electrical equipment. From reliable sources it is estimated that 130,000 hp. will be utilized in electrification of mills, in addition to the demand for transportation and lighting purposes.

ELECTRICITY SUPPLY SCHEME FOR ROCKHAMPTON, AUSTRALIA, PROPOSED.—The City Council of Rockhampton, Australia, is considering an appropriation of £100,000 for various purposes, including an electricity supply scheme.

HYDRO-ELECTRIC DEVELOPMENTS UNDER WAY IN GERMANY.—In addition to the large Bayernwerk scheme to develop the waterpower resources of Bavaria, Germany, on a large scale, a number of smaller projects are under way, including an installation on the Inn River, near Muhldorf, by the Inwerk-Bayrische Aluminum Gesellschaft. Another is on the Waginger See in Upper Bavaria, where it is proposed to develop a maximum of 7,000 hp. A third is on the Main River near Oberwallenstadt, which is nearly completed. Both of these projects are owned by the Munich Gesellschaft für Licht und Kraftversorgung.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Sweden (No. 4,692) of electrical coffee grinders, electrical fittings, etc.

Purchase is desired in Mexico (No. 4,693) of a complete outfit for radio-telephonic instruments, capable of receiving messages up to 800 miles.

An agency and consignment is desired in Belgium (No. 4,694) for meters for electricity, gas and water, etc.

Purchase is desired in South Africa (No. 4,698) of electrical apparatus, wireless apparatus and novelties, including devices for advertising.

An agency is desired in Australia (No. 4,704) for electrical equipment, including transformers, insulators and instruments.

An agency is desired in Norway (No. 4,706) for wireless-telephone apparatus.

An agency is desired in Spain (No. 4,710) for small electric egg beaters, for use at soda fountains.

Purchase and an agency is desired in India (No. 4,726) for electrical apparatus, brass and copper rods and tubes, boiler fittings, etc.

Purchase and agency is desired in Austria (No. 4,743) for automobile accessories, such as lighting systems, electric starters, etc.

Purchase is desired in Mexico (No. 4,749) of wireless-telephone systems and apparatus.

An agency is desired in Switzerland (No. 4,754) for electric refrigerators for residences.

Purchase is desired in Spain (No. 4,755) of small electric heaters for home use and electrical machinery and apparatus of all kinds.

PROPOSED HYDRO-ELECTRIC PROJECT AT HUAMPANY, PERU.—The construction of a canal 3.8 miles long from the tailrace of its Yanacoto plant to a proposed hydro-electric station at Huampany, *Commerce Reports* states, is under consideration by the Empresas Electricas Associades. The proposed plant will operate under a head of 352 ft. and will be equipped with three units of 1,000 hp. each, all reaction turbines.

PROPOSED ELECTRIC PLANT IN FRANCE.—Plans are under way by the Société de Forces Motrices du Haut-Rhin, according to *Commerce Reports*, for the construction of a hydro-electric station on the Rhine at Kembs. The plans provide for the development of 80,000 hp., to be used in the Mulhouse district.

A CONCESSION GRANTED TO UTILIZE WATER POWER OF BREMO RIVER, ITALY.—The Società Forze Idrauliche Alto Brembo has been granted a concession to utilize the waters of the upper part of the Bremo River to operate five hydro-electric plants, to develop a total of 35,668 hp.

AN UNDERGROUND CABLE TO CONNECT PARIS AND STRASBOURG, FRANCE.—An underground cable line for telegraph and telephone service, *Commerce Reports* states, is to be laid between Paris and Strasbourg. The cost is estimated at about 100,000,000 francs.

New Apparatus and Publications

BACK-PRESSURE VALVE.—The H. S. B. W.-Cochrane Corporation, Seventeenth Street and Allegheny Avenue, Philadelphia, is distributing a leaflet describing the "Cochrane" motor-operated back-pressure valve, arranged for remote control.

OILED TUBING.—The Mica Insulator Company, 68 Church Street, New York City, is distributing a leaflet calling attention to its "Empire" oiled tubing for radio insulation and for the electrical industry in general.

WATT-HOUR METERS. — Bulletin No. 20 issued by the Sewickley Electric Manufacturing Company, Sewickley, Pa., describes and illustrates the "Semco," model 1, watt-hour meters.

SYNCHRONOUS MOTORS — "Synchronous Motors for Ammonia Compressor Drive" is the title of a booklet published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., which calls attention to the advantages of electrically driven ice plants and gives illustrations of installations in ice-making and refrigerating plants, packing houses, etc.

ELECTRIC COFFEE URN. — Landers, Frary & Clark, New Britain, Conn., have recently added to their line a complete table service, including an electrically equipped "Farmington" pattern coffee urn and accessories.

SUSPENDED ARCH.—Bulletin No. 102 issued by the American Arch Company, Inc., metallurgy and power department, 17 East Forty-second Street, New York City, describes and illustrates the "American" suspended arch.

INSULATORS. — The Locke Insulator Corporation, Victor, N. Y., is distributing bulletin No. 1, catalog No. 25, covering its strain insulators for guy dead-end and anchor service.

RADIO BATTERY POTENTIOMETER. —The Cutler-Hammer Manufacturing Company, Milwaukee, has recently placed on the market its new C-H radio "A" battery potentiometer.

MICARTA GEARS. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a twenty-page booklet, folder No. 4,506, entitled "Salient Facts on Silent Gears," in which it describes the advantages of the use of "Micarta" gears and pinions.

New Incorporations

THE M. B. LIGHT & POWER COMPANY has filed articles of incorporation with a capital stock of $100,000 to generate and distribute electricity for lamps, heaters and motors. The directors are Albert J. Moses, Jesse M. Moses and Charles H. Colville, Oneida, N. Y.

THE DIXIE ELECTRIC LINE COMPANY, Greenwood, S. C., has been chartered with a capital stock of $1,000 to distribute electricity. The officers are R. A. Wash, president; R. A. Ellison, vice-president, and M. G. Bowles, secretary and treasurer.

THE DUNCAN ELECTRIC COOKER COMPANY, Hammond, Ind., has been incorporated with a capital stock of $250,000 by W. A. Duncan, B. Bracher, J. B. Horton, N. M. Duncan and Donald Campbell.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LOWELL, MASS.—Plans are being prepared by the Lowell Electric Light Corporation in conjunction with Stephen Kearney, city engineer, for a new ornamental lighting system on the new river boulevard from Bridge Street to the Dracut line.

SPRINGFIELD, MASS.—The United Electric Light Company has been granted a permit to erect an addition to its building on Myrtle Street.

COS COB, CONN.—The New York, New Haven & Hartford Railroad Co. is planning to install an additional turbo-generator at its local plant.

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Middle Atlantic States

BROOKLYN, N. Y.—The Brooklyn Edison Company plans to call for bids in January for general contract for its proposed generating plant on Marshall Street, to cost about $1,000,000. Thomas E. Murray, Inc., 55 Duane Street, New York, is engineer.

MONROE, N. Y.—The Orange & Rockland Electric Company has petitioned the Public Service Commission for authority to issue $185,600 in capital stock for extensions to its system, including the installation of an electric lighting system in Tuxedo, to add a three-wire circuit to Highland Falls, and a new substation in Highland Falls, and to erect an interconnecting transmission line from its power plant to the line of the Rockland Light & Power Company in Hillburn, a distance of 13 miles, the latter to cost about $95,800.

NEW YORK, N. Y.—The Navy Purchasing Officer, South and Whitehall Streets, has been authorized to purchase two double-pole circuit breakers (N.S.A.F. req. 94½) and twelve switchboard panels (N.S.A.F. req. 101½).

OWEGO, N. Y. — The Owego Light & Power Company has contracted with the Binghamton (N. Y.) Light, Heat & Power Company for electricity for local distribution. A new transmission line to Sayre, Pa., will supply the service.

WESTFIELD, N. Y. — Extensions and improvements are contemplated to the municipal electric light plant, including the installation of a 1,000-kva. switching tower and transformers, a 625-kva., 25/62.5-cycle frequency changer and a new switchboard. Harry Mettendorf is superintendent.

CARTERET, N. J.—The local plant of the Public Service Electric Company was recently damaged by fire.

HILLSDALE, N. J.—Steps have been taken by the Civic Association of Hillsdale Association to secure improvements to the electric lighting service.

PEMBERTON, N. J. — Bonds to the amount of $20,000 have been authorized for a municipal light and power plant.

SERGEANTSVILLE, N. J.—The New Jersey Power & Light Company is planning to erect a transmission line in Delaware Township, with distributing systems in a number of towns. A franchise has been asked.

SPOTTSWOOD, N. J. — The Borough Council is considering granting a franchise for the establishment of an electric light plant here.

ALLENTOWN, PA.—A power house will be built in connection with the proposed locomotive and car shops to be erected here by the Central Railroad of New Jersey, 143 Liberty Street, New York, to replace present shops at Ashley and Mauch Chunk.

BLOSSBURG, PA.—The property of the Blossburg Electric Light & Power Company is said to have been acquired by capitalists of Harrisburg, said to be associated with E. L. Phillips & Company, New York, which recently acquired the plants at Hornell and Warsaw, N. Y. The construction of a plant, to cost about $1,000,000, in Blossburg, at the mouth of the large soft-coal mines here is reported to be under consideration.

CHAMBERSBURG, PA. — The Business Men's Association is preparing plans for improvements to the lighting system.

KITTANNING, PA.—Preliminary plans are being prepared for a hospital and power house to cost about $250,000, for the Armstrong County Community Hospital. Crow, Lewis & Wick, 200 Fifth Avenue, New York City, are architects.

PHILADELPHIA, PA. — The Philadelphia Electric Company contemplates increasing the output of its power plant at Beach and Palmer Streets by 90,000 kw.

PHILADELPHIA, PA.—The City Council has approved an appropriation of $160,000 for the installation of a power system and tunnels at the Institution for Feebleminded at Byberry. The installation of a 50-ton refrigerating plant for the City Hospital has been authorized. F. T. Armstrong, Room 316, City Hall, is purchasing agent.

PHILADELPHIA, PA. — Motors, controlling devices and other electric equipment will be installed in the printing plant to be erected at Thirty-fourth and Market Streets by the Stephen Greene Company, Sixteenth and Arch Streets, to cost about $500,000.

PITTSBURGH, PA.—The Night Hawk Peninsular Mines, Ltd., James R. Dodworth, 323 Fourth Avenue, chairman of the board, plans to build a hydro-electric plant at its mining properties early in the spring. Electric mining equipment will also be installed at the properties.

WHITE HAVEN, PA.—Application has been made to the Public Service Commission by the White Haven Power & Light Company, recently organized, to furnish electricity for lamps and motors in White Haven.

BALTIMORE, MD.—The Petroleum Export Company, Equitable Building, will install electric power equipment in connection with its proposed new oil-refining plant, to cost about $400,000.

BALTIMORE, MD.—Bids will be received by the Board of Awards, office of the City Register, until Jan. 3 for a quantity of ornamental iron lamp posts. John J. Hanson is superintendent of lamps and lighting.

BALTIMORE, MD.—Plans are being prepared by James Farnam, 114 West Eighteenth Street, Chester, Pa., for a one, two and four-story industrial plant, with power house, at Baltimore, totaling 165 ft. x 325 ft., for a company whose name is temporarily withheld.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company plans to erect a generating plant at Dundalk, where a site has been acquired. Plans are under way for the construction of a number of electric substations in 1923, to cost $1,380,000. Transmission and distributing lines will be extended.

MILTON, W. VA.—The Milton Electric & Telephone Company, recently organized, plans to install a local system. William Sutherland is interested in the company.

PARKERSBURG, W. VA.—The Blackwood Electric Steel Corporation, recently organized, will install electric power equipment at its proposed local plant. F. S. Blackwood is president.

BRISTOL, VA.—Extension to the ornamental lighting system on State Street is under consideration.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 24, 1923, for refrigerating and ice-manufacturing plant for Pearl Harbor, H. T.

North Central States

DETROIT, MICH.—Plans are being prepared by the Public Lighting Commission for the erection of a substation, 56 ft. x 83 ft., on Woodward Avenue. Smith, Hinchman & Grylls, Marquette Building, are architects.

ST. IGNACE, MICH.—Improvements are contemplated to the municipal electric plant, including changing the equipment for the use of oil instead of coal for fuel. The cost is estimated at $27,500.

CLEVELAND, OHIO.—Plans are being prepared by W. Koehl, architect, Park Building, for the construction of convent, school and power house, to cost about $350,000, for the Sisters of Good Shepherd, East Thirtienth Street and Carnegie Avenue.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, until Dec. 29 for two steam-turbine reduction gear-driven forced-draft fans, two steam-driven centrifugal boiler-feed pumps, one hydraulic-turbine-driven centrifugal boiler-feed pump and four hydraulic-turbine stoker drives for the Fairmount pumping station, division of water, Department of Public Utilities.

DELAWARE, OHIO.—Bids will be received by W. H. Duffy, director of public service, Oak and Ninth Streets, Columbus, until Jan. 4, 1923, for construction of power house, 60 ft. x 80 ft.; laundry with two 30-ft. x 90-ft. wings; a 15,000-gal. coagulating and a 26,000-gal. reserve reservoir, small pumping station and sulphur well at the Girls' Industrial School at Delaware.

LIMA, OHIO.—The Ohio Power Company has acquired the local plant and system of the Ohio Electric Railway Company. Extensions and improvements will be made.

ST. MARY'S, OHIO.—Arrangements have been made by the Western Ohio Railway Company for the installation of a 5,000-kw. turbine in its local plant.

ZANESVILLE, OHIO.—The Kerns-Gorsuch Glass Company, a subsidiary of the Hazel-Atlas Glass Company, Wheeling, W. Va., will install electric power equipment in connection with a new plant in Zanesville, for which a bond issue of $800,000 has been arranged.

ZANESVILLE, OHIO. — Plans for the proposed plant of the Columbia Chemical Division of the Pittsburgh Plate Glass Company, Frick Building, Pittsburgh, to be erected in Zanesville include a power house. The cost is estimated at $2,000,000.

BOWLING GREEN, KY. — Preliminary plans and surveys have been started by the Kentucky Public Service Company and the Kentucky-Tennessee Light & Power Company for the erection of 66,000-volt transmission lines to connect their properties and other properties which they serve. Later this system will be connected with the water-power development at Muscle Shoals.

NEWPORT, KY.—The installation of an electrically driven pump in the waterworks station is under consideration by the Board of City Commissioners.

BLUFFTON, IND.—The installation of a 1,500-kw. turbine in the municipal electric light plant, to cost about $28,000, is under consideration.

INDIANAPOLIS, IND. — Bids will be received by the board of sanitary commissioners, Sanitary District of Indianapolis, until Dec. 28 for mechanical equipment of section 4, division III, for the sewage-disposal plant, including power-plant piping, air-washing equipment, electric centrifugal pumping units, electric wiring and fixtures, rotary driers, stokers and conveying machinery, etc. Charles H. Hurd, Merchants' Bank Building, Indianapolis, is consulting engineer.

KOKOMO, IND.—The American Steel & Wire Company, Chicago, contemplates improvements to its local plant to cost about $400,000. The work will include an addition to power house, installation of new boilers, stokers and auxiliary apparatus.

PETERSBURG, ILL.—The Central Illinois Public Service Company is negotiating for the purchase of the Abbott Light & Power Company. If taken over, extensions and improvements, including the installation of additional equipment, will be made.

LADYSMITH, WIS.—Contract will soon be awarded by the City Council for the installation of an ornamental lighting system.

WAUKESHA, WIS.—The City Council has authorized the lighting committee to secure estimates of cost of an ornamental lighting system, to be installed next spring when other improvements will be made.

BEMIDJI, MINN.—The installation of a new generating unit, to cost about $15,000, is under consideration by the Minnesota Electric Light & Power Company.

NORTHFIELD, MINN.—The Board of Directors, St. Olaf's College, has awarded a general contract to M. J. F. Kump, Northfield, for the erection of a one-story power plant at the institution, to cost about $300 000.

RED WING, MINN.—The City Council has adapted a resolution calling for the construction of a municipal electric light and power plant. The proposed plant is to have sufficient capacity to operate the pumps for the waterworks and to serve the curb-lighting system of the city and other portions of the street-lighting system.

STOCKPORT, IOWA.—The Van Buren Light & Power Company contemplates extending its transmission lines to Farmington and Bonaparte and possibly to Keosauqua.

BOLIVAR, MO.—The City Council has engaged Alexander & Beatty, engineers, 535 West Commercial Street, Springfield, Mo., to prepare plans for a municipal light and power plant, to cost about $32,000.

JEFFERSON CITY, MO.—Improvements are contemplated by the Jefferson City Light, Heat & Power Company, including the installation of new boilers, generators, turbines, water and gas mains. Equipment will also be installed to secure water from the Missouri River.

KIRKSVILLE, MO.—Extensive improvements and extensions are contemplated to the waterworks system, including the installation of electrically operated pumping machinery and other power apparatus. The cost is estimated at about $325,000. Black & Veatch, Mutual Building, Kansas City, Mo., are engineers.

SEDALIA, MO. — A permit has been granted to the City Light & Traction Company for the erection of a new power house, to cost about $60,000.

JAMESTOWN, N. D.—A power house will be built in connection with a number of new buildings to be erected at the Trinity Hospital. G. R. Horton is architect.

LA MOURE, N. D.—The Midwest Power Company, Bradley, has plans under way for a local power plant to cost about $50,000.

CHANCELLOR, S. D.—The installation of an electric lighting system in Chancellor is under consideration. It is proposed to erect a transmission line to connect with the plant at Lennox. The cost of the project is estimated at $12,500.

Southern States

CHERRYVILLE, N. C. — Bids will be received by J. M. Crocker, city clerk, until Jan. 9, for the installation of an ornamental lighting system. The Carolina Engineering Company, Wilmington, is engineer.

GREENVILLE, S. C. — The Greenville Ice & Refrigerating Company will install electric power equipment in connection with extensions and improvements in its plant. T. E. Keith is president.

CORDELE, GA. — The Georgia-Alabama Power Company is securing the right-of-way for extension of its transmission line from Americus to Cordele. Right-of-way from Albany to Americus has already been obtained.

COLEMAN, FLA.—The Council is considering the installation of an electric lighting system.

MONTGOMERY, ALA.—The Atlantic Ice & Coal Corporation, Atlanta, Ga., will install electric power equipment in connection with its proposed ice-manufacturing and cold-storage plant here, to cost about $300,000.

CHATTANOOGA, TENN.—The Atlantic Ice & Coal Corporation will install new electric power and refrigerating equipment in connection with proposed extensions to its ice plant, to cost about $150,000.

HOHENWALD, TENN.—The Council is considering the installation of an electric light and power plant and waterworks system.

BEEBE, ARK. — A company is being organized by E. H. Abbington, president of the Citizens' Bank, to install a local electric light and power system. A franchise has been granted.

McRAE, ARK. — The City Council has granted V. C. Pettie and W. D. Self a fifty-year franchise for the installation of an electric distributing system.

MONROE, LA. — The Monroe-Louisiana Carbon Company will build a power house in connection with its proposed local carbon plant, to cost about $250,000.

LAWTON, OKLA.—The Lawton & Duncan Electric Company contemplates improvements to its system, to cost about $70,000. The work will include the installation of a 1,500-hp. boiler at the local plant, and two 1,500-hp. engines at the Quanah plant, and also repairs to the distributing systems and the high-tension line between Lawton and Chillicothe, Tex.

PAWHUSKA, OKLA. — An ornamental lighting system will be installed on Kihekah Street.

RUSH SPRINGS, OKLA. — The local electric light plant, owned by Roy J. Randolph, has been acquired by the Chickasha (Okla.) Gas & Electric Company. Application has been made for the franchise to install a commercial light and power system by the company.

BROWNSVILLE, TEX. — The Texas Power & Light Company has applied to the County Commissioners of Cameron County for permission to erect electric transmission lines along the highways of the county.

CROSBYTOWN, TEX.—The Cap Rock Jersey Farm, Inc., contemplates developing 340 acres, at a cost of $150,000. The project includes an electric light plant, creamery, etc.

DALLAS, TEX.—An ornamental lighting system will be installed on Jefferson and Beckley Avenues. G. D. Fairtrace is city engineer.

EL PASO, TEX.—The El Paso Electric Railway Company has preliminary plans under way for an addition to its generating plant. Line extensions and other improvements will be made.

McKINNEY, TEX.—Plans for the proposed new textile mill to be erected by the Texas Cotton Mills Company provide for a one-story power house. The entire cost is estimated at about $600,000.

SABINAL, TEX.—Plans are under way for the installation of an ornamental lighting system on Main Street.

VERNON, TEX.—The local plant of the Texas Public Service Company has been acquired by the Texas Central Power Company, which will be operated by the Vernon Ice & Electric Company, a subsidiary of the Texas company, recently organized. Extensions and improvements will be made to the system, including the installation of a 500-hp. engine for which contract has been placed.

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Pacific and Mountain States

ALGONA, WASH. — The Puget Sound Electric Railway Company has submitted a proposal offering to furnish electricity for lighting purposes in Algona.

INCHELIUM, WASH.—The Department of Conservation and Development has issued a permit to Fred M. Mitchell for the Inchelium Water Power Company to build a dam and divert the water of Stranger Creek, a tributary of the Columbia River, for power purposes. It is proposed to build a hydro-electric plant to furnish electricity for lighting, manufacturing and irrigation purposes.

OAK HARBOR, WASH.—The Oak Harbor Mill Company is planning to build a power plant at its mill and install a local distributing system. A fifty-year franchise has been granted.

HUNTINGTON, ORE. — The Sun Portland Cement Company, recently organized, plans to build a power house at its proposed local cement mill, to cost about $400,000. H. A. Ross is president.

PENDLETON, ORE.—The Pacific Power & Light Company is planning to erect a 60,000-volt transmission line from Pasco, Wash., to Pendleton.

FRESNO, CAL.—The San Joaquin Light & Power Company is clearing right-of-way for the proposed transmission line which will run from the base camp on upper Kings River to Fresno and other valley points.

PASADENA, CAL. — An ordinance is being prepared for an ornamental lighting system on Colorado Street and on Madison Avenue.

PORTERVILLE, CAL.—Negotiations are under way for the purchase of the local light and power system from the Southern California Edison Company to be operated by municipality. Extensions and improvements will be made.

SAN FRANCISCO, CAL.—The California-Oregon Power Company has applied for permission to issue $500,000 in capital stock, part of the proceeds to be used for extensions and improvements.

SARATOGA, CAL.—Plans are being prepared for the installation of an ornamental street-lighting system. The Saratoga Improvement Club is interested.

VISALIA, CAL.—An ornamental lighting system will be installed in the Isalia Home Builders' district.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has applied to the State Engineer for permission to construct a hydro-electric power plant on the Green River, to develop 188,000 hp.

SUPERIOR, ARIZ. — Negotiations are under way between the Magma Copper Company and the Salt River Valley Water Users' Association for additional electrical energy to the amount of 1,500 kw. Additional power is to be generated through waste heat of the company's proposed reverberatory smelter.

LAS CRUCES, N. M.—An ornamental light system will be installed on Main Street.

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Canada

MEAFORD, ONT.—A bylaw providing for the purchase of the electric plant of the Georgian Bay Milling & Power Company will be submitted to the ratepayers on Jan. 1.

QUEBEC, QUE.—The Quebec Development Company contemplates hydro-electric developments along the Saguenay River, to cost about $10,000,000. For further information address W. L. Lee, engineer, 511 Fifth Avenue, New York City.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 28, 1922)

1,437,189. Electrolytic Condenser; R. D. Mershon, New York, N. Y. App. filed Nov. 3, 1919. Provides shorter paths for current from outer surfaces of plates.

1,137,209. Electrical Connection Clamp; W. Wenderhold, New York, N. Y. App. filed Dec. 1, 1917. Clamp for carbon holders and electric terminals.

1,437,223. Pocket Magneto; R. K. Brewster, Kingston, N. Y. App. filed June 24, 1920. For firing off explosives.

1,437,232. Electrical Apparatus; J. J. Frank, Pittsfield, Mass. App. filed June 21, 1921. Auxiliary tank allows for expansion of oil in transformers, etc.

1,437,237. Telegraphic Signal Transmitter; W. Glaser, Chicago, Ill. App. filed Jan. 13, 1922. Hand-operated contacts for dashes, vibrator for dots.

1,437,240. Apparatus for Detecting Minute Values of Energy; E. C. Hanson and W. L. Carlson, Washington, D. C. App. filed May 28, 1920. Heterodyning of two or more oscillating electric currents to produce a beat.

1,437,247. System of Electrical Distribution; G. E. Hulse, Newark, N. J. App. filed April 13, 1920. Lighting of railway cars from variable-speed generation.

1,437,257. Process of Welding and Apparatus Therefor; R. Mattice, Philadelphia, Pa. App. filed March 10, 1921. Stranded welding electrode of iron with central strand of copper.

1,437,267. Rheostat; E. G. Perkins, Youngstown, Ohio. App. filed Nov. 26, 1921. Rheostat with two relatively independent resistance units.

1,437,268. Casing Construction for Rheostats; E. G. Perkins, Youngstown, Ohio. App. filed Jan. 6, 1922. Frame for holding resistance elements.

1,437,287. Battery; L. W. Willis, Montville, N. J. App. filed Oct. 4, 1920. Primary battery with increased current capacity.

1,437,290. X-Ray-Tube Shield; W. D. Coolidge, Schenectady, N. Y. App. filed March 27, 1919. Does not lower voltage at which tube may operate.

1,437,302. Ozone Generator; H. B. Hartman, Scottdale, Pa. App. filed Feb. 8, 1922. To be used with water-purifying apparatus.

1,437,324. Combined Conduit, Junction Box and Outlet Box; A. H. Tashjian, Cleveland, Ohio. App. filed Jan. 19, 1921.

1,437,336. Alternating-Current Rectifier; F. Blaser, Aarau, Switzerland. App. filed July 27, 1922. Mechanical device for changing direction of current.

1,437,343. Storage-Battery Solution; G. Howard, Laverne, Okla. App. filed July 24, 1922. Comprises sulphuric acid, distilled water, sodium bicarbonate, sodium borate and salicylic-soda.

1,437,356. Electromechanical Telephone System; W. T. Powell, Rochester, N. Y. App. filed Jan. 11, 1919. Automatic exchange system.

1,437,357. Revertive Test System; W. T. Powell, Rochester, N. Y. App. filed April 9, 1919. Busy or idle condition of telephone line is determined by presence or absence of definite potential at test terminals.

1,437,361. Controlling and Regulating System for Dynamos; W. J. Rickets, London, England. App. filed April 14, 1920. Electron-tube regulator for generators charging storage batteries.

1,437,367. Line Interconnecting System; F. M. Slough, Rochester, N. Y. App. filed Jan. 6, 1919. Automatic telephone-exchange system.

1,437,375. Tack Indicator; J. L. Young, Brookfield, Mo. App. filed July 30, 1920. Indicates projection of nails in shoe.

1,437,383. Electric Water Heater; S. G. Crane, Toledo, Ohio. App. filed July 19, 1920. Water used as element in automatic heater.

1,437,384. Electric Water Heater; S. G. Crane, Toledo, Ohio. App. filed July 13, 1922. Automatic heater connected in pipe line.

(Issued Dec. 5, 1922)

15,504 (reissue). Outlet Box; W. H. Wood, Norwalk, Conn. App. for reissue filed Oct. 6, 1922. Easily applied to walls of buildings already plastered.

1,437,400. Method and Apparatus for Indicating the Geographical Location or Movement of Bodies; W. W. Conners, Elizabeth, N. J. App. filed June 12, 1919. By use of directive radio transmitting apparatus.

1,437,420. Electric Heating System; D. Hill, West Barrington, R. I. App. filed April 15, 1922. Electric house-heating furnace.

1,437,421. Electric Motor; J. S. Holliday, Wilkinsburg, Pa. App. filed June 26, 1919. Direct-current motors operated by pulsating direct current.

1,437,422. Artificial Line; R. S. Hoyt, Brooklyn, N. Y. App. filed July 9, 1919. For stimulating impedance of periodically loaded telephone line.

1,437,436. Signal Device; F. J. Metzger, New York, N. Y. App. filed Oct. 7, 1921. Neon tube used as signal on automobile.

1,437,439. Apparatus for Controlling Unidirectional Electric Currents; A. F. Nesbit, Wilkinsburg, Pa. App. filed Nov. 17, 1914. Adapted to the precipitation of suspended matter in gaseous and fluid bodies.

1,437,457. Signaling Apparatus and Circuits; J. F. Toomey, New York, N. Y. App. filed Nov. 24, 1919. For controlling supervisory signals with toll line and trunk circuits.

1,437,468. Storage-Battery Plate; B. Ford, Philadelphia, Pa. App. filed Nov. 24, 1920. Current-carrying rods slanting in direction of lug.

1,437,470. Storage-Battery Counter Cell; W. E. Kershaw, Philadelphia, Pa. App. filed Dec. 22, 1920. Insoluble anode and solution of chromic acid constituting a depolarizing agent.

1,437,481. Immersion Water Heater; P. A. E. Armstrong, Loudonville, N. Y. App. filed April 19, 1921. Rustless heating element in water.

1,437,498. Oscillation; L. De Forest, New York, N. Y. App. filed June 16, 1916. Vessel containing electrodes for use with electric signaling systems.

1,437,507. Electrode; C. G. Fink, Yonkers, N. Y. App. filed Jan. 21, 1920. Anode for electrodeposition of copper from copper sulphate electrolytes.

1,437,553. Electric Battery; D. C. Reed, Flushing, N. Y. App. filed May 9, 1919. Dry cell inactive until water is added.

1,437,569. Apparatus for the Oxidation of Atmospheric Nitrogen; B. Thomas, Seattle, Wash. App. filed April 27, 1920. Arrangement for electrodes.

1,437,603. Coated Dry-Cell Electrode; A. S. MacKenzie, Elmhurst, and R. C. Benner, Bayside, N. Y. App. filed March 27, 1922. Protective layer of gelatinized paste on inner surface of zinc container.

1,437,607. Electron Tube; E. L. Mueller, Chicago, Ill. App. filed Nov. 18, 1920. Radio tube with arc as source of electron discharge.

1,437,613. Lightning Grounding Device; E. H. Peterson, St. Paul, Minn. App. filed Oct. 3, 1919. Applied to wire fence.

1,437,622. Primer; W. J. Thomas, Chicago, Ill. App. filed Aug. 5, 1920. Applied to automobiles having vacuum-tank feed system.

1,437,629. Theostat; H. L. Zabriskie, Westfield, N. J. App. filed July 20, 1921. Method of mounting rheostat arm.

1,437,643. Signaling Device; J. Francisco, Toledo, Ohio. App. filed Dec. 22, 1921. Rear signal for automobile.

1,437,679. Relay for Telephone Circuits; J. E. L. Puget, Paris, France. App. filed Feb. 16, 1921. Reversible amplifier for telephone systems.

1,437,687. Electrical Conductor Terminal Connector; H. B. Sherman, Battle Creek, Mich. App. filed July 8, 1920. For spark plugs.

1,437,701. Electric Lighter; A. Zecchini, Turin, Italy. App. filed April 15, 1921. Cigarette or cigar lighter.

1,437,723. Theft-Proof Electric Light Bulb; D. R. Coughlin, Des Moines, Iowa. App. filed Oct. 28, 1920. Bulb when once installed cannot be removed until filament has burned out.

1,437,724. Electric Regulation; J. L. Creveling, White Plains, N. Y. App. filed May 2, 1916. Automatic voltage regulator for distribution lines.

1,437,760. Apparatus for Producing Cold Electric Discharges; J. Kuhlenschmidt, Berlin-Hohenschonhausen, Germany. App. filed July 25, 1922. Used to produce ozone, sterilize liquids, etc.

1,437,772. Radio Apparatus; J. B. Nowlan, Denver, Col. App. filed June 13, 1922. Coupler for insuring accurate adjustment of the tuned circuits of receiving apparatus.

1,437,778. Service Switch; A. B. Rypinski, Brooklyn, N. Y. App. filed April 2, 1921. Customer's service switch for testing meters.

1,437,780. Trolley Controller; C. W. Shanaberger, Arrow, Pa. App. filed June 1, 1920. Mechanism for lowering and shifting locomotive trolley.

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Electrical World

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W. H. ONKEN, JR., and HAROLD V. BOZELL, *Editors*

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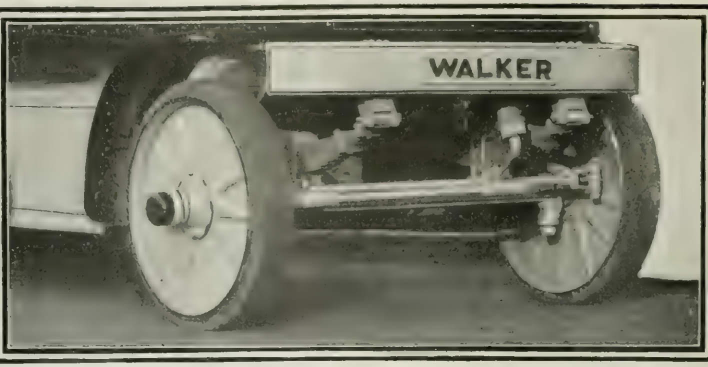

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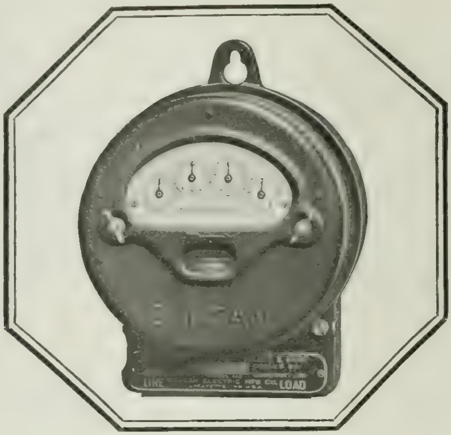

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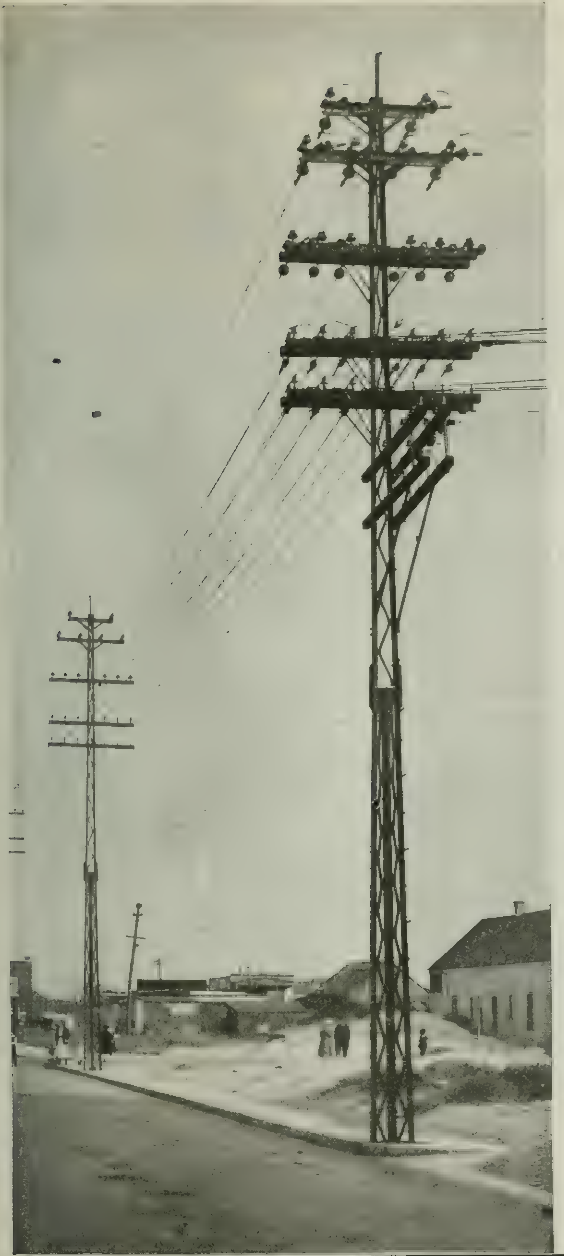
Lafayette, Ind.

DUNCAN WATTHOUR METERS



Big Bates Poles for Distribution

Heavily loaded distribution lines on city streets present a frequent problem to engineers responsible for overhead line construction. Big poles to carry the load require space that is sometimes difficult to secure. Arrangements for guying these big poles are complicated by lack of space and by existing structures as well as by the right of way which cannot be obstructed.

The Gary Heat, Light, and Water Company maintain an extensive distribution system, parts of which are heavily loaded and along busy public streets. The line shown here is one of these, where the use of Bates Steel Poles has removed the difficulties which usually attend this class of construction.

Notice the pole in the foreground, which is a corner pole in the line and carrying a good size load of feeder cables. This, as well as the rest of the line, is standard Bates construction, a 65-foot pole built up of three one-piece Bates Steel Poles.

Though these are big poles, they do not look cumbersome nor heavy, and they are set into the sidewalk with less obstruction than would be necessary with other poles of sufficient strength to carry the load.

Bates Big Steel Poles are being used in a number of applications where great strength must be provided within limited space for setting and erection. Full data on the applications and cost of Bates Poles will be provided upon request to our nearest district office.

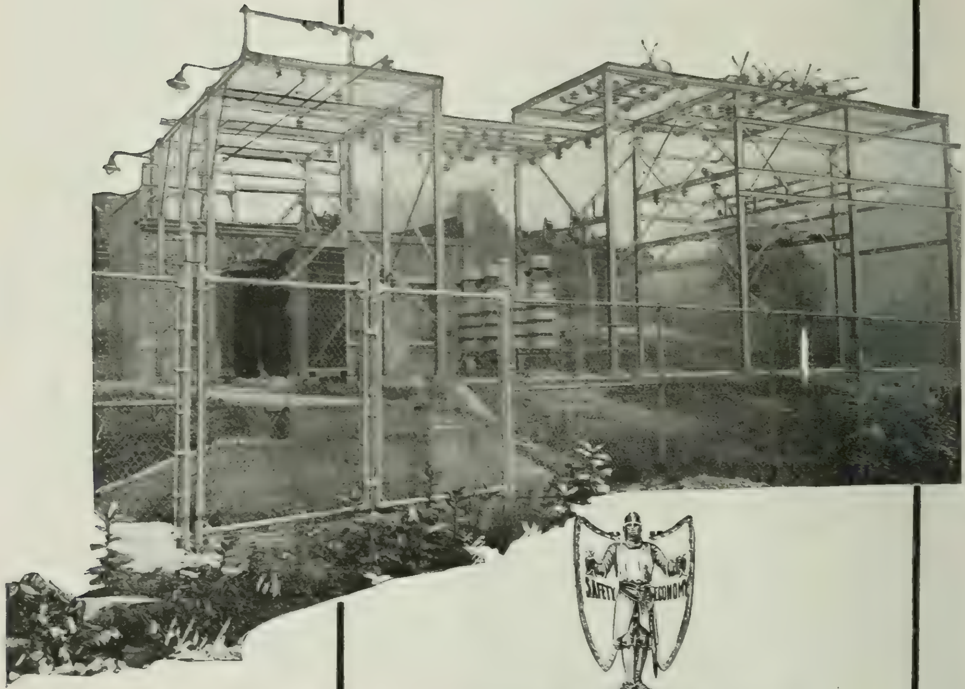
Bates Expanded Steel Truss Co.
208 South La Salle Street, Chicago, U. S. A.
District Offices in All Principal Cities

BATES ONE PIECE EXPANDED STEEL POLES

Elpeco Substations

IF you are considering the construction of a new substation—we shall be glad to submit photos of some Elpeco installations for your consideration.

Our Engineering Department is at your service to cooperate in laying out new work.



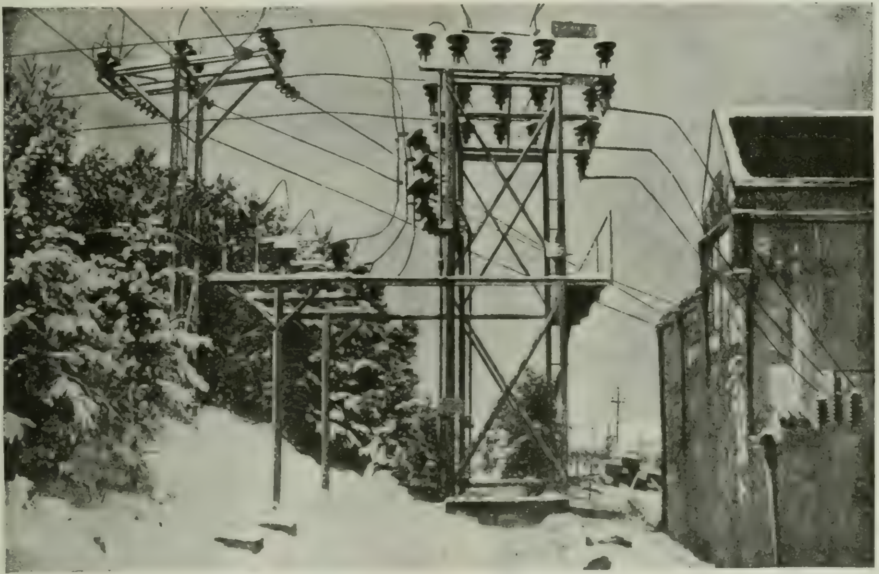
SAFETY ECONOMY

ELPECO

ELECTRIC POWER EQUIPMENT CORPORATION
PHILADELPHIA

HIGH TENSION EQUIPMENT

How Long Can a Air Break Switch Go Without Re-Greasing?



Unit-Type 50,000 15,000 Volt Steel Tower Substation Giving Service in Norway

Alemite Greasing

HOW often switch bearings need greasing depends upon the design and local conditions. But when they do need greasing it is a difficult matter unless the switch is properly equipped. Delta-Star Switches now have "Alemite" High Pressure Grease Cups—so just use a grease gun. Simple, isn't it?

Ice Breaking

MOST of the trouble with ordinary switches is due to sticking or freezing of the bearing and contacts. Delta-Star Switches also have the "A.R.T." ice breaking blade movement so forceful in its action that it breaks the ice. The combination of this feature with "Alemite" greasing insures satisfaction.

If you haven't our publications you are missing something

DELTA-STAR ELECTRIC CO., 2433-59 Fulton Street, Chicago, Ill.

Manufacturers of High Tension Equipment

New York, N. Y., 25 Broad St.
Boston, Mass., 294 Washington St.
Rochester, N. Y., 119 Main St., E.
Syracuse, N. Y., City Bank Bldg.
Buffalo, N. Y., 595 Ellicott Square
Kansas City, Mo., Interstate Bldg.
St. Louis, Mo., Railway Exchange
Salt Lake, Utah, 313 Dooly Bldg.

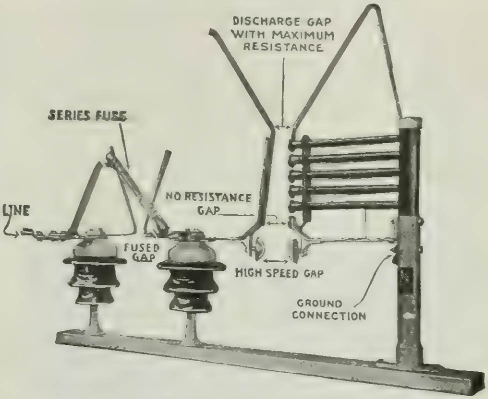
Toronto, Ont., 67 Yonge St.
Indianapolis, 518 Trac. Term. Bldg.
Seattle, Wash., Hoge Bldg.
Philadelphia, Pa., 1333 Real Estate Trust
Columbus, Ohio, 600 Joyce Realty Bldg.
Minneapolis, Minn., 310 Security Bldg.
Los Angeles, Cal., I. W. Hellman Bldg.

Birmingham, Ala., 827-830 Brown-Mark Bldg.
Pittsburgh, Pa., Union Arcade
Soc. Francaise Ohio Brass & Electric
7 Rue de Tilsitt, Paris, France
A S, Kraftoverforing, Kristiania, Norway
Carrick Wedderspoon & Co.
Christchurch, New Zealand

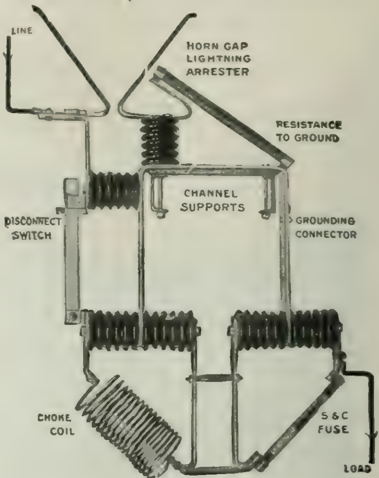
DELTA-STAR

The Standard of Comparison

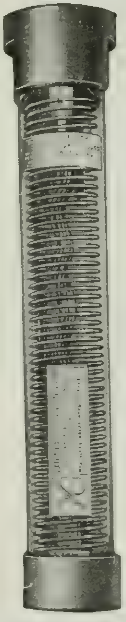
UNIT TYPE INTERCHANGEABLE PARTS



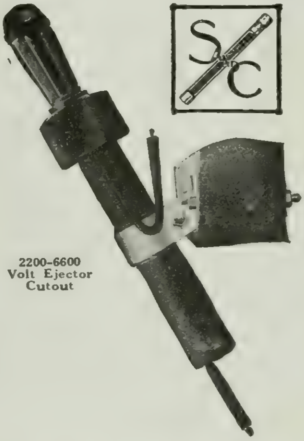
25,000 Volt Type H Form 3A Arrester



Single Pole 15,000 Volt XW Combination



25,000 Volt 100 Ampere S&C Fuse



2200-6600 Volt Ejector Cutout

High Voltage Protective Equipment

Assured protection is a valuable asset. An investment in S&C High Voltage Switching and Protective Equipment represents such protection. The security of such an investment is *firmly* established by years of satisfactory service in the field.

"S&C" FUSE

is the correct trade name although it has been referred to and described as "Carbon Tetrachloride," "Tetrachloride," "Pyrene," and "Chemical' Fuse. The Manufacture, Sale and Use are controlled by United States and Foreign Patents, granted and pending. The **S&C FUSE** is manufactured in the United States only by **Schweitzer & Conrad, Inc.**

Extra High Voltage Fuses
Lightning Arresters
Primary Cutouts
Fuse Mountings
Fused Switches
Disconnect Switches
Choke Coils
Pole Top Switches
Bus Bar Supports
Outdoor Substations
Rural Service Equipment
Voltage Detectors

Write for Bulletin on This Equipment

SCHWEITZER CONRAD, INC.

4435 RAVENSWOOD AVENUE CHICAGO. ILLINOIS U.S.A.

New York City, 50 Church St., Room 2070
Buffalo, 950 Ellicott Square Bldg.
Boston, Mass., 88 Broad St., Room 910
Pittsburgh, Pa., 1306 Keenan Bldg.
Cleveland, Ohio, 1202 Illuminating Bldg.
Youngstown, Ohio, 109 Wick Ave.
Oakland, Cal., 708 Oakland Bank Bldg.
St. Louis, 1004 Federal Reserve Bank Bldg.
Kansas City, 717 Bryant Bldg.
Omaha, Nebr., 513 Electric Bldg
Minneapolis, 915 Metropolitan Life Bldg.
Los Angeles, 211 I. W. Hellman Bldg.
Sioux Falls, S. D., 213 W. Ninth St.
Birmingham, Ala., 426 Jefferson Count Bank Bldg.
Toronto, Ontario, 24 Adelaide St., East
Winnipeg, Man., 703 Confederation Life Bldg.
Vancouver, 609 Credit Foncier Bldg.
Montreal, 134 Coristine Bldg.

Westinghouse
Suspension Strain Insulators

WESTINGHOUSE ELECTRIC

You can depend upon Westinghouse Suspension Strain Insulators to meet the severest service conditions. Each unit is rated at 11,000 volts and weighs approximately nine pounds.

These insulators are a product of our porcelain insulator works at Derry, Pa., a plant devoted to one thing only, the production of porcelain insulators of Westinghouse Quality.

Style No.312992

Style No.312990

Westinghouse Electric & Manufacturing Company
Agent for Westinghouse High-Voltage Insulator Company
(Successor to Pittsburgh High-Voltage Insulator Company)
General Office and Works, Derry, Pennsylvania

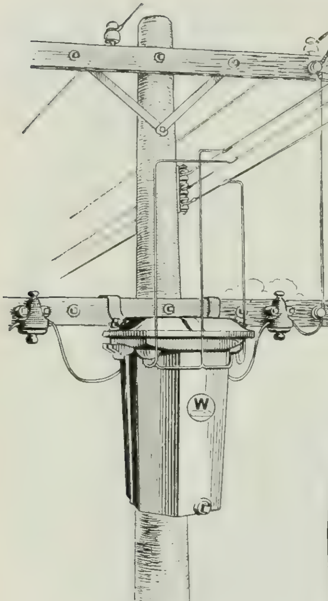
Westinghouse

Westinghouse Steel-Clad Type S

Westinghouse Type S Steel-Clad Transformers are one-third lighter in weight, making them easier to handle and reducing pole strain

but—

when it comes to the coil winding and insulation, they are the same reliable Type S design.



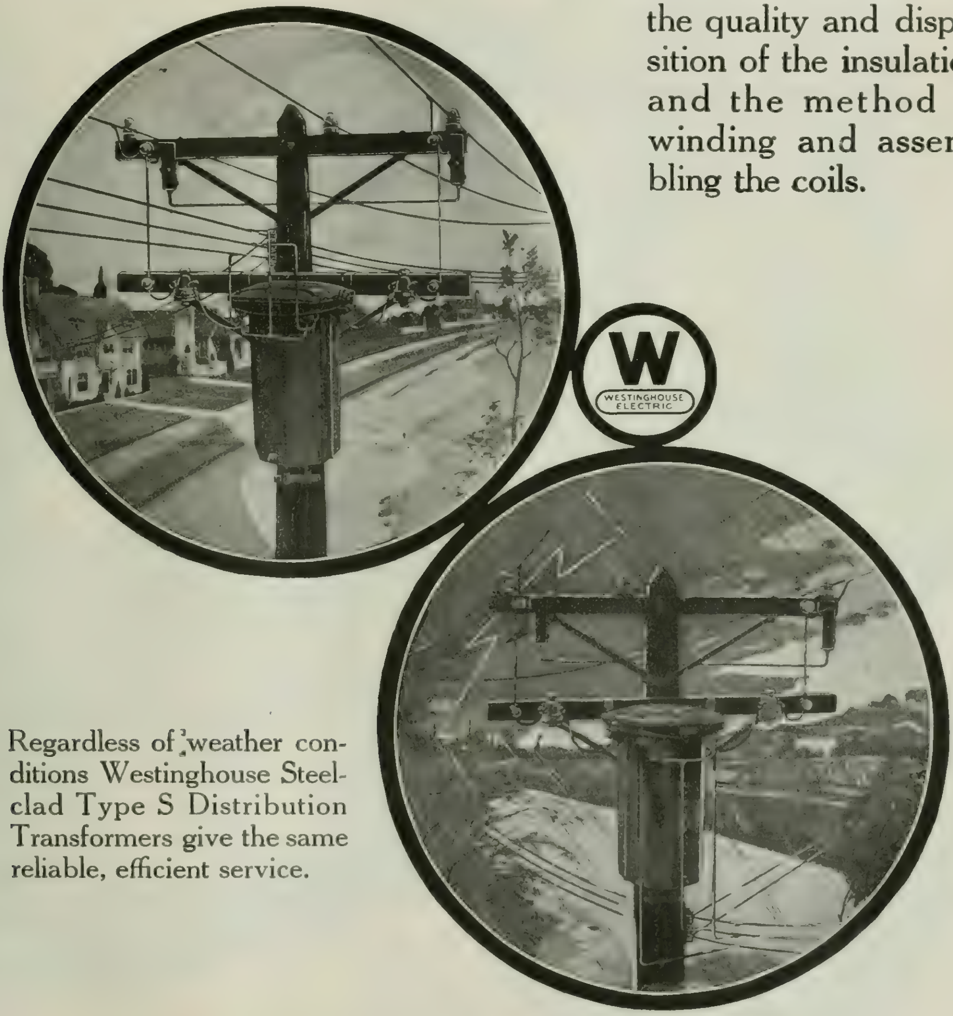
The only way we knew to improve Type S Transformers was to lighten the cases.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

Westinghouse

Distribution Transformer

The reliability of Westinghouse Type S Steel-Clad Transformers results from the quality and disposition of the insulation and the method of winding and assembling the coils.

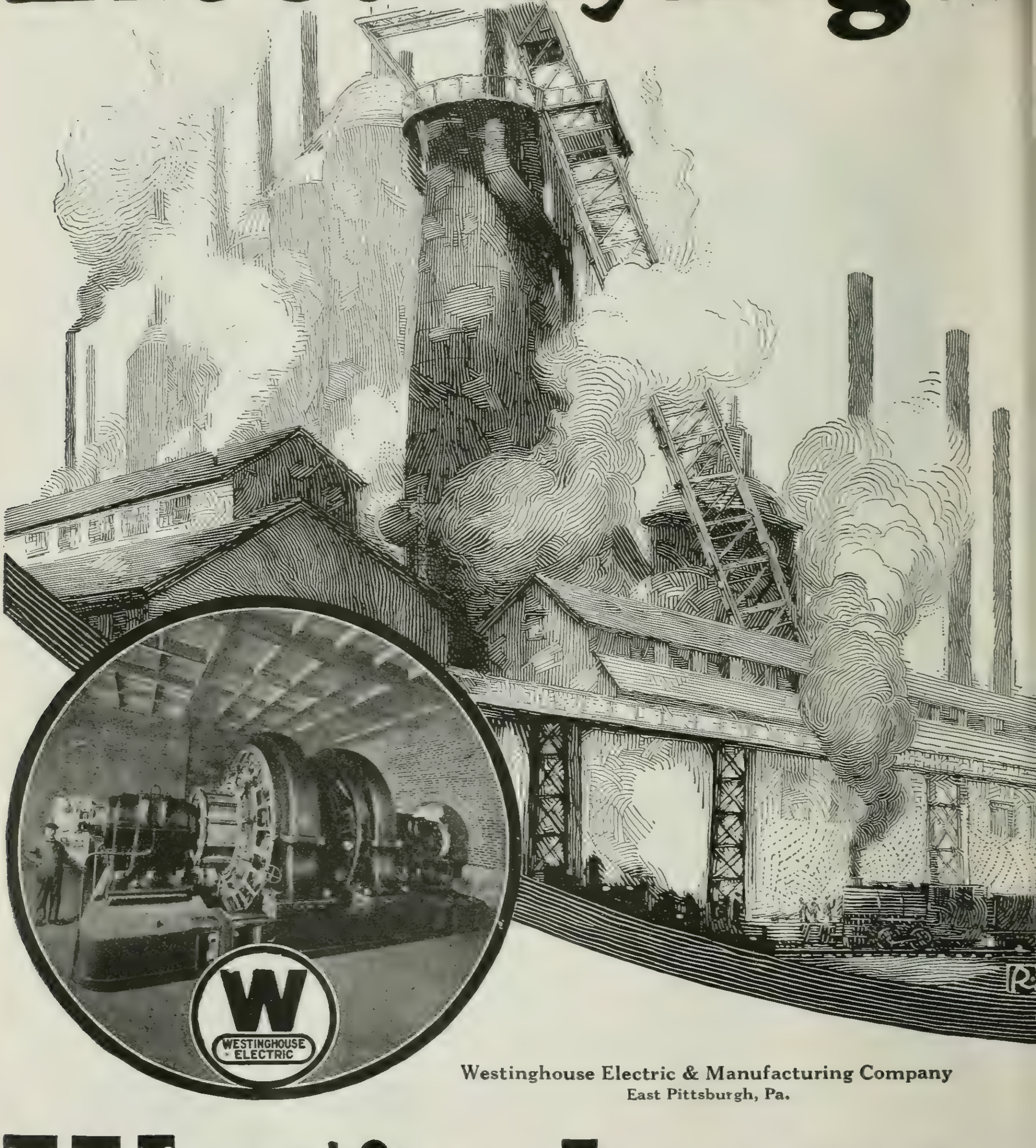


Regardless of weather conditions Westinghouse Steel-clad Type S Distribution Transformers give the same reliable, efficient service.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

Westinghouse

Electrifying the



Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

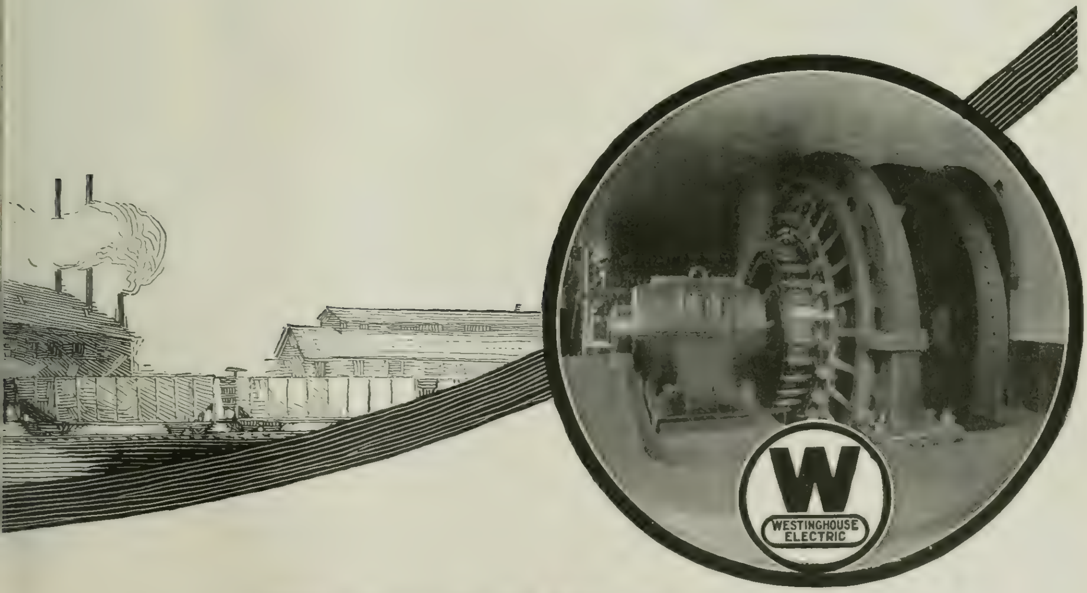
Westinghouse

Steel Industry

No better illustration of the progressiveness of the Westinghouse Company can be found than the splendid part it has played in the electrification of the Steel Industry. Due, in no small part, to the pioneer Work of the Westinghouse Company, the steel industry now utilizes more electrical horsepower than any other industry.

In 1891 the first electric motor was installed in a steel mill. It was a Westinghouse motor. In 1905 the first large rolling mill motor—a fifteen hundred horsepower unit—was installed at the Edgar Thompson Works of the Carnegie Steel Company. It, also, was a Westinghouse motor. In 1906, the first reversing mill motor in the United States was installed by the Illinois Steel Company at South Chicago, Illinois. This again, was a Westinghouse motor. These motors were history-makers in the steel industry.

The development of the reversing mill motor is one of the most remarkable and noteworthy achievements of electrification. These tremendous motors—developing as high as seventeen thousand horsepower and which are almost instantly stopped, started and reversed by the simple turn of a master switch—form the very basis of this great industry. More than seventy per cent of all such motors at present in operation, are Westinghouse.



Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

Westinghouse

Brushes for Ro

For the DC Side—

N C C
259

Average Characteristics—

Specific Resistance (ohms per inch cube)	.0018
Carrying Capacity (amps. per sq. inch)	60
Peripheral Speed (ft. per minute) (max. recommended)	6000
Hardness (scleroscope)	55
Strength (lbs. per sq. inch)	2900
Contact Drop	Very High
Coefficient of Friction	Low
Pressure Recommended (lbs. per sq. inch)	2–3

No. 259 is a new electrographitic brush, which combines high carrying capacity, high contact drop, and low friction. It is absolutely non-abrasive. This brush was developed to cover a field of service that was partly covered by Nos. 255 and 257, these grades being limited somewhat in their range of speed. No. 259 is not so hard as Nos. 255 and 257, and consequently operates more quietly, at the same time being applicable to higher speed machines.

We recommend No. 259 especially for the DC side of all types of rotary converters (both 25 and 60 cycles) where the mica is undercut, voltages 80-600, current densities up to 60 amperes per square inch, and peripheral speeds up to 6000 feet per minute. It is also recommended for DC industrial motors and generators with slotted commutators, voltages 80-600, current densities up to 60 amperes, and peripheral speeds up to 6000 feet per minute.

This brush has proved satisfactory on high speed, high current density service where heretofore a more expensive graphite brush has been necessary to secure satisfactory operation.

Write for Catalogue No. 37

NATIONAL CARBON COMPANY, INC.
CLEVELAND, OHIO

tary Converters

For the AC Side—

Ringsdorff ET-10

Average Characteristics—

Specific Resistance (ohms per inch cube)	.0000047
Carrying Capacity (amps. per sq. inch)	115
Peripheral Speed (ft. per minute) (max. recommended)	6000
Hardness (scleroscope)	19
Strength (lbs. per sq. inch)	4900
Contact Drop	Very Low
Coefficient of Friction	Low
Pressure Recommended (lbs. per sq. inch)	2–2½

Ringsdorff ET-10 is a metal graphite brush having a low coefficient of friction. This characteristic, in addition to a low contact drop and the ability to carry high current densities, allows it to operate on brass, bronze, and copper slip rings at speeds up to 6000 feet per minute with minimum dusting and ring wear.

The many successful applications of this brush on converters in all parts of the country have proved its value.

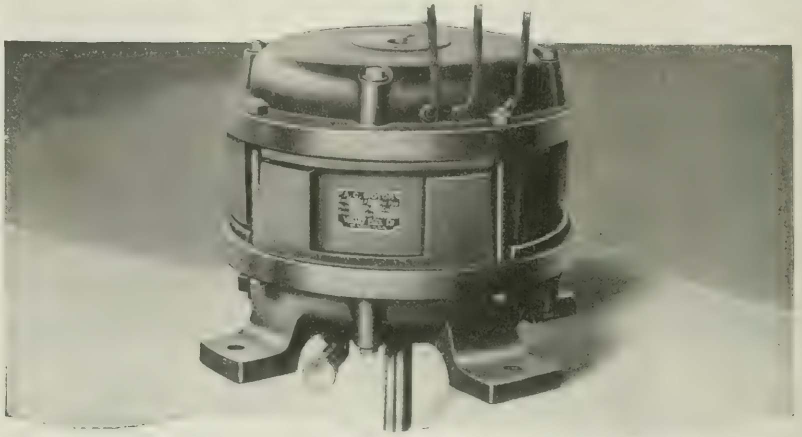
We consider it the best metal graphite brush of high carrying capacity for application on slip rings of rotary converters—DC voltages 80-600, frequencies both 25 and 60—that has been produced to date by any brush manufacturer either in this country or abroad.

* * *

and Supplement No. 37-A

NATIONAL CARBON COMPANY, INC.
CLEVELAND, OHIO

SKF



Ball Bearings in Vertical Motors

Solve the Lubrication Problem

IT is particularly difficult with step bearings in vertical motors to maintain proper lubrication, especially during the first few seconds of starting. Destructive metal to metal contact often exists and if an oil film fails to form by the time the motor is up to speed, bearing failure quickly follows.

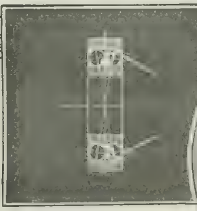
In this vertical motor the lubrication problem is solved by using ball bearings which do not depend upon the maintenance of an oil film for their satisfactory performance. These bearings run practically frictionless in sealed housings, remain cool and show no discernible wear.

An **SKF** marked deep-groove radial ball bearing takes the combined radial and thrust load at one end of the shaft while an **SKF** marked self-aligning ball bearing takes the radial load at the other end of the shaft. This combination makes the design of the motor simple, compact and economical in manufacture.

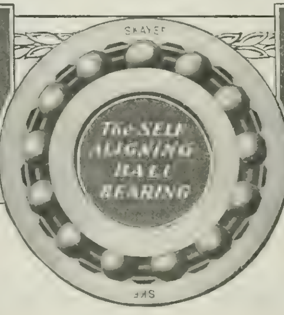
THE SKAYEF BALL BEARING COMPANY

Supervised by **SKF** INDUSTRIES, Inc., 165 Broadway, New York City

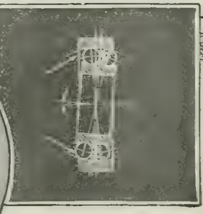
869



Normal View



SKAYEF
The SELF ALIGNING BALL BEARING
SKF



Deflected View

BALL BEARINGS

The Highest Expression of the Bearing Principle

Nº 5

OF A SERIES OF ARTICLES PICTURING THE INFLUENCE OF THE ENGINEER IN THE AFFAIRS OF THE WORLD. PRESENTED BY THE McGRAW-HILL COMPANY, INC , WHOSE PUBLICATIONS HAVE SERVED THE ENGINEER THROUGH HALF A CENTURY OF INDUSTRIAL PROGRESS

THE SAFETY OF INDUSTRY

SOME four centuries ago Leonardo da Vinci wrote a treatise on flying in which he endeavored, though not with entire correctness, to describe the mechanism of a bird's flight. It took the intervening centuries to make his theory a fact; and theory is valuable only when it becomes a fact.

¶ It is the irrefutability of basic facts which gives the modern engineer the leadership in many of our greatest and most essential undertakings.

¶ In his hands he holds the safety of this industrial age. Not merely its commercial stability, but the solution, as well, of many of our problems of government, of the revision of ethical principles, the defining of international agreements. From his statistical data will be gleaned much of the means for the social and material reconstruction of the world.

¶ The rise of the engineer as a leader in thought development has been rapid. It has come through proof of his ability to analyze, deduce and conclude; and then to put these findings into action, to express energy in terms of fact.

¶ An impressive proof of his leadership is his being found among the directors of many important financial, commercial and industrial corporations. And when an engineer speaks his associates give heed. For he does not surmise, he states facts; he does not offer conjecture or guesses, he submits statistical evidence.

¶ These newly risen leaders are the producers of facts, the originators of statistics, the developers of proofs. Theirs is the science of truth. They deal with absolutes, yet have no dogmas, for their absolutes are bases for operations, not limitations of practice.

¶ No new truth startles the engineer. He is able to see the combinations of circumstance which lead to the one and only possible conclusion which the new truth proclaims. The engineer gives the safety of certainty to industry.

Coal Age

Electrical World

Electrical Merchandising

American Machinist

Industrial Engineer
(Published in Chicago)

Engineering and Mining Journal-Press

American Machinist
European Edition
(London)

Power

Engineering News-Record

Bus Transportation

Electric Railway Journal

Ingenieria Internacional
(Printed in Spanish)

Chemical and Metallurgical Engineering

Journal of Electricity and Western Industry
(San Francisco)

McGRAW-HILL COMPANY · INC ·
NEW YORK

ROME WIRE

"Super Service"

Cord and Cable

1 Rome Super Service Cord and Cable is new—new in construction—new in the service it renders—new in the terrific tests it withstands. Fit for the toughest job in every service where endurance counts.

2 Fine stranded copper, effectively insulated and built up with cotton and rubber, over all a heavy layer of Super Service 60% rubber with embedded cords, vulcanized in steel molds under tons of pressure.

3 Send for a sample, get a bit of it between your hands, feel that moulded-on name, try to break it, tear it, cut it—treat it to the most destructive tests you know—and know why we call it Super Service.

So —
You Snip the Coupon—We Ship the Sample

DON'T DO IT TO DAY — DO IT NOW !!!

TO THE ROME WIRE COMPANY, 151 RAILROAD STREET, ROME, NEW YORK
PLEASE SEND THAT SAMPLE OF ROME SUPER SERVICE PERSONALLY TO:

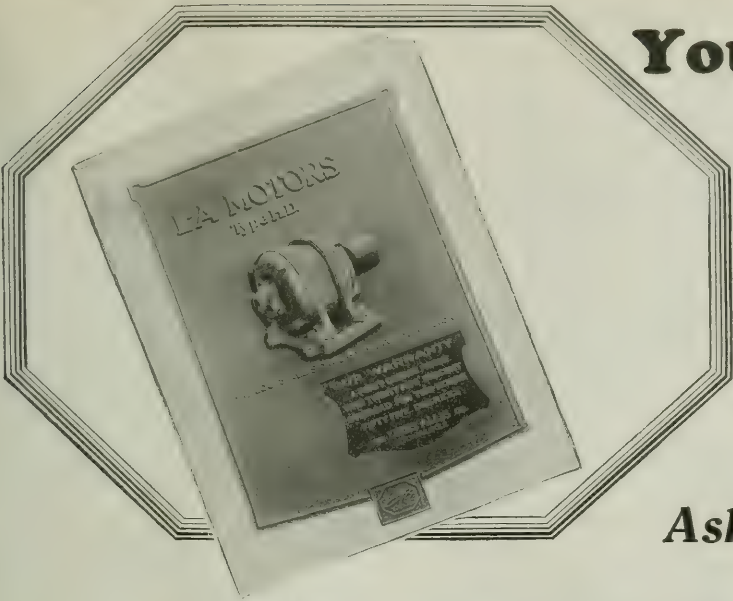
Name: ______________________ *Company:* ______________________

Check Kind Wanted
Super Service Cable ☐
Super Service Cord ☐
Super Service Heater Cord ☐

Address: ______________________

2109-L

WIRE ROME



You should read this Bulletin

Ask for a Copy

It will give you complete details of the

L-A Type H. D. [Heavy-Duty] Motor

A 40 degree motor with 25% two hour overload at 55°

This motor has attracted exceedingly lively attention from motor users who need machines that will endure hard service with little attention.

One of its big advantages is that it puts an end to rotor troubles. That is because the rotor winding is a single sheet of pure copper with only one joint in each end ring and that joint lapped and silver welded. There are no rotor bar joints. This rotor is practically indestructible.

And that is only one of many advantages in this motor.

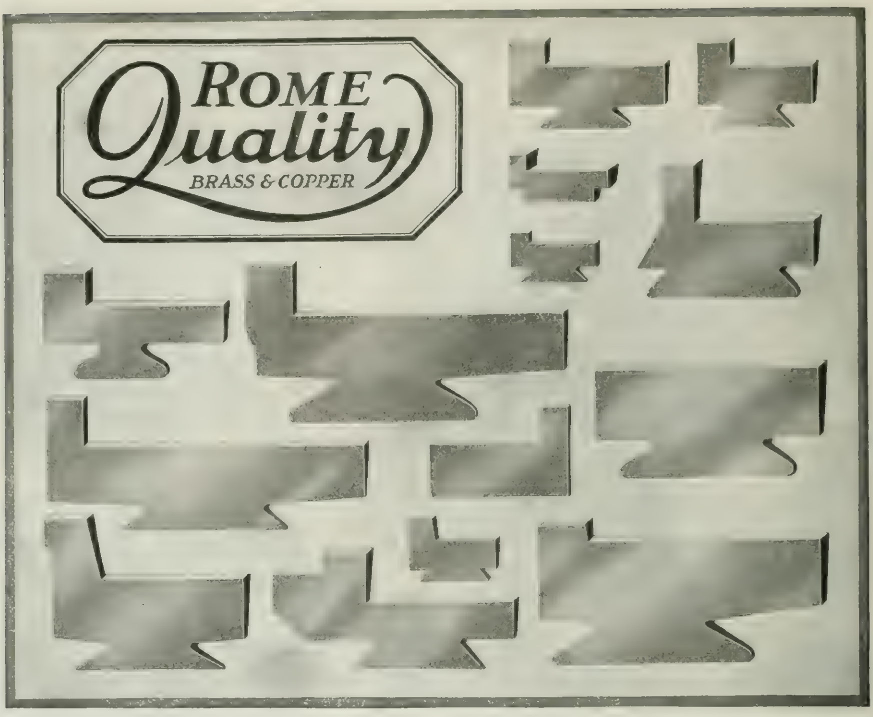
Our H. D. Bulletin tells you all about it. What this heavy duty motor will do—and why.

Your Copy is Ready for You

THE LOUIS ALLIS CO.
merly **THE MECHANICAL APPLIANCE COMPANY**
ESTABLISHED 1901
MILWAUKEE, WIS.

L-A Motors

Watson Motors



Accuracy is the watchword

Accurate sizes, gauges, and dimensions of Rome Quality Commutator Segments are insured by a careful system of inspection.

Because they are uniform and "true", Rome Quality Commutator Bars and Segments are widely known and used by those who are exacting in their electrical copper requirements.

To provide a wearable surface, a hard, durable finish is given to Rome Commutator Copper.

Rome Electrical Copper is made for every electrical purpose. Permit us to quote on your requirements.

BRASS COPPER BRONZE

Sheets; rolls; rods; anodes; tubes, brazed and seamless; strips; extruded shapes; angles and channels; tapered tubes and hose pipes; door rail; commutator bars and segments; electrical copper bar; and rivets and burs.

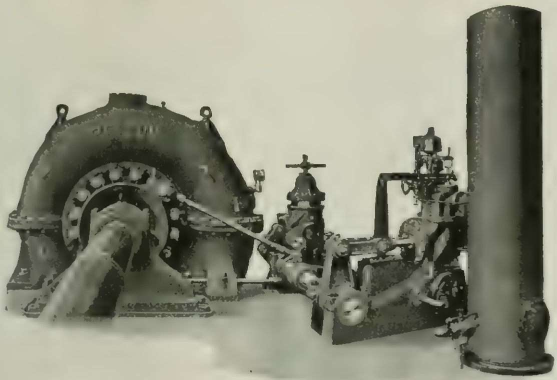
ROME BRASS AND COPPER COMPANY–ROME, N.Y.

BRASS ROME COPPER

2118-P

PELTON

Around the World With Pelton



CHAPTER VI.

CHILE

Chile possesses abundant potential waterpower, and the limited local supply of fuel makes its development of particular importance to the welfare of the entire nation. There are a number of important Pelton installations, the largest being the Maitenes plant, part of whose output supplies the pioneer railroad electrification in the country, comprising 144 miles of heavy traffic line between Valparaiso and Santiago.

The plant comprises three Pelton turbines, each with a maximum capacity of 11,500 H.P. under a head of 600 feet. A shop assembly of one of these turbines is shown above. They are typical of the large capacity horizontal single overhung reaction turbine as developed by the Pelton Company, and are among the highest-head units of this type.

Among the advantages of this type of construction is the ease with which access may be obtained by simply removing the draft elbow, without dismantling either generator, shaft, or bearings. The saving in time and labor when replacing worn parts is particularly important for installations using silt-laden water.

Hydraulic balance of the runner is obtained by providing wearing rings at a point as close to the shaft axis as the discharge diameter of the runner will permit. Provision is made so that the degree of wear of the renewable clearance rings may be inspected without taking down the turbine.

(Chapter VII, which will appear January 27, will discuss British Columbia)

THE PELTON WATER WHEEL CO.

Hydraulic Engineers

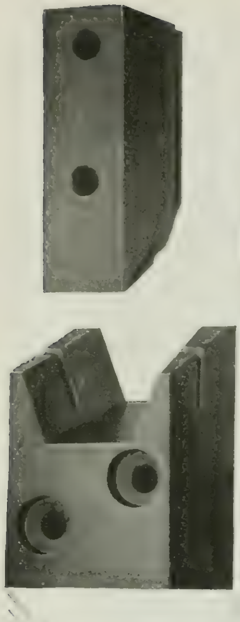
1995 Harrison Street
San Francisco, Calif.

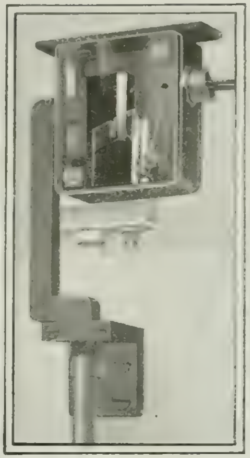
100 Broadway
New York, N. Y.

ASSOCIATED COMPANIES:

Wm. Cramp & Sons Ship & Engine Bldg. Co.
I. P. Morris Department, PHILADELPHIA

Dominion Eng. Works, Ltd.,
MONTREAL





Safeguarding Elevator Service

Moral obligation to safeguard elevator service with interlocking electrical switches, is now well recognized. In the development of any such system, every precaution must be taken that the device function perfectly with minimum care or attention, under practically all conditions.

For the switch lock plates, the vital part of their "ES" Positive Electro-Mechanical Interlock, the Elevator Supplies Company, Inc., of Hoboken, N. J., required a material which would (1) possess high dielectric and mechanical strength, (2) present a hard, impervious surface, highly polished, (3) remain oil and moisture-proof, and (4) be capable of economical molding in the special shapes desired.

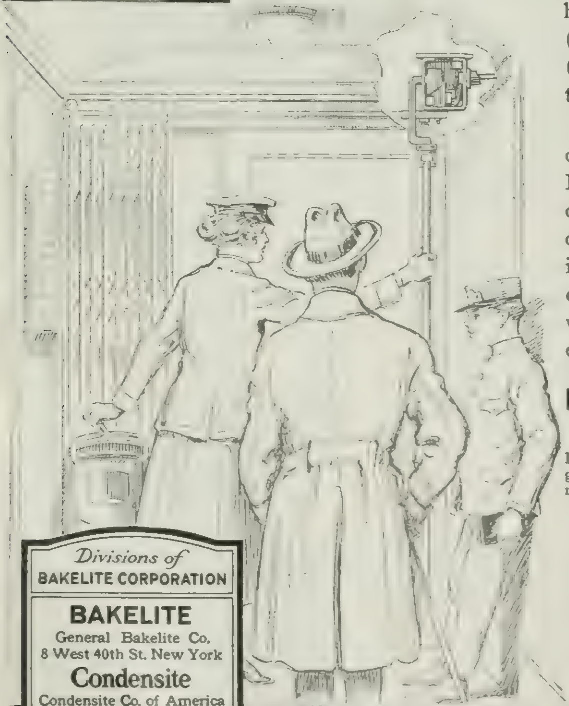
They selected Condensite, a phenolic condensation product, which like Bakelite and Redmanol, is a non-hygroscopic material, chemically inert, and mechanically and dielectrically strong — dependable. Molding these pieces procured increased production of known and uniform quality with all tooling or fitting in final assembly eliminated.

BAKELITE CORPORATION

Address the Divisions

Each Company maintains a research laboratory which will gladly cooperate with manufacturers in the working out of new applications.

3102-B



Divisions of
BAKELITE CORPORATION

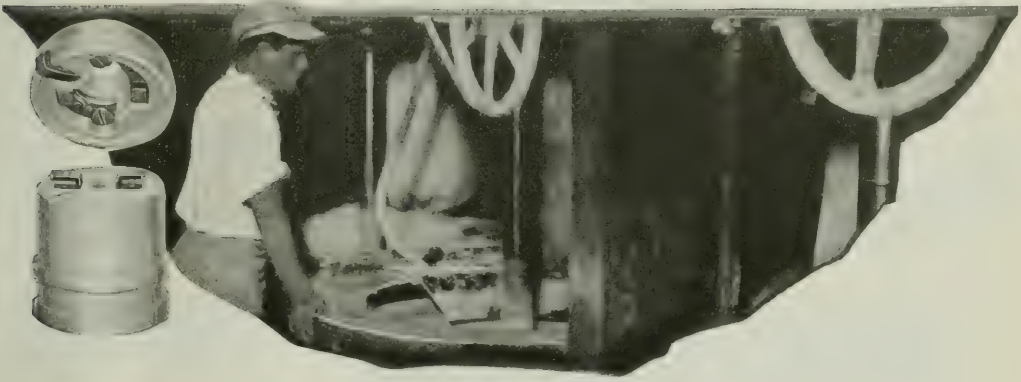
BAKELITE
General Bakelite Co.
8 West 40th St. New York

Condensite
Condensite Co. of America
Bloomfield, N. J.

REDMANOL
Redmanol Chemical
Products Co.
636-678 West 22nd St.
Chicago, Ill.

The Material *of a* Thousand Uses

Wiring devices form an important part of the wiring of any building—have them reliable



Porcelain Sockets

G-E "snap catch" porcelain sockets are easily installed due to the absence of screws. The body has two bayonet hooks which engage two flexible phosphor bronze contacts in the cap, locking securely but permitting easy disassembly without disturbing wiring or turning off current. All types of body (pull, key, push button and keyless) are interchangeable with all types of "snap catch" caps and bases.

Economical assembly—simple construction—safety and dependability—all you could ask of a socket.

G-E Threaded Catch Sockets

Sturdily built sockets that will easily support the weight of any reflector now manufactured and resist sidewise leverage and sharp blows. Cap cannot pull loose from shell and no amount of vibration will loosen threaded ring when properly installed. Threaded ring, knurled to provide finger grip, securely holds cap and shell together. Two lugs in the cap fit in any pair of eight slots in the shell effectually preventing any rotation between the cap and shell. The usual types of caps and interiors are available—with the exclusive G-E swivel locking feature, if desired.

G-E Renewable Fuses

First quality fibre tubes assure resistance to the pressure of short-circuit blowouts.

Metal parts are carefully gauged and machined for maximum strength, perfect fit and alignment; special treatment prevents engaging parts from "freezing."

Ferrules of knife blade type have knurled finger grips. In the ferrule type, notched anchor plates are threaded into the ferrules, insuring positive alignment and easy reloading. Vents around threads give positive ventilation.

For economy, use renewable fuses only for circuits where variable loads cause frequent blowouts.

General Electric Company

General Office
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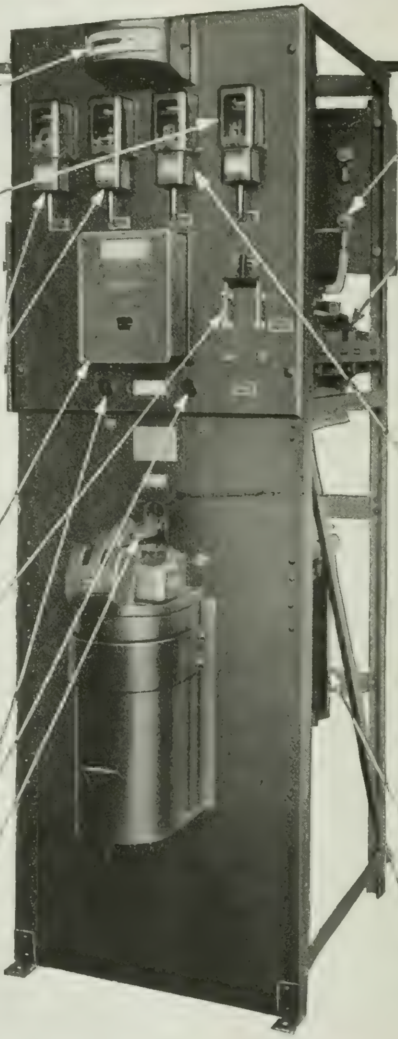

Ammeter

Reclosing Relay
Provides definite time interval between opening and reclosing of breaker.

Overload Relays
Open oil circuit breaker on overload.

Watthour Meter

Control Power Switch
In upper position, allows breaker to reclose automatically.
In lower position, opens breaker and suspends automatic reclosing feature.

Indicating Lamps

Motor Mechanism for Operating Oil Circuit Breaker

Disconnect Switch

Current Transformer

Notching Relay

Function:
Suspends automatic reclosing feature, if the breaker is opened three consecutive times, providing the time interval between each opening is less than a predetermined value.

Operation:
The first opening of the breaker causes the relay to notch one step on the ratchet mechanism, but the relay contacts are not opened.

The second opening of the breaker (within a predetermined time) causes the relay to notch the second step on the ratchet mechanism, but the relay contacts are not opened.

The third opening of the breaker (within the same predetermined time) causes the relay to notch the third step on the ratchet mechanism. The contacts of the relay open immediately and remain locked in this position.

If, on the first or second step of the notching relay, the breaker had remained closed, the relay would have returned to its original position. Subsequent openings of the breaker would then start a fresh sequence of operations of the relay and breaker.

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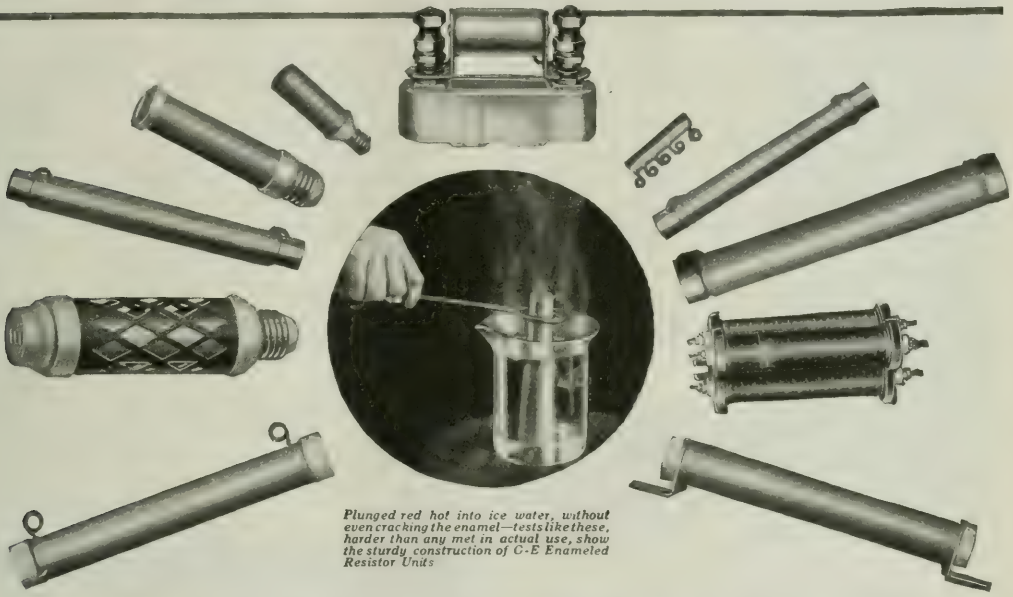

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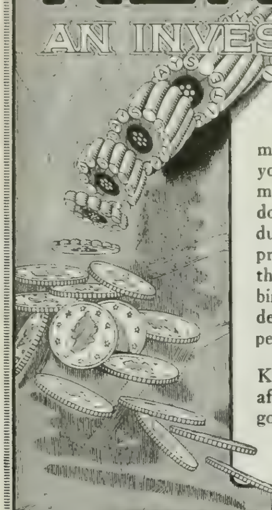

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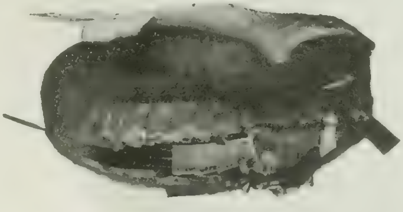

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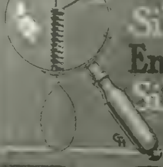

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Volume 80 New York, Saturday, December 30, 1922 *Number* 27

Christmas Business Has a New Meaning

NOT many years ago the Christmas season, from the business viewpoint, stood for little more than anxiety and added responsibility to the central-station executive. It marked the high point of the winter peak—that was about all. For during the very shortest days when the demands of lighting customers were greatest the holiday season superimposed additional demands upon the station.

Stores used larger-sized and additional lamps indoors and installed decorative, outline or festoon lighting outside, and they kept open later. Special sign and street lighting was made a feature of the shopping district. Christmas preparations and merrymaking increased the use of light in residences. Factories worked overtime on Christmas business, with extra demands for power and light. And the station ran at capacity and beyond. So the dawn of December 25 was ever welcomed with genuine relief.

The Christmas season was a burden then. But times and conditions have been changing and, while load peaks still exist, the commercial aspect of the season is steadily becoming to the central-station man more what it is to other manufacturers and merchants.

TODAY the Christmas season presents primarily an opportunity to introduce the use of electric labor-saving and comfort appliances into the homes of more people —to extend the idea of the use of electricity. Year after year the sale of electric Christmas gifts increases by tens of thousands of appliances. They have all become standard gifts, displayed and sold in department stores and many other shops that feature Christmas goods, as well as in the stores of every electrical dealer and in central-station salesrooms. We have just witnessed the closing of the most successful selling season for these electrical specialties in our history. And what is the result?

Each season, when the Christmas spirit weakens everybody's sense of thrift, countless men and women who until then have hesitated to spend the money purchase appliances for friends, for relatives and for their own households. Men buy their wives a dishwasher or an ironing machine, or it is decided in the family circle that they would all like best to have the old house wired. Gifts of money are, after Christmas, spent to purchase some appliance that has long been wanted. And the presence of the new equipment in the home inspires the installation of additional convenience outlets that have been needed. All this is business, now established, running into figures almost unbelievable.

IF THIS has come to pass in spite of central-station apathy toward merchandising and in spite of the inexperience of electrical retailers, it is the clear expression of a fast-growing popular desire for electrical appliances and the ability of some merchants to sell these goods. It is irrefutable evidence of a large neglected waiting market not only in the appliances themselves but also in the future energy consumption their distribution means.

William Rowell Putnam

A central-station executive with vision who ranks as an authority on central-station merchandising policies.

THE growth of the electrical industry is primarily a question of the building up of power loads, and to those who have laid the foundation for the growing use of power should be credited much of the phenomenal development of this industry. W. R. Putnam, vice-president and general manager of the Idaho Power Company, is one of this group of builders and pioneers. For the working out of the principles back of the merchandising of electric ranges the industry is indebted to a greater extent to Mr. Putnam than to any other man. As chairman of the electric range committee of the Northwest Electric Light and Power Association in 1917 he made the first comprehensive analysis giving accurate data on costs, merchandising methods and problems of accounting. This led to his appointment the following year as chairman of a similar committee of the National Electric Light Association. The report of this committee still stands as a work of reference in its field.

Mr. Putnam did not begin his career as a utility man. His native state was Minnesota, where after attending the public schools and state university he became a bookkeeper in a Minneapolis bank. Fate, however, saw to it that a small electric property at Red Wing, Minn., should fall into his hands. He spent ten years as manager of this company, turning his hand as occasion arose to every department of the enterprise. He spent the next decade in managerial and executive work with various electrical companies in the Mountain States and the Middle West. The Menominee & Marinette Light & Traction Company claimed his services as general superintendent, and later as general manager of the Dakota Power Company at Rapid City, S. D., he entered the field of hydro-electric power. In 1914 he became sales manager and afterward commercial manager of the Utah Power & Light Company. Here he accomplished a remarkable task in working out cost data so that the status of the commercial department, its costs and its importance to the company could be readily judged. Since 1919 he has been vice-president and general manager of the Idaho Power Company, and under his management this company has converted one out of five residential consumers to the use of the electric range.

Mr. Putnam has always believed in the work of the industry as a whole and has been prominent in association work in every part of the country where he has been stationed. He helped to organize the Minnesota Electrical Association, was active in the work of the Wisconsin Electrical Association and for many years past has been one of the leaders in the Northwest Electric Light and Power Association.

Editorial Comment

Electrical World, December 30, 1922

Volume 80 Number 27

A Resolution for Greater Service

TESTIFYING before the Joint New England Railroad Committee, Judge George Anderson of Boston, a former member of the Interstate Commerce Commission, charged that the steam railroad executives of the country were "lacking in virility, ingenuity and elasticity" and that their "gross inefficiency and arrogance had aroused the hostility of the public as well as of their employees." While it is apparent that Judge Anderson has little or no faith in our privately owned and operated railroads, he nevertheless voiced the opinion already held by many in this country.

The attack is of a nature to arrest attention, and we are wondering whether sooner or later some one of like standing may not make a similar charge against the executives of electric public utilities. At the moment we know of none to whom such a charge would apply. Nevertheless, since this is the season of resolutions, might it not be well for executives of electric public utilities to engage in a little introspection and honestly attempt to ascertain whether they or their organizations are unconsciously acquiring a spirit of arrogance?

The slogan of every electric public utility for the new year should be "Greater service," and if greater service is to be obtained, there must be virility, ingenuity, elasticity and efficiency. Lacking these, failure is inevitable, for our business would then be

> Fixed like a plant on its peculiar spot
> To draw nutrition, propagate and rot.

The Engineer Arrives in British Politics

A COMPILATION of the occupations of members of the new British House of Commons contains the welcome if surprising information that among them are twenty engineers. We shall have to wait for a directory of the Sixty-eighth Congress to know just how many the newly elected House of Representatives will contain, but it is quite certain that there will be nothing like a score. Even were it otherwise, their opportunities for shaping legislation according to engineering standards, as green members of a chamber where experience and priority go for everything and untried ability is at a discount, would be small. In Great Britain, on the other hand, with the House divided between four quarreling factions and with Parliament's direct control over public works in all parts of the country, twenty resolute and united men should be able to accomplish something to infuse efficiency, economy and energy into governmental enterprises where these qualities may be lacking and to maintain them where they exist.

We do not know that the score of engineer M.P.'s are resolute and united, nor are we presumptuously suggesting that they should form a parliamentary "bloc." But in a House where 140 trade unionists will fight for and against the paternalism that they love and hate, where eighty lawyers will divide jurisprudential hairs, where thirty writers will turn statistics and bluebooks into copy, where seven brewers and distillers will watch out lest the pussyfooter gain an entrance, and where two "housewives" will shrill vociferously in a wilderness of males, the solitary clergyman thereto elected might pardonably extend a blessing to twenty engineers whose personal interests are ineluctably intertwined with the promotion of those internal improvements and those friendly external relations on which a nation's welfare is based.

"Our Duty as Well as Our Right"

ELIHU ROOT, speaking as chairman of a meeting of the Council of Foreign Relations, said: "We as a nation must come to recognize not only our rights as citizens, but our duties." Secretary of Commerce Hoover, in a concise and clear essay on "American Individualism," makes of the same thought the basis of the national American principle of equality of opportunity. These expressions of public men are concrete evidence that the way to leadership in this world of mixed affairs lies in putting "duty" before "rights," the moral purpose of individualism ahead of the selfishness of the individual.

There are many applications of these elementary principles, but none more immediate than was developed at the dinner of the Council of Foreign Relations. Our partnership in Europe's problems is needed. Albert Thomas, director of the International Labor Office, Geneva, and a Frenchman whose sincerity and high purpose are evident, says that Europe is on the verge of collapse, not because of economic conditions alone, for there are, he says, favorable sides to these, but "because of the apathy of the working classes as a mass, the 'don't-care' spirit, the hopelessness of peoples sickened by war." Everywhere in Europe, he reports, there is among the producing classes a moral let-down which in its fundamental character he compares with the decline of Rome.

Evidences of this aftermath of war are not absent from America. Costs are high not alone because of maladjustment of the forces of supply and demand, but because the spirit of work, the individual ideal of duty to the job, is lacking. This decline in moral stamina demands drastic action. We must as individuals neither expect profits for less service nor wages for less work. We must as a people recognize duty to a prohibitive law as well as our individual rights as citizens. We must as a nation see our "duty" to our sister nations as well as our "rights."

America has a fraction of the troubles of Europe. Our children are not green with undernourishment as they are in Germany. Our people are not asking for bread and getting stones as in Russia. Relatively as individuals and as a nation we are well off. What are we doing with our opportunity?

Dean Kimball in his presidential address before the American Society of Mechanical Engineers restated the engineer's relation as a citizen and as an engineer to these problems. Engineers may take an intimate part as citizens in the solution of international affairs by setting up the ideal of duty as well as right.

But engineers have a very practical opportunity to lay the foundation of a better understanding between nations by establishing a means for the exchange of facts regarding industrial and economic life which underlie the political and nationalistic debates. A world engineering survey of oil deposits, oil products and oil requirements as regards production and consumption would form a basis for the discussion of how to divide some local oil region without going to war about it. Men would debate the local division on the basis of a universal knowledge of the location and value of all the world sources, enabling conclusions fair and just to all to be reached. The machinery for accomplishment has not been devised. An engineering bureau of the League of Nations would be quite as fundamental as the Labor Bureau. But in whatever form the machinery is evolved the place and the need of the engineer both as a citizen who can place duty ahead of rights and as an engineer-analyst of facts are obvious, and his assumption of this duty is surely coming.

Why There Is Dearth of Central-Station Salesmen

AMONG the pressing problems confronting central-station commercial managers right now is that of finding suitable men as salesmen both in power sales and appliance merchandising. We hear much comment to the effect that "our old salesmen left us during the war and we can't get men to take their places, so we must start all over and train an entirely new crew." All of this is true, but while these new men are being found and trained to the business it may not be amiss to look back and consider just why the old salesmen left and also why they are not now returning to the central station. In a word, they were not paid enough. Love of the game and a certain fascination about being connected with the light and power company were strong influences to hold some good men for a time even in the face of better offers, but finally in justice to themselves they were forced to go to more lucrative fields.

There are many central-station executives who, through mistaken ideas of economy, have long pursued a backward policy in the remuneration of their salesmen. These salesmen are the ambassadors of the company to the high court of the customer. They are representatives. Yet many companies have been paying salaries so small that they do not appeal to men who could truly represent them, and on top of that in many cases the company executives have given their salesmen that belittling appellation "solicitors." To make these jobs attractive to men of the caliber wanted for this work it is necessary to hold out something more than the glory of the business. There must be both recognition and reward.

If the central-station companies want salesmen who are really competent and not just peddlers, it will be well for many of them to revise their scales of compensation so that this work will carry with it something more than a bare living and specialized experience. Our great central-station industry has been built up by engineers who have stuck with it—why not make the salesmen just as permanent? The market offers plenty of opportunity to interest men capable of real achievement and to pay them well out of the profits that their efforts bring.

The Eternal Problem of Rate Making

THE making of rates for electric service is, and apparently ever will be, a trial to the soul. The real desire, of course, is to play the game fairly and to base rates on sound equity. If there were a system of rates both scientific and practical, it would have been adopted years ago. But, as we have many times said, the problem does not admit a unique solution. The conditions are too complicated and the independent variables too many. The best approximation is obtained by selecting a practicable number of variables and merging the rest by general average into either constantly or simply grouped variables. We publish this week a paper by Messrs. Greene, Schoonmaker and Gorton which admirably deals with this sort of situation. It shows both the general nature of the solution and how it can be worked out with relatively simple assumptions, and in particular it shows the method of treating the demand charges from various viewpoints. We think that as a matter of fact the items of fixed and energy charges cannot be dealt with in a uniform way the country over, so that a fair amount of latitude must be permitted. And after all the commoner factors are duly scheduled the diversity factor is likely to break in with a new set of complications; but by the use of the orderly plans for cost analysis here shown it is certainly possible to lay out a system of charging which broadly is fair to both parties and which may be of real use in smoothing the way. We note and heartily approve the authors' opinion that rates which tend to limit the consumption of energy by underrating service charges and overstressing energy charges are ultimately bad business.

Attain Simplicity in Motor Control

THE problem of motor control in a sugar refinery is on the whole a very unusual one, because the process is imperatively continuous and every part of it must be co-ordinated accurately on pain of serious trouble. Of course, the same general principle controls in other industrial lines, but nowhere else is the working together of the various parts of the process quite so essential. Therefore it is necessary to take as few chances as possible in the matter of motor control, while at the same time a certain amount of interlocking must be regarded as an absolute necessity.

In a broad, general way a constant effort was made in planning the Baltimore installation of the American Sugar Refining Company, discussed on page 1433 of this issue, to attain the maximum of simplicity because of the relatively low grade of labor employed and the large labor turnover. On the other hand, the requirements for continuity necessitated a certain degree of complication. No plant is ideally simple. The engineer has at every stage of design to strike an average between that simplicity which means nearly complete absence of apparatus not absolutely necessary and that simplicity which accomplishes desired results with as little complexity as possible.

One of the radical steps taken in this case was the abolition of fuses, all motors being under the control of comparatively simple individual circuit breakers. With the equipment provided there is no question as to the size of a fuse, or of what particular fuse has blown, or where the electrician whose duty it is to replace the blown fuse is. Aside from this, the general principle was followed of having the entire control equipment manually operated so far as conditions permitted. Right here the necessity of interlocking intervened, for a certain group of the machines must work together harmoniously to keep the product going in its regular progression. To this end the circuit breakers in any group of machines in which regular sequence has to be followed are electrically interlocked, so that if a breakdown occurs at any particular point all the machines preceding this point also stop, while those following it in the sequence go on and discharge the material in process, thus clearing the way for a fresh start. Before the interlocking scheme was completely worked out it necessarily departed from ideal simplicity, but to good purpose.

A study of this second paper by Roger B. Stevens gives an excellent idea of the progress of orderly design in the details of this particularly modern and instructive industrial equipment.

The Voltage Limit for the Pin-Type Insulator

THE great step upward in voltage in electric power transmission came with the advent of the suspension insulator. The pin-type insulator seemed at about 60,000 volts working pressure to be reaching its practical limitation. There were several good reasons for a limit to appear. First, the manufacture of insulators big enough to have an adequate flash-over limit becomes exceedingly difficult on account of the weight and thickness of the sections and the danger of mechanical imperfection of sectionalization in the interest of better construction is carried too far. Second, it is difficult to make these big insulators thoroughly homogeneous, well vitrified and free from the imminent danger of flaws developing through temperature changes. Finally, the mechanical strains on the whole affair from the wire tied into the top groove become rather serious when the circuit is a heavy one. One of the great outstanding advantages of the suspension type of insulator is that it can allow a certain not inconsiderable amount of end play which greatly relieves some of the strains on the line. An article in the current issue by Paul Ackerman of the Shawinigan Power Company gives a most instructive account of the successful adaptation of the pin-type construction to several 90,000-volt lines.

It is the rather general belief among engineers that the wet flashover voltage of an insulator must give a factor of safety of two to two and one-half, preferably the latter, over the rated working voltage. This opinion we believe to be absolutely well founded, but the Canadian experiment shows that with skill and no little courage a line can be operated on a materially smaller factor of safety, provided one is willing to accept a little inconvenience in the way of temporary failures. As a matter of fact, the system has been running with a very creditable degree of success for the past four years. The tables of failures given in the paper before us show that serious interruptions were few and that interruptions directly chargeable to the low factor of safety were still fewer. Temporary interruptions were rather numerous, but the precautions taken in the way of relay protection were so effective that the damage from brief short circuits was minimized.

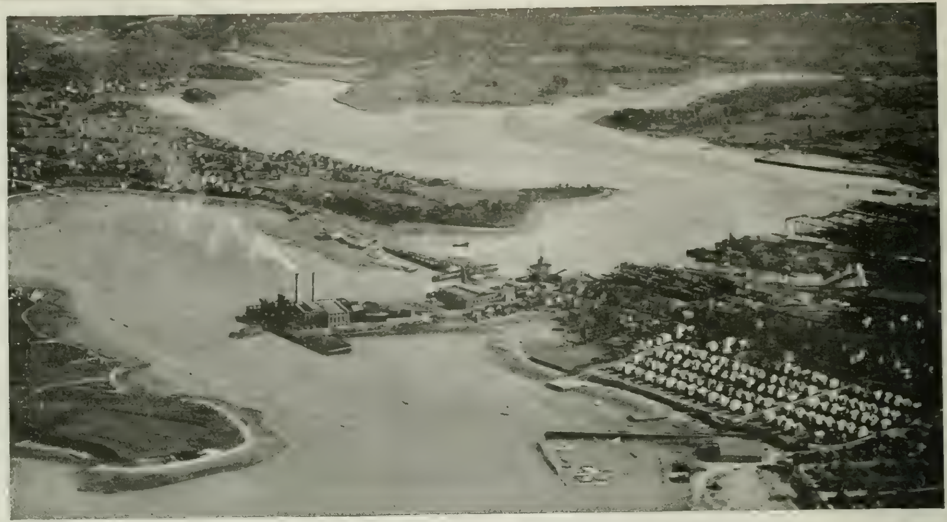
The relays were very ingeniously planned to work in pairs, an overload and differential relay pulling together to clear a short-circuited line in the shortest possible time. This protective feature is worth particular attention, and it seems to us to have been a very important factor in maintaining service in spite of "taking a chance" on the insulators. But it seems, too, that the insulators were unquestionably of very high quality as a whole, even if some trouble was experienced from temperature cracking.

Most of the additional difficulty is likely to have come not from direct failure of the insulator as such, but from the shift from delta to Y connection, establishing thus the same danger of grounding on the towers at 60,000 volts that had previously existed between wire and wire with each independently insulated. Bringing the ground up to the individual insulator is likely to enhance the chances of trouble unless the insulator is very materially stiffened, but it is a procedure so necessary at times in transmission work that one must cheerfully take the chance and strengthen the insulator when he gets the opportunity.

Considering this fact, the experience on these circuits from the Shawinigan Falls plant has been remarkably encouraging and speaks volumes for the quality of the insulators. The factor of safety was cut to a figure which would not have been adopted except from necessity, but the care with which the job was engineered enabled the transmission company to get away with it. It is not an example to be followed in planning a new line or in reconstructing an old one if the load conditions are such as to justify the complete expense of reinsulation, but it ought to encourage those who are hard put to it in the matter of line losses to take cheerfully the modest risk involved in raising the voltage without rebuilding the line. To any thinking of such a step we would earnestly pass out the advice to examine very carefully the relay protection, which seems to have been so important a feature in the case before us and to make sure that their insulators are as good as those which have done such sterling duty on the Canadian system.

Predictions Which Come True

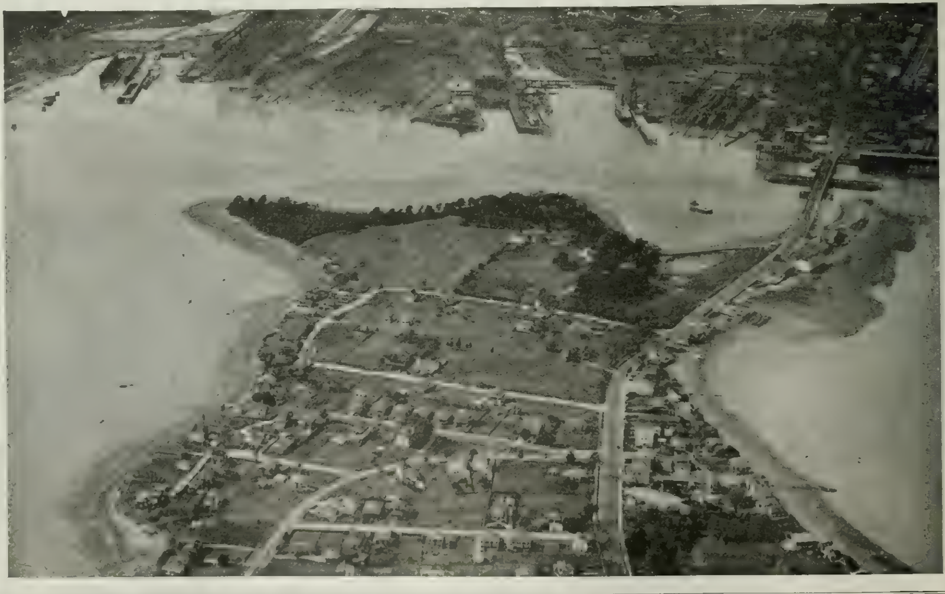
ON MAY 14, 1921, we made the following observation on Governor Miller's appointees to the New York Public Service Commission: "On the whole, the Public Service Commission law as revised is good, but the appointees so far must be accepted on faith. Evidently experience in public utility affairs did not count in their preferment. But a body composed of five Republicans appointed for a term of ten years at a salary of $15,000 a year and removable only by impeachment or legislation seems to us to offer an excellent opportunity for Democrats when they come into power to legislate the commission out of office and appoint five of their political faith." This prediction is about to come to pass. The Democrats will come into power in New York next week, and Governor-elect Smith is talking vociferously on "home-rule" regulation for utilities. What we can expect is a new commission with "home rule" as the excuse for legislating the present incumbents out of office. Such is politics.



Value of Airplane Photographs in Plant Reconnaissance Shown at Boston

THE decision by the Edison Electric Illuminating Company of Boston to build a 300,000-kw. steam generating plant at Weymouth, Mass., followed an exhaustive study of Greater Boston and its surroundings, the advantages and disadvantages of various possible sites being carefully considered by the company's engineers and executive officers. In connection with the study of the finally selected site in relation to the town of Weymouth, the general shore line of Fore River, railroad facilities and relative channel depths seven airplane photographs were taken. These photographs, of which two are reproduced herewith, make it possible to obtain a general understanding of the topography at a glance, including cleared and wooded areas, location of buildings, etc. The shore line is well defined, as the pictures were taken at low tide. The relative depths of the water are clearly discernible, as the shallower portions appear much lighter in color than the main channel, which has been dredged sufficiently to float battleships and other large craft which may be launched at the adjacent shipyard.

The new generating station will be built on a tongue of land jutting out into Weymouth Fore River and directly opposite the Fore River works of the Bethlehem Shipbuilding Corporation, Ltd.



Handling Cost Elements in Fixing Rates

How Accurate Cost Analysis May Be Used in the Establishing of Equitable Charges—Why Energy, Consumer and Demand Elements Should Be Considered Separately—Allocation of Demand Costs

By W. J. GREENE, C. F. SCHOONMAKER and C. B. GORTON

IN THE first article of this series (*Electrical World*, Oct. 21, 1922, page 878) a method was given for allocating the energy, consumer and demand expenses of a general light and power system to the classes of consumers. The second article (*Electrical World*, Oct. 28, 1922, page 928) gave an example illustrating the method. This article gives a method by which class rates based on the cost of service can be developed from the costs allocated to the class.

It is now generally accepted that rates for the sale of utility service should follow the cost of rendering the service. This form of rate charges to each consumer the costs incurred in furnishing the service. In the following discussion reasons are given why each cost element must be considered separately if equitable rates are to be developed.

THE unit energy cost should be the same for every consumer of a general light and power system regardless of the number of kilowatt-hours used. Owing to differences in distribution losses, there may be differences in unit energy costs between different systems in the same city and between similar systems in different cities served from a common transmission system. These differences are recognized and are properly reflected in unit energy costs by the method of allocation proposed. Power-plant unit energy costs vary from hour to hour because of differences in power-plant loads, quality of fuel, cost of fuel, the energy portion of material and labor, and operating methods; but there should be no differentiation made in unit energy costs between systems or between consumers of a system because of these variations. Of all of these variables the only one that can be affected by a consumer is the power-plant load, because the size and time of a consumer's load are the only factors under his control, and a change in power-plant load may result in the same, an increased or a decreased power plant unit energy cost. The public utility industry is based on the principle of the economic community of interests, and any change in unit energy costs should be shared by all in proportion to their consumption. To illustrate we will assume a plant with a 5,000-kva. load and with a new consumer about to be added with a 5,000-kva. load, resulting in a total plant load of 10,000 kva. Larger and more economical equipment would be installed for the combined load, resulting in lower unit energy costs. It is evident from a cost basis that the new consumer should not receive a greater portion of the reduced unit energy cost than the other consumers, because the lower unit energy cost was obtained only by the combination of the two loads. Therefore all energy costs should be averaged and any variation in costs should be shared by all consumers of a system in proportion to their kilowatt-hour consumption. Fluctuating prices of fuel, material and labor and generating plant economy can be reflected in rates by providing for periodic adjustments for any variation from a base energy rate.

CONSUMER COSTS INDEPENDENT OF CONSUMPTION

Consumer expenses (Table II, *Electrical World*, Oct. 28, page 930) are those expenses that vary directly with the number of consumers and are independent of the consumers' energy consumption and demand.

The unit consumer cost of a general light and power system may be co-ordinated in a rate as follows:

(1) *Make It a Function of Demand.*—Consumer expenses can be reduced to a unit cost per unit of demand, but when so expressed all consumers whose demands are less than the average demand per consumer would not be charged with their share of the consumer costs. Those consumers with a demand greater than the average would be charged with more than their costs. This method should not be considered because of its inaccuracy and the fact that its application would still further complicate the already difficult problem of coordinating the demand costs in rates.

(2) *Make It a Function of the Total Kilowatt-hours Used.*—Consumer expenses can be reduced to an average unit cost per kilowatt-hour, but when so expressed all those consumers whose consumption is less than the average number of kilowatt-hours per consumer would not be charged with their share of the consumer costs. Those consumers who use more than the average number of kilowatt-hours per consumer would be charged with not only their own consumer cost but also with a portion of the consumer cost of those consumers whose consumption is less than the average. The utility may collect all the consumer costs in this manner, but not without discrimination. The real weakness of the method is that it results in inequitable and discriminatory rates.

(3) *Make It a Function of a Certain Number of Kilowatt-hours Used by Each Consumer.*—If an attempt is made to collect consumer costs on a certain number of kilowatt-hours used each month by each consumer, the same objections exist as in the second method, though to a lesser degree.

(4) *Make It a Function of Minimum Charge.*—(a) Collect a portion of the consumer cost in the minimum charge and the balance as a part of the kilowatt-hour charge for the kilowatt-hours included in the first turning point. The error of this method is that those consumers who use less than the average of the kilowatt-hours included in the first turning point pay less than their consumer costs, those who use more than the average pay more than their portion. (b) Collect all the consumer costs in a minimum charge which includes the cost of the kilowatt-hours in the turning point. The error of the plan is that the consumers who use less than the turning point will pay for electricity not used.

(5) *Make It a Separate and Distinct Charge.*—If the unit consumer costs are made as a separate and

distinct charge, the consumer element can be introduced in rates in a simple and accurate manner. Each consumer would pay only his proper portion of the costs.

It has been shown that energy and consumer costs can be reflected accurately in rates by keeping the two elements separate. Demand costs are more difficult to introduce accurately in rates. A kilowatt-hour demand charge can be obtained by dividing the total demand costs by the total kilowatt-hours sold, and the cost can be introduced into rates by adding the result to the unit energy cost; but such a procedure is far from accurate except for those consumers whose kilowatt-hour consumption per unit of demand is approximately that of the weighted average consumption per unit. The arguments given against relating consumer costs to kilowatt-hours apply, but in a greater degree, to the plan of relating all the demand costs to kilowatt-hours. A portion of the demand cost can, however, be allocated accurately on a kilowatt-hour basis. The method of determining this portion will be described in another paragraph.

Allocation of the Demand Costs

The unit demand cost found by dividing the total demand cost of a class by the sum of the demands of all consumers in the class would be accurate only for those consumers who have a load factor equal to the weighted average load factor. To those consumers who have a load factor lower than the average will be given a cost greater than their actual costs, and to those consumers who have a higher load factor will be given costs less than actual costs. Demand costs cannot be introduced accurately in rates by the use of a unit demand charge obtained in such a manner.

The method developed for allocating the capacity costs of a class to the consumers of the class is described below:

1. Divide the average monthly capacity expense of the class by its equivalent peak responsibility.
2. Divide the capacity expense of the class for the period by the sum of its consumers' monthly maximum demands.
3. Determine the average monthly load factor of the class, based on the sum of its consumers' monthly maximum demands.
4. Divide the difference between the results obtained in items 1 and 2 by 100 minus the average monthly load factor of the class (item 3). The quotient is the unit charge per unit of demand for a 1 per cent load factor.
5. The unit charge (item 4) divided by 7.3 (1 per cent of average hours per month) is the unit demand charge per kilowatt-hour.
6. The unit demand charge (item 5) multiplied by the kilowatt-hour consumption of the class is the portion of the capacity costs that can be correctly collected on a kilowatt-hour basis.
7. The difference between the capacity costs of the class and the cost determined in item 6 is the portion of the capacity costs that should be collected on a demand basis.
8. Divide the demand portion of the capacity expense (item 7) by the sum of the consumers' monthly maximum demands; the result is the unit demand charge.

In the problem previously given (*Electrical World*, Oct. 28, page 928) to illustrate how a plant's capacity costs are allocated to the classes of consumers the demand costs for each class were: Residences, $853; commercial light, $145.96; commercial power, $254.02.

The load characteristics of the classes were:

	Kw.-Hr.	Equivalent Peak Responsibility	Sum of Maximum Demands
Residences	10,200	70	850
Commercial light	5,780	15	100
Commercial power	16,170	28	120

Applying the method to the data gives:

	Residences	Commercial Light	Commercial Power
1. Unit peak responsibility factor	$12.19	$9.73	$9.07
2. Unit maximum-demand factor	$1.00	$1.46	$2.12
3. Average monthly load factor, per cent	1.64	7.92	18.43
4 Unit charge for a 1 per cent load factor, cents	11.38	8.98	8.52
5. Demand portion per kw.-hr., cents	1.5584	1.23	1.06
6. Demand portion allocated on a kw.-hr., basis	$158.96	$71.09	$171.40
7. Demand portion allocated on a demand basis	$693.88	$74.87	$82.62
8 Unit kva. demand charge, cents	81.6	74.9	68.9
Unit Costs:			
Electricity cost, cents	5.26	4.93	4.76
Demand cost, cents	81.6	74.9	68.9
Unit consumer cost	$1.03	$1.03	$1.03
Total Costs:			
Electricity cost	$536.52	$284.95	$769.69
Demand cost	693.88	74.87	82.62
Consumer cost	825.12	72.40	30.63
	$2,055.52	$432.22	$883.04

The differences between these values and the ones given in the original problem are caused by the use of approximate unit costs.

Any method that would accurately allocate the demand costs of a class to its consumers would require instruments that would show the relation between each consumer's peak responsibility, maximum demand and load factor. The method developed makes some assumptions and there is an error introduced by these assumptions. The amount of the error is greatly reduced, however, because the portion of the costs that are affected by the error is relatively small, and also because in the residence class where the greatest error may occur the probability of any wide variation in the consumers' load characteristics is remote. In this class 67 per cent of the total costs are allocated without any error being introduced. In the commercial light class 83 per cent of the cost is accurately allocated. In the commercial power class 91 per cent is accurately allocated.

It is believed that the economical saturation of a district in the use of electricity depends to a large extent on the form of rate used in the sale of the service. The best development cannot be attained where some classes of consumers are receiving service at less than cost. This places a burden on the remaining classes that will prevent their using the number of units of service that they otherwise could afford to use economically.

If the unit charges for electric service are determined on a cost basis, the consumer and the utility will have a correct measure of the quantity of electricity that can be profitably and efficiently used.

The usual form of rate for residential service is one that tends to limit the kilowatt-hour consumption, because all or a large portion of all the costs are collected on a kilowatt-hour basis. The energy cost of serving residential consumers is a very small percentage of the total costs. If rates were used in which the kilowatt-hour charge covered the energy and a small unit portion of the demand cost, those consumers would have a great incentive to increase the use of energy. No class of service has such a poor load factor as the residential class, and in no class is the possibility of development so great.

Selection and Control of Motors

Avoidance of Service Interruptions Without a Trained and Expensive Maintenance Crew and Under Necessity of Operating with Common Labor Was Chief Problem in American Sugar Refining Company's Plant

By ROGER B. STEVENS*
Consulting Engineer, New York

A FLEXIBLE METHOD OF OPERATING PUMPS IS USED TO CARE FOR FLUCTUATING DEMANDS

CONTINUITY of operation, the elimination of the necessity for a large force of trained and expensive maintenance men, the use of common labor (largely foreign and colored) and the high labor turnover attendant upon the employment of this class of workmen were factors as important in determining the selection and installation of motors and control apparatus at the Baltimore plant of the American Sugar Refining Company as in deciding the features of distribution described in the Dec. 9, 1922, issue of the *Electrical World.* In this plant approximately 500 motors, aggregating 7,900 hp., were to be installed, the largest being 300 hp. Motor speeds have been kept low wherever possible, in most cases ranging from 750 to 900 r.p.m. In almost all cases the connection between the motor and the driven equipment is by means of a silent chain, spur or worm-gear reducers or direct application to the driven shaft. As pointed out before, each step in the sugar-refining process is vitally dependent upon those processes immediately preceding and following it, and any change in the production rate at one point must be accompanied by a simultaneous change throughout the chain, or loss will result. Owing to the nature of the labor employed, it would be decidedly out of place to use equipment which requires a high degree of skill and care in its operation. In addition the higher labor turnover makes it essential that equipment be provided which green labor can be trained to operate in a minimum of time.

In view of the fact that this plant was to be the largest direct-current industrial project that had come up within recent years, and that the attention of manufacturers has been turned for some time almost exclusively to the development of alternating-current industrial equipment, special attention had to be paid to the selection of motor equipment from the standpoint of excellence of construction, dependability of service and the availability of repair-part stocks.

A decision was finally reached that while a number of small manufacturers were in a position to supply direct-current motors which were eminently satisfactory from the standpoint of ruggedness, efficiency and general excellence of construction, the advantages of the service in their own local shops which could be obtained from larger manufacturers were too great to be overlooked. Both the Westinghouse and the General Electric Company could assure the maintenance of a complete stock of repairs and spare parts for all the equipment which they might furnish in Baltimore. As a result, all motors for the power and boiler plants with their starting equipment were purchased from the General Electric Company, and those for the process buildings, with a few exceptions where special equipment was purchased, of which the motors were an integral part, were procured from the Westinghouse Electric & Manufacturing Company.

To take advantage to the fullest extent of the adjustable-speed possibilities of the direct-current shunt or compound-wound motor, every drive where there was the slightest possibility of future change in speed has been provided with a motor whose normal full-load speed is considerably (5 to 25 per cent) lower than the expected requirement. This provision, with the installation of a combined starting and field-regulating rheostat, capable of increasing the motor speed anywhere from 10 to 100 per cent above normal full-load speed, allows almost any possible future requirement within the power of the motor to be met without interchanging motors. To prevent overspeeding of the equipment through careless operation of the field rheostat, the amount of field resistance required for the highest speed under present conditions was determined as soon as the plant started to work, and the excess resistance was shunted out with an easily removable soldered jumper.

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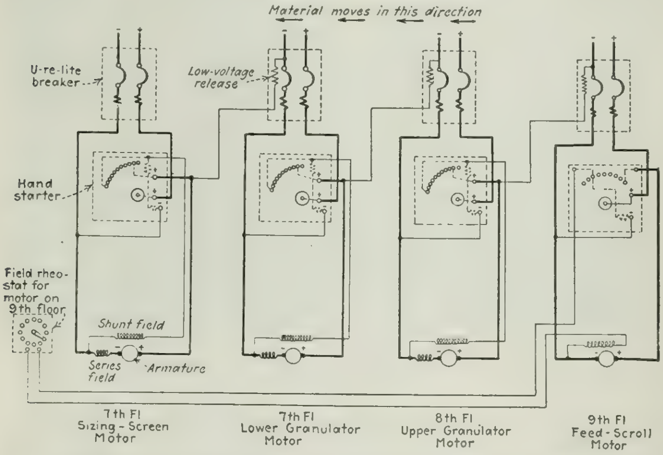
The factors influencing the selection of equipment which were outlined at the beginning of this article seemed to point to the desirability of providing automatic control. However, the maintenance of an extensive equipment of automatic devices requires the employment of a comparatively large force of high-priced men, and even with the best of care short-time shutdowns for adjustment and minor repairs are bound to be frequent unless a large and expensive stock of spares is maintained and unless routine replacements are made before trouble develops. Consequently, the decision was made that the cheapest and most reliable operation was to be obtained from the installation of as much rugged manually operated equipment as possible and by the use of every available safety device and protective appliance to prevent accident and destruction of equipment from careless and improper operation. Where automatic equipment was required every precaution was taken to have it as simple as possible in operation and construction and to protect it in every way from mechanical or electrical injury.


Material moves in this direction
U-re-lite breaker
Low-voltage release
Hand starter
Field rheostat for motor on 9th floor
Shunt field
Series field
Armature
7th Fl Sizing - Screen Motor
7th Fl Lower Granulator Motor
8th Fl Upper Granulator Motor
9th Fl Feed - Scroll Motor

INTERLOCKING SYSTEM FOR MANUAL STARTERS OF SEQUENCE PROCESSES

Probably the greatest single step toward the attainment of ideal conditions was made by the installation of individual motor circuit breakers and the complete elimination of the troubles and expense attendant upon the use of fuses.

Fuses Avoided

The writer believes that of all the electrical causes of lost time in electrified industrial plants the greatest is the blowing of fuses. Especially is this true in a factory where material is routed through a series of machines or processes in a continuous sequence of operations, each dependent upon the proper and complete functioning of the units immediately preceding and succeeding it in the chain. The blowing of a fuse under these conditions means that an electrician must first be sent for. He must determine the size of fuse required and obtain it from the storeroom and then return and install it—in most cases entailing a total delay of from a half to three-quarters of an hour.

In some factories this delay means a loss which amounts to an astounding figure when proper account is taken of the time lost by the machine directly affected and its operator, the machines immediately following it in the process and their operators, and the machines preceding it, which must be stopped or slowed down to prevent the piling up of partly worked material in an unstable condition. The importance and extent of the indirect losses due to stoppage of machines depends to a large extent upon the nature of the material worked and the amount of storage provided in the various parts of the process.

In the case of a sugar refinery the sugar is almost constantly in a condition which allows it to be left for only a very few minutes without serious deterioration.

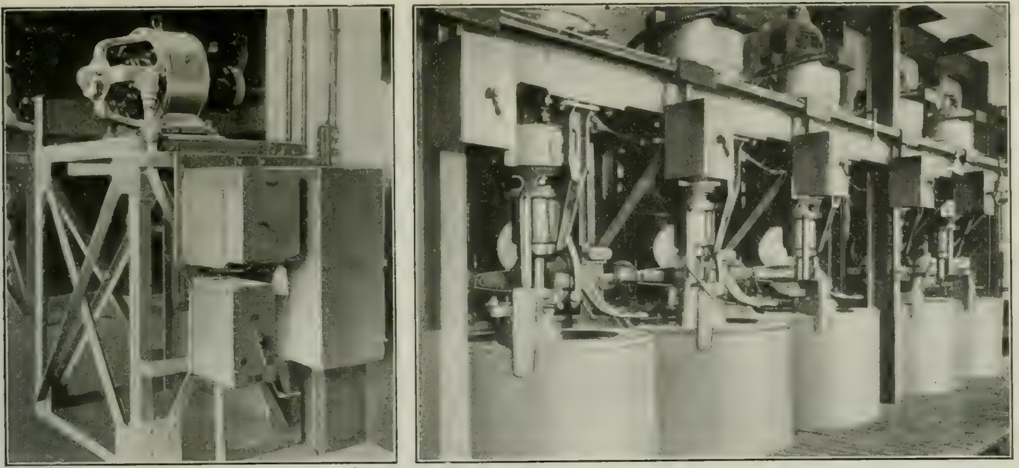
A case very much in point is that of the mixers under the vacuum pans. Each mixer may hold at one time as much as 80,000 lb. of sugar and syrup mixture, and should the agitators stop for any considerable length of time the whole batch hardens and must be dissolved with hot water and put through practically the whole refining process again. During the period while the mixer is being emptied and cleaned—a matter of hours—the four to eight centrifugal machines which depend upon it for their supply of raw material are rendered idle with their operators.

Thus frequent stoppage of equipment and delays in restarting may become very expensive.

The natural result, if fuses are used, is that after a few stoppages due to momentary or continued overload, the electrician in charge puts in a heavier fuse, or the man operating the machine "jumpers" the fuse block with a piece of No. 4 copper wire, where it can't be seen. Then the trouble stops—until a real overload comes along, after which a new motor has to be installed, while the old one is sent to the shop for the rather expensive job of rewinding.

These dangers were realized to such an extent that figures were compiled proving conclusively that the installation of a circuit breaker, provided it could be properly protected from unauthorized tampering and at the same time left available for easy and quick operation, would pay for itself in a surprisingly short time. Such a breaker was made available by the Cutter company at just about the time the designs of the Baltimore refinery were under way. It consists of an "ITE" circuit breaker in a steel box, operated from outside by an insulated handle so arranged that after the breaker is closed it may be blocked or tied in any position without interfering with the overload operation of the arms. This arrangement overcomes one serious objection to the use of breakers on individual motors. In addition, the apparatus is so arranged as to be non-closable on overload, and is equipped with a direct-acting time-limit device to take care of starting overloads. The box may be locked to prevent tampering with the adjustments, and the arms may be locked out to allow repairs with safety.

A feature which made this circuit breaker especially well adapted to the requirements of the present installation is the fact that no overload relays are used, the overload device acting directly on the tripping mech-



SOME PRACTICALLY FOOLPROOF MOTOR AND CONTROL INSTALLATIONS

anism instead of on an auxiliary control circuit, thereby simplifying the mechanism considerably and assuring positive and dependable operation.

THREE CLASSES OF MOTORS TO PROTECT

For the purpose of determining the method of protection to apply, all motors in the plant were divided into three arbitrary classes, depending upon their application, size and method of control, as follows:

1. Motors of 50 hp. and below, with manual starters.
2. Motors of more than 50 hp., with manual starters.
3. Motors of any size with automatic starters.

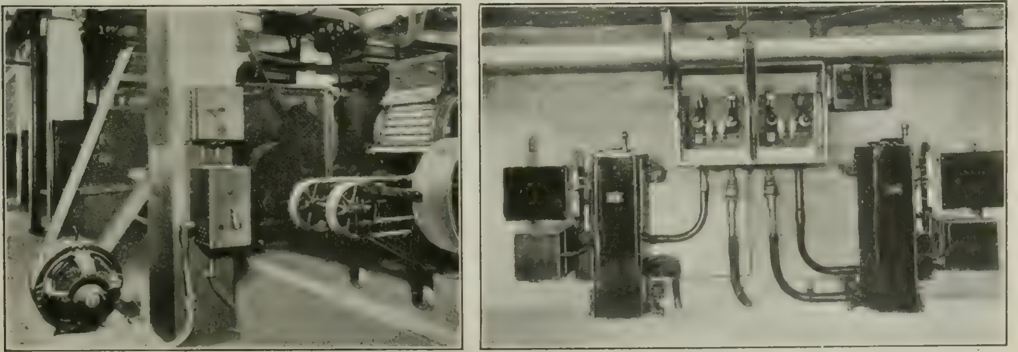
The reason for differentiating between the first two classes was the excessively high first cost* of the completely inclosed externally operated type of breakers in capacities about 250 amp. For this reason motors of the first class were provided with "ITE" type W. breakers, installed in cabinets identical with those throughout the distribution system, the only difference being that the motor breakers were provided with time-limit devices to take care of starting overloads, while the distributing circuit breakers were so equipped only when the largest motor on the circuit to be protected might be expected to take a starting current comparable with the setting of the feeder breaker.

In most cases of this kind the breaker and its cabinet have been grouped with those protecting the other branch feeder circuits from the same floor, and a separate feeder has been run from the breaker group to the individual motor.

Motors of class 2 are in every case equipped with the standard type of fully inclosed breaker. This class includes most of the motors in the plant.

Motors of class 3 required careful consideration. Standard counter-emf. starters (automatic) were available which could be procured with overload trip and time-limit relay protection on the main-line contactors. This allowed them to operate as single coil breakers, but the grounded-neutral lighting system in the plant necessitated the use of two-coil protection. Since this could not be procured as standard equipment from the companies which furnished the other control apparatus, three alternatives were left:

1. Separate circuit breakers could be installed, as in the case of the manually operated machines, but this seemed an unnecessary expenditure when the contactors were already in place and would partly serve the purpose.



SAFETY SWITCHES AND CONDUIT WIRING CHARACTERIZE THIS INSTALLATION

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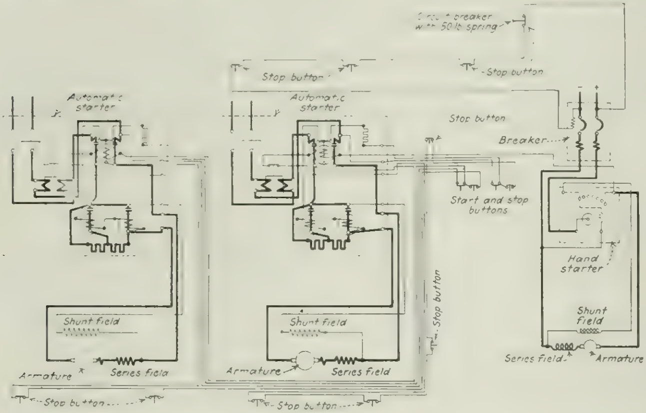
*Since the time this plant was designed completely inclosed and externally operated breakers have been developed in the larger sizes at a price proportionate to the smaller ones.

2. A fuse could be installed in the unprotected side of the line. This was never seriously considered.

3. Starters could be procured from competitive manufacturers with double coil protection. This possibility was considered and dropped, as the automatic starters were to be a comparatively unimportant part of the total installation (from the standpoint of number installed), and it was felt that the advantage to be gained would be overbalanced by the disadvantages introduced by the break in the standardization program and the necessity for carrying a stock of additional parts and familiarizing the maintenance force with another class of control equipment.

The expedient finally adopted was to purchase standard type C counter-emf. controllers with special double-pole, double-coil overload relays and main-line contactors with time-limit attachment and to dispense with the separate circuit breakers. By purchasing in quantity and under the regular sliding-discount-scale motor agreement, the cost of the controllers so equipped was probably less than the cost of standard equipment from other manufacturers would have been. At the same time, the advantages attendant upon the use of one manufacturer's equipment throughout were retained.



INTERLOCKING APPLIED TO AUTOMATIC STARTERS FOR SEQUENCE PROCESSES

Sequence Processes Interlocked

Owing to the fact that sugar and its derivatives are handled in this factory by a sequence of machines with a minimum of storage facilities between them, it was very important that if one of the machines should stop the machines ahead of it should also stop to prevent piling up of material and flooding of the stopped machine. In the older refineries this result has been partly attained in a rather makeshift way by using the group drive. This has several disadvantages, the outstanding ones being that as the machines are ordinarily placed on different floors in order to obtain a gravity flow of material, the use of belt drives through holes cut in the floor was necessary. Besides, when trouble occurred, the material remaining in the machines could not be run out. Electrical interlocking of the individual machine drives was consequently selected as being more satisfactory.

Interlocking has been effectively carried out by providing the motor breakers with no-voltage-release attachments and supplying voltage for the holding coil on each machine from a point between the motor and breaker of the machine following it in the sequence. In this way the stoppage of a machine from any cause immediately stops all the machines preceding it in the series and prevents piling up of material, while the machines following it continue to run and discharge the material which remains in the system. This has been of special value in the case of elevating and conveying machines dumping into each other and into other machines. This interlocking scheme was also used in the raw-sugar elevators and conveyors. Here complications were added, however, by the fact that three conditions must be met, namely, the continued operation of units 1 and 2, combined operation of units 1 and 3, and independent operation of all three units.

These conditions were met by using a small Westinghouse type M drum switch with the contact fingers changed to give the desired connection changes. To change from night to day operation it is only necessary to move the handle on the master switch from the position marked "independent" to that marked "1 and 2" or "1 and 3" on the accompanying schematic diagram.

The two schemes outlined, or modifications of them, have been used wherever conditions made it desirable, with the result that one of the greatest troubles experienced by the existing refineries has been completely overcome.

One of the most interesting of the motor applications is that in connection with the pumps which furnish cooling water for the jet condensers on the vacuum pans. As nearly as could be calculated when the equipment was purchased, the demand on these pumps might vary anywhere between 3,000 gal. and 13,000 gal. per minute, with the changes taking place almost instantaneously. This meant either that the pumps must be kept running at all times at a sufficient high capacity to supply the greatest possible demand and with a large amount of water going into the overflow during the time of a demand less than maximum or else that a system of control sufficiently sensitive and quick-operating to take care of the rapidly changing demand and maintain a good head of water in the tanks must be designed. The problem was further complicated by the fact that the water supply was to be taken from the Patapsco River at a point where tidal conditions imposed a variable suction head on the pumps, so that the head-delivery characteristic of the pumps could not be utilized to any great extent in maintaining control of the pump discharge.

The problem was solved by installing three centrifugal pumps, each directly driven by a 300-hp. motor with a speed range of 850 r.p.m. to 975 r.p.m. and with a nominal capacity range of 3,000 gal. to 6,500 gal. per minute at a total head of 140 ft. These pumps were arranged to discharge into three tanks all at the same level, the largest of which contains floats operating three eleven-point drum controllers installed at 4 ft., 8 ft. and 12 ft. from the bottom. These controllers in turn operate full automatic starting and ten-point field-control panels at each of the pump motors.

Starting with a full tank and no pumps operating, the operation of the control system is as follows:

When a demand for water occurs, the level in the tanks drops until float No. 1—the upper one—drops sufficiently to engage the first point on its controller. This closes the starting circuit of pump No. 1, and the motor comes up to its slow or full-field speed, delivering approximately 3,000 gal. per minute, more or less, depending upon the condition of the tide and the variations in the pump characteristic, motor temperature, etc. Should the discharge then be sufficient to take care of the demand, the tank level is maintained and the pump continues to operate at its low speed. Should the demand be greater, the float continues to drop and the drum cuts in the trip circuit of the first field-resistor contactor, which drops out and allows the motor to speed up slightly. This continues until either the pump discharge is equal to the demand or the controller has cut in all ten field-control points of the No. 1 pump. Should the latter condition occur, any further drop in the tank level is accompanied by the cutting in successively of the starting and field-control points of the controller for the No. 2 pump and ultimately by the No. 3 unit. The last condition will probably never occur except upon the failure of unit No. 1 or No. 2, as two pumps are designed to supply sufficient water for the present capacity of the refinery.

When the demand on the tanks decreases, the operation of the control is just the reverse of that described.

Unless some means were provided for interchanging the pumps and controls, it may be seen that unit No. 1, which is the first to start and the last to stop in each cycle of operation, would wear out long before unit No. 3 began to show signs of deterioration. In the original design it was proposed to meet this condition by periodically lifting the float and drum controller operating chains from their sprockets and shifting them in such a way that the floats would drop into operating position in a different sequence. However, the inaccessibility of the floats would probably result in their neglect by the operating force. Hence panels carrying six eleven-pole double-throw switches were installed, with the switches so cross-connected that any pump may be connected to any float control. It is expected that the pumps will be rotated as to position in the operating cycle at regular periods.

Education and Industry

BY J. B. WHITEHEAD
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EDUCATION and educational methods are the subjects of continued discussion, largely because of their importance and of the difficulty of arriving at definite conclusions as to the value of particular plans and methods. Their importance is perhaps sufficiently obvious and is attested by the constant stream of suggested modifications pouring in upon educators from practically every field in which the product of our colleges and universities is used. The difficulty in reaching conclusions as to the value of these modifications lies in the length of time involved in giving them a trial and in the uncontrollable variation in the raw material—that is, the student body—upon which the trial is made.

Consequently modifications of existing methods usually come either as the result of some more or less general recognition of desirable qualities in the graduate for a particular field of work, qualities in which he is stated to be conspicuously lacking, or a school may introduce a new plan or a new course, generally to meet a newly recognized need, though often in these cases the motive of self-advertisement is also evident. In the field of engineering we have seen a demand for familiarity on the part of the student with the practical phases of the profession result in a heavy overbalancing of college curricula with a multiplicity of courses on special applications. We are now in the full tide of the reaction from this excess and are approaching a saner recognition of the importance of the fundamental sciences, the English and liberal branches, which make for a broader and more confident outlook, so essential as a foundation upon which the narrower professional training may be laid, to the final product of a resourceful and courageous engineer.

This reaction is one of the most hopeful signs seen for some time by educators, for it indicates a realization of the most serious difficulty with which teachers of engineering have to contend; that is, the poor average quality of the entering student. The first 10 or 15 per cent of the graduating class of any first-class school will usually be found to be well trained and to have many of the qualities now emphasized as desirable, notwithstanding the fact that they may have been graduated from schools which differ quite widely in the matter of curricula and the methods of instruction. The next 40 or 50 per cent represent the great average who have succeeded in getting through but who probably carry away with them little in the way of confident knowledge of the material covered during the period of formal training. The remainder we need not consider, as probably being worse off.

EARLY TRAINING LEAVES INDELIBLE IMPRESSION

Now the point is that the topmost group have come through with profit, largely because that somewhere earlier, either through heredity or early training, they have received a sense of personal responsibility, an ability to concentrate on a task, and particularly an unwillingness to advance to new problems until those which have gone before have been satisfactorily solved. The origins of such personal characteristics are very difficult to trace. Probably heredity bears some part, but unquestionably the early processes of training have an enormous amount to do with the subsequent attitude of the student toward his work. In fact, it seems probable that home influence, in the nature of example, personal interest and stimulus, has much more to do with this question than the early character of schooling. And a further point is that the alterations and improvements that are suggested for our regular courses, while they are all helpful and sound in principle, must necessarily be of relatively small importance in their influence upon the character of the product, owing to the brief period during which the student is in our hands and the wide variation in his natural fitness for undertaking the serious personal effort demanded by the formal course of training for the profession of engineering.

Industry has been slow to recognize these facts, but the reaction referred to above is a direct result of a realization of their importance. The demand for character, stability, independence of thought and action, is a demand for a sense of personal moral responsibility in a young man's attitude, as he takes his place in the bodies social and politic. If this sense is not inculcated in the early influences and training brought to bear upon him, the best way to repair the omission is by education—education, as far as consistent, in the history and experiences of mankind, to be found in the liberal subjects making up the curricula of the college of arts and sciences and forming a foundation upon which the subsequent professional courses may be more safely laid.

Breadth of Training Necessary

But has the reaction toward a broader training, as manifested in changes in the better types of four-year curricula, gone far enough? Educators say they have gone as far as they dare in inserting general and underlying subjects at the expense of professional ones, having in mind the necessity of turning out a graduate who may be reasonably equipped on the technical side. But is the result satisfactory as yet? Certainly a large majority would answer in the negative. Let us consider, then, in further detail the relation of engineering education to industry and see if a method of further improvement is not suggested.

It will be granted without question that the principal object of the school of engineering is the training of engineers, meaning by the term "engineer" one who, to express it briefly, is capable of planning and executing. This being so, it appears that the principal duties of a school of engineering are four, lying in approximately the following order: (1) Training in the fundamental scientific and technical principles underlying the respective fields of engineering; (2) general and cultural studies aiming to fit the graduate for contact with both social and business life; (3) training in the specialization pertaining to the respective fields of engineering; (4) further specialization as related to particular manufacturing and industrial methods.

Criticisms of Present Courses

Criticisms of the product of our present engineering schools are usually made on two general grounds, first, that the equipment for special fields of activity is too limited, and, second, that there is a lack of independence of thought and action, of powers of expression and the like. That is, of the four important duties of a school of engineering mentioned above, it may be said that with the present four-year course of our best type of schools (1) is possible and (2) and (3) may be begun or partially covered. There remains undone much of (2) and (3) and all of (4). If, as in some schools of good standing, more effort and time are given to (2) and (3), it can only be done at the sacrifice of important attention to the other duties.

The situation, then, is obviously unsatisfactory, inasmuch as the product of our engineering schools is really an unfinished one. Apparently it can only be corrected by an elevation of the entire plane of engineering education. The most desirable solution would be to place training for engineering as a profession on a complete graduate basis, requiring a collegiate degree for entrance to the professional school. This, however, is impracticable, if not impossible, because the profession really requires many workers with training considerably short of that pertaining to a finished engineer. Numbers of young men look to positions of this type for an early livelihood and could not, even if they were fitted for it, afford the time for the complete formal training. Furthermore, the industries do not demand, and possibly do not need, very many men of complete professional training. It is these two facts, namely, the rush of young men to the making of a living and the short-sighted demand of the industries for a quick product, which seem to explain our present unfortunate situation.

However, an intermediate plan does appear to be not only desirable but possible. For example, two years of college work in fundamental scientific studies required for admission and three or four years in formal professional courses would go far toward correcting existing difficulties. This plan is now being tried at Columbia University and one or two other places. It is not supported, largely because of the absence of concurrence in the plan by a sufficiently large number of other institutions. Such a plan could obviously include an extension of present specialized courses and the adding of others to meet particular industrial needs.

Many engineering schools recognize the shortcomings of the present situation. They offer to meet it with graduate courses following the regular four years' undergraduate work. This, however, is not sufficient, as is evidenced by the fact that very few students enter these graduate courses.

Concentration on Engineering Principles

It appears, therefore, that engineering education as at present organized can best help the industries not by attempting to add new courses or methods of instruction, but by continued concentration on thorough training in fundamental scientific and engineering principles. In doing this they do not bring their graduate up to a point where he can enter immediately into efficient participation in industrial work, but he is undoubtedly better equipped in this way than in any other for learning by experience to meet special demands. Methods for illustrating the subject matter during instruction by contact with the industries, as, for example, by contemporaneous participation therein by shop work, visits, etc., are all secondary to the main purpose and may well be determined by the opportunities offered in particular communities; but unless it is broadened and lengthened the best standard course in our schools of engineering can do little more than establish a sound underlying and general training.

The industries can best help engineering education, and thereby themselves, first by demanding men who have had some graduate training, and, second, by the material encouragement and support of promising young men through their graduate work by scholarships or otherwise. As long as young men can get reasonably good jobs in the industries at the end of four years, they will continue to take them, and consequently this situation will continue just so long as the industries offer the jobs.

Pin Insulators on 90,000-Volt Line

Changed from 60,000 Volts Delta to 90,000 Volts Y —With Effective Relay Protection and Heavy Duty Oil Switches Found as Reliable as Former Voltage

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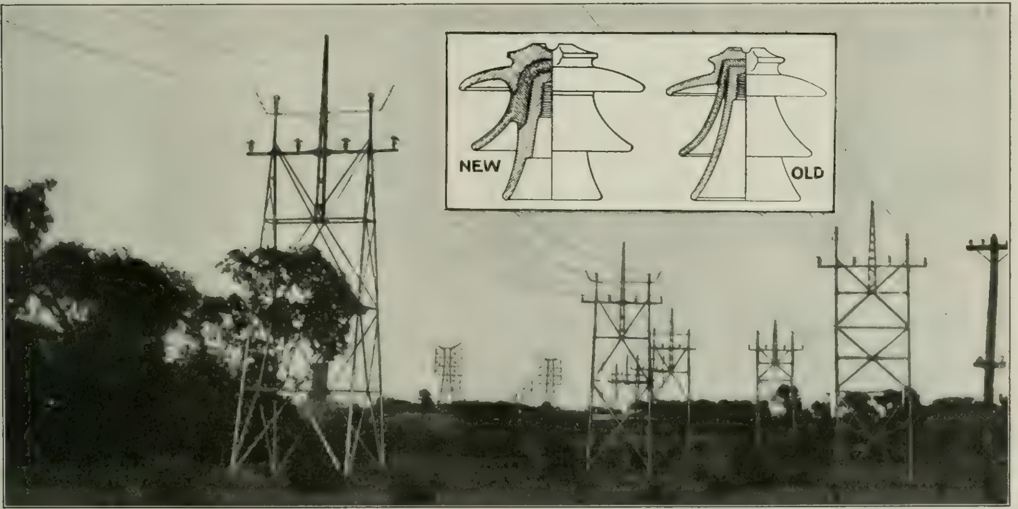
ALTHOUGH it has been the customary practice to consider 60,000 volts to 70,000 volts as the limiting operating pressure for lines supported on pin-type insulators, the tests and experience of the Toronto Power Company, extending over a period of several years, have proved the feasibility of using insulators of this type having only 150,000 volts wet flashover for 90,000-volt Y-connected lines, provided certain conditions are met. In general, these conditions are that effective relay protection and amply large circuit breakers are provided. In addition, the insulators have to fulfill certain requirements, chiefly that they resist puncture and power arcs and that they be built to avoid internal stresses.



FIGS. 1 AND 2—NEW PIN-TYPE INSULATORS USED FOR 90,000-VOLT OPERATION, AND OLD TYPE

Under such conditions 90,000-volt (Y) transmission lines supported on pin-type insulators have proved virtually as effective and reliable as 60,000-volt (Δ) transmission. Furthermore, lightning interference on the 90,000-volt lines has hardly increased compared with that on 60,000-volt lines. Although there are indications which tend to show that the insulation safety factor used on 90,000-volt operation represents about the lowest safe value, there are other indications which show that there still exists ample margin for average conditions. Analysis of the operating results on the Toronto system indicate that more reliable service, even at 100,000 volts, could be obtained, provided the transmission system could consist of three or more parallel lines separated from each other rather than in close proximity.

The significance of this experience is that it shows the feasibility of raising the line voltage of existing systems without expensive structural changes, except possibly improving the quality of the insulation and installing an effective relay system. This possibility may prove of great economic consequence to many companies since it will permit a large increase in their transmission line capacity without great expense. However, each case must be carefully considered on its own merits, since general operating conditions, the layout of the system, the importance of the service, the reliability of the insulators selected, the possibility of effective protection, etc., are all factors which influence the decision on such a change.

Voltages of 60,000 to 70,000 are considered the practical operating limit for transmission lines using pin-type insulators, because it has always been assumed that safe operation necessitates a minimum of wet flashover of at least two to two and a half times the maximum line voltage, and because 150,000 volts to 160,000 volts wet flashover is the practical limit which can be obtained with pin-type insulators of the customary shape. If an attempt be made to build a pin-type insulator of higher wet flashover, it will become unduly large and heavy, or if built in detachable parts it will become mechanically weak by reason of the excessive height.

The adoption of such a high safety factor as mentioned has been chiefly influenced by the enormous number of insulator failures experienced in the past and now fortunately being reduced.

Conditions Leading Up to the Study

The lines on which the observations resulting in the foregoing conclusions were made are trunk lines transmitting power from the Niagara Falls power plant to Toronto, a distance of 80 miles. The original installation consisted of one double-circuit steel-tower line with spans of approximately 400 ft. The conductors were arranged in triangular formation 6 ft. apart and consisted of 190,000-circ.mil copper cables. This line was put in operation in the latter part of 1906 at 60,000 volts, it being among the first lines to operate at this voltage.

In 1912 a second double-circuit steel-tower line was erected with 650-ft. spans and 8-ft. conductor spacings, using the same size conductor. At the same time step-up and step-down stations were re-equipped with modern 90,000-volt switching equipment of high short-circuit rupturing capacity, to meet the requirements of the increased generator capacity. The lines were to be reinsulated for 86,000-volt operation. At that time the insulator problem proved to be a rather difficult one, and it was finally decided to retain the voltage of 60,000, especially since prospective load conditions did not necessitate the immediate increase of operating voltage—the doubling of lines offering sufficient capacity.

During the war years new conditions arose. One of the four lines was dismantled, the copper being used for other lines. Thus only three lines were left available for the Toronto load. At that time the idea of raising the line voltage was reconsidered, and it was decided that two lines at 85,000 volts would take care of the Toronto load just as well as three lines at 60,000 volts. Thus an increase in line voltage left the prospect of another line becoming available for other use. All lines also badly needed reinsulation. A change to two-line operation on higher voltage saved the expense of reinsulating the third line.

The possibilities of such a change were carefully studied and the observations led to the following conclusions:

(1) Economically, 90,000-volt operation could only be considered feasible if it were possible to retain the pin-type construction, since any change to suspension insulators would involve too great an expenditure.

(2) The largest economical size of a pin-type insulator having satisfactory mechanical strength and reasonable weight had a wet flashover of 150,000 volts. The ultimate permissible operating voltage on this type of insulator depended entirely on the wet flashover safety factor, which was considered necessary to assure safe operation. Observations on 60,000-volt lines over a period of several years showed that a transmission line with partly damaged insulation operating under trying weather conditions had continued to give service for hours or days until the damaged insulators were found and replaced. An analysis of such cases indicated that for such conditions a wet flashover of about 1.6 to 1.7 times the normal line voltage was sufficient to withstand any line surges except lightning. This flashover safety factor corresponds to 2.8 to 3.0 times the normal voltage to ground so long as the voltage to ground is balanced.

From these observations it was concluded that a pin insulator of 150,000-volt flashover would safely permit 90,000-volt operation, provided flashovers from lightning were accepted.

(3) Lightning flashovers were considered acceptable provided that the insulator was able to resist puncture and power arcs that would permanently disable the line and provided that the line circuit breakers were of sufficient rupturing capacity to clear the short circuits effectively.

From past operating records it could be hoped that about 75 per cent of the lightning short circuits would affect only one line at a time, despite the close proximity of the two circuits on one steel tower. With effective relay protection it could be hoped, furthermore, that all these short circuits would be cleared without interruption to service while operating on two lines in parallel. The remaining 25 per cent of lightning interferences had to be expected to involve both lines simultaneously, but this was not considered a serious matter, provided that the lines were not permanently damaged.

It was realized that 90,000-volt operation would possibly increase the total number of lightning shorts compared with 60,000-volt operation, but the increase was considered to be small.

(4) Operation at 90,000 volts on one double-circuit steel-tower line and on pin insulators of 150,000 volts wet flashover was therefore considered quite safe and

TABLE I—LINE SHORT CIRCUITS AND THEIR CAUSES

		Short Circuits Causing Trouble of Transient Nature											Short Circuits Causing Permanent Damage and Disabling Line Until Repaired							
Operating Voltage	Year	Lightning	Bad Insulators	Birds	Slushy Snow	Sleet and Wind	Switching Surges	Blasting	Miscellaneous Outside Interference, Kites, etc	Unknown	Total Transient Troubles No.	Total Transient Troubles Per Cent of Total Shorts	Lightning	Bad Insulators	Sleet and Wind, Tower Collapse, Ground Wire, etc.	Miscellaneous Outside Interference, Kites, etc.	Blasting	Total Permanent Troubles No.	Total Permanent Troubles Per Cent of Total Shorts	Grand Total of Shorts
60,000	1916	14				2				1	17	46	6	13	1		. .	20	54	37
	1917	18									18	60	1	9	. .	2		12	40	30
Δ	1918 Jan. 1-Oct.	7		1	. .						8	47	5	3		1		9	53	17
90,000	1918 Nov. 1-Dec			1						. .	1			1				1	. .	2
⅄	1919	21	1						4	5	31	86	2		1	2		5	14	36
	1920	21		2	5	17			3	6	54	95	1		1	1		3	5	57
	1921	21		2			2	3	7	22	57	92	1	1	1	1	1	5	8	62
	1922 Jan. 1-Oct. 15	9		1					2	18	30	75	1		8	1	. .	10	25	40
Reference Number to Columns	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)

not more hazardous than the then existing 60,000-volt operation on three or four parallel lines, provided that (a) a puncture-proof and power-arc-proof reliable and permanent insulator was developed; (b) an effective relay protection for the double-line system was installed, and (c) flash-overs and occasional momentary interruptions from lightning were accepted.

(5) From investigations of experiences with insulators in preceding years it was concluded that the insulator must fulfill the following requirements to be safe on 90,000-volt operation: (a) its design and the quality of the porcelain must be such as to resist puncture when subject to flashover; (b) it must be glazed all over to eliminate deterioration due to porosity; (c) it must be made of heavy shells and of such shape as to avoid internal stresses so as to eliminate cracking due to sudden temperature changes and so as to offer reasonable assurance of resisting power arcs; (d) severe routine test and most careful inspection must be conducted at the factory.

(6) The relay protection had to be absolutely dependable and equally effective for short circuits from one end to the other extreme end of the line.

Furthermore, it was essential that the protection be instantaneous at either end so as to prevent the serious secondary disturbances on the synchronous load. From past experiences it was evident that the standard principle of protection with time-limit overload relays at the power-house end reverse energy relays at the terminal end of the line was not dependable enough and that a more positive and reliable scheme must be developed.

From the foregoing considerations it was realized that the whole success of 90,000-volt operation on pin-type insulators depended on a satisfactory solution of the insulator and relay problem.

FEATURES OF INSULATOR ADOPTED

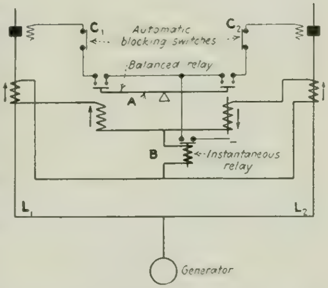
By working in close co-operation with the porcelain manufacturer an insulator was developed of the shape shown in Fig. 2. As may be observed, the insulator is a three-piece unit similar in general appearance to the standard pin-type insulator, but differing considerably in details from the older type.

The new insulator differs chiefly in having thicker shells and more rounded shapes intended to avoid internal stresses. Preference was given to the three-shell insulator, as compared with the four-shell insulator, to obtain heavier individual shells at a fixed permissible total weight. The shells were glazed all over and had smooth sand-glazed surfaces to eliminate surface cracks and moisture penetration. About a thousand insulators were installed on the 60,000-volt lines during the winter season of 1916 to 1917 in order to obtain operating experience.

The relay problem was solved by developing a double-line protection based on the fact that with synchronous load and occasional steam power at the Toronto terminal a short circuit in one of the lines would cause an excess current in the faulty line compared with the sound line. Fig. 3 shows schematically the protection.

This protection was installed early in 1917 on the 60,000-volt lines. In case of a short circuit within one of the two lines there will always be sufficient current difference between the lines to actuate relay *B* and thus trip the faulty line by the joint action of relays *A* and *B*. A detailed description of the protection and four years' operating results were given in a paper published in the April, 1921, issue of the *Journal* of the Engineering Institute of Canada. Tests and operating results proved the system fully effective.

With the relay protection fully up to expectation and the insulators offering promise of success (they had then been in operation too short a time to allow definite judgment), the essential problems for successful 90,000-volt operation were considered solved. As a result the change was decided upon early in 1918. During the summer of that year the lines were reinsulated with the new pin-type insulator. The strain insulators were taken down, retested, and good ones used again in strings of five to seven disks. A limited number of strain insulators of the well-known heavy type were also installed. By October of that year the reinsulation was completed and the change-over to 90,000 volts was carried out. Successful operation has been maintained ever since, and the results are fully up to expectations.



L_1 and L_2 are the two parallel lines. *A* represents a balanced lever which moves to the side of heavier current, thereby selecting the faulty line. *B* is an instantaneous relay connected differentially in the current circuit between the same phase of the two lines, thus responding only to a difference in the line currents. The purpose of this relay is to prevent the balanced lever from tripping any line in case of a short circuit beyond the line. The lever could never be so perfectly balanced that it would remain in the horizontal position with equal current in the two lines. The lever would move to one or the other side and as a result would trip a line if the relay *B* would not keep the trip circuit blocked under any such condition. Switches C_1 and C_2 are automatic blocking switches controlled by the oil circuit breakers in order to avoid wrong relay action under certain conditions.

FIG. 3—RELAY PROTECTION WHICH HELPED MAKE 90,000-VOLT OPERATION WITH PIN-TYPE INSULATORS POSSIBLE

A summary of operating results compared with those obtained with 60,000-volt operation is given in Tables I to IV, and in the following paragraphs:

As may be observed in Table I, which shows the number of line short circuits and their causes for four years with 90,000-volt operation and for the three years preceding with 60,000-volt operation, the total number of short circuits (column 20) increased considerably on 90,000 volts. This would appear unfavorable, but upon closer investigation it will be observed that the low insulation safety factor is hardly to be blamed for this increase. Later it will be shown that the increased number of short circuits in no way influenced the service because of the effectiveness of the relay protection. In most of the short circuits troubles were of a transient nature (columns 11 and 12) and did not disable the line permanently. From columns 18 and 19 it can be observed that the troubles of a permanent nature have been reduced in number. Furthermore, the permanent troubles caused by damaged insulators have been reduced to a negligible quantity (columns 13 and 14), amounting to never more than two permanently disabled lines per year from this cause compared with as many as nineteen in 1916.

Improved insulation is entirely responsible for this marked change, showing that the quality of insulation is far more important than an excessive safety factor of flashover.

The causes of the large increases in troubles of transient nature can be seen from a study of columns 2 to 10. It will be noticed that the causes indicated in columns 6, 9 and 10 are the chief ones, none of them, however, being the result of low flashover safety-factor.

Sleet and wind (column 6) produce an entirely mechanical trouble due to wires whipping together. Miscellaneous outside interferences (column 9) were also due to mechanical causes—something coming in contact with the line. The increase in this kind of trouble compared with 60,000-volt operation is attributable chiefly to the grounded neutral, since most of these troubles were shorts of one wire to ground. On 60,000-volt delta operation these troubles would have caused a momentary ground without short-circuit disturbance.

Troubles of unknown origin (column 10) may be looked upon suspiciously as being caused possibly by the low flashover safety factor. It may be pointed out, however, that the majority of these troubles occurred during the summer time and during fair weather; that is, at a time when the flashover safety factor was high. Only three troubles occurred during rainy weather; that is, at a time of low flashover safety factor. Another significance of these troubles is the fact that most of them were single wire-to-ground flashovers. This was noticeable on one phase of the oil circuit breaker showing distress, the voltage and load disturbances being light. The foregoing indicates that these troubles were most likely due to birds or kites or outside interferences leaving no trace.

TABLE II—TROUBLE RECORDS WITH 60,000-VOLT and 90,000-VOLT OPERATION

Operating Condition				Total Interruptions Caused by Following Line Troubles								Line Shorts Cleared by Relay Action or Self-Clearing Without Interruption						Shorts Cleared Without Interruption in	
					Multiple Line Short Interrupting All Lines Caused by														
Operating Voltage	No. of Steel-Tower Lines	Total No. of Circuits	Year	Line Shorts While Operating on One Line	Lightning	Tower Collapse	Bad Insulators	Unknown	Miscellaneous Outside Interference	Total	Total No Interruptions	Self-Clearing	Arc Extinguisher	Parallel Line Protection	Double Line Protection	Total	Total Line Shorts	Per Cent of Total Line Sorts	Per Cent. of Total Line Shorts While on Multi-Line Operation
60,000	2	4	1916	6							6		9	22		31	37	84	100
	2	4	1917	2	4					4	6			8	16	24	30	81	86
△	2	3	1918 Jan 1-Oct.	5	2		1		1	4	9			1	7	8	17	47	66
90,000	1	2	1918 Nov.1-Dec.												2	2	2		...
⅄	1	2	1919	3	5	1				6	9	1			26	27	36	75	82
	1	2	1920	9	2					2	11				46	46	57	81	96
	1	2	1921	2	7			1	3	11	13	2			47	49	62	79	82
	1	2	1922 Jan1.-Oct.15	5	6	1		1		8	13				27	27	40	68	78
Reference Number to Columns	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)

The increased number of short circuits is attributable therefore to the grounded neutral and not to the low safety factor of flashover. The exceptionally large number of unknown troubles in 1921 is probably attributable in part to blasting operations on some large canal construction in the close vicinity of the lines.

The only troubles which could have been caused by the low flashover safety factor are those indicated in columns, 2, 3 and 5. Lightning (columns 2 and 13) would obviously have more tendency to cause flashover the lower the flashover safety factor is. However, operating results indicate that very little change can be observed from this cause. In fact, the lightning season of 1922 indicates a record in small number of lightning interferences compared with the best years of 60,000-volt operation.

The troubles due to slushy snow (column 5) may have been caused by the low safety factor of flashover leaving insufficient leakage path and thus causing a complete flashover. The troubles of this nature all occurred during the same storm under conditions of very heavy wet snow and a very strong wind which packed the wet snow underneath the insulator skirts. It is not impossible that this might have caused these troubles, but this condition seems to occur very rarely. Similar conditions had occasionally arisen previously, when operating on 60,000 volts. In this respect, therefore, 90,000-volt operation may in no way be considered worse than operation at 60,000 volts. There is also serious doubt whether the flashovers occurred on the pin-type insulators or on the strain insulators.

Megger tests on the strain insulators carried out about three months following the foregoing trouble disclosed the fact that there were several strings with only one or two good units, thus presenting a wet flashover of only 50,000 volts to 90,000 volts against the 150,000 volts for the pin insulator. Therefore it would seem more logical to assume that some of the strain insulators may have caused the flashover. Since 1920 the number of disks on strain insulators has been increased and a close inspection is made every year. No similar trouble has been experienced since. Snowstorms of the kind described have been reported since this change without apparent ill effect, but since it is rather difficult to compare the severity of storms of this kind, it is not possible to state definitely the actual cause of the former troubles.

Troubles from switching surges (column 7) have been almost completely absent. The two cases reported in 1921 occurred the same day, when a line was taken out of service, and during fair weather. Nothing was found on the lines to which this trouble could be attributed. Still, in view of the fact that no such troubles were experienced at other times, it is well to assume that at that time some transient trouble existed reducing the flashover value. No direct harm was caused by the switching surges so that their occurrence is not important. With modern sensitive settings on arresters it should be possible to eliminate such troubles entirely.

Operation during lightning storms has suffered in no way due to the low flashover safety factor, as may be observed from Table III. The total number of line short circuits from lightning is approximately the same with 60,000 volts and with 90,000 volts. On the other hand, there was a marked decline in the permanently disabled lines due to the superiority of the new insulator with respect to puncture and power-arc strength.

From an analysis of Tables I and III it can be clearly observed that the low safety factor of flashover is in no way responsible for the large increase in the total number of line shorts since operating on 90,000 volts. The increase is caused chiefly by the grounded neutral. On the other hand, the tables show that the improved quality of insulation has reduced the permanent insulator troubles to a negligible quantity despite the low safety factor of flashover.

EFFECT OF LINE TROUBLES ON SERVICE RECORD

As shown by Table II, which indicates the service records obtained with 60,000-volt and 90,000-volt operation, the service has not been seriously affected by line troubles, despite the large increase in the number of short circuits, due principally to an effective relay protection and the fact that most of the troubles were of a transient nature. The total number of service interruptions (column 11) was slightly larger than with 60,000-volt operation, but in no way increased in proportion to the number of line shorts (column 17). This increase in the total number of service interruptions, however, is not attributable entirely to the low safety factor of flashover, as will be shown hereafter.

While operating on one single line, line shorts (column 4) are particularly responsible for the large number of total interruptions in 1920. This was attributable to the fact that the 90,000-volt system was only a double-circuit system, so that during a comparatively large part of the time operation had to be maintained over one line, while the other line was out of service for repair, inspection or other purposes. It is rather surprising, therefore, that this cause (column 4) does not have more effect with 90,000-volt operation than with 60,000-volt operation, where four parallel circuits were available.

The total number of interruptions while operating lines in multiple increased in general, as shown in column 10. The causes of such interruptions are tabulated in columns 5 to 9.

Lightning (column 5) seems to have a greater tendency to strike both lines simultaneously. This may be attributed to the reduced safety factor of flashover. In the writer's opinion, however, such increase is incidental, since the induced lightning voltage is of such great magnitude that the small change in safety factor of flashover could hardly have any significance. In any event the simultaneous interference with both lines was primarily caused by the close proximity of the two lines carried on the same steel tower and could be entirely eliminated if the two lines were separated sufficiently to avoid simultaneous interference.

All other interruptions (columns 7 to 9) were caused by interferences where low safety factor of flashover is in no way responsible.

Total interruptions by tower collapse (column 6) due to extremely severe cyclonic windstorms were unavoidable in view of the fact that both lines were carried on the same steel-tower line.

The cause of unknown interference (column 8) was apparently a flashover blowing into the opposite line, thus causing a double-line short circuit, or else was the result of improper relay action due to rather limited generator capacity at that time.

TABLE III—LIGHTNING SHORT CIRCUITS AND THEIR EFFECT ON INSULATORS

Operating Condition	Year	Shorts Causing Permanent Damage			Shorts Causing Transient Trouble		Total Lightning Shorts
		Puncture	Power Arc	Total	Number	Per Cent of Total	
60,000 Δ	1916	1	5	6	14	70	20
	1917	1		1	18	95	19
	1918	4	1	5	7	58	12
90,000 λ	1919	1	1	2	21	92	23
	1920	.	1	1	21	96	22
	1921	.	1	1	21	96	22
	1922		1	1	9	90	10

Total interruptions due to miscellaneous outside interferences (column 9) while operating lines in multiple were all caused by a trouble starting on one line and spreading into the adjacent line because of its close proximity.

Line shorts cleared by relay action (columns 13 to 16) indicate how, with effective protection, line short circuits do not have to be dreaded as much as in former days.

As a whole, Tables I to III show why 90,000-volt operation can be considered as satisfactory as, or in fact better than, the previous 60,000-volt operation so far as line insulation is concerned, despite the low safety factor of flashover. All interruptions could have been saved by a trunk-line system consisting of three or more independent single-circuit tower or pole lines sufficiently separated to avoid spreading of trouble from one line to the adjacent one, provided that such a system was equipped with an effective relay protection. It is true that several serious shutdowns have occurred since operating on 90,000 volts, but the cause of these has been mechanical troubles, tower collapse and cable breakages due to exceptionally severe weather conditions. There is only one case that resulted in serious interruption (about one hour) which may be attributable to low safety factor of flashover. This occurred during the snowstorm of 1920, at which time for about an hour no voltage could be maintained on the lines. However, as previously mentioned, there is some reason for doubting whether the pin-type insulators or strain

TABLE IV—SERVICE RECORD OF 90,000-VOLT PIN-TYPE INSULATORS

Year	Approximate No. of Insulators in Service	Number of Damaged Insulators Replaced on Lines						Total No. Insulators Replaced	
		Insulators Disabling Line, Until Replaced Damaged by			Insulators Found on Patrol or Yearly Special Inspection, Damaged by				
		Lightning							
		Puncture of Lowest Skirt, Exploding Upper Skirts	Power-Arc Damage	Bad Insulator	Power Arc from Lightning Flashover	Stone or Shot	Cracked Insulator Uncertain Whether Temperature Crack or from Stone	Number	Per Cent of Total No. of Insulators in Service
1917	1,000								
1918	7,000								
1919	7,000	1	1		9			11	0.13
1920	7,000		1		7	9		17	0.21
1921	7,000		1	1	14	14	5	35	0.43
1922	7,000		2		9	7	15	33	0.41
Reference Number to Columns	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

insulators were responsible for this condition. The foregoing case and the few shorts from switching circuits are doubtless an indication that the practical lower limit of safety factor of flashover is probably approached in these lines. On the other hand, there are other indications which show plainly that, despite the low safety factor of flashover, a considerable margin of safety still exists under normal operating conditions. Some of these observations may be cited hereafter.

In 1919, during lightning and heavy rainstorms, while operating only one line, and with isolated neutral, one of the line cables swung into a telephone pole and burned off. The cable fell to ground and produced a solid ground, thus raising the voltage to ground on the two sound phases to 90,000 volts. Despite the low flashover safety margin on these two sound phases, no flashover occurred. The line operated thus for about ten seconds until the operator cleared the line.

When reinsulating the lines in 1918 the old strain insulators were retested and used again. By some oversight one of the five disk strings was put up with four punctured disks and only one good disk, thus presenting a flashover of approximately only 85,000 volts dry and 50,000 volts wet. Still, the line operated successfully for two weeks on 90,000 volts in dry weather and failed only during the first rainy day, under which condition of course the flashover value of the bad string dropped below the normal voltage to ground.

Lightning flashovers often leave pin insulators with one of the three skirts broken. Yet yearly inspection always discloses a limited number of insulators with cracked skirts which are not causing any trouble despite the reduced flashover value. The inspection is carried out every spring, so that it can be reasonably assumed that some of these cracked insulators existed during the most trying time of wet snowstorms or other bad weather conditions.

FUTURE OF THE PIN INSULATOR

Insulator failures have been so numerous in the past decade that the advocacy of a low safety factor of flashover could only be justified if proof were given of a remarkable change in the quality of the line insulator. Based on a few years' experience only, it is rather difficult to make a definite statement on this point. Still, tendencies of insulator troubles show up usually within the first few years, so that the records of Table IV should offer a fair basis for judgment as to the future of the pin-type insulator used on these lines. According to columns 2 to 4, it will be observed that during the five years' service with this type of insulator only a very few cases occurred in which insulators caused permanent disabling of a line. Only one bad insulator was responsible for the disabling of a line (column 4).

In a few instances lightning caused some power-arc damage, but in only one case did it puncture the insulator, and then only the lower skirt. During two years' service there were only two punctures. In both cases the lower skirt was punctured and the upper shells broken off from the heat effect. It is easily possible that these two insulators may have been overlooked in the factory inspection. Therefore, it can be well hoped that the dreaded trouble of complete puncture as experienced on old insulators is virtually eliminated in this new-type insulator.

Power-arc damage (columns 3 and 5) cannot be avoided unless some arcing ring or horn protector is employed. The damaging effect from this cause, however, is so small, considering the large number of flashovers, that no such complication was necessary.

Damage to insulators found on patrol and special inspection which had not caused line disturbances is enumerated in columns 5 to 7. An insulator was damaged by power arc during a lightning storm without, however, permanently disabling the line (column 5). The number of insulators damaged by malicious outside interference is shown in column 6. This is an unavoidable loss, but owing to the ruggedness of the new insulator this loss has also been reduced as compared with the old 60,000-volt insulator.

The only damage which raises some doubt as to the permanency of the new insulator is the one indicated in column 7. The old 60,000-volt insulator had developed temperature cracks in the head in an alarming way. Similar cracks showed up on the bottom disk of the new 90,000-volt insulator from the bottom rim upward. No sign could be detected of chipping, which would have indicated that the cracks were caused by stones or shots. Hence it was admitted that they might have been caused by excessive temperature changes. Upon close investigation it was found that 75 per cent of all the damaged insulators were in zones where injury to insulators from stone throwing had always been excessive. The remainder were all near country roads or other easily accessible places where outside interference would be quite possible. Not a single case was found at an isolated cross-country point. While, therefore, there is some doubt left as to the actual cause of these cracks, there is very strong reason to believe that the insulators were damaged by stones or shots.

The records of Table IV are very encouraging and indicate plainly that the modern pin-type insulator is not afflicted with the serious ailments of the older type, but is becoming as reliable as any other part of the transmission line, provided that the proper type and quality of insulation is chosen. Operating experience on the 90,000-volt lines shows that it was perfectly justifiable to adopt a very low safety factor of flashover based on the assumption of being able to obtain a pin insulator of high quality and permanency.

Appreciation must be expressed to F. G. Clark, chief engineer of the Toronto Power Company, whose courageous and optimistic stand and confidence in the engineer's recommendation permitted the realization of this feat, which would have been considered reckless by the majority of engineers, but which has proved to be fully feasible and may have a considerable economic influence on future transmission engineering.

Amsteg Station of the Swiss Federal Railways

On Nov. 22 the large Amsteg power station of the Swiss Federal Railways was put in operation. This station, in the Canton of Uri, furnishes the electric energy for the Gotthard railway lines, receiving its power from the River Reuss, the Tellibach, the Kärstelenbach and the Etzlibach. It is the largest of the hydro-electric plants of the Federal Railways. Its completion required 800,000 man-days, 180 tons of explosives and 150,000 tons of cement. The station, together with those of Ritom and Göschen—the latter at the entrance of the Gotthard tunnel—will supply the entire electric power for the traffic on the Gotthard line from Basle to Chiasso and in addition supply the energy for the branch lines from Lucerne to Zurich and from Thalwil to Richterswil

Solving the Merchandising Problem

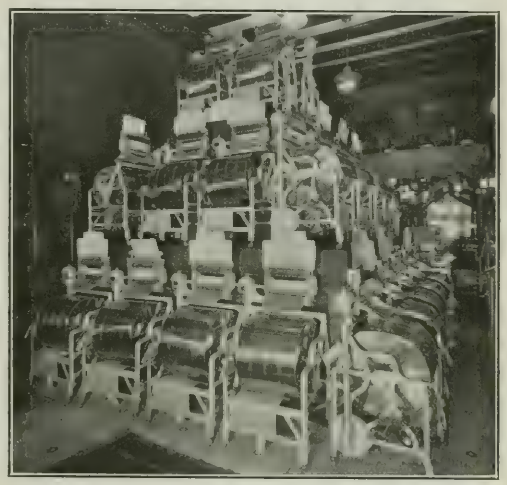
How the Pittsburgh Utility Formed a Separate Company to Operate a Chain of Gas and Electric Shops Exclusively for Sale of Appliances at a Profit

ONE of the broadest and most comprehensive merchandising policies yet adopted by an electric light and power company is presented in the organization by the Philadelphia Company in Pittsburgh of a group of chain stores in the territory served by that company's subsidiary gas and electric properties. For a number of years the company has been endeavoring to develop a means of offering to its customers adequate facilities for the purchase of household appliances. All of the space in the company's general office building in the Pittsburgh business section, however, was taken up by executive and clerical offices. Moreover, the location of this building was not suited to the merchandising of appliances to the best advantage. Nevertheless, the company believed that it had a further duty to perform than merely delivering gas and electricity regularly in a given quantity. It considered that it was just as much a part of the company's service to offer customers a store where they could inspect and purchase the right appliances.

After making a careful study of the problem it was decided to establish a number of branch stores within convenient reach of all customers. With this purpose in mind the Equitable Sales Company was formed in November, 1920, and stores were opened at a number of important points in Pittsburgh and vicinity. In July, 1921, Harvey A. Keys, formerly an active figure in Chicago's electrical circles as division manager of the Commonwealth Edison Company's electric shop for ten years, was made vice-president and general manager of the company. One of his first moves was to christen the stores the "Gas and Electric Shops," and by that name they are rapidly becoming a household word in Pittsburgh.

These shops, of course, were primarily to provide adequate means for the display and sale of appliances, but to encourage customers to visit them facilities were provided in each of the stores for customers to meet the officers and employees of the company for the adjustment of service or misunderstanding, for making application for service as well as the payment of bills and for obtaining information relative to the use of the appliances and fixtures which would give the most satisfactory and economical service. Six stores in all, each called the "Gas and Electric Shops," have been in operation since November, 1920, and it is the most extensive operation yet undertaken in Pittsburgh for the sole purpose of merchandising appliances.

The accompanying illustrations and the group of views on page 1446 of this issue show the interior and exterior arrangement of the stores, which are all designed to give the best possible display to the appliances. The largest is established in the Jenkins Arcade in the Pittsburgh shopping center and is so situated that two whole sides of a large storeroom are given over to window space which is used for display purposes and the constant demonstration of some appliance. These windows are so arranged that in addition to the articles shown in the windows passersby have an unobstructed view of the appliances on the floor. Inside, all-glass showcases are provided for the display of heating appliances and wall cabinets are used for the smaller appliances and lamps.



AN INTERIOR DISPLAY OF ELECTRIC WASHERS WHICH BROUGHT GOOD RETURNS

A notable feature of the main store as well as the other shops of the Equitable Sales Company is the number of appliances shown on the display floors. Of each of the larger devices such as washing machines, vacuum cleaners and ironing machines at least four or five are shown. But this is done without giving the shop a cluttered-up appearance, and it has the distinct advantage of impressing visitors with the stocks carried and the popularity of the appliances.

In addition to the large Jenkins Arcade shop, one is located in the East Liberty section of Pittsburgh on Penn Avenue and another on the north side on West Ohio Street. Others are in McKeesport, Sewickley and Beaver Falls, The general layout of all of the shops is very similar. A cashier's window is found at the rear of the store so that customers coming in to pay bills or place an order for service must of necessity pass the showcases and the appliances displayed on the floor. This has proved valuable in arousing interest and making openings which salesmen can follow up.

As the Equitable Sales Company is an entirely separate and distinct company from the gas and electric utilities in Pittsburgh, the stores are conducted to make a profit, and they have so far been better than self-supporting. In discussing the merchandising operations of his company Mr. Keys explained some of the methods and policies which are followed and emphasized the prime importance of quick stock turnover, the need of

Salesrooms and Windows of the "Gas and Electric Shops," Which Perform a Real Merchandising Service in Pittsburgh

constant use of active demonstrations of appliances in the windows and storerooms and the value of a liberal use of advertising.

"Window demonstrations, particularly for the stores in busy sections," said Mr. Keys, "are to my mind the most valuable means we have of attracting people to our stores. They result in increasing the sale not only of the appliances being demonstrated but of others as well. Not that we always are, but we try to keep, just a month or two ahead in the preparation of features for displays and demonstrations as we attempt to have something in the way of a change every two weeks.

FEATURING WINDOW DEMONSTRATIONS

"Last summer we played up electric curling irons with demonstrations in our windows. Three girls from sixteen to eighteen years old with bobbed hair acted as models. They had previously shampooed their hair so it would be perfectly straight, and then the use of the electric curling iron was demonstrated. The window was furnished with a dressing table and chairs, and each model served about an hour and a half each day. So many spectators were attracted to our windows that traffic officers had to keep a space on the sidewalks cleared. As a result of these demonstrations curling-iron sales were tripled and have held up very well since that time.

"Special displays of washing machines are made during campaign drives, the most recent being a massed display in the form of a pyramid as shown in one of the accompanying cuts. Each machine was marked with a display card, and the bottom row of machines was kept in operation. Spotlights were directed at the display, and the attention it attracted well repaid us for our trouble.

"Another demonstration which attracted large crowds was that of a man attired in a tuxedo suit with a mask over his eyes to lend an air of mystery. This man turned a series of cards which described the features of an electric washer, and at the same time he pointed out these features on a machine in operation. After two weeks his costume was changed to represent that of a red devil, and this revived interest for another two weeks. Other demonstrations which have never failed to draw people to our windows and into the stores have been electric flatirons, ironing machines and cleaners.

"Advertising, both direct by mail and in the newspapers, brings very good sales results. We have established a policy of setting aside 5 per cent of the gross amount of our sales for advertising. Lately we have been sending out folders with return post cards in broadsides of five to ten thousand. While we cannot tabulate the number of returns, they have been very satisfactory and have kept our salesmen busy following them up. We will continue this form of advertising.

"On some of the larger appliances—that is, the vacuum cleaner, washer and ironing machine—we are operating on the resale plan whereby the manufacturer supplies a crew of salesmen under a supervisor. These men are paid by the manufacturer but work from our stores, and we receive a percentage on each machine sold. While this does not give us such a large gross volume of sales, it cuts down the selling cost and does away with high investment in stocks. At present there are forty such salesmen working on cleaners and twenty-five on washers and ironers. Other electric appliances are sold from the shops and are a part of our regular merchandising business.

"We find that we must watch our stocks very closely and buy in such quantities as will keep our rate of turnover high. By this is meant that on an article about which we have any doubt of its moving quickly we prefer to buy in less than standard lots and sacrifice some discount rather than take the miximum-quantity discount and find later that we have considerable money tied up in dead stock. All material received and disbursed is entered daily in a stock ledger which gives us a day-to-day inventory of the stock on hand. On fast-moving material a minimum quantity is established and a reorder comes through automatically when this point is reached. Under this arrangement stock is renewed without delay and we are able to keep our stock investment at a very low figure. Not considering the appliances sold on the resale plan, we will turn over our stock investment about ten times during 1922.

"We endeavor to carry as complete a line of electrical equipment and supplies as we can sell. In addition to appliances and lamps we carry regularly such articles as tape, lamp cord, knobs, tubes and cleats, dry batteries, wire and radio supplies. There is a surprisingly good demand for this class of material, and as it is all sold over the counter for cash and the customer takes it with him, involving no delivery expense, we find it extremely profitable. On some articles there is, of course, a marked seasonal demand and care must be taken not to carry these over for six months or a year.

LIST PRICES MAINTAINED

"Unless it becomes necessary to mark down the price of some appliance that is becoming shopworn or has proved to be a slow mover, we do not make any special offer. This policy has been adopted for two reasons: We want to maintain list prices, and there is not sufficient margin to permit of cutting prices and making a profit.

"Of the appliances the best sellers are irons, curling irons, toasters, heating pads, grills, percolators, washers and vacuum cleaners. This year's sales of three leaders will be approximately 3,000 washing machines, 3,600 vacuum cleaners and 7,000 electric irons."

The organization to handle the work is comparatively simple. There is a general office in the Jenkins Arcade, where Mr. Keys makes his headquarters and where an office force has charge of the records of all sales and the issuing of orders for the delivery and installations of appliances sold. Here also is a shops manager who supervises the appliance shops. At each of the "Gas and Electric Shops" is a store manager who has charge of his store and the salespeople who are working in the territory surrounding that store. Salesmen report to these stores and not to the general office. In addition, there is a general storeroom where stocks are maintained and disbursed to the different shops as needed. This is in charge of a storekeeper.

While Mr. Keys prefers not to quote actual figures, he points out that the "Gas and Electric Shops" are organized as an independent merchandising business and that, while it is not large, a profit has been made on the year's operations. In this connection it is worth noting that during the first year the shops had to go through the confusion of organization when business was in the doldrums in 1921. The Equitable Sales Company then was self-supporting and now is making a profit which is significant of the possibilities of merchandising when it is carried on in a businesslike manner.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Cash Value of Power-Factor Correction

To the Editors of the Electrical World:

I was a little disappointed in an article contained in the Nov. 4 issue of the *Electrical World* entitled "Cash Value of Power-Factor Correction." I think the figures given at the bottom of the right-hand column on page 981 are wrong. The entire coal used for generating power in the example cited is not increased 1.56 times. The losses in the line would be increased 1.56 times with an 80 per cent power factor, but the coal required to supply this extra loss would be no more per kilowatt than that required to generate the general output of the station. I am somewhat afraid that the statement as printed in the *Electrical World* will be accepted as a fact by many of the smaller companies, while to me it is clearly an error. **George B. Leland,**

Stamford Gas & Electric Company, General Manager.
Stamford, Conn.

To the Editors of the Electrical World:

In the Nov. 4 issue of the *Electrical World* there is an article by Fred C. De Weese entitled "Cash Value of Power-Factor Correction." This article is very interesting and timely, but there are a few important points on which, I believe, Mr. De Weese is in error.

In the first column of the article, under the subtitle "Present Methods Unsatisfactory," he states that it requires 56 per cent more copper to transmit a given load at 80 per cent power factor than it does at 100 per cent power factor. This statement is true enough if we consider that the economic wire size is in proportion to the power loss in the line. However, this assumption is not correct, as is apparent from Kelvin's law. The economic size of wire for a given delivered load is proportional to the current, or, in other words, inversely proportional to the power factor, instead of inversely proportional to the square of the power factor. Of course, this statement does not consider the effect of regulation, but in the majority of practical cases, if the transmission line is the correct economic size, it is large enough for reasonable regulation.

A table on page 981 also would apparently assume that the economic size of copper is proportional to the square of the current, and the last paragraph on page 982 seems to be also in error. **P. D. Jennings.**

Puget Sound Power & Light Company, Assistant Engineer.
Seattle, Wash.

The above letters were submitted to Fred C. De Weese, the author of the article referred to, for comment. Mr. De Weese's reply follows:

To the Editors of the Electrical World:

In the criticism by George B. Leland of a statement contained in my article on "Cash Value of Power-Factor Correction" he says: "The losses in the line would be increased 1.56 times with an 80 per cent power factor, but the coal required to supply this extra loss would be no more per kilowatt than that required to generate the general output of the station." This is absolutely true. The coal per generated kilowatt-hour may even be slightly lower, owing to the fact that the plant may have a better load condition; but Mr. Leland evidently overlooked the fact that the statement reads: "The amount of coal required to *deliver* a kilowatt-hour at the lower power factor is $4 \times 1.56 = 6.24$ lb.

In the absence of tests it is necessary to make assumptions to have a basis to work from, and in this case I have assumed the transmission losses to be 10 per cent of the generated power, and the point I am trying to convey is made very clear by the following:

If the coal required to deliver a kilowatt-hour at 100 per cent power factor is 4 lb. and the transmission losses are 10 per cent of the generated power, the coal per generated kilowatt-hour will be 3.6 lb., and as we have an additional generation of 111 kw. to make up the losses at the lower power factor, or $198 + 111 = 309$ kw., the coal in the first case will be $198 \times 3.6 = 713$ lb. and in the second case $309 \times 3.6 = 1{,}113$ lb. The power delivered in each case is 178.2 kw.; then we have $713/178.2 = 4$ lb., and $1{,}113/178.2 = 6.24$ lb.

Referring to P. D. Jennings' criticism, I will say that the article shows only the actual copper losses at the various power factors and does not take into consideration the economies of design.

There is one thing that we must face and that cannot be sidetracked, and that is the I^2R losses. It takes actual fuel to make up these losses, and in many cases on small wire lines, with a very great drop in power factor, the I^2R losses may be greater than proportional to the square of the current, because the resistance is higher from the heating of the increased current.

In the second paragraph of Mr. Jennings' letter he says: "The economic size of wire for a given delivered load is proportional to the current." This law holds good only with a constant load.

The table on page 981 does not assume that the economic wire size is proportional to the square of the current, but shows the actual copper losses for a given delivered load at the various power factors. It is to be noted that the statements referred to at the beginning of the second paragraph and the end of the last paragraph of Mr. Jennings' letter are in line with the calculations as shown in the table on page 981.

Fred C. De Weese,

Eastern Minnesota Power Co., General Superintendent.
Pine City, Minn.

Advertising Electricity by Radio

To the Editors of the Electrical World:

It appears to me that radio broadcasting can and should be used to acquaint the American public with the many inherent advantages of applied electricity. An organized effort, however, is required to do this efficiently. The plan would benefit the industry and the country as well. Furthermore, if not overdone, it would be a novel and acceptable form of advertising.

As a prelude to the usual method of entertainment offered, each broadcasting station could furnish a short, interesting and instructive talk on the proper application of electrical energy for light, heat and power, outlining the advantages to be derived from each. The talks could be furnished by a group of interested manufacturers, each talk dealing with only one subject at a time and being of as popular a nature as the subject will allow.

When public instruction in this manner in other fields of endeavor is apparently acceptable, there seems to be no reason whatever why the industry which is fostering the development of radio could not take advantage of this method of advertising. The National Electric Light Association, in co-operating, might here find an opportunity to create good will toward the central station.

Salem, Mass. **John J. Brophy.**

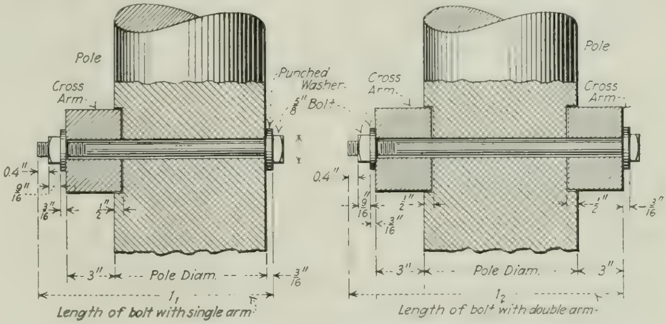
Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of Economically Utilizing
Electrical Energy in Mills and Factories

Crossarm Bolt Lengths for Various Poles

WHEN estimating material required for wooden-pole line construction it is usually necessary to determine the number and the proper lengths of the bolts to be used for clamping the cross-arms to the poles. The required number of these bolts is easily computed, but the suitable lengths are not so easy of determination. The proper bolt length varies with the size of the pole and also (because poles taper) with the position of the arm on the pole. Because of these two variable factors it ordinarily requires considerable time to calculate the proper bolt lengths. If the bolt lengths are not thus carefully estimated, they will probably be either too long or too short, with consequent waste or delay. From the accompanying table the proper lengths of bolts for the various standard-size poles and for the different gains with both single and double arms may be read directly.

The first four double columns show the proper bolt lengths for red and white cedar poles having tops of different circumferences based on the National Electric Light Association classifications. In the fifth double column are shown the proper bolt lengths for the National Electric Light Association and the Western Red Cedar Association poles of class A and class AA respectively. These two classifications both specify the same circumference for the pole top but use the different class letters noted to designate the poles. In the sixth double column the Western Red Cedar Association classification is shown as the National Electric Light Association classification does not include poles of this circumference.



DETERMINING PROPER LENGTH FOR A CROSS-ARM BOLT

The elements of detail which are factors in the determination of proper cross-arm bolt length are shown in the illustration. The bolt lengths of the table are based on the average taper of white cedar poles. For class A white-cedar poles this taper is (according to standard specifications) about 1 in. for each 5 ft. of pole length. For red-cedar poles the taper is only about ½ in. per 5-ft. length.

For certain of the gains two different bolt lengths are given. The greater length should be employed if the poles are "running full" or if the taper is considerable, as with white-cedar poles. If the poles are "running scant" or if the taper is slight—as with red cedar—the shorter bolt length may be used. The shorter bolt lengths are very nearly the exact theoretical lengths, based on perfectly circular section and uniform taper as given in the standard pole specifications. However, since in practice poles do not always run uniform, it will be safer to employ the longer bolt length for the poles just described. The shorter lengths allow a surplus (distance bolt extends beyond nut) of 0.4 in.; if the longer-lengths bolts are used, the surplus may be 1 inch.

Other detail assumptions which were employed in computing the bolt lengths of the table are: The center of the first gain is 12 in. vertically from the pole top. The vertical distance between centers of gains is 24 in. The cross-arm thickness is 3½ in. The bolt diameter is ⅝ in. The gains are ½ in. deep.

L. D. MOORE,
Electrical Engineer.
Missouri Pacific Railroad Company,
St. Louis, Mo.

LENGTH IN INCHES OF CROSS-ARM BOLTS WHICH SHOULD BE USED FOR CEDAR POLES OF DIFFERENT CLASSIFICATIONS

	National Electric Light Association Specifications								N. E. L. A. and Western Red Cedar Assoc. Specifications		Western Red Cedar Assoc. Specifications	
	Red Cedar E. White Cedar D. 17-in. top		Red Cedar D. White Cedar C. 18¾-in. to 20-in. top		Red Cedar C. White Cedar B. 22-in. top		Red Cedar B. White Cedar A. 24-in. to 25-in. top		Red Cedar A. (N.E.L.A.) Red Cedar AA. (W.R.C.A.) 28-in. top		Red Cedar AAA. 30-in top	
Gains	Single-Arm	Double-Arm	Single-Arm	Double-Arm	Single-Arm	Double-Arm	Single-Arm	Double-Arm	Single-Arm	Double-Arm	Single-Arm	Double-Arm
First	10	13	11	14	12	15	13	16	14	17	*14 15	18
Second	10	13	11	14	12	15	13	16	14	17	15	18
Third	11	14	*11 12	15	*12 13	16	*13 14	17	*14 15	18	15	18
Fourth	11	14	12	15	13	16	14	17	15	18	*15 16	19
Fifth	*11 12	15	12	15	*13 14	17	*14 15	18	*15 16	19	16	19

* Use short-length bolts where pole circumferences are scant or taper slightly as with Western Cedar. Use longer-length bolts where circumferences are full or taper considerably, as with white cedar.

Locomotive Batteries

STANDARDS adopted by the Electric Power Club denote that the capacity of storage batteries for locomotives shall be based on a six-hour rating. Trays for locomotive batteries of the lead-acid type are to be constructed with sides not less than ⅜ in. thick, ends not less than 1 in. thick, and bottoms not less than 1 in. thick.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Production Increased 25 per Cent by Better Lighting

The production of finished spindles has been increased 25 per cent by the substitution of directed illumination for daylight in the textile-spindle shop of Johnson & Bassett, Worcester, Mass., manufacturers of wool-spinning machinery. After each grinding operation the spindles need to be straightened. This operation, requiring the utmost skill, is performed by revolving the spindle on a stand by hand, noting the minute variations from normal true revolution and correcting them by placing the spindles on wooden blocks and striking with a brass hammer. Each time a spindle is straightened a workman spends from two to five minutes upon it.

Until the lighting layout was improved four men worked at rough straightening, employing daylight. At times an ordinary low-wattage lamp was used. The finish straightening, however, could not be done satisfactorily under conditions of varying daylight. The workman used shades and endeavored to keep all direct daylight from the spindle except from one direction. When ordinarily dark afternoons came it was necessary to suspend work entirely. This was because the ordinary lamp, no matter where placed, caused a red line reflection the entire length of the spindle, and work could be done but a short time under such conditions.

A temporary angle reflector was hung from the ceiling at the left side of the work. A 150-watt blue "Mazda" lamp was used. As soon as the light was turned on the direct rays showed too strongly. A silvered reflector cap diffuser was taken from one of the old general lighting units and placed over the side and end of the blue bulb, the cap shading in the direction of the work, and then the whole fixture hung to deliver the best light.

The results were remarkable. The light was soft, strong, broad on the spindle, non-glaring and with no sharp reflections. It was immediately decided to make it permanent. An adjustable-arm ball-and-socket ceiling fixture was installed and the light held rigidly where it best suited the workmen.

The finish straightener now works under the artificial light all day long to the exclusion of any shadow-casting daylight. Instead of maintaining that artificial light could not be used at all for straightening, his ideas and those of every one in the plant are now changed about lighting. The old general lighting units, although not of the approved RLM type, were cleaned, relocated and hung higher, and a bowl enameled lamp was used resulting in a very even distribution of light.

At this plant all production centers on the finish straightener. As a result of his being able to work continuously and using artificial light whether the sun shines or not, production has easily been increased 25 per cent. These are figures ascertained by the management after comparing monthly outputs.

W. S. Mowry,
Power Salesman.
Worcester Electric Light Company,
Worcester, Mass.

The Elasticity of Pipe Bends

Graphical Determination of Several Standard Bends Represented —Bends of Larger Dimensions Than Those Ordinarily Used Are Recommended

In selecting the proper size and shape of pipe bends to care for a given expansion and in determining the force exerted by a bend in a given state of deflection the three accompanying charts will aid materially. These charts were presented by Sabin Crocker* and Sterling S. Sanford* in a paper presented before the annual meeting of the American Society of Mechanical Engineers on Dec. 4 to 6 at New York. They are the result of careful mathematical study and exhaustive tests and should prove of value to power-plant engineers.

The bends considered are the quarter-bend, U-bend, expansion U-bend and double-offset expansion U-bend with the forces applied as shown in the small figures in the illustrations. The forces and stresses set up in bends made up of pipe sizes up to and including 20 in. and bent to radii up to and including 120 in. may be read from these graphs without the necessity of solving complicated formulas. In general, bends of larger dimensions than ordinarily used are to be recommended. Results as obtained from the charts are said to be on the side of safety. In some cases the bends tested showed greater flexibility than was anticipated.

Determination of Maximum Bending Stress

The maximum bending stress in the pipe wall of the bend for any expansion in the pipe line which must be cared for is shown in Fig. 1. Inasmuch as the stress is proportional to the outside diameter of the pipe for any deflection or expansion of the bend, and is independent of its weight, this diagram serves for all weights of pipe. The diagram is drawn up for 8-in. pipe, and values for that size may be read directly. For instance, an 8-in. expansion U-bend, formed to a radius of 60 in. and required to take up an expansion of 0.7 in. in the pipe line, would have a maximum bending stress set up in it of 5,380 lb. per square inch.

A sample problem will indicate the method to be used for other sizes of pipe. Since the stress is proportional to the diameter of the pipe, the value of the stress for any size of pipe may be obtained after finding the stress in an 8-in. pipe. The proportion between stresses can be made directly on the diagram by following the radial lines diverging from its lower right corner.

Problem. A 12-in. double-offset expansion U-bend having a radius of 90 in. is to take up an expansion of 1 in. Required, the maximum bending stress in the bend.

From the intersection of 1 in. on the deflection-expansion scale and $R = 90$ in., extend horizontally to the vertical line under 8-in. pipe, which is referred to as the "base line," and then obliquely (with a line passing through lower right-hand corner) until under 12-in. pipe on the upper scale as shown by the arrows on Fig. 1. The result is 2,040 lb. per square inch.

Since the stress is directly proportional to the displacement, this diagram may be used for expansion values which fall beyond its range by multiplying both stress and displacement scales by the same factor. For instance, if a 5-in. expansion is to be considered, the stress for an expansion of 1 in. should be read on the graph and multiplied by five.

The forces set up in the pipe line when pipe bends are used to take up the expansion are shown in Figs. 2 and 3. As these relations are func-

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*Engineers with the Detroit Edison Company.

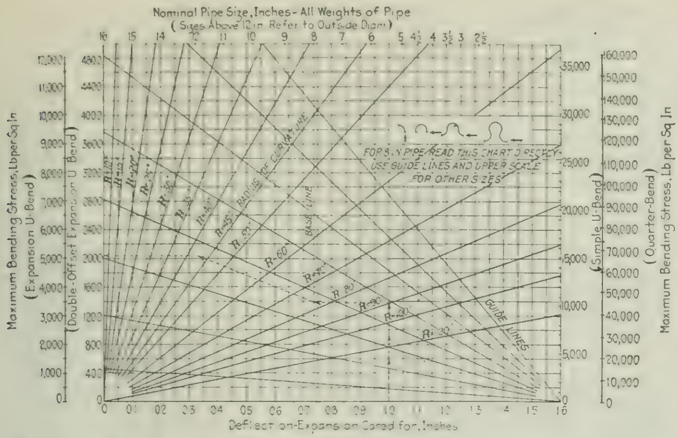


FIG. 1—STRESS VERSUS DISPLACEMENT FOR VARIOUS SHAPES AND SIZES OF PIPE BENDS

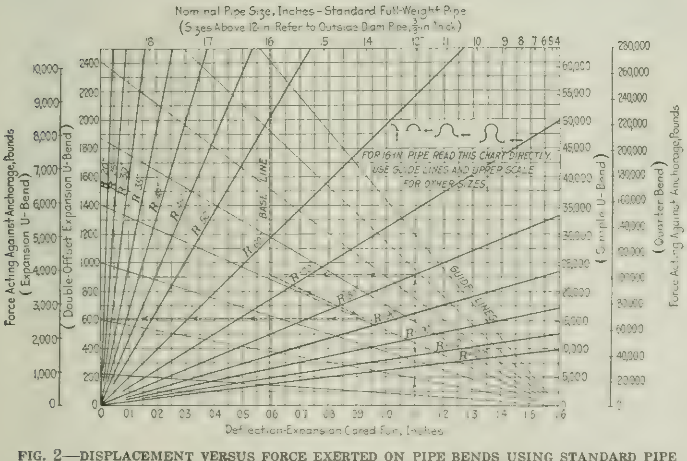


FIG. 2—DISPLACEMENT VERSUS FORCE EXERTED ON PIPE BENDS USING STANDARD PIPE

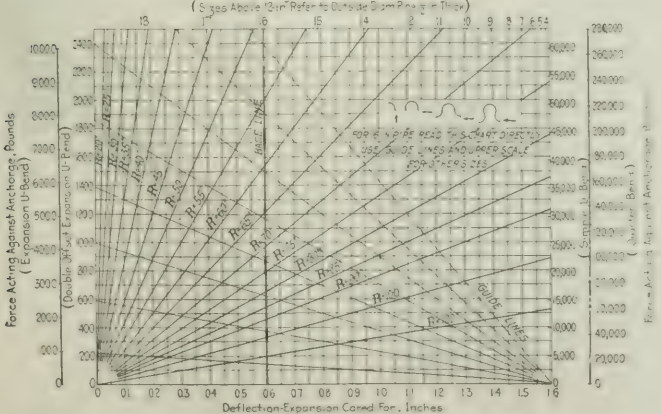


FIG. 3—DISPLACEMENT VERSUS FORCE EXERTED ON PIPE BENDS USING EXTRA STRONG PIPE

tions of the moments of inertia of the pipe sections, the internal diameters affect the results, and Fig. 2 has been drawn for "standard weight" and Fig. 3 for "extra-heavy" pipe. These diagrams are for 16-in. pipe, and values for this size may be read directly. The scale of pipe sizes at the top of diagram is laid off according to the moment of inertia of the pipe section, as the force to produce a given deflection in the bend is proportional not to the diameter, but to the moment of inertia of the pipe.

After finding the force existing for a given deflection in the 16-in. pipe, the value for any other size of pipe may be obtained by using the radial lines diverging from the lower right corner and the vertical base line under 16-in. pipe for making the proportion. The solution for a sample problem is indicated by the dash lines in Fig. 2. A double-offset expansion U-bend made of 14-in. O.D. pipe, ⅜ in. thick, formed to a radius of 80 in., is required to take up an expansion of 1.1 in. in the pipe line. From the diagram, the force acting against the pipe anchorage is 610 lb.

Since the force is directly proportional to the displacement, these diagrams also may be used for values which fall beyond their range by considering both force and displacement scales as multiplied by the same factor. It should be noted that in using these diagrams the pipe size refers to the size of pipe used in the bend and has nothing to do with the size of pipe in the rest of the line.

The limits of safe expansion values for pipe bends as commonly quoted in engineering texts and handbooks are apparently correct only for the double-offset expansion U-bend. For the other shapes the published values are much in excess of those given here. Mr. Crocker and Mr. Sanford contended that these limits should be revised to agree with the formulas which are presented in their paper and from which the charts were calculated, for unless the published tables are used with large factors of safety, the forces and stresses existing in pipe lines will be excessive and dangerous.

In the discussion following this paper attention was directed by at least two speakers to apparent oversights that make the calculated results differ from test results. The advisability of considering expansion loops made of straight pipes was suggested by a few speakers. Some questions were raised regarding the effect of pressure and temperature on the flexibility and stress in bends.

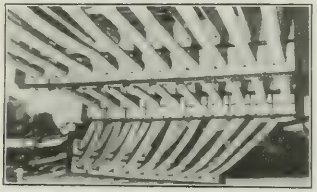
W. B. Campbell contended that some of the conclusions from actual tests are not accurate because they are based on ideal conditions. This was carried farther by R. Cramer, who said that the assumption that the neutral fiber runs through the center of the pipe bend does not result in entirely accurate conclusions.

Another speaker called attention to some U-bends which did not allow the deflection which he had calculated, whereas some double offset expansion U-bends allowed more than twice the deflection. This speaker contended that designers need not fear ripples or buckling on the inside of pipe bends since they reduce stress in outside fibers and increase flexibility. Seamless tubing was urged for bends requiring large-diameter pipe, because with its use there is not the danger of rupturing the outside of the bends.

Field Editor Electrical World.
New York, N. Y

Sectional Cable Support Saves Space

TO FACILITATE handling cables in the substation of the Travelers Insurance Company at Hartford, Conn., served by the Hartford Electric Light Company, the convenient suspension frame illustrated herewith is used. Twenty cables of a size up to about 500,000 circ.mil can be accommodated in an insulator-supporting structure 40 in. long, 11 in. high and built of angle irons and iron strap. Each cable is held in position by two inverted L-shaped pieces of porcelain set into the frame side by side and in two horizontal rows, the frame being assembled of 2-in. angles at the top and sides, with intermediate sections composed of 4-in. bars ½ in. square bolted to vertical bars ½ in. thick by 1 in. wide.



OVERHEAD STRUCTURE THAT AIDS IN HANDLING CABLES

D. A. Read,
Assistant Secretary.
Travelers Insurance Company,
Hartford, Conn.

Supplying a Constantly Increasing Load

THE problem of the yearly increase of load on distribution lines and short transmission lines without undue voltage drops and power loss may be satisfactorily solved by such curves as are shown in the accompanying illustrations. In general, the growth of any electric property closely approximates a geometrical progression of the form $y = ax^n$ where y = peak load, kilowatt-hours per year or number of consumers. a = initial value of peak load, etc. x = 1 plus annual percentage increase. n = time element, or number of years.

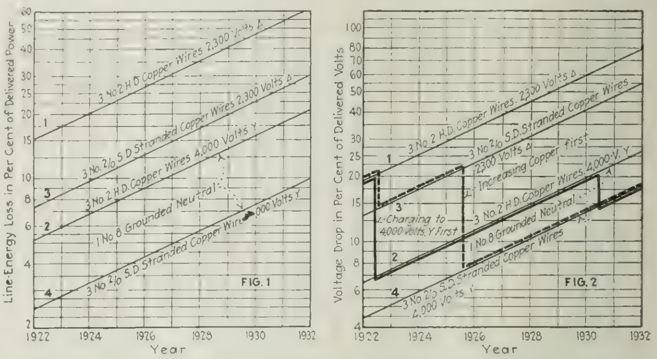
This means that the load n years from now will be equal to the present load multiplied by "1 plus annual percentage increase in load," which increase has first been raised to the nth power.

If the logarithm of the load, or the log of any function of load, is plotted against time, the resultant curve is a straight line. Semi-logarithmic plotting paper makes this curve particularly easy to construct.

Voltage drop in a short transmission line or distribution line is a function of the current, which in turn varies directly with the load. Hence plotting the logarithm of voltage drop against time gives a straight line curve. Knowing the present load and applying the proper annual percentage increase, we may compute the line drop for two different years and draw a straight-line curve through these points.

Energy loss is also a function of the current and may be similarly calculated and plotted.

We have applied this principle to show the voltage drop and energy loss in the distribution line supplying Harvey's Lake from Dallas, Pa. This line is 6.78 miles long, with conductors spaced the equivalent of 25 in. apart, and supplies energy at three-phase, 60 cycles. The maximum load measured in 1922 has been 123 kw. The power factor is assumed at 90 per cent and the annual load increase at 15 per cent. With these data the voltage drop and the energy loss were calculated for various conditions of wire size and line voltage. The curves shown are plotted from these computations and apply to this line. While these curves are specific and apply only to this particular line, the method is fundamental and the same principles may be used to plot similar curves.



CONDITIONS OF INCREASING LOAD FROM YEAR TO YEAR ON DISTRIBUTION AND SHORT TRANSMISSION LINES AIDED BY GRAPHICAL STUDY

The energy loss in per cent of delivered power is plotted against time for four conditions in Fig. 1. Curve No. 1 is drawn for No. 2 B. & S. gage hard-drawn solid-copper wire operating at 2,300 volts delta. Fig. 2, curve No. 1, shows the voltage drop in per cent of delivered volts for the same conductors operating at the same voltage, as measured at the receiving end. The initial point of these curves depends upon the value of current for 1922 and upon the constants of the line. The slope of each curve is the same and is dependent upon the annual per cent increase in load.

Changes in line constants alter the initial position or starting point of the curve but do not change its slope, so but one point need be computed for other types of line construction and parallel lines can be drawn through these points. Curves Nos. 2. 3 and 4 are therefore parallel to curve No. 1 and show the energy loss and voltage drop to be expected in the future if the line is operated at

4,000 volts Y, changed to No. 2/0 copper, or changed to No. 2/0 copper and operated at 4,000 volts Y.

The writer has found this curve sheet an excellent way to illustrate the advantages of raising the distribution voltage on this particular line from 2,300 volts delta to 4,000 volts Y. It is felt that this method has a wide application to similar problems.

The accuracy and value of this method depend upon the following:

The initial or starting point must be correctly chosen, and if possible the curves should run back several years. Where past loads are not available, the present maximum load should be determined with curve-drawing ammeters and the voltage measured at the consumer's meter. If the voltage is found to be abnormally low, the initial load figure should be increased by reference to performance curves for "Mazda" lamps, induction motors or whatever devices comprise the principal load.

The line constants must be accurately determined. The size of wire, spacing and total length from origin to load center must be known or closely estimated.

The annual increase in load must be carefully chosen to suit local conditions. Where past load records are available the annual percentage increase may be taken as the average of these figures. Otherwise the engineer must use his own judgment, based upon conditions found in similar territory.

Any voltage drop may be set as the critical or limiting value. Assuming that the sending voltage can be increased so that 10 per cent buck or boost regulators will compensate for the line drop, we may call 20 per cent the critical value, as shown in Fig. 2. Whenever one of the voltage-drop curves crosses this critical value we shall have either to increase the size of conductor or to raise the voltage. The heavy zigzag dashed line shows the result of increasing the size copper first, and the solid line the result of changing to 4,000 volts Y first.

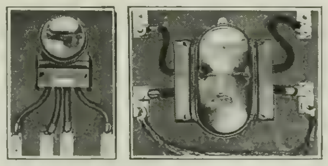
After analyzing the curves the next step is to estimate the cost for each solution, and in the particular case noted it was found cheaper to install new transformers and a fourth wire for the grounded neutral, changing to 4,000 volts Y, than to increase the size of copper to No. 2/0.

R. E. CURTIS,
Distribution Engineer.

Luzerne County Gas & Electric Company,
Kingston, Pa.

Safely Jumping Large Self-Contained Meters

USUALLY when a meter setter installs a large-capacity meter he is more concerned with leaving a neat job than he is with the difficulties of the testers who come after him. But a consideration of these difficulties and the adoption of methods to overcome them will be amply repaid in the time saved by the tester in jumping the meters and the lessened liability to short circuits with their attendant danger and interruption of service.


RUGGED TERMINALS FOR TESTING SELF-CONTAINED METERS

The manner in which meters may be set to avoid short circuits is shown in the accompanying illustrations. A short circuit never occurred while these meters were under test. The pictures were taken with the meters mounted on a box after they were removed to permit alterations to an installation. Originally they were mounted together on a slate panel, all leads being behind the panel, and as the Connecticut Light & Power Company, to which the installation belongs, does not supply back-connected meters, some plan was required which would give short flexible leads in front. This was accomplished in the following manner:

Copper studs ⅝ in. in diameter threaded their entire length were brought through the panel and through pieces of busbar, 3 in. x 2 in. in size, and made tight with nuts on front and back. The meter wire was bent and lugs were attached so that one lug slipped over the stud easily and was held in place by a nut while the other was fastened in the meter. To provide means for jumping the meter, as is shown in the accompanying illustration, a piece of 5/16-in. copper rod was sweated into the bar, allowing ¼ in. to project on the bottom to keep the bar from turning when the nuts were made up. Jumpers were put on without disturbing the meter wires, after which the top nut on the stud and the two screws in the meter terminal were removed and the meter wire was taken out. The meter on the left of the illustration is a single-phase, three-wire instrument, while that on the right is a three-phase, three-wire meter.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

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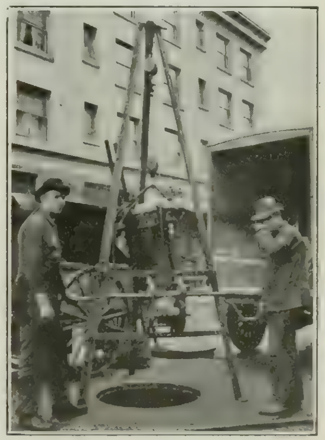
Light Tripod for Handling Subway Transformers

FOR the purpose of handling subway-type transformers the collapsible steel tripod shown in the accompanying illustration has been constructed by the Northwestern Electric Company of Portland, Ore. The leg swings in against the crossbars supporting the winch, allowing the tripod to be placed in against the side of a truck and easily transported from place to place. The tripod is 11 ft. high with a leg spread of 4½ ft. at the base. It is constructed of 2½-in. angle iron, and the weight, including the winch, is approximately 200 lb. The winch is made up of a drum of 4½-in. diameter, 10-in. gear and 2½-in. pinion, having a tooth ratio of 62 to 16. Three-eighth-inch stranded-steel rope is used with a set of double blocks.

Standard 2,400/240/120-volt subway-type transformers up to 75-kw. rating are readily handled with this equipment, and the leverage ratio is such that much larger transformers could be easily handled. By making use of a second-hand winch this tripod was constructed at a total cost of about $100.


COLLAPSIBLE 200-LB. TRIPOD USED FOR HANDLING SUBWAY TRANSFORMERS

E. F. PEARSON,
Electrical Engineer.

Northwestern Electric Company,
Portland, Ore.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Store Lighting as a Source of Income

Great Opportunity Presented for the Central-Station Company to Gain Additional Load Which Will Bring in Profitable Revenue Almost Immediately

By J. J. Kirk and W. E. Underwood
Store-Lighting Committee, Lighting Sales Bureau, N. E. L. A.

SOME idea of the revenue-earning value of store and commercial lighting may be gained from the known demand for incandescent lamps for commercial purposes and from the generally accepted figures as to the amount of central-station load and income represented by lighting as against power load.

Approximately 47 per cent of the incandescent lamps manufactured in 1922 were required for store and other commercial lighting. The proportion for 1921 lamp demand was not greatly different. If it is true that lighting load, as a whole, consumes 23 per cent of the central-station output and represents 59 per cent of the central-station gross revenue, we may reasonably surmise that 47 per cent of this is in the commercial lighting field. In short, then, commercial lighting is roughly 10 per cent of the central-station load and represents 25 per cent of the gross income. It should be stated that the figure of 47 per cent of lamps manufactured does not mean the number of lamps made but their dollar value, which corresponds rather closely to their ratings in watts and therefore to the central-station load they produce.

The store-lighting load and the resulting income are considerably greater than the residential lighting or industrial lighting demand. This one field is without doubt at the present time the best big-volume profit maker within the central station's purview. It is so good that it merits especial attention and specialized effort in expanding and enlarging it to its maximum as speedily as possible.

Residential lighting demand has increased during the last two years at a rapid rate owing principally to an excessive housing shortage. Not only has the building rate been rapid, but very many old homes have been wired. Even with this boom, however, residential lighting still plays second fiddle to commercial lighting in total kilowatt-hour load and annual revenue. The reason is easy to comprehend. The average store, according to Commonwealth Edison statistics, has a connected load of 2 kw. and a load factor of five hours a day. The average home has a connected load of 762 watts and a load factor of one and one-half hours per day. Then remember that 40 per cent of the home load is in appliances and that a rather small part of the connected load in the home is in use at any one time, while the entire store lighting load is effective during the major part of five hours per day. With these facts in mind it is obvious that it takes a lot of homes to equal one store when it comes to a consideration of central-station revenue.

The industrial lighting field is excellent but not so large as store lighting. With factories working at 60 and 70 per cent of capacity and with comparatively few as yet running night shifts, the lighting income from this source is much smaller than it once was or than it may be again when prosperity has climbed a few rungs higher up the ladder.

The Opportunity for Expansion

To stimulate home lighting demand—to accelerate the speed with which homes are wired or to get people to use more lamps or higher-wattage lamps or more appliances—is a rather slow process. It must be done chiefly by a program of advertising, education and easy-payment financing. There is not so much opportunity here for the central-station solicitor immediately to put more profitable load on the central-station lines. The field is too broad for the lighting-sales specialist to pay his way.

The recent stringency and the need for the average factory executive to pare his expenses has made it very difficult to sell more light in this field.

But in the store-lighting field the central-station lighting salesman has found things to his taste. Merchants everywhere for the past year have been in a most favorable frame of mind toward good illumination. It is almost impossible to find a merchant who will not readily admit the importance of illumination in drawing and holding trade. And competition is keen—a big factor in making the merchant eager to invest in anything within reason that will make his store conspicuous and bring new buyers into it.

Getting Into Action

It has taken a long time for the central station to realize that fundamentally its problems are the same as those of any other manufacturer, first to make something and then to dispose of it in the best market. For years we have been so beset with tremendous engineering problems that the marketing of kilowatt-hours has been slighted. We were so eternally busy trying to manufacture energy at the lowest possible cost that we forgot the equally vital need of selling it at a profit.

The start was the realization that load factor had a bearing on profit. Then came the discovery that some kinds of load were more profitable than others, but with these basic facts before them there are still many central stations which are not applying them to the full extent.

A manufacturer of ready-to-wear clothing, of clocks, furniture, or of whatever you please, knows to the fraction of a cent what profit he makes on each commodity. And he chooses certain lines as leaders because they sell rapidly or because of an especially good profit margin. Those are the things that his salesmen try hardest to sell. From time to time he changes his leaders—switches his main selling effort from one commodity to another because of the season or condition of the market. Why this generally accepted idea in all other lines of business is not more widely followed in the central-station industry is a mystery. Just now store lighting is the obvious leader for the sales endeavor of the central station. It should be a leader, first, because it can be readily sold at the present time; second, because it is a big-volume business, and, third, because it is an extremely profitable business.

Here's a sample of what can be done: In 1921 the Commonwealth Edison Company investigated a thousand stores selected at random. The average illumination intensity for these stores was very low. Only 25 per cent had 5 foot-candles or more. Only 2 per cent had 10 foot-candles or higher intensity. In 1922 a thorough campaign of concentrated sales effort on stores was made in which a standard of 10 foot-candles was aimed at. This campaign added 45.7 per cent to the store-lighting revenue of this central station!

If the lighting level of all Chicago stores can be brought up to the low level of 5 foot-candles, it will add another 32,000 kw. to the central-station load and more than a million dollars to the annual income. Boosting the lighting level of stores to 10 foot-candles will add two and a half million dollars.

RIGHT WAY TO SELL STORE LIGHTING

A recent survey indicates (in percentage) the following general and average condition of store lighting:

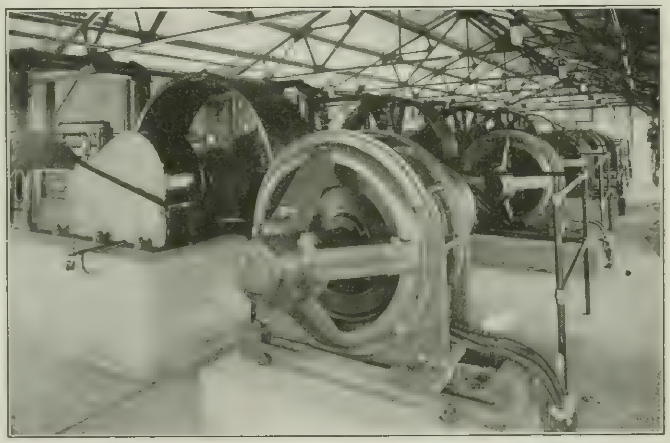
	Store-Interior Lighting	Store-Window Lighting
Good	27	10
Fair	43	18
Poor	30	72

Whatever discrepancies there may be in these figures when applied to any particular locality, they at least indicate that really good store lighting either for windows or store interiors is the exception rather than the rule.

Better lighting can most easily be sold to those stores which already have fair or reasonably good illumination. In fact, many of these merchants believe that they have good lighting and are proud of their lighting installations. When it is demonstrated to them that better lighting is possible at no great cost they are the easiest customers to convince.

The lighting salesman who really knows something about store lighting and window lighting and how to improve it, and who is able to figure the cost right on the job, is the one who will sell most successfully. It pays also to pick one good type of store-lighting unit and to concentrate sales effort on it. Carrying a demonstration unit inevitably helps sales. The same may be said for choosing and carrying one type of window-lighting unit.

The average merchant thinks of lighting in terms of profit to his store. He is most easily "sold" on the idea that better illumination, which to his mind always means brighter illumination, will bring more trade. Recent tests on the relation between lighting intensities and the "pulling power" of show windows prove how absolutely right the merchant is in this surmise.



COMPRESSOR ROOM OF CASING HEAD GASOLINE PLANT

Merchants who have installed better illumination cite many advantages, such as greater profit, fewer returned goods, improved courtesy and more regular attendance on the part of floor salesmen, the sale of slow-moving goods, the speeding up of sales, greater cleanliness and better reputation for the store.

OPPORTUNITY FOR 1923

Whatever other opportunities may present themselves in 1923, it seems hardly possible that any more profitable opening for increased central-station income can arise than better store lighting. It is something that any central-station company may cash in upon immediately, and the very best sales season is at hand during the next few months.

Electric Power for Casing Head Gasoline Process

A FURTHER development in the use of electric power in oil-field operations is seen in the complete electrification of a number of casing head gasoline plants in the Midcontinent field. Substitution of electric drive for steam for this purpose is effecting economies as great as those it has already accomplished in oil-well drilling, and, as the nature of the work permits of continual operation at a constant demand for twenty-four hours per day, it offers a very desirable type of load for the central station.

In extracting the gasoline from the natural gas the absorption process is used, whereby the gas is sent through a container under 30 lb. to 50 lb. pressure per square inch, the container being previously charged with naphtha or mineral-seal oil, both products of the crude-oil refinery. The naphtha or heavier oil absorbs much gasoline from the gas as it passes through the container under pressure. If naphtha is used, the resulting product is gasoline as it comes from the container. If the heavier mineral oil is used, the product is distilled and the gasoline taken out as in the ordinary refining process, the mineral oil being returned to the container for further use. The amount of gas necessary to produce a gallon of gasoline varies with the fields. In the Midcontinent fields the yield is from 0.5 gal. to 8 gal. to 1,000 cu.ft. of gas.

The gas is piped into the mains after it has been processed and is used for fuel either in the field or in the cities that are served with natural gas. Its B.t.u. value is not affected by the processing.

Two new casing head gasoline plants belonging to the Chester & Smith Corporation of Tulsa, Okla., have just begun operation with complete electrical equipment at Eastland, Tex. These two plants are processing 20,000,000 cu.ft. of natural gas a day, and the company is adding electrical equipment in all other gasoline plants as occasion presents itself.

The particularly favorable features of motor drive for these plants are found to be low first cost, low maintenance and continuity of service, and, on account of the extremely short drive, much less building space is required than otherwise would be possible for engine-driven compressors of the same size. This latter condition is exemplified most forcibly at Plant No. 108, shown here, where compressors with a total capacity of 10,000,000 cu.ft. of gas per day and a connected load of 1,180 motor horsepower are housed in a compressor building 30 ft. x 100 ft.

The motor-driven compressor equipment and auxiliaries are uniform in both plants. The major equipment at Plant No. 107 consists of four 16-in. x 16-in. x 16-in. duplex compressors, each driven by a 200-hp., 440-volt induction motor; two 12-in. x 12-in. x 12-in. duplex compressors, used for handling noncondensed vapor gases, each connected by short belt drive to a 60-hp., 440-volt induction motor, and the various loading, oil-circulating and water pumps, belt-driven from a line shaft, which in turn is driven by a motor identical with those used on the vapor units. The equipment at Plant No. 108 is identical with that at Plant No. 107, with the exception that this latter plant has five main units.

The transformer bank supplying the compressor plant is situated about 150 ft. away. All wiring is in conduit, and inclosed fuses are used on secondary wiring. Oil switches are used on the compensators. Thus any danger of fire or explosion is minimized.

The main compressors are used for drawing the natural gas from the fields through a series of gathering lines and operate at an average vacuum of 10 in. of mercury at the suction side of the compressor and a discharge pressure of from 28 lb. to 30 lb. per sq.in.

All motors are operated at full load twenty-four hours per day and have been in operation for from three to twelve months with an operating record, based on actual time in service, of from 98 to 99 per cent.

In the case of Plant No. 108 about 10,000,000 cu.ft. of gas is passed through the process per day. The average demand, which is almost constant, is 800 kw., and the plant consumes approximately 20,000 kw.-hr. every twenty-four hours, producing in that time an average of 20,000 gal. of gasoline.

Power is supplied from the distribution system of the Oil Belt Power Company, at Eastland, Tex., which also supplies all commercial and oil field power in the Ranger, Eastland and Breckenridge districts.

News—Its Relation to the Utility[*]

What a Newspaper Man Sees in the Public Service Company and His Suggestions for Getting the Story Across to the People —News Versus Propaganda

BY BRAINARD PLATT
Assistant to Vice-president, *Courier-Journal* and Louisville *Times*
Louisville, Ky.

I BELIEVE this circumstance of a newspaper man addressing a convention of public utility men in an open convention is unique in Kentucky. Such a case has been slow in coming to this commonwealth as elsewhere. It represents a new alignment of relationship established only after a long struggle by the news-distributing agencies—that is, the newspapers—to humanize the heads of public utilities.

"What is news in relation to public utilities?" The *Courier-Journal* and *Times* "style book" defines news as "that characteristic of any happening which gives to it an appeal beyond the circle of those immediately concerned," and that is as good a definition for you as any. In applying this definition it is necessary for you to classify the corporations and the papers. For instance, what will be a news item in a town of a few thousand to a paper published weekly might not be a news item to a daily paper published in a city of the first, second or third class.

It is the big activities of the utilities that are the obvious news—the building of new units for a plant, the extension of facilities, the development of old policies or the change to new ones, floating a large loan or canceling one, defying a strike or settling a strike, organizing the employees in the union or out, promoting a welfare movement such as was done by the Louisville Railway Company or squelching one, increasing a wage scale or reducing one with or without the consent of the employees, trying a new process for purifying water, getting into new gas fields, reducing the cost of gas or electricity, increasing the rate, discovery of new processes for cheapening production of electricity and so on indefinitely.

It is conceivable that some of what the newspapers and the public would seize as most important news would be pooh-poohed by the company. That might be because the public is the ox that is being gored and the utility is the ox that is sinking in the horn. I say this is conceivable. It is also conceivable that at some distant date all contracts made by utilities with the public will be written in the open. When this is the practice the news the public wants will be the news the companies are willing to give out. It will be the casual item the reporter picks up as he passes along the way of the utilities' head offices. It sounds a little Utopian, of course, but why not hitch the wagon to a star?

THINGS THE PUBLIC WANTS TO KNOW

When that time comes the newspapers would know, for instance, exactly what is in the back of everybody's head when lampblack factories are established in natural-gas territories. They would know without peradventure of doubt just why old-line telephone companies fight independent companies in the newspapers and out and then suddenly lie down with the lambs and purr as they sleep. They would know, too, straight off, why railway companies at first fight the stranger seeking to lay tracks in their midst and then welcome him with open arms.

Please do not understand me to say that such time is not on its way. It is. One of the encouraging signs was the manner in which the Louisville Railway Company handled its negotiations with the city when it was seeking to readjust the fare. There were no press agents distributing the news for the company. Reporters were welcomed by the company and the developments were discussed from time to time by the reporters and the railway heads. Each day brought forth its particular item, the building up of which was made easy by the co-operation of those in the railway's employ best able to help. It was possible for the public to follow the negotiations step by step, and that was the public's right.

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[*] From an address at the annual meeting of the Kentucky Association of Public Utilities at Lexington, Ky., Dec. 12, 1922.

No talk on news from public utilities would be complete without a word on the universally read news—I mean the accidents and tragedies. The trivialities under the accident classification, of course, need not be considered, but the accidents of consequence are legitimate news always in all kinds of newspapers. Facts should be readily available to newspapers from authentic sources. The reporter should not be required to use rumor and reports. The far-sighted heads of public utilities will put at the disposal of the news gatherer every facility for getting at the facts, no matter who in authority may suffer thereby. Formerly this was not done. Now it is being done more and more. There is a disposition on the part of utilities to accept responsibility where responsibility is justly due, and that state of mind removes much of the reason for suppression and evasion.

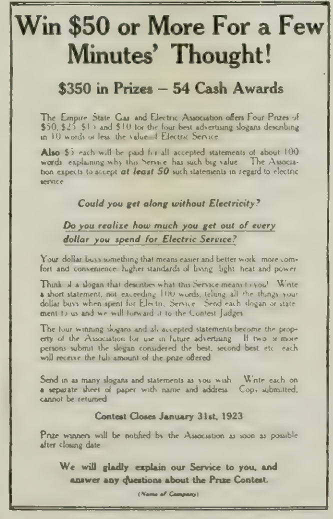
It is my idea that newspapers should know news confidentially only that when the release date comes they may be in a position to handle the news more fully. No newspaper and no reporter should accept news in confidence with their hands tied perpetually on that news. Those of you men who have had news dealing with reporters know that they can be trusted; you know that they do not violate confidences.

Propaganda Not News

In all business publicity there is often difficulty in drawing the line between news and propaganda. News, of course, is welcomed freely to newspaper columns. This should speak for itself. The propaganda should go to the advertising columns properly labeled so that the public will know who and what is speaking. If the utilities fail to see the difference, they can send everything they believe to bear the earmarks of news to the newspapers and the papers will winnow out the news. Undoubtedly you will be visited by representatives of the business office on some of the matter that only the business office can with propriety handle. You will find the advertising columns of the newspapers powerful instruments in your hands if they are used honestly to educate the public. They form an honorable approach toward the public and, used in connection with pure, "honest-to-God" news, running as it develops in the news columns, they help the public to appreciate public utilities as desirable citizens.

A Slogan Contest for New York

To focus the attention of the public on the value of electric service a contest for a suitable slogan for the industry will be launched on Jan. 1, 1923, throughout the entire State of New York by the Empire State Gas and Electric Association. Announcements of the contest, like that reproduced here, are being sent to every utility in the state with the request that they give it publicity by posting it prominently in their offices and also running the announcement as paid advertising in the newspapers.



Win $50 or More For a Few Minutes' Thought!

$350 in Prizes – 54 Cash Awards

The Empire State Gas and Electric Association offers Four Prizes of $50, $25, $15 and $10 for the four best advertising slogans describing in 10 words or less the value of Electric Service

Also $5 each will be paid for all accepted statements of about 100 words explaining why this Service has such big value The Association expects to accept ***at least 50*** such statements in regard to electric service

Could you get along without Electricity?

Do you realize how much you get out of every dollar you spend for Electric Service?

Your dollar buys something that means easier and better work more comfort and convenience higher standards of living light heat and power

Think of a slogan that describes what this Service means to you! Write a short statement, not exceeding 100 words, telling all the things your dollar buys when spent for Electric Service Send each slogan or statement to us and we will forward it to the Contest Judges

The four winning slogans and all accepted statements become the property of the Association for use in future advertising If two or more persons submit the slogan considered the best, second best etc each will receive the full amount of the prize offered

Send in as many slogans and statements as you wish Write each on a separate sheet of paper with name and address Copy submitted, cannot be returned

Contest Closes January 31st, 1923

Prize winners will be notified by the Association as soon as possible after closing date

We will gladly explain our Service to you, and answer any questions about the Prize Contest.

(Name of Company)

ANNOUNCEMENT OF NEW YORK SLOGAN CONTEST

The slogan contest, which will close on Jan. 31, is the result of the work of the association's advertising committee, which is endeavoring to increase the value of utility advertising by injecting into it more about the fundamental value of electricity as a service. It is felt that advertising effort has been scattered and spasmodic, with the result that the public has come to take the service pretty much for granted. It is the purpose of the committee to concentrate attention first through the contest itself and later through the use of the ideas and material which it produces.

What Other Companies Are Doing

Jefferson, Tex.—The Jefferson Ice & Light Company, under contract with the City Council, has begun installation of twenty-two 250-watt street lights on ormanental iron standards, forming a "white way" for the principal business street, and is also changing street lamps in the residence section from 32-watt to 60-watt units.

Delphos, Ohio—On Saturday, Dec. 9, the Northwestern Ohio Light Company held a successful electrical show which drew an attendance of 800. Electrical appliances were exhibited and "prospect" cards asking for demonstrations were obtained. This large attendance, secured at a time when merchants were attending to the week-end country trade, speaks well for the interest in the show.

Boston, Mass. — Electrical gifts for modern homes were featured in a special Christmas booklet prepared this year for companies under the management of Charles H. Tenney & Company, Boston, and distributed to 56,000 customers taking electrical service from these utilities. The booklets featured Christmas-tree lamps, hollow ware, portable lamps, washers and other articles of convenience and were illustrated through the co-operation of manufacturers and by photographs taken specially for these companies. A "shopping list" on the back cover added a convenient touch.

Lake Geneva, Wis.—Sales of electricity by the Southern Wisconsin Electric company for the twelve-month period ended Sept. 1 showed an increase of 14 per cent in kilowatt-hours sold as compared with the previous twelve months. New customers added to the company's lines averaged an increase of 10 per cent. For the first six months of 1922 the company reported an increase in gross revenue of 16 per cent over the corresponding period in 1921.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Surface Condensing Plant and Auxiliaries.—The design of condensers has been greatly improved during the last few years, and the condenser is now one of the most important and efficient units employed in power production. This efficiency is dependent upon the even distribution of the steam over the surface and freedom from eddies and stagnant pockets, the general proportions of the cooling surface, and the quantity of circulating water used. A "Contraflo" surface condenser of English make for use in conjunction with a 10,000-kw. turbine is described. This is designed to condense 106,000 lb. of steam per hour and to maintain a vacuum of 28.7 in. The auxiliary equipment for this condenser is also considered.—*Engineer*, Oct. 20, 1922.

Evaporation: A Study of the Various Operating Cycles in Triple-Effect Units.—A. L. Webre.—A general method of discovering the best operating cycle for triple-effect evaporators is described. A heat balance is worked out for a typical case and the type of conclusions which may be reached is indicated.—*Chemical and Metallurgical Engineering*, Nov. 29, 1922.

Generation, Control and Switching

Relations of the Electric Power Industry to the Industrial Corporation.—C. P. Steinmetz.—A discussion of the economic relations between the electric power industry and the industrial corporations using electric power and producing by-product energy. The author compares the possible economies of central-station production with those of a local isolated power station. With a considerable amount of by-product energy and a local station built to utilize all the by-product energy the power output of the local station may sometimes or frequently exceed the power demand of the industry so that power could be fed back into the central-station system. In other words, sometimes the central station would supply power to the local plant and at other times the local station would return power to the central station. With such a power exchange an arrangement of the charge for power received and credit for the power returned would have to be made, which in itself is a very difficult problem. The author believes that a great step in the industrial development of the country would be taken if the relative economy of a progressive industrial corporation using considerable power and producing considerable by-product energy and an equally progressive electric power corporation could be worked out.—*General Electric Review*, December, 1922.

Transmission, Substations and Distribution

Standardization of All New Equipment for the Reconstructed Coal Mines of France.—G. Jaula.—To insure the most intensive and efficient exploitation of the French coal mines which were destroyed by the enemy, a general electrification program was established in 1916 for their reconstruction and future operation. This program is described at length. The three-phase, 50-cycle system has been chosen, with 15,000-volt transmission and 3,000-volt secondary tension. Three-phase oil-immersed, core-type, 1,000-kw. transformers have been installed, three at every mine. All power lines are laid out in underground cables to insure a greater reliability of the energy supply. All oil switches for the 15,000-volt lines are designed for a rupturing capacity of 40,000 kva. and a test voltage of 55,000. In spite of the much higher first cost, the Leonard direct-current system has been chosen as the standard type of electric mine hoist in preference to the direct drive with a three-phase motor. A considerably lower energy consumption, more uniform power demand, better power factor and finer regulation were among the chief factors which led to the selection of the direct-current drive. Asynchronous motors are used for the mine exhaust fans and synchronous motors for all compressors. In all new generating stations the pulverized-coal firing system has been installed.—*Revue Générale de l'Electricité*, Nov. 11, 1922.

Units, Measurements and Instruments

Tensile Properties of Low-Carbon Steel.—H. J. French.—An investigation to determine the effect of temperature deformation and rate of loading on the tensile properties of low-carbon steel below the thermal critical range. An apparatus for determining tensile properties of metals at high temperatures and the results of tests of several grades of boiler plate from 20 deg. C. to 465 deg. C. are described. The effects of cold and blue work on the properties of these steels throughout the range given are discussed, and in addition some results are given showing the effect of tensional elastic overstrain on the proportional limit at different temperatures and its subsequent behavior with time. Effects of variations in rates of loading and the modified apparatus used for this work are also described.—*Technologic Paper No. 219 of the Bureau of Standards.*

Temperature Coefficient of Insulation Resistance of Rubber-Covered Wire.—The temperature coefficient of insulation was investigated for two kinds of wire, namely with rubber content of 40 per cent grade and 20 per cent grade. The mechanical properties and chemical compositions were tested and analyzed for specimens from eight Japanese manufacturers. The results as stated by the article showed that the temperature coefficient of insulation resistance of the rubber-covered wire not only increases as the rubber content decreases but has also a tendency to increase in nearly proportional relation with the amount of organic substances in rubber compound extracted by various solvents, and that the degree of vulcanization has almost no influence upon the temperature coefficient.—*Researches of the Electrotechnical Laboratory, Tokyo, Japan.*

Illumination

Application of Lighting to Restaurants and Schools.—This issue is devoted to two papers presented at the Swampscott convention of the I. E. S. These are "Lighting for Public Eating Places," by J. L. Stair, and "Practical Applications of the Principles of School Lighting," by H. B. Dates. An abstract of the former paper can be found in the convention report on page 760 of *Electrical World* for Oct. 7, 1922, and an abstract of the latter can be found on page 759 of the same issue. The complete discussion following the reading of the school-lighting paper is included.—*Transactions of the I. E. S.*, November, 1922.

Motors and Control

Application of Electricity in the Manufacturing Industry.—The development of electric logging methods in the lumber industry is considered in this article, which contains an account of skyline logging, in which a steel cable is anchored to the timber on the crest of a hill and the logs are transported to the mill below. Other points considered are the distribution of energy through forests, electric rafting and the advantages of applying electricity to this industry.—*Electrical News*, Nov. 1, 1922.

When to Ground Conduits and Motor Frames.—Edgar P. Slack.—The first of a series of articles dealing with when, how and why to ground conduit and motor frames, based on the National Electrical Code requirements. The grounding of motor frames is required for motors operating at more than 150 volts potential and accessible to other than qualified attendants. A further requirement is that when frames are not grounded and the voltage of the circuit exceeds 150 to ground the frames shall be permanently and effectively insulated from ground.—*Power*, Nov. 7, 1922.

Wound-Rotor Connections.—A. C. ROE.—Rotors of slip-ring induction motors are wound in almost the same way as stators. The slight differences from the stator winding are, however, of vital importance. The author points out just what these differences are. He gives figures and diagrams which explain how the connections should be made on any wound rotor. Of special value is a simplified kind of diagram which may be applied to a stator or any other kind of winding.—*Industrial Engineer*, November, 1922.

Heat Applications and Material Handling

Specifications for Welding Wire.—H. G. KNOX.—When the American Welding Society's wire committee undertook to prepare a single set of standard specifications, the diversity of uses and the differences of opinion as to suitable welding wires made the problem a difficult one. It was finally decided to adopt the specifications used by the Navy Department as a guide in preparing the specifications for welding wire. Copies of the welding-wire specifications as they now stand may be obtained from the society. These cover the material, physical properties, nomenclature, chemical composition, recommended sizes, tests and wire for gas and non-ferrous welding.—*Journal of the American Welding Society*, November, 1922.

Handling Material in Automotive Plant.—Tractor operation in the Studebaker Corporation, South Bend, Ind., has accomplished a large saving in productive labor and has also worked admirably with the system of maintaining small banks of material in each department operating, for the reason that it works on a schedule basis entirely and tends to keep the flow of material constant. The trains of materials are made up entirely in the different clearing stations and rough stores. The trucks are lifted from their piles in rough stores and placed in proper order in the making-up aisle, ticketed for transfer and coupled together by the rough-stores men. A description is given of how all the materials are handled by tractor. A complete system of time checking is developed which makes delays very few.—*Iron Age*, Nov. 16, 1922.

Electric Heating by Ironless Induction.—E. F. NORTHRUP.—The author has conducted a series of experimental and theoretical investigations on inductive electric heating which lead up to the present applications of this method with currents of higher frequency than are employed by commercial lighting and power. The fundamental principles to apply in heating inductively with currents of frequencies sufficiently high to make the use of iron unnecessary for increasing the magnetic induction are considered. Details of construction and circuit diagrams are also touched upon. The article is about eleven pages long and gives a comprehensive study of this subject.—*General Electric Review*, November, 1922.

Traction

Some Arguments for Railroad Electrification.—W. J. DAVIS, JR.—Many logical reasons for electrification of steam railroads are given by the author. Several comparisons between steam and electric railroads are made. The accompanying table affords a comparison between steam and electric operation as applying to sections of the main lines of two large railroad systems. Both systems are single-track with the usual percentage of sidings. The length of sections considered is 330 miles for road A and 260 miles for road B. The costs are given in the form of percentages, the basis being the total cost of steam service for the freight traffic. It is assumed that electric power will be purchased in each case. The figures for steam service were obtained from operating records. The costs for the electric system are estimated. It will be seen that the total net savings in operation are 40.38 per cent for road A and 36.57 per cent for road B. Expressed in terms of capital cost, these savings become 16.3 per cent and 17.1 per cent of the net cost of electrification after deducting the replacement value of the steam locomotives. These two cases may be considered as fairly representing the economies to be expected from electrification.—*General Electric Review*, December, 1922.

PERCENTAGE COMPARISON BETWEEN STEAM AND ELECTRIC OPERATION OF RAILROADS FAVORS ELECTRIFICATION

Item	Road A Steam	Road A Electric	Road A Reduction	Road B Steam	Road B Electric	Road B Reduction
Fuel or power	33.80	27.50	6.30	38.34	32.70	5.64
Locomotive repairs	30.40	10.70	19.70	23.65	8.35	15.30
Lubricants and supplies	2.35	1.41	0.94	2.39	1.44	0.95
Engine-house expense	4.62	0.77	3.85	9.00	2.50	6.50
Enginemen	13.76	6.82	6.94	13.60	8.22	5.38
Trainmen	15.07	8.10	6.97	13.02	7.82	5.19
Maintenance trolley		4.32	*4.32		2.39	*2.39
Total	100.00	59.62	40.38	100.00	63.43	36.57

* Increase.

Telegraphy, Telephony, Radio and Signals

Electric Dictaphone. — K. PERLEWITZ.—The article describes a dictation recorder similar to the types used in America. Instead of using a membrane which is set in vibration by the voice, a specially constructed telephone receiver with a stylus attached to the steel membrane is carried along the axis of the rotating wax cylinder. Very strong magnets in the receiver, in conjunction with a speech-amplifying electron tube mounted within the apparatus, guarantee a reliable and permanently adjusted recorder. The machine is fully automatic, and all operations, as, for example, the change from dictating to listening, are remotely controlled by push-buttons. The telegraphone, as it is called, has a wide use. Owing to its electric recording principle, it can be used to register any telephonic message. It is further possible to have one recording apparatus, installed in a room outside of the offices, made electrically accessible to several dictators, each of whom has only a small transmitter and a double-throw switch on his disk.—*Elektrotechnische Zeitschrift*, Nov. 16, 1922.

Radio Communication.—The December issue of *Q S T* contains several methods for sending and receiving by radio. C. R. Leutz describes a super-heterodyne unit that has given very satisfactory results. A. H. Babcock gives a discussion on the design of a small continuous-wave transformer. In attempting to adapt super-regeneration to short-wave telegraph reception James Wood carried out a number of experiments the results of which are given in an article. Among other subjects covered are continuous wave experiments and results, reception of signals from Europe, description of a spark transmitting set and description of a single-tube super-regenerator, based on the methods that have been employed by E. H. Armstrong.—*Q S T*, December, 1922.

Miscellaneous

Mechanism of Lubrication.— WILLIAM STONE.—An explanation of the principles of lubrication as developed mathematically by Reynolds and Michel and employed by the latter in the design of the Michel thrust and journal bearings. The pamphlet contains thirty pages, illustrated by diagrams and photographs of working models in operation.—*Industrial Australian and Mining Standard.*

Talking Motion Pictures. — E. NESPER.—This article gives an account of different attempts made in Europe to develop a system to synchronize action in a motion-picture film with acoustical performance. In 1918 Seibt perfected a receiving and reproducing apparatus which is free of acoustical distortions. This was accomplished by using inertialess tubes, amplifiers and a newly developed electrostatic telephone. With this arrangement a motion picture is taken on a standard-size film, occupying about seven-eighths of the available picture surface, while on the remaining surface are registered the fluctuations caused by the talking or singing of the actor. Action and speech are in this way registered on the same film simultaneously.—*Elektrotechnische Zeitschrift*, Oct. 26, 1922.

News of the Industry

Chronicle of Important Events and General Activities,
Announcements and Reports of Association Meetings, Court Decisions and
Commission Rulings and News of Electrical Men

Indiana Supreme Court Sustains Consolidation

The authorization in January last by the Indiana Public Service Commission of the consolidation of seven northern Indiana utility companies into the Indiana Electric Corporation has just been upheld by a decision of the Indiana Supreme Court reversing the finding of the Superior Court of Marion County, which had held that the commission acted illegally. The suit to annul the commission's action was brought by the cities of Kokomo and Indianapolis, the Indiana Railways & Light Company of the former city and the Merchants' Heat & Light Company of the latter being two of the companies merged. Much public opposition to the merger sprang up at the time it was first authorized, and the Mayor of Indianapolis staged a sensational descent of citizens upon the State Capitol.

◆

Southern Power Resumes Full Service

A suspension of the order issued last month by the Southern Power Company curtailing the use of power by various industrial plants, principally cotton mills, took effect on Dec. 20. The curtailment order, or rather request, was put into effect Nov. 27. The users of power co-operated efficiently with the power company in the effort to conserve power and a period of danger was safely passed. Rains have now, it is thought, insured plenty of water for the power plants until next summer at least, and by that time the power company expects to have its new auxiliary steam plants and its new hydro-electric plants in operation.

◆

Two Sets of Books Need Not Be Kept in California

California electric light and power companies which have annual operating revenues of more than $250,000 need keep only one set of books of accounts as the result of an order of the California Railroad Commission establishing a new system of accounting for these corporations. The new system conforms substantially with that of the Federal Power Commission and embodies sound accounting principles and practices.

The greatest departure thus made from the system of accounting which is now in effect is the classification of property on a functioning basis, or on the basis of what it is used for instead of the material it contains. For example, transmission and distribution systems can now be listed as separate accounts instead of jointly with sub-classifications for wire, poles, insulators and the like. Similarly, there will be separate accounts for hydro-electric and steam plants under the new system.

An exception to the new ruling is made by the commission in the case of electric corporations which operate only steam generating plants, transmission and distribution systems or which operate only transmission and distribution systems and also operate gas plants. They may keep their accounts and records during 1923 in accordance with the system now in effect.

Street-Lighting Tables for 1923

FOLLOWING its practice for thirty-four consecutive years, the *Electrical World* has prepared tables showing the proper time for lighting and extinguishing street lamps. The tables for 1923 are now ready, and a copy of them will be sent free to any subscriber upon request to *Electrical World*, Tenth Avenue and Thirty-sixth Street, New York. For more than one copy a charge of 25 cents each is made to cover a portion of the postage, printing and compilation costs.

Program of Portland (Ore.) Central Station

Extensions and betterments in the properties of the Portland (Ore.) Railway, Light & Power Company during the coming year will mean the expenditure of $5,000,000, according to Franklin T. Griffith, president of the company, who has just returned from the East. Half of this amount will go into the new Oak Grove hydro-electric project on the Clackamas River, which will be completed by the summer of 1924. The waterwheel and generator have already been ordered for the first unit, which will develop 25,000 kw. The plant will have an ultimate capacity of 75,000 kw. and will cost about $10,000,000. The rest of next year's outlay will be expended in improvements that will keep the properties of the company thoroughly modern.

Political Status of Fight on Indiana Commission

It is doubtful whether the opponents of the Indiana Public Service Commission who for six months have been endeavoring to crystallize opinion in favor of its abolition will get far in the coming session of the Legislature. The Democratic members of that body, who will form a strong minority, had been counted on by the foes of the commission to favor doing away with state regulation, but they are likely, as foreshadowed by the result of a caucus, to content themselves with advocating "home rule" and to favor leaving the commission in control over utilities which are more than local in their scope. There will be a determined fight by the utilities all over the state against any such change in the law.

◆

Philadelphia Electric to Pay Wage Dividend

A "wage dividend" for 1922 has been declared by the Philadelphia Electric Company, according to an announcement by Joseph B. McCall, the president. Payments under this plan will be made from the earnings of the system over and above fixed charges, dividends of 8 per cent on preferred and not less than 8 per cent on common stock and proper credits to surplus account. Employees through the calendar year 1922 will receive 2 per cent on their pay for that year, employees through 1921 and 1922 will receive 4 per cent, employees of three and four years' standing will be paid 6 per cent, and employees for five years or more previous to Dec. 31, 1922, will have 8 per cent. The plan is for this year only, but may be continued from year to year, at the discretion of the directors.

◆

Oklahoma Utilities Increasing Capacity 146 per Cent

Construction plans for 1923 for the Standard Gas & Electric Company's subsidiaries in Oklahoma will increase their present capacity from 34,102 hp. to 84,102 hp., a gain of 146 per cent. The Muskogee plant of the Oklahoma General Power Company, originally planned for 10,000 hp., will be increased to 30,000 hp., while the Oklahoma Gas & Electric Company will construct another steam plant with a capacity of 20,000 hp. near Harrah, about 20 miles from Oklahoma City. Both of these plants will be erected by the Byllesby Engineering & Management Corporation. The plant at Muskogee is planned for the use of either coal or fuel oil, while the Harrah station will be able to use coal, oil or gas.

This increased capacity will directly benefit the forty-two communities now served, since, as previously announced, plans have been recently made for the construction of a 60-mile high-tension transmission line to connect the system of the Oklahoma Gas & Electric Company with that of the Fort Smith Light & Traction Company. The first named company also serves eleven communities in Arkansas through the Mississippi Valley Power Company, which was recently organized to acquire and operate approximately 60 miles of high-tension lines in that state. Of the forty-two towns served by the Oklahoma Gas & Electric Company, fifteen were added to the transmission system in 1922, and nine of these abandoned municipally operated electric plants in favor of central-station service. The total number of electric service customers in 1918 was 27,730. In August last this figure had risen to 44,850.

Design Features of Cahokia Station

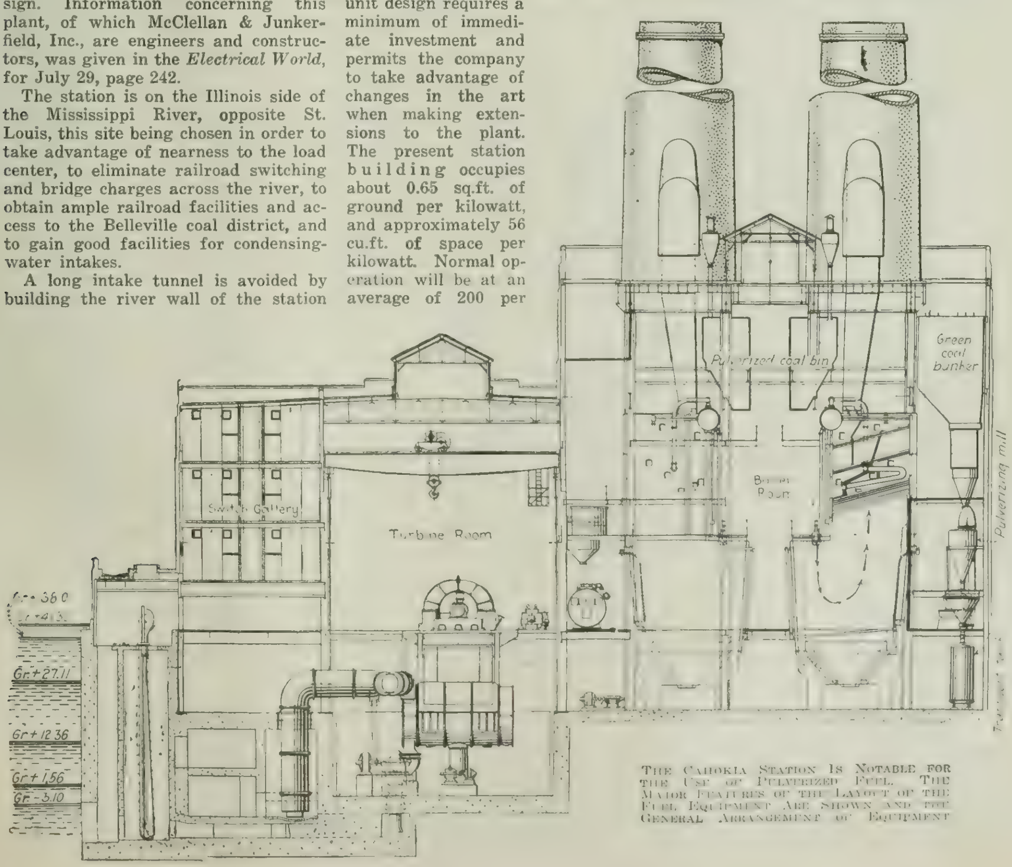
Intake Tunnels, Condensing Equipment, Coal-Handling and Pulverizing System, Phase Arrangement, Control Rooms and Other Points of New St. Louis Power House

CENTRAL-STATION engineers are watching with interest the developments in the design of the new Cahokia plant of the Union Electric Light & Power Company in St. Louis, because it will incorporate interesting features in the use of pulverized fuel and will represent late developments in station design. Information concerning this plant, of which McClellan & Junkerfield, Inc., are engineers and constructors, was given in the *Electrical World*, for July 29, page 242.

The station is on the Illinois side of the Mississippi River, opposite St. Louis, this site being chosen in order to take advantage of nearness to the load center, to eliminate railroad switching and bridge charges across the river, to obtain ample railroad facilities and access to the Belleville coal district, and to gain good facilities for condensing-water intakes.

A long intake tunnel is avoided by building the river wall of the station on the inner harbor line, the tunnels not projecting outside the building. The ultimate station is to contain four unit sections, each containing two turbo-generator units. At present there are being installed two 30,000-kw. turbines, supplied by eight boilers, each with 18,000 sq.ft. of heating space. The unit design requires a minimum of immediate investment and permits the company to take advantage of changes in the art when making extensions to the plant. The present station building occupies about 0.65 sq.ft. of ground per kilowatt, and approximately 56 cu.ft. of space per kilowatt. Normal operation will be at an average of 200 per cent rating and for short peaks at 300 per cent rating. The steam pressure will be 300 lb. with 250 deg. superheat at the throttle. A distinct feature is the inclusion of all the preparation plant for the pulverized fuel within the walls of the boiler room. The pulverizing rooms are isolated from the plant proper by concrete partition walls and floors and are so arranged that the windows on the outer walls will relieve the pressure in the remote contingency of an explosion.

The site is a few hundred feet south of the south limits of East St. Louis, between the government levee and the river, and consists of about 50 acres of low, flat river-bottom ground, which at time of high water last spring was entirely flooded. It was therefore necessary to provide additional levees on the site to connect with the existing levee and with the high railroad embankments, in order to construct the plant. The difference between extreme high and extreme low water is nearly 45 ft. The condensing equipment is placed in an elliptical pit whose floor is 42 ft. below the turbine platform. The entire station is supported on concrete piles. The river wall on the inner harbor line, which is also the west wall



THE CAHOKIA STATION IS NOTABLE FOR THE USE OF PULVERIZED FUEL. THE MAJOR FEATURES OF THE LAYOUT OF THE FUEL EQUIPMENT ARE SHOWN AND THE GENERAL ARRANGEMENT OF EQUIPMENT of station, consists of interlocked concrete sheet piles, about 75 ft. long and weighing 15 tons each. The turbine room, electrical bay and river bay are supported on pre-cast concrete piles and the boiler room on standard Raymond concrete piles. On the north and east this site is bounded by hundreds of acres of railroad yards.

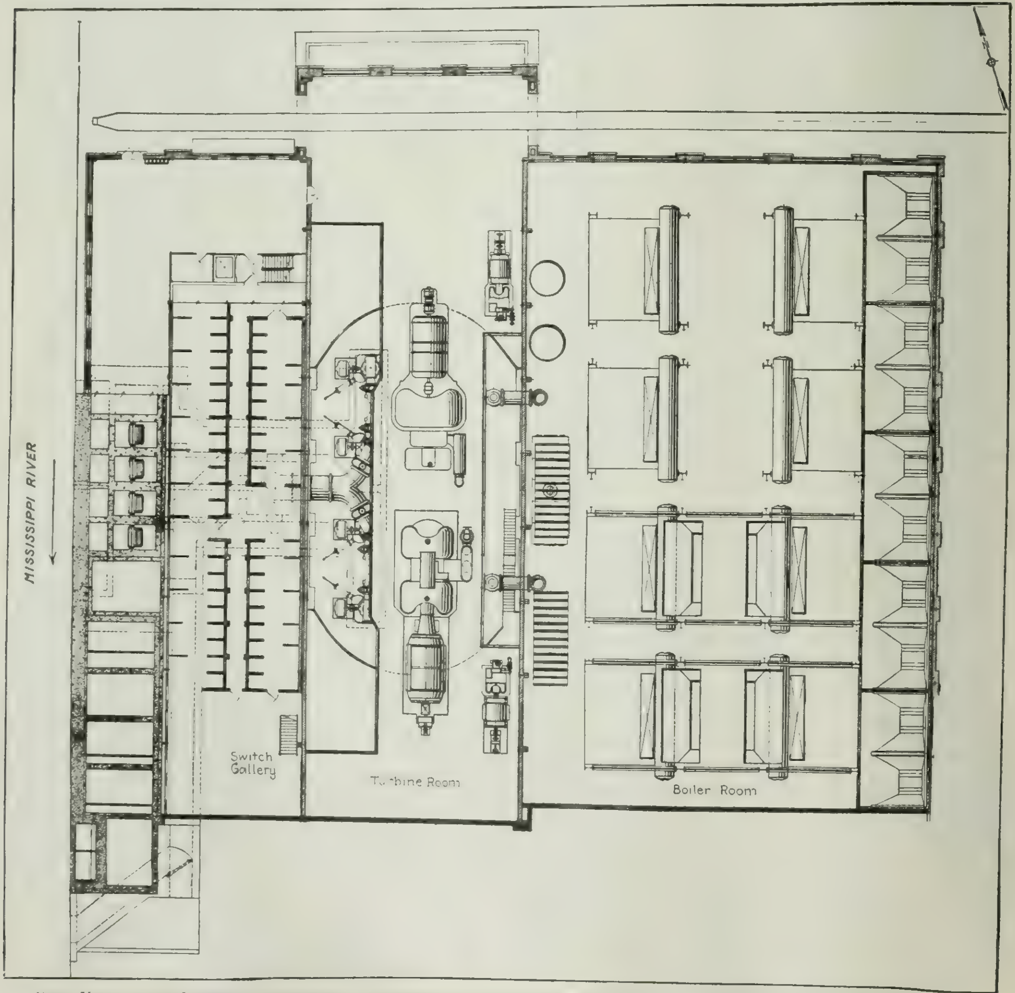
Coal-Handling System

The incoming coal in railroad cars passes over track scales to a car dumper of sufficient capacity for the ultimate plant. From the dumper the coal goes over belts to a Bradford breaker of sufficient capacity to supply one-half the ultimate station. From the breaker the coal passes on belts to two vertical conveyors of the same total capacity as the breaker, and thence on another belt conveyor of half this capacity to the raw-coal bunkers for the first section, or one-quarter of the ultimate plant. The raw coal from the overhead bunkers is delivered by gravity through a stationary dryer to the pulverizing mills. From the mills it passes to small pulverized-fuel hoppers and thence to a Quigley transport system, including a 4-ton blowing and weighing tank for each mill. From each tank the fuel goes by means of a 4-in. pipe to the bunkers, one of which is installed in front of and above each boiler. These coal bunkers have a total capacity of 75 tons each.

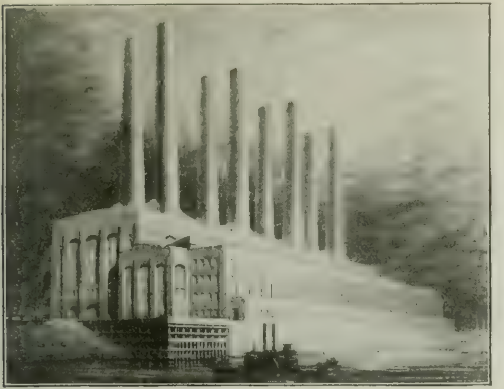
There are eight pulverized-coal mills for the eight boilers, which when operating sixteen hours per day will pulverize the coal needed for twenty-four hours of boiler operation. In addition, there are two spare mills installed as a reserve. Natural draft will be used in the plant and no economizers will be installed, although space is available should fuel prices warrant their installation at a later date.

Energy will be generated at 13,800 volts, three-phase, 60 cycles, and transmitted at this voltage and at 33,000 volts through step-up transformers. All the units and feeders are connected to a 13,800-volt bus, with sectionalized main ring, and in addition there is a reserve bus. Ultimately an outdoor substation may be used with 66,000-volt outgoing lines. Adjoining sections of the low-tension main bus are connected through reactors. A sectionalized scheme is used without reactors for the reserve bus. Each bus section consists of one main unit and a group of feeders.

A vertical isolated phase arrangement for buses and circuit breakers will be installed, employing a separate floor for each phase. The main and reserve buses of the same phase are on



Plan View of the Present Construction at Cahokia, Showing General Features and Relative Location of Apparatus



View of Ultimate Plant from River

A Concrete River-Retaining Wall

one floor in separate rooms with an operating aisle between. A truck-type circuit breaker is to be suspended from the side walls of the breaker compartment, containing the single-pole element for each phase. The large oil circuit breakers are operated by vertical rods from the floor below the lowest phase floor. Disconnecting switches will be remote, manually operated and mechanically interlocked with the oil circuit breakers.

Control Rooms

There will be a main generator and feeder control room on the level of the lowest phase floor of the switch house near the temporary end of the station. This level is about 12 ft. above the turbo-generator platform. Another room for the heat-balance control will be directly under the main switchboard control room on a level with the turbo-generator platform. From this room remote control of some of the auxiliaries is available, such as of the speed and throttle of house turbines and certain motor-driven pumps. The control will permit stopping of the auxiliaries but not starting them.

The boiler-room control will be under the direction of a boiler-watch engineer with the control for each four boilers near the individual boilers in this group. Control of the fuel feeders to the burners is obtained by direct-current motors, with a supply obtained through the use of duplicate motor-generator sets.

Nearly all auxiliaries are electrically operated and with few exceptions are constant-speed equipment.

The station is built for bulk power purposes and will have three direct tie lines to the present Ashley Street station and other 33,000-volt and 13,800-volt lines to existing and new substations. Outgoing lines are protected with overload relays and sheath transformers. The step-up transformers are installed on a platform outside the switchhouse. Feeders will leave the station partly in underground ducts and partly as submarine cables crossing the river.

The new station is expected to be in operation next fall to carry load in excess of that derived from Keokuk water power and the present Ashley Street steam station.

More Ontario Hydro Losses

Deficit of Over $200,000 Indicated on Central System, Which Was Acquired in 1916

A REPORT issued by the government board of inquiry which, under the direction of W. D. Gregory of Toronto, is looking into the operations of the Hydro-Electric Power Commission of Ontario shows that there have been continuous losses on the Central Ontario System, which was acquired by the province from the Electric Power Company in April, 1916, for $8,350,000 and for which ten-year 4 per cent bonds were issued. The system comprises two main sections, one supplying electrical energy to certain municipalities, private companies and others in central Ontario, the other generating and transmitting energy in the municipalities of North Bay, Callender, Powassan and Nipissing, much further north. In the first of these sections gas works, waterworks, a pulp mill and pulp lands and the Peterboro Radial Railway are included.

Many Losses Shown

According to the accountants employed by the board of inquiry, or royal commission, the estimated operating deficit on the system for the year ended October, 1922, was $38,200, and for the whole period of Hydro ownership the total net losses are given as $207,168. Municipalities where there has been a profit are demanding that they be allowed to take over the local plants instead of having the surplus receipts applied to cover up shortages in other places. If this were done, the province would have to stand losses represented by sums paid for intangibles when the system was acquired. These intangibles, representing good will, potential water power and similar things, amounted to $2,677,342, and the investigating accountants see no way by which the province could be reimbursed for this sum or any part of it were the plants turned over to the municipalities.

On the Peterboro Radial Railway there has been a total net loss of $119,708, on gas works in various towns a loss of $104,674, and on contracts for the supply of electric light and power to various municipalities and private companies a loss of about $169,000 in three years. The evidence shows that the losses on the system are not merely under contracts which the Hydro-Electric Commission took over, but on business done by the commission itself after it acquired the system. The facts as presented show a state of affairs not very much better than that on the Nipigon division made public some time ago.

Hoover Advocates Fewer Government Agencies

Reorganization of the government agencies dealing with commerce, mining, manufacturing, shipping, fisheries and transportation facilities into three groups, each under an assistant secretary, was recommended by Secretary of Commerce Hoover in his annual report to Congress.

Whether these groups, which would concern themselves respectively with industry, trade and navigation, should be brought into the Commerce Department, he declared, was secondary to the necessity for the grouping itself, in order to obtain concentration of purpose to eliminate overlapping. A direct saving of upward of $1,000,000 a year in administration would be possible under the plan, he estimated, while many times that amount would be given to the public in increased values and services.

Administration of these functions, Mr. Hoover explained, now is divided among seven different departments of widely different major purposes, with the result that there is "inevitable overlap, duplication and lack of purpose."

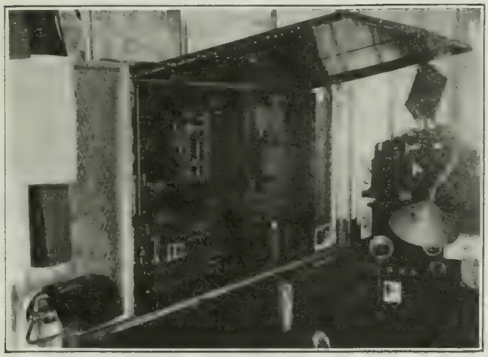
Progress in Carrier-Current Telephony

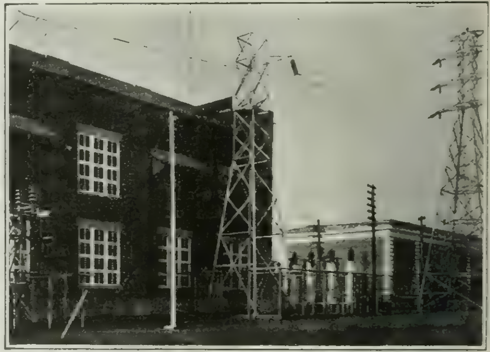
Successful Tests by Pennsylvania Water & Power Company Over 40-Mile Line Between Holtwood, Pa., and Baltimore—Utica and Hartford Use Method

OPERATING tests of a carrier-current system of telephone communication were held Wednesday and Thursday of this week in Baltimore by the Pennsylvania Water & Power Company, which has installed the system on its 40-mile, 70,000-volt, three-phase transmission line between the Holtwood (Pa.) hydro-electric generating station and a substation in Baltimore. Communication under varying conditions was effected in both directions. The Pennsylvania Water & Power Company is among the first three companies to adopt carrier current for commercial operations. The system was installed first by the Utica (N. Y.) Gas & Electric Company, and it has also been put in operation recently by the Hartford (Conn.) Electric Light Company. The tests at Baltimore were made under the direction of F. A. Allner, chief engineer of the operating company, in conjunction with engineers of the General Electric Company who installed the system. Mr. Allner is chairman of the radio committee of the National Electric Light Association.

A 220-volt storage battery is used to operate a motor-generator developing 1,000 volts direct current. This is then passed through a 50-watt pliotron oscillating tube which gives about 5,000 volts alternating current at 15,000 cycles. This current is then transferred to the transmission line through a capacity coupler. A second 50-watt tube used as a modulator is then employed to superimpose the voice on the higher-frequency current, and the voice frequency is thus carried along with the carrier current. Reception is effected by apparatus similar to that used in ordinary radio, employing a detector tube and two stages of audio-frequency amplification. It is possible also to ring a signal bell before beginning conversation.

Mr. Allner, in commenting on the tests to a representative of the *Electrical World*, said he believed the carrier-current telephone system should prove of immediate interest and usefulness to central stations confronted with communication problems, especially those operating remote generating stations in connection with overhead long-distance high-voltage transmission lines. The decision of the Pennsylvania company to install carrier current dated back to trouble encountered in 1921 as the result of a severe electrical storm, Mr. Allner said. "Our tests," he continued, "are intended to show how well the carrier-current system meets a variety of actual conditions as nearly as we can produce them."


Transmitting and Receiving Equipment for Interstation Carrier-Current Telephone System


Transmission Line to Which the Carrier-Current Equipment Was Capacitatively Coupled

Among the tests made was to effect communication with an arcing ground between the high-tension line and ground, while grounding all the high-tension lines at one or more points and while short-circuiting two phases of the line, thus throwing the phases out of balance and creating heavy ground currents.

In addition to the three companies mentioned, the General Electric Company is installing similar systems for ten other central stations on lines carrying up to 220,000 volts.

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Northern States Power Is to Build 100,000-Hp. Plant

The Northern States Power Company announced on Wednesday that the construction of a five-million-dollar steam-turbine power plant in St. Paul, to generate 100,000 hp., will start next week. This plant is to be the first step in an eighty-million-dollar program hailed as the greatest electrical development yet projected in the Middle Northwest. Plans include the St. Croix River development and others with a total potential output of 200,000 hp.

The St. Paul Gas Light Company last week filed an application with the Federal Power Commission for a license to build a 20,000-hp. electric power plant in St. Paul on a Mississippi River island, to cost $1,500,000.

◆

Engineering Graduates in Commercial Work

That engineering college graduates are handicapped without a supplementary commercial training is the conclusion based on research investigations just completed by Dr. W. F. Rittman and W. F. Reilly of the Carnegie Institute of Technology, Pittsburgh. In the *Carnegie Technical Journal*, a quarterly publication of the alumni and students of the institution, Messrs. Rittman and Reilly present what they hold to be substantial proof of the need of commercial training in technological college courses.

With the co-operation of the alumni office a study of the present occupations of Carnegie graduates was made. Of the engineering graduates from 1908 to 1921, the investigations showed that approximately 67 per cent are now engaged in commercial or managerial work. These graduates include those from highly technical fields, such as mechanical, electrical, civil, chemical, metallurgical, mining and sanitary engineering and science.

An interesting tabulation in the report shows the following percentages of engineering graduates in all departments who are now in commercial or managerial capacities: Mechanical engineering, 65; electrical engineering, 60; civil engineering, 73; chemical engineering, 59; commercial engineering, 91; metallurgical and mining engineering, 67; sanitary engineering, 60; science, 77. The authors say that "the great majority of graduates use their technical education as a means of getting into commercial or managerial work."

The Carnegie Institute of Technology was one of the first technical institutions to incorporate a separate commercial engineering course in its College of Engineering.

Ford After High Dam

Detroit Manufacturer Files a Direct Application for Power from Mississippi at St. Paul

IF THE Minnesota Legislature does not take action involving the use of the High Dam built by the federal government in the Mississippi River between St. Paul and Minneapolis, the Federal Power Commission is expected to act quickly in the matter. The conflict over who shall utilize the power which can be developed there has already cost the United States government nearly $700,000. The matter has been further complicated by the filing of an application by Henry Ford.

The trouble began when the St. Paul Association induced the city of St. Paul to file an application with the Federal Power Commission for the right to develop the power which could be produced at the dam. The St. Paul Association is endeavoring to establish a new industrial area and as a part of that campaign had obtained the promise of Henry Ford to build a factory to employ 5,000 men on the understanding that the association would obtain power rights which it would transfer to him.

This action caused the Northern States Power Company to file a conflicting application. Still another conflicting application was filed by the city of Minneapolis. The Federal Power Commission held a hearing, but a decision was delayed so as to give the Municipal Electric Corporation, composed of the cities of St. Paul and Minneapolis and the University of Minnesota, an opportunity to obtain the necessary state legislation to construct and operate the power plant.

TWIN CITIES AT ODDS

It is thought by those who have observed the situation closely that there is no chance for the two cities to get together on any proposition. In the meantime it has become apparent that the Power Commission will hardly grant a license for such an indirect arrangement as is involved in the St. Paul-Henry Ford scheme.

One of Mr. Ford's policies is not to make a contract with a public utility corporation, because he contends that a commission at any time can break his contract. Otherwise the logical way to handle the matter would be to grant a license to the Northern States Power Company, whose large generating and distribution system would make possible the utilization of all of the secondary power. So far as the federal government is concerned, an equally satisfactory solution would be to grant a license to Mr. Ford, with the requirement that he install equipment so as to make full use of the secondary power and that he sell his surplus to public utility corporations. This arrangement would be satisfactory to all concerned, it is believed, except the city of Minneapolis, which feels that it has a half interest in the power rights and that by such an arrangement St. Paul would be getting more than its share. The Minneapolis interests claim that a real-estate scheme really is the foundation of the plan put forward by the St. Paul association. This the St. Paul interests deny.

Prospects Favorable for Ozark Utilities

Power developments in the Ozark territory will receive another impetus when the 60,000-hp. dam is completed on the White River at Table Rock. A permit for this development has been issued by the Federal Power Commission to the Empire District Electric Company, Joplin, Mo., an H. L. Doherty property. This 175-ft. dam, which will cost $15,000,000, will create a reservoir about 63 miles long with a shore length of about 500 miles. It will back up the White River to Beaver, Ark., and the James River to a point near Galena, forming two lakes approximately 80 miles in length. The company is also laying plans to erect two other dams, one near Moore's Ferry and the other at Horseshoe Bend, below Forsyth, on the White River.

Tennessee Has Its First Utility Conference

The establishment of good public relations, the significance and importance of regulation by utility commissions and the value to the utility industry of the Tennessee Public Service Information Bureau were the principal themes of the first public utility conference held in Tennessee, when more than a hundred operators met at the State University in Knoxville on Dec. 14.

The session was called by Percy Warner, chairman of the Tennessee Public Service Association. One of the principal addresses of the day was that by Julian H. Campbell, chairman of the Tennessee Railroad and Public Utilities Commission. In speaking on the public's interest in the commission he told the utility men that the orders of the regulative body must inspire the confidence of the public and still provide an incentive to the utility.

Another address of importance was made by Lovick P. Miles of Memphis, general counsel for the Memphis Power & Light Company, who related the history of regulating utilities, saying that the plan for a state tribunal with complete jurisdiction is now generally regarded as the best means to compel the utilities and the public to discharge their obligations.

Speaking on "How the Public Utility in the Small Town Can Aid in Building Up the Community," W. S. Harkness of Jellico urged such operators to enlist the support and activity of the mischievous boys of the town.

Other speakers were President H. A. Morgan of the University of Tennessee and Ross Murphy, director of the Tennessee Public Service Information Bureau. Judge H. B. Lindsay presided at the luncheon where part of the program was given.

The Utility and the Public

President Smith Dwells Upon Their Relations and Champions Customer Ownership

FRANK W. SMITH, president of the National Electric Light Association and vice-president of the United Electric Light & Power Company, New York, addressed the Rotary Club at Newburgh, N. Y., recently on "What Does the Public Utility Mean to the Public?"

Quoting Martin J. Insull's definition of a public utility as "a business affected with a public interest," Mr. Smith said: "This public interest is, of course, by no means one-sided, for as the success of the public depends on the success of the utilities, it is also true that these utilities, which are in every sense of the word public servants, depend to a opinion.

"There is now invested in the business in the United States more than five billion dollars. The business has a gross income of more than nine hundred million dollars. It employs directly a force of nearly two hundred thousand men and women, and indirectly it is estimated that it employs more than two hundred and fifty thousand other workers. The industry has harnessed falling waters and made their energy available to the extent of about eight million horsepower, and the capacity of the stations operated by steam, both large and small, is in excess of fourteen million horsepower. It has been estimated that by 1930 the present generating capacity of the electric light and power companies will be doubled, or, in other words, in seven years' time the electric industry will be called upon to create as much as it has created so far during its entire existence of about forty years.

THE PUBLIC THE REAL OWNER

"Now, who are the real owners of this 'big business'? As a matter of fact, the people themselves. First, somewhere in the neighborhood of two million thrifty security holders have invested their savings with the light and power companies and the number is growing rapidly. The public has come to realize that this class of investment is safe and affords a fair rate of return, and the companies have come to realize on their side that their best interest lies in taking their customers and the public generally into partnership with the utilities as holders of their securities.

"Then we come to another class of owners—every person who carries a life insurance policy, because it must be remembered that the insurance companies themselves are heavy investors in securities of electric light and power companies. Three hundred millions of dollars are thus invested. Likewise every depositor in the national banks of the country is interested, directly or indirectly, in the success of the electric light and power business. And there are upward of twenty-seven millions of these depositors in the country."

Consolidations Under Way in Wisconsin

The Middle West Utilities Company, owner of the Eastern Wisconsin Electric Company properties in Oshkosh, Sheboygan and Fond du Lac, has acquired the entire holdings of the syndicate which late in 1921 obtained a controlling interest in the Ironwood & Bessemer Railway & Light Company, the Ashland Light, Power & Street Railway Company and the Big Falls Water Power Company. After the acquisition of control in the three companies the name of the Big Falls Water Power Company was changed to the Lake Superior District Power Company, and under that name they were merged a few months ago. By the transaction just consummated the Middle West Utilities Company, which was a participant in the syndicate, obtains for itself all of the common stock of the Lake Superior District Power Company, together with certain preferred holdings and other assets.

Acquisition by the Wisconsin Edison Company of Milwaukee of an interest in the Badger Public Service Company, which operates electric light and power lines in Sheboygan County and the eastern part of Fond du Lac County, has been announced by W. N. Albertson, president and general manager of the Badger Public Service Company. The Wisconsin Edison Company is a subsidiary of the North American Company of New York City, which controls the Milwaukee Electric Railway & Light Company and the Wisconsin Gas & Electric Company of Kenosha and Racine.

In addition to communities in Washington and Ozaukee Counties, the Badger Public Service Company serves districts around Elkhart Lake, Crystal Lake, Greenbush and Glenbeulah, in Sheboygan County, and St. Cloud, Calvary, Mount Calvary, Malone and Johnsburg, in Fond du Lac County.

The Badger Public Service Company is, as already stated in the *Electrical World*, involved with the Eastern Wisconsin Electric Company in a controversy over the right to extend lines into the town of Calumet. The State Railroad Commission recently gave this right to the Eastern Wisconsin Electric Company, but the Badger Public Service Company has appealed the decision to the circuit court in Madison.

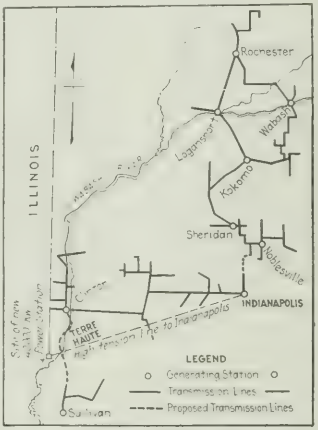
American Engineering Council to Meet Jan. 11

Meeting in Washington, D. C., on Jan. 11 and 12 for its annual conference, the American Engineering Council of the Federated American Engineering Societies will consider problems of national interest, including the report of the committee on work periods in continuous industries, which has declared in favor of the eight-hour day. Dean Mortimer E. Cooley of the University of Michigan, president of the federation, will preside.

On the evening of Friday, Jan. 12, a dinner, at which engineers from all parts of the country will be present, will be given in honor of Prince Gelasio Gaetani, the new Ambassador from Italy, who has recently arrived in this country. Prince Gaetani is himself a technical man and was formerly a resident of the United States, having graduated from the School of Mines of Columbia University in 1903 and practiced successfully in the art of ore dressing in the western part of the country.

Financing the Indiana Consolidations

The offer by Stone & Webster, Inc., and New York and Boston banking houses of $3,800,000 Central Indiana Power Company 7 per cent preferred stock is a step in the financing of that consolidation of electric power and lighting utilities, which will serve about seventy cities and towns in Central Indiana, with Indianapolis as a center. These places are all to be interconnected and will depend in part on the new power station with an initial rating of 40,000 kw. to be built on the Wabash River in the center of 3,400 acres of coal lands which the company has acquired. The system will serve half a million people, and the total cost of the new station and the interconnections is put at $12,000,000. The power house will be built by Stone & Webster under the supervision of Kelsey, Brewer & Company of Grand Rapids, Mich., managers of the new system.



Territory Served by Central Indiana Power Company System

Authorization from the Indiana Public Service Commission has been granted to the Northern Indiana Power Company to purchase and consolidate the Indiana Railways & Light Company of Kokomo, the United Public Service Company of Rochester, the Noblesville Heat, Light & Power Company, the Sheridan Water, Light & Heat Company, the Wabash Water & Light Company, the Logansport Utilities Company and the Roann Light & Power Company. This consolidation was noted in the *Electrical World* for Dec. 2, page 1235. Its headquarters will be at Kokomo, and Joseph H. Brewer has been elected as its president. Stone & Webster, it is reported, have taken $5,000,000 of the Northern Indiana Power Company's securities.

Craft Favors Separation of Two Kinds of Research

"Leave the fundamental and scientific research work to the universities, but not the industrial research," said E. B. Craft, chief engineer of the Western Electric Company, in an address made at Montreal on Saturday, Dec. 16, to the Engineering Institute of Canada, at a largely attended meeting. "The universities are concerned with pure scientific research, and they should confine themselves to that, leaving industry, through its own specialized research, to solve its own industrial problems.

"Purely scientific research demands a different type of mind from that demanded by industrial research," Mr. Craft went on to say, "and it requires both experience and practical observation to find the latter type, although men more adapted for fundamental scientific research are turning to the industrial field because it offers more immediate results, both financially and in practical achievement. But the two must be kept separate if we are to get the best results and keep both pure science and scientific industrial research on this continent to the forefront."

Hydraulic Race Company Gets Revocable License

Action on the part of the Federal Power Commission authorizing a revocable license to the Hydraulic Race Company, involving a diversion of 500 cu.ft. per second of water through the State Barge Canal at Lockport, N. Y., has occasioned surprise. It was expected that some understanding would be reached with New York State officials before any action was taken. It is true that the Federal Power Commission had made ineffectual efforts to reach an agreement with the officials of New York State. A part of the delay at least can be charged to the test which the State of New York is making of the federal water-power act and to the coming change of administration in the state. It is believed, however, that the action of the Federal Power Commission will precipitate early action on the part of the New York State authorities.

An oral protest was made at a hearing at the offices of the commission on Dec. 19 by representatives of the Western New York Utilities Company. It was made plain that the New York officials are planning a power project at Lockport which would conflict very seriously with the project of the Hydraulic Race Company.

Brief News Notes

Eastern Connecticut Power Company Expands. — The Eastern Connecticut Power Company, Montville, Conn., has purchased the People's Light & Power Company and the affiliated Danielson & Plainfield Gas & Electric Company, furnishing electric light and power in the towns of Killingly, Danielson, Brooklyn, Plainfield, Canterbury, Griswold, Jewett City and other smaller towns and villages of eastern Connecticut.

Ohio Power Company Buys Lima Plant.—The Ohio Power Company of Newark, Ohio, has been authorized to purchase the electric lighting and steam-heating system formerly operated by the Ohio Electric Railway Company in the city of Lima. The sale price was $1,700,000. The property was recently sold by the receiver. The Ohio Power Company is to assume $1,250,000 underlying bonds and $200,000 in prior liens, besides paying $250,000 cash for the property.

Hartford Company Votes Stock Increase.—The Hartford (Conn.) Electric Light Company at a meeting held on Dec. 19 voted to increase the capital stock of the company from $10,000,000 to $12,000,000, and the directors were authorized to offer the new stock at the ratio of one share of new to five shares of old stock, at par. It was announced at the meeting that the 1922 energy sales of the company had been estimated at 130,000,000 kw.-hr., while the business of last year totaled 97,000,000 kw.-hr.

Fight Over Municipal Plant at Hagerstown, Md.—Mayor Charles E. Bowman and the City Council of Hagerstown, Md., desire to pass an ordinance authorizing a bond issue of $300,000 to build a new municipal electric light plant. The project is opposed by a number of citizens who claim that they can purchase energy from the Potomac Public Service Corporation cheaper than the city can supply it. The plan will probably be submitted to a vote of the people.

Irrigation Board Favors Retailing, Not Wholesaling Energy.—The directors of the Modesto-Turlock irrigation district in California are opposed to wholesaling electric power to any city or community that may be served when the district installs its transmission lines from the Don Pedro Dam hydroelectric plant, where 15,000 kw. will be developed in connection with an irrigation project. It is the purpose of the directors to retail the power generated at the plant and distributed by the transmission lines now under construction. The city of Turlock, Cal., has already been refused power at wholesale rates. A recent application of the district asks for a franchise from the Board of Supervisors of Merced County for the erection of a transmission line and distributing system in the county to enable the district to sell electricity outside of the corporate limits of towns in Merced County.

Illinois Utility to Buy Abbott Light Company.—The Central Illinois Public Service Company has applied to the State Commerce Commission for permission to buy the property of the Abbott Light & Power Company at Petersburg. The agreement provides for an issue of $200,000 in preferred stock and $200,000 in first and refunding mortgage gold bonds. The Abbott company has a station capacity of 800 kva. and serves Petersburg, Ashland, Mason City, Pleasant Plains, Tallula, Middleton and Greenview.

Wisconsin Hydro-Electric Company Gets Chetek Plant.—Keen rivalry which has existed between the Wisconsin-Minnesota Light & Power Company of Eau Claire and the Wisconsin Hydro-Electric Company of Apple River for the control of the Chetek Light & Power Company of Chetek has been brought to an end by the announcement of the Chetek Light & Power Company that it has sold its plant and lines to the Wisconsin Hydro-Electric Company. Possession of the plant will be given as soon as the new line connecting Chetek with the power line running about one and a half miles east of Dallas is completed. The new owners have two plants on the Apple River and one at Colfax.

Hydro-Electric Development on the Rio Grande.—A permit has been granted by the State Engineer of New Mexico to Daniel L. Evans and associates to develop a 15,000-hp. hydroelectric project at the mouth of White Rock Canyon, on the Rio Grande west of Santa Fé, N. M. The project will cost about $1,500,000 and must be completed within a reasonable length of time. According to information furnished by the State Engineer, the plant will be capable of supplying electrical energy for commercial use to Santa Fé, Las Vegas and Albuquerque, and there is a possibility of obtaining enough power to electrify the main line of the Santa Fé between Albuquerque and Las Vegas or at least over the Glorieta grade.

Improved Equipment for New York City Ferryboats.—The most modern developments in electric drive will be utilized on the municipal ferryboats now under construction for New York City, according to a statement from the General Electric Company. Each of these three boats will be propelled by an eight-stage condensing Curtis marine-type turbine, and will be equipped with one General Electric turbine-driven alternating-current generator. This generator will in turn drive two marine-type two-speed induction motors having double squirrel-cage rotors. The high-speed winding will deliver 2,100 shaft horsepower at 176 r.p.m., and the low-speed winding will deliver 100 shaft horsepower at approximately 122 r.p.m. The ship may be maneuvered either ahead or astern.

Associations and Societies

Western Society Forms Illuminating Section.—On Dec. 15 the Western Society of Engineers formed an illuminating engineering section with A. L. Arenberg as chairman and J. J. Kirk as vice-president.

Chicago Electric Club's New Officers.—On Dec. 12 the Electric Club of Chicago elected the following officers for the new year: President, Paul W. Donoko; first vice-president, Earl W. Donoko; second vice-president, Henry Nixon; secretary, J. C. Hall; treasurer, V. R. Lanestrom.

Southwestern Division, N. E. L. A.—Officers and committeemen of this division are busy making arrangements for the four-day meeting of the committees of the section at New Orleans in conjunction with the executive committee of the national body on Jan. 16 to 19. Preparations will then be made for the annual convention of the division, to be held in Oklahoma City on March 14 to 16 next, following the meeting of the Oklahoma Utilities Association. Six hundred delegates are expected in March.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

Federated American Engineering Societies—Washington, Jan. 11-12.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland

Western Association of Electrical Inspectors—Chicago, Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Iowa Engineering Society—Des Moines Jan. 23-26.

Wisconsin State Association of Electragists—Milwaukee, Jan. 24-26. H M. Northrup, 23 Erie St, Milwaukee.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Atlantic Division, New York, Feb. 14; executive committee, Atlantic City, Jan. 15-16. Franklin Overbagh, 411 S. Clinton St., Chicago

American Institute of Electrical Engineers—New York, Feb 14-16 F. L. Hutchinson, 33 West 39th St., New York.

American Institute of Mining and Metallurgical Engineers New York, Feb. 19-21.

American Physical Society—New York, Feb 24. D. C. Miller, Case School of Applied Science, Cleveland.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg, Oklahoma City

Southwestern Division, N. E. L. A.—Oklahoma City March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 16-17 R V Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23 John N. Cadby, 445 Washington Bldg., Madison.

American Electrochemical Society—New York, May 3-5.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Recent Court Decisions

Powers of Illinois Commission.—In Terminal Railroad Association of St. Louis vs. Public Utilities Commission it has been held by the Supreme Court of Illinois that an intervening petitioner in a hearing on the application of a railroad for increased freight rates was not deprived of the right to have his complaint of excessive charges heard by the commission because the complainant in the case withdrew its petition, nor does the fact that a rate charged is that recognized by the public utilities act prevent the commission from determining complaints of unreasonableness and discrimination. (136 N. E. 797.)[*]

Control Over Rates for Natural Gas Transported from Outside State Denied to Commissions.—In two recent cases (Central Trust Company of New York vs. Consumers' Light, Heat & Power Company and State of Missouri vs. Kansas Natural Gas Company) United States district courts, sitting in Kansas and Missouri respectively, have denied that the state utility commissions have any jurisdiction over the rates charged for gas brought into the state by pipe line from another commonwealth. The only body that can regulate rates charged by such companies exercising no franchise rights in the state where control is sought is the Interstate Commerce Commission. (282 Fed. 680 and 341.)

Injury to Employee in Forbidden Place Held Not Compensable.—Where a painter working at an electric power plant was killed by contact with electric current as he commenced his day's work, without reporting to his foreman as required by instructions, and mounted a ladder which he set in a dangerous place, where he had been forbidden to work, the accident was not one arising out of and in the course of employment within the workmen's compensation act, and the employer was not liable. This was the decision of the Supreme Court of Michigan in an action for damages brought by the widow of Louis Gacesa against the Consumers' Power Company. (190 N. W. 279.)

What Is a Reasonable Extension of Service?—According to a decision of the Supreme Court of Oklahoma, in Oklahoma Gas & Electric Company vs. State, an order of the Corporation Commission requiring a gas company to extend its mains and service pipes to meet the reasonable needs of a community within the corporate limits of the city in which the company is operating under a franchise cannot be deemed arbitrary, unreasonable or unconstitutional where it appears that the company had a full hearing before the commission, that it is the only one authorized to serve the community in question with gas, and that the rate of return upon the cost of the extension, though amounting initially to only about 4 per cent, will probably soon become ample because of the growth of said community, and where the record does not show that the extension will render the business of the company as a whole unprofitable or cause an additional burden upon the gas consumers as a whole by making necessary an increase in the rates. (209 Pac. 777.)

Company Liable for Death of Policeman Who Shook Cable to Restore Light.—In Anderson vs. San Angelo Water, Light & Power Company damages were sought for the death of a policeman who sought to restore an arc light which had gone out by shaking the cable to which the lamp was attached for raising or lowering. It was shown that this practice was usual with members of the police force and that it was carried on with the knowledge and tacit approval of the company. The man who was killed, however, grasped the cable above instead of below an insulating knob and, the insulator next the lamp being defective, received a shock which proved fatal. The company alleged contributory negligence, but the Court of Civil Appeals of Texas overruled the plea and sustained the verdict of the trial court. (244 S. W. 571.)

Commission Rulings

Burden of Cost of Extensions on Company.—An electric utility, the New Jersey Board of Public Utility Commissioners has declared in a complaint brought by one Chapman against the Electric Company of New Jersey, must supply service to a person past whose premises a line has been extended, without requiring a contribution to the cost of building the line and without regard to whether this person reimburses another with whom it is alleged he had contracted to contribute to the cost of obtaining the extension. This is true, the commission held, notwithstanding the fact that in the absence of this extension, procured as a result of the contract, it might not have been the company's duty to extend such service.

Theoretical Going Value.—No allowance for hypothetical, non-existent going value should be considered, declared the Michigan Public Utilities Commission *in re* Michigan State Telephone Company. "When a plant is valued as a going concern and the cost of organizing the company, getting the money together to build it, engineering it, laying it out and constructing it, getting the business and putting it in operation are included, the prevailing practice of including therein a theoretical, non-existent element of going value is indefensible. . . . The capitalization of operating losses under the guise of going value is absurd. It may make a non-paying concern more valuable than a paying one."

California Commission Explains Its Functions.—In view of two recent decisions of the California Supreme Court, one sustaining and the other reversing the California Railroad Commission in setting aside preferential contracts, the court holding in the latter case that the company concerned was not a public utility and hence that the commission did not have power over its contracts, the commission has issued an explanatory statement of its powers and functions, from which the following extracts are taken: "The commission has power over contracts, irrespective of the time they were made, entered into between public utility corporations and consumers, in which certain consumers—usually large and sometimes interlocked interests—seek to secure favored treatment and preferential rates at the expense of the great body of users. . . . The state in creating the commission charged it with the duty of correcting these abuses. The courts in a consistent line of decisions long antedating the creation of commissions have declared null and void inequitable contracts made by public utilities to the advantage of those favored and to the disadvantage of the great body of consumers. The Supreme Court of this state in repeated decisions has upheld the commission in the establishment of fair and just rates when to do so contracts specifying other rates for certain individuals and groups had to be disregarded. If this power were not inherent in the state, public regulation never could have started, for the utilities could have forestalled its regulatory powers by making in perpetuity contracts with favored consumer interests. . . . If an individual or a company has not dedicated its service to public use, but supplies only a limited number of private consumers and does not hold itself out to serve the public, the courts and this commission recognize such contracts as private and do not exercise or seek to exercise any control over them. On the other hand, when any individual or company dedicates itself to a public service, holding itself out to serve all persons in a given area, it thereby becomes a public utility, its service attains a public utility status, and the superior regulatory powers of the state prevail over any private contracts which it has attempted to make. . . . It may be said, in conclusion, that the duty of the court ends when it applies the law to the facts of a given case. The duty of the commission only fairly begins at this point, for the people of this state have imposed upon the commission the duty not only of requiring a public utility to furnish adequate and satisfactory service, but also of fixing rates that will permit the utility to function and at the same time will be fair to the users and not out of harmony with the value of the service as determined by local conditions as well as by broader economic considerations."

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[*] The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Robert Sibley Takes Up University Alumni Work

Robert Sibley, for several years editor and more recently editorial director of the *Journal of Electricity and Western Industry* and Pacific Coast editorial director of the *Electrical World* and *Electrical Merchandising*, has resigned these positions with the McGraw-Hill Company to become associated in an executive capacity with the alumni work of the University of California. Mr. Sibley's connection with the McGraw-Hill Company's electrical journals will not, however, be completely severed, as he will retain his connection with the *Journal of Electricity and Western Industry* as a consulting editor and will also act as Pacific Coast consultant to both the *Electrical World* and *Electrical Merchandising*.

Mr. Sibley's connection with and contributions to the electrical industry in the country west of the Rockies are too well known to those in the industry in that aggressive electrical community to require extended discussion. Taking up editorial work on the *Journal of Electricity and Western Industry* while he was still professor of electrical engineering in the University of California, he developed the *Journal* into a publication which has rendered noteworthy service in its field. In rejoining the University of California he leaves behind him an organization of men in the McGraw-Hill Company of California who will carry forward the standards and purposes which he and his associates have established during the last two years in the service of the three papers with which he has been connected.

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Harold R. Miller has been transferred from the Keokuk Electric Company to the assistant engineering manager's office in the Boston office of the Stone & Webster organization.

E. B. Powell of Stone & Webster, Inc., who sailed on the Majestic on Oct. 28, with Major Frederick Pope, to make a general investigation of power plants in Europe, was taken seriously ill soon after his arrival in France and has been at the American Hospital in Neuilly. Recent cablegrams from the physician in charge of Mr. Powell indicate a slow but continued improvement in his condition.

F. H. Cothran, division engineer of the Southern Power Company, will take active charge of the engineering work on the 200,000-hp. hydro-electric development project which is to be financed by J. B. Duke of Charlotte and New York and Sir William Price, Canadian capitalist, in the Province of Quebec, Canada. Mr. Cothran has been in charge of the Southern Power Company's developments in North Carolina. W. S. Lee, chief engineer of the Southern Power Company, will also give much time to the Canadian project, dividing his time between Quebec and North Carolina.

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Carl D. Jackson Leaves Wisconsin Commission

Carl D. Jackson, who has been a member of the Wisconsin Railroad Commission since 1915 and chairman since 1916, has resigned that post, to take effect Dec. 31. Mr. Jackson has announced that he will practice law in New York City, and among his future clients he has already numbered the National Electric Light Association and the American Gas Association, which have come to recognize Mr. Jackson's fund of knowledge and ability in public utility affairs.

One of the outstanding features of Mr. Jackson's service as a commissioner was his activity in the National Association of Railway and Utilities Commissioners, where he was successively second vice-president, first vice-president and president, his presidential term having expired last month. He has always been active in constructive committee work in that organization, and the leadership of the Wisconsin commission in railroad and public utility regulation is due in no small part to his work.

Mr. Jackson was born in Evanston, Ill., in 1870 and graduated from Harvard in 1894. He practiced law continuously in Wisconsin from 1894 until his appointment to the commission in 1915.

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Edgar Rypinski has been appointed manager of the Canadian plant of C. Brandes, Inc., which is known as Brandes, Ltd.

Obituary

F. J. Baker's Death Removes Another Utility Leader

Frank J. Baker, vice-president of the Public Service Company of Northern Illinois, Chicago, died suddenly of heart failure on Dec. 18 at his home in Wilmette, Ill. Mr. Baker was born in Cleveland in 1864 and was educated at the University of Michigan, where he took the degree of bachelor of science in 1887. Later he studied at the Northwestern University Law School in Chicago, obtaining the degree of bachelor of laws in 1897. In 1902, in association with Samuel Insull, Mr. Baker was active in the formation of the North Shore Electric Company, of which he served as vice-president from 1902 to 1911. In that year the Public Service Company of Northern Illinois was incorporated, being a consolidation of the North Shore Electric Company and a number of other public utility companies operating in the northeastern part of the state. From the organization of the company until the time of his death Mr. Baker was vice-president in charge of the operation, construction, purchasing, stores, claim and right-of-way departments. He was a member of the National Electric Light Association, American Institute of Electrical Engineers and Western Society of Engineers.

F. J. BAKER

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Warren A. Myers, prominent manufacturer, banker and former newspaper publisher, died on Christmas morning of heart disease after an illness of two years. Mr. Myers was secretary-treasurer of the Robbins & Myers Company Springfield, Ohio, manufacturer of electrical equipment, and was always active in civic movements. He was publisher of the Springfield *Sun* for a number of years. Mr. Myers was thirty-seven years of age.

Fred A. Marsh, general purchasing agent of the Link-Belt Company, died at his home in Chicago on Dec. 11 at the age of fifty-two. Mr. Marsh had been a member of the Link-Belt organization for over thirty-three years. He was one of the organizers of the Purchasing Agents' Association of Chicago and served as the first president, and had been a director in the National Association of Purchasing Agents.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

The Way to Increase Jobbers' Profits

How the Electrical Man Can Group His Specialties and Staples and Widen His Profit Margin—Getting Hints from the Grocer—Some Good Examples

By Claude L. Matthews
Vice-President and Secretary W. N. Matthews & Brother, Inc., St. Louis

A GREAT many men who sell electrical materials nowadays are complaining of lack of profit. They say that there is not enough money in electrical goods at ruling prices and with the large amount of competition which both the manufacturer and the distributor encounter at the present time. They say that something ought to be done about it. I agree with them. They are right. But in my opinion the thing that must be done is something that they have got to do themselves, and it is a very simple thing at that. In a word, the electrical industry has reached a point where its staple products are easy to sell and small in profit, and its specialties, which require hard work to sell, are about the only lines that offer large profits. Therefore, in order to net a satisfactory degree of profit on his sales, a distributor must contrive to sell enough specialties with his staples so that the average of his profits will hold a level somewhere between staples and specialties.

Specialties are usually really improved staples, providing a new way to do a piece of work or perform a service. The price set on these specialties must reward the manufacturer for his work of development, must give some extra compensation to the distributor for additional work in creating a market and must provide a saving to the user. When making, handling and buying reliable specialties, each branch of the industry gets its reward in proportion with the greater service value involved.

Group Them Like the Grocer

All this is natural and right and common to other established industries. Stand a while in a grocery store and see what happens. People come in to buy sugar, flour, bread, canned tomatoes, prunes and coffee. These are self-selling staples and the profit margin is very low. Therefore the grocer wastes no display space upon them, but on his shelves and counters and in his windows and showcases he features marmalade, fancy crackers, special cheeses, nuts, canned fish and fancy candles, and these are what he sells. He takes orders for the staples; he talks about the specialties and points them out and recommends them. That is where he concentrates his selling, and that is where he makes his profits in the grocery business. And the same is true in other lines, in other trades.

C. L. MATTHEWS

Now, there is no reason why the electrical jobber and the electrical retailer should expect anything else. We are so young in this industry, and all our goods have been specialties so recently, that we are not yet entirely reconciled to handling a larger line in which the volume of the business is in staples that give little profit and the bulk of the opportunity for profit lies in the creative selling of specialties that must be sold by main strength, ingenuity and applied imagination. But, nevertheless, we are facing this very situation, and distributors of electrical materials must recognize it and begin to plan their selling so that they may group their staples and their specialties and sell them together. They must make their low-profit self-selling lines carry the higher-profit specialties by associating with the staples other lines that the customer uses with them and putting the selling pressure on these selected specialties whenever an order for the staple is in process. But the average distributor is not doing this extensively today.

Some Good Examples

I know one case of a small jobber who set up in business in a city with small capital. He knew that he could not afford to spend much time on low-profit staples. He decided to leave the staple lines temporarily to the bigger established jobbers there and devote himself to specialties. He knew that the salesmen of these other houses were not bothering much to push the specialties because they could pick up orders on staple lines more easily. So he just followed them around and sold the high-profit specialties that can be used with wire and conduit and the rest of the big-volume lines that they were selling. He got rich on it and now can sell the staples too.

I sat beside a jobber's desk the other day when the telephone rang and he took an order from a light and power company for some cable—a good-sized shipment. I asked him how much he made on it. He answered, "Two per cent." I said, "Why didn't you suggest that as they use that cable they will need various fittings? You could have sold them clamps for dead-ending and for turning corners, for one thing, and made more profit than you will on the cable itself, and yet you never said a word about it." He had simply taken an order and he hadn't tried to sell a thing. And yet I know another jobber who the other day sold two carloads of cable and 300 cable clamps, and he made more on the clamps than on the wire.

Just as it is possible to sell cable and clamps together and raise the rate of profit on the sale, it is as easy and as profitable to group other staples and specialties that are associated as the customer uses them. When a man sells such staples as poles, cross-arms, glass insulators and the simple pole-line hardware devices, he can also sell specialties such as fuse switches, slack pullers, guy anchors and guy clamps and in many cases save the consumer big money in labor, which the distributor makes no profit on. When he sells "Mazda" lamps he can group with them portable guards, lamp guards, lamp changers, fixtures and glassware for commercial, industrial, showcase and window illumination and floodlighting. When he sells large appliances, like washing machines, vacuum cleaners, ironers, sewing machines, ranges or dishwashers, he can group with them smaller table appliances, flatirons, small radiators, curling irons and so on. When he sells sockets, conduit and wire, he can tie in with them complete lighting fixtures and lamp and glassware units or motors and automatic control switches, according to whether the stuff will be used on light or on power installations. In each case you combine the sale of a low-profit staple with the sale of some better-paying specialty that can be used with it by your customer.

This has been brought forcibly to mind in many cases where the orders apparently have been placed by the buyer for staples by direct shipment. If the salesman on the job had given his customer and his house the proper thought and service, there is no question that he would have received a further order for specialties which would have bolstered up the gross volume of profit on the entire purchase.

What the Manufacturer Can Do

This is more than a bright idea, or just a scheme for selling. It involves a principle of distributing and marketing goods that is well established in other fields but has not been recognized and applied extensively by the electrical jobber. It is, therefore, also something more than good advice to the distributor. It is a matter which manufacturers of electrical goods should take no less an interest in and advocate and promote in every way possible. A very large electrical distributor is consistently and systematically trying to sell pole-line materials grouped this way. It would pay us all if other jobbers and manufacturers too would get behind the same idea and both in their advertising and their selling show the jobber how to group his lines with others and why he should.

It would pay the manufacturer of staples because the jobber would find a way to get more money out of staples by using them to help sell specialties. The jobber would then quit complaining about these low-profit lines, and the manufacturer would certainly welcome the cessation of complaints. It would help the manufacturer of specialties because more of his goods would be marketed. It would certainly help the disributor because he would begin to realize a greater margin of profit on his volume of sales. And undoubtedly it would raise the standard of construction and increase the sale of energy-consuming devices and accessories.

As long as the jobber is content merely to catalog goods and then wait for orders, just so long will his orders be mainly for staple goods that are very competitive in price and small in profit, and his sales of the big-profit specialties will also be small. Under these conditions he will continue to feel that he is underpaid for the work he does, and he will be right. But if he is willing to borrow a leaf from the salesbook of the grocer or the department-store man and introduce a reform in his method of selling, he can group his staples and his specialties together, strike an average between their wide and narrow profit margins and make some money.

Foreign Market for Steel Poles

Extension of Credit and Establishment of Confidence Are the Main Factors in Developing It—Transmission Lines Erected in Other Countries Are Well Built

By Walter A. Bates
General Manager Bates Expanded Steel Truss Company, Chicago

Two problems immediately stand out when a manufacturer turns his eyes toward a foreign market with thoughts of increasing business. First, he must determine or at least approximate whether the eventual demand for his merchandise will be great enough to warrant the venture of establishing a foreign market. This is the deciding step. Should his assumptions be based on erroneous and misleading facts instead of concrete specific details of the various foreign markets, then the venture can do naught but fail. No herculean effort can save the situation if this first proposition is not based on sound economic principles.

The second problem is a direct function of the first. If the answer to this first question is affirmative, then the manufacturer must study the new requirements imposed upon his distribution system. This will involve further inquiries into questions ranging from policies of foreign jobbers, foreign business methods and credits to the proper methods of shipping and packing.

When we first went after a steel-pole trade in foreign fields we had variouns problems with which to contend. Among these were the establishment of acquaintance, confidence and credit. We got in touch with new markets originally through advertising in the proper mediums. Upon receipt of an inquiry we would send complete detailed information on points the prospective customer had brought out, together with as much more as experience had shown to be required. Then when an order would be received the credit situation naturally followed as the most important subject. It is our general policy to have confirmed, irrevocable credits established for sufficient time, in order to make shipments and to present documents.

The foreign buyer, however, contrary to general opinion, does not seem to object to this procedure. He takes it for granted and needs only to be met half way finally to close a business deal. Advertising can be directly credited with bringing about our Italian business, which has grown very fast. Our latest order for poles to be used in the electrification of the state railways called for 21,800 poles.

In our foreign connections we have carefully chosen only business firms of long standing and closely allied to the electrical industry. These engineering houses have proved to be the very best, since we have had only one unpleasant experience in our exporting history, and that we believe was due to the world depression, directly affecting Europe, where this particular house was established.

As for the value of a steel-pole line, the foreigners, like the Americans, have been quick to appreciate that the first cost, while as low as any other type of first-class construction, has the tremendous additional value of instinctively impressing upon the bond-buying public the permanence of the security and property behind the bonds. This has been many times a deciding factor.

THE FOREIGN ATTITUDE

In the distribution development of steel poles for foreign trade we have run into many peculiar situations, each distinctly appertaining to a local situation. For instance, in some countries we found that the rules for pole-line construction required factors of safety ranging around five. Now, since most American construction is built with a factor of safety of one and a half to three, this difference must necessarily increase the investment without increasing the rate of return. Although it has been difficult to alter time-established precedents of construction, some of our efforts in reducing this extremely high factor of safety have been successful. By showing these foreign engineers that in the act of manufacture every one of our steel poles was automatically tested by the process of shearing and expanding itself and that the strength of each such manufactured pole varied but 3 to 4 per cent from an average strength, some progress has been made toward lowering the factor of safety to within reasonable limits.

Our problem of shipping and packing has been comparatively easy to solve because of the nature of the material itself. Since foreign shipments are listed either by dead weight or by the space occupied, we have been fortunate in having our poles pack so closely that it is cheaper to ship them by weight than by space. These steel poles can be grouped in a very small area since they fit together so compactly.

As a rule the foreign engineers are thorough and efficient in their examination and make purchases only after complete physical tests. All this has proved our published figures of tests and has thus established the necessary element of confidence.

Survey of Business Conditions

Motor Deliveries Begin to Require Attention

So gradual has been the improvement in the motor trade since early in 1922 that distributors and consumers have had little idea of the increasing pressure upon factory facilities which has lately begun to be felt in some quarters. The demand for both fractional-horsepower and integral-horsepower motors up to about 50 hp. rating has now attained proportions that warrant more consideration of deliveries on the part of motor dealers in their relations with manufacturers. It would be an exaggeration to say that production facilities are now being utilized to the full throughout the motor-manufacturing field, for the market is sharply competitive, and if the truth were known, patronage is undoubtedly unevenly spread around.

Motor sales agents can be found in large numbers who are on the alert to increase their regional business greatly; but, on the other hand, the tide is rising all the time, and conditions justify taking a longer look toward the future in gaging motor sales than has up to now been the rule. In a representative case deliveries now range from ten to twelve weeks on larger motors and from stock to about six weeks on the smaller and moderate-speed types. Manufacturing for factory stock is rapidly declining in face of current demand, steel delivery conditions and labor shortages. Prices are firm, and the reward of earlier ordering will be more assured shipments on promised dates, as the situation appears at New Year's.

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Business Approaches Level at Peak of 1919-1920 Boom

In its ninth bi-monthly review of industrial-economic conditions in the United States, just issued, the National Industrial Conference Board says:

"The recovery of business in the United States since the severe depression late in 1920 and early in 1921 has been unusually rapid, and industrial activity today is fast approaching the level at the peak of the boom of 1919-1920. General business is probably not quite up to this point, but the general situation is sound and far better than could have been reasonably expected at the beginning of 1921 or even at the beginning of 1922.

"The business and industrial situation as a whole has shown a remarkable degree of improvement since the slump of 1920 and 1921. An index of industrial activity compiled by the National Industrial Conference Board and including seventeen of the principal basic industries of the United States showed that, compared with the monthly average for 1919-21 as a base, industrial activity for the month of October stood at 124.8. This compares very favorably with 65.7, the index number for January, 1921, and the low point since the beginning of 1915. The peak was reached in October, 1919, and the high point for 1922 so far was reached in June, when the index stood at 119.9.

"This index of industrial activity shows that the index rose 10 per cent from September to October and was 22.6 per cent higher in October, 1922, than in October, 1921. These facts indicate that industry has recovered much more rapidly than is generally supposed and that it is now at a very high point. In fact, it has been higher only on two occasions, namely, in July, 1918, and during the after-war boom in 1919 and 1920.

"During October and November there was a steady improvement in the industrial situation. Fundamental conditions have become more sound. The evidence of this is to be found in those indices which are commonly accepted as measuring business conditions. The production of pig iron and steel ingots has increased, and during October it reached the highest point since the beginning of 1921. The unfilled tonnage of the United States Steel Corporation also rose considerably, indicating that even the increased production of iron and steel during October is by no means keeping pace with demand, which continues at a high rate. Commercial failures have decreased. Railroad car loadings have reached almost record-breaking figures; in fact, car loadings for the first ten months of 1922 are higher than for any similar period."

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb	$0.0295	$0.0295	$0.0273
Cold finished shafting, per lb	0.0378	0.0378	0.0373
Brass rods, per lb	0.171	0.1700	0.15
Solder (half and half), per lb	0.24	0.23	0.20
Cotton waste, per lb	0.11	0.11	0.112
Washers, cast iron (½-in.), per 100 lb	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.11	3.11	. . .
Machine oil, per gal	0.36	0.36	. . .
Belting, leather, medium, off list	30-10@50%	40-5@50%	. . .
Machine bolts, up to 1-in. x 30-in., off list	55@60%	50@65-10%	50@60-10%

Prospects of Jobbers in South and West

Conditions Are More Favorable—Better Cotton in Tennessee—Building Operations in Carolinas Indicate Big Business—Optimism in Missouri—Improvement in Utah

THAT the last four months of 1922 have shown a heavy increase in Southern and Western jobbers' sales in most lines and that the year 1923 promises more prosperity than the year 1922 is seen in the four following opinions upon the outlook for the year 1923, written by leading jobbing authorities in Tennessee, the Carolinas, Missouri and Utah.

HAPPIER FEELING PREVAILS

Tennessee.—W. R. Herstein, vice-president and general manager of the Electrical Supply Company, Memphis, Tenn., believes that the electrical business men of his state look back upon 1922 and forward to 1923 with a much happier feeling than that with which they regarded the outlook a year ago. He continues: "Cotton and lumber are our chief industries, as the whole world knows. The boll weevil is not altogether an unmixed evil. Things in the cotton belt are seldom normal; either we have an overproduction, with a very low price, or we have a short crop at a fancy figure. Of the two, the short crop and high price bring the greater prosperity to this section, because when the crop is long and the price low planters will not sell their cotton and cannot pay their debts. On the other hand, when prices are high, cotton moves rapidly, money comes into the country and prosperity reigns.

"During 1922 the boll weevil took about half the crop, but the remaining half will bring about as much as the total crop would have brought anyway, with the added advantage that, as before stated, cotton is now being shipped out and money is coming in.

"The housing shortage in this part of the country is not yet entirely remedied, and building progresses satisfactorily. On the other hand, we are at present undergoing a mild condition of inflation, which makes it necessary for us to watch stocks and credits carefully to avoid a repetition of 1920. If we can successfully do this, I think this section can look forward confidently to a prosperous business in 1923."

SELLING THE JOBBER TOO WELL

The Carolinas.—William Farr, president and general manager of the Piedmont Electric Company, Asheville, N. C., says:

"The past two years have been years of many ups and downs. We no sooner thought we were on a straight track and ready for smooth running than we came to an abrupt turn, and the man in business today, whether manufacturer, jobber or dealer, to succeed must have the ability readily and quickly to adapt himself to circumstances, not only adjust himself, but be able to take advantage of them.

"Lately we have sensed a certain amount of pessimism expressed by manufacturers when they send out inquiries to the jobber to ascertain what his demand will be beyond his present requirements, the jobber having in mind the hand-to-mouth buying of the dealer. There is no one especially to blame for this condition, but, rather, let us put the responsibility on all of them. In the first place, the manufacturer in many cases does not insure the success of his line by an efficient sales organization, or if he has a good selling organization, he doesn't seem to have any plan. Too much is spent on 'selling' the jobber and too little on 'selling' the public. The jobber, in turn, scatters his efforts over too wide or too large a line, and in some instances he does just about as much good as a hunter going out to kill a bear with a shotgun that's loaded with bird shot. We believe that the jobber who best serves his trade and is the best customer for the manufacturer is the one who concentrates on certain lines of one manufacturer. There are enough lines to go around, so that each jobber could specialize. It's done on appliances; why not in general supplies?

"Some of the contractors are already aroused to the fact that they have let slip from them a line of business that would have been most profitable and that belongs to them by reason of their electrical knowledge; that is, supplying their home-town trade with electrical appliances, and not only supplying their customers' wants, but creating a demand and following up the 'prospect' half sold by the national advertising of some of our best-known lines. It's quite apparent from a review of the advertising columns in most of our large newspapers that the dealer has no faith in advertising, while the jobber indulges in it to a very limited extent.

"The report of building operations in the Carolinas for the last three months of 1922 indicates that we shall see big business along that line in 1923; for although for the last three months of 1922 there was a decrease of 10 per cent in the number of building permits as compared with the corresponding period of the previous year, the value of the buildings for the same period in 1922 was 22 per cent greater than in 1921."

VIGOROUS BUILDING ACTIVITY

Missouri.—"The outlook for 1923 in affairs electrical is distinctly one of encouragement," says J. L. Buchanan, president of the Wesco Supply Company, St. Louis.

"In the public utility field in this vicinity there are a number of important power-house projects in active course of construction. These are not only potent consumers of electrical material now, but presage with their completion an added stimulus to the more general use of electricity in the territories served.

"The vigorous building activity promises an improving market for wiring materials, and a healthier railroad situation means busy industrials with consequent demand for motor-control devices, etc.

"In the merchandising field distinct progress is in view, with a great leader in the central-station industry giving this subject time and study and with large manufacturers duly organized for analysis and action.

"Beyond all of these things, the most hopeful sign is the increasing evidence on every side of the realization that there is no substitute for hard work."

IN SIGHT OF NEW PROSPERITY

Utah.—J. A. Kahn, president of the Capital Electric Company, Salt Lake City, Utah, states:

"In no section of the country has the business depression been more general and persistent than in the Intermountain region. This is accounted for by the fact that the three basic industries —mining, agriculture and stockraising —have all been hard hit by the slump in prices.

"It seems, however, that we are now emerging into the light of a new prosperity. The last four months of 1922 have shown a particularly healthy increase in volume of sales in most lines. The average increase for the year over 1921 in the electrical industry is somewhere within the range of 10 and 20 per cent.

"A much better showing would have been made had agricultural conditions not been in such a demoralized state. Prices for farm crops have been altogether inadequate, and a lack of cars for shipping at crucial periods has greatly aggravated the situation. The sugar industry, however, is in a much improved condition, growers receiving better prices and acreage yields showing to advantage.

"The prospect for improvement is encouraging. Big coal and iron development projects are about to be undertaken, outside capital having taken a keen interest in the vast resources of this region. Within the next few months millions of dollars will probably be expended in lands, equipment, building and labor. The manufacture of pig iron on a large scale will be a great stimulus to business and industry in this section.

"Natural gas in commercial quantities has recently been discovered at a point near enough to Salt Lake City and Ogden to make its utilization for domestic and manufacturing purposes quite certain. Copper, silver, lead and coal mining have all been resumed on a much better scale. Building in 1922 has been confined almost exclusively to residences. In the coming year larger construction jobs will likely be undertaken.

"Although the gain for the past year has not been so satisfactory as business men had hoped it would be, yet there is every reason for an optimistic outlook for 1923."

Steam Turbine Business for 1923

Says Demand Will Exceed Supply—Growth of Central-Station Load During 1922 Has Been So Great that Purchases Have Absorbed Production

By E. H. Sniffin
Manager Power Sales Department, Westinghouse Electric & Manufacturing Company

THE volume of business that will be placed in 1923 for prime movers will be limited only by the manufacturing capacity; the demand will exceed the supply. The growth of central-station load during 1922 has been so great that the purchase of new generating capacity during the past six months has pretty well absorbed production, in large units at least, for the greater part of the new year. On top of this there is in active negotiation additional business equal to four or five months of the builders' capacity.

Production of steam-turbine generating units will be very large during 1923. For the greater part of two years production has been light, as there was a dearth of new business during the eighteen months' period ended last summer. Prime-mover installations involve new construction, and new construction means new financing. When the money market is easy the turbine business is good. When money tightens the central stations are forced to get along with what they have, often crowding everything to the limit to meet the public demand. There are few businesses where the future requirements can be predicted with greater accuracy. And it is one of the anachronisms of the business, from the standpoint of both the central station and the manufacturer, that we cannot establish a more even rate of production, year in and year out, for this product, whose use after all is predicated upon a very even increase in public demand. If we assume, which we can do, that the average increase in central-station load is so much per year, then some way might conceivably be found to bring the country's production facilities to approximately that same uniformity. The result would be a vast improvement in public utility service. It would avoid the present condition of laying off thousands of skilled mechanics one year and trying to find them the next. And it would reduce the cost of everything by giving a more uniform load to the manufacturing plants.

Are we treating labor or capital fairly in thus persisting in our economic blindness? Shall we continue to have our great industrial plants sometimes too small for the country's demands, but withal working on an average load factor of less than 50 per cent? It cannot be argued that this is a chimerical hope which runs counter to the law of supply and demand, for the public demand for electrical power is a very constant and assured fact, a more tangible, a more definite and predictable basis for security issues than most other business undertakings. Let us hope that the whole electrical industry, and the financial world as well, will try to find the means of remedying this regrettable condition.

The Metal Market

Copper Buying Improved—Lead Is Inactive—Tin Consumers Seem Well Supplied

Buying of copper is somewhat better than usual, but not at all phenomenal, as higher levels in the market have been quoted. For some time producers in general have been well sold up, so at the first sign of a strengthening in price they are preparing to hold a little above the market and see if the price will come up to their quotations. The lead market for the week has not been unusually active, and the advance by the smelting company last week came as a surprise to most followers of the market. The increase in price resulted from strong fundamental conditions, from the continued excellent demand of the paint, cable, battery and ammunition makers, all of whom are specifying rather more than expected, and from the fact that production has not been stimulated by higher prices to the extent that had been hoped. There seems to be sufficient lead to meet the demand at present prices in all markets. Price premiums are quoted for spot supplies, with little or no demand. Demand for tin continues almost non-existent, consumers appearing to be well supplied with all of the metals they need for present requirements. Prices have, of course, followed London, but have ruled somewhat below parity.

NEW YORK METAL MARKET PRICES

	Dec. 20, 1922 Cents per Pound	Dec. 27, 1922 Cents per Pound
Copper		
Electrolytic	14.00	14.50
Lead, Am. S. & R. price	7.10	7.25
Antimony	6.50	6.40
Nickel, ingot	36.00	36.00
Zinc, spot	7.05	7.05
Tin, Straits.	37.00	38.00
Aluminum, 98 to 99 per cent..	22.50	23.00

Collections in the Northwest Are Slightly Improved

Collections in the Northwest are slightly improved. For November the record was forty-seven days for outstanding accounts. Contractor-dealers are paying a little more promptly, although in general they are slow. Jobbers are compelled to be strict in the extension of credit in this direction, for many firms are still in a precarious condition financially. The probability is that the number of doubtful accounts that the jobbers will be compelled to write off their books for this year will be greater than it has been for a number of years.

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

STOCKS of appliances are low owing to the unusually heavy buying of holiday goods during the holidays. Radio stocks also are low because of the increased interest during the last few weeks. Weatherproof wire advanced slightly last week, although demand is only fair. Fixtures are going in better volume, the residential types apparently selling best. A slight increase in activity for smaller motors is reported in the larger cities of the East and Middle West. Lamps are moving in greater volume. The conduit shortage is more acute with little relief in sight.

New York

Appliance Sales Heavier than a Year Ago—Wire Stocks Improved—Lamps Active

Sales of appliances during the last two weeks, according to several jobbers, were much heavier than a year ago, and in some instances stocks were almost depleted. A pick-up in the motor market is reported, the smaller sizes selling in better volume. Wire stocks are somewhat improved. A scarcity of conduit continues, with little hope for relief in the near future. Stocks generally are lower in preparation for the inventory period.

Lamps.—Much improvement is reported. Replacement business is slightly better but the bulk of orders is going to the recently constructed residences and stores. A slight falling off in the sign industry is reported. Stocks are ample.

Wire.—An advance of 1 cent in the base price for weatherproof is the feature of the week's market, although sales are not great. Lamp cord and other rubber-covered is selling in greater volume than for some weeks past.

Motors.—Some authorities say that 1922 motor sales are approximately 20 per cent higher than they were in 1921. Smaller motors are receiving the most attention in the present market. Stocks are ample and prices generally are firm.

Fixtures.—Heavy gain is reported in residential fixtures, as well as for commercial types. Stocks are high.

Radio.—Better broadcasting is helping radio considerably. Sales during the holidays are said to be very satisfactory. Greatest demand has been for the small crystal sets. Other parts are moving well. Heavy competition has caused prices for the low-quality sets to fall.

Boston

Appliance Business Rises to High Peak —Motor Deliveries Are Slower— Prices Stiffening

A sharp peak in the demand for appliances of all sorts featured the week just closed. Leading jobbers were practically cleaned out of electrical gift goods in some cases by Saturday. General business in New England is well maintained, but buying for stock has dropped to insignificant volume as the inventory period arrives. Building and engineering contracts in New England continue to run far ahead of last year, the total for the week ended Dec. 19 being $6,072,500, against $4,131,000 for the same week in 1921. Prices are firmer on wire and flexible armored conductor. Deliveries are causing some anxiety.

Wire.—Weatherproof wire is up 1 cent on the base price, though sales are moderate. Rubber-covered wire is moving actively. Stocks are ample and shipments in good shape from the factories.

Motors.—Sales in this district will run 25 to 35 per cent ahead of last year, from all appearances. Deliveries tend to lengthen somewhat as the demand grows and existing factory facilities are absorbed.

Lamps.—While New England has not shown the expansion in lamp business reported from some other sections, the year's total will probably run better than 1921 in many sizes and types. The long strikes in the textile mills hurt buying, and only recently have orders begun to hit substantial volumes. General lamp purchases by the public have increased by leaps and bounds this year. Prices are steady. Portable lamps were in such demand last week that motor-truck shipments from factory to retailer were necessary in some cases.

Rigid Conduit.—Stocks are spotty and the demand is pressing the supply hard. Considerable "pick-up" business is a feature of current sales. Arrivals of carload shipments from the factories are irregular.

Radio Equipment.—The holiday trade increased to a whirlwind finish at the week end. More diversified broadcasting programs and improved transmitting apparatus have stimulated the response of a critical buying public. Retail prices are widely variant on competitive tuning coils, telephones and other parts, but the better-known established sets were selling on fairly firm lines as the week closed. Unquestionably some retailers were overstocked at Christmas.

Cross-Arms.—Healthy sales are reported by jobbers catering to public utility needs. Deliveries are reported good and prices firm.

Appliances.—An overwhelming wave of buying swept this district last week and New England factories were striving hard to meet rush-order conditions. Two large jobbers reported being nearly shorn of appliances Saturday. Socket devices for table and other home use were in chief demand, and even the larger units like washers hit a swift pace.

Chicago

Christmas Appliance Trade Overshadows Standard Wiring Materials— Radio Improving

Trade in the electrical industry this week has devoted more attention to the Christmas buying of appliances than to the stable jobbing lines. Call for electrical trains and tree-lighting outfits has been very good. Dealers report their stocks depleted on both these items and lowered on the regular line of heating appliances. Comparative figures of Christmas activity are difficult to obtain, but all jobbers state that their 1922 business is above that obtained in 1921.

Chicago building permits for the thirteen months ended Nov. 31 total $213,881,450. For the first eighteen days of December permits listing $12,859,950 were registered. This year will show the largest value in building construction in the history of Chicago.

Wire. — Demand for rubber-covered wire is good, but the seasonal slump has started. Stocks are fair.

Conduit.—Stocks are still low and the demand has fallen off.

Flexible Armored Conductor.—Action on this conductor is still sluggish. Stocks are normal.

High-Tension Equipment.—Sales are still active as reported by all manufacturers. One firm sold four outdoor substations ranging from 33,000 volts to 135,000 volts with capacities of 600 kw. to 6,000 kw. Some of this equipment goes to a Middle Western utility. Another company has sold sixty 15,000-volt fuse mountings and fuses, while another concern received orders for some 66,000-volt outdoor substation equipment for a utility in Illinois.

Safety Switches. — The 30-amp. size has been in active demand until the seasonal drop in building construction. Stocks are fair but not excessive.

Lamp Cord.—Christmas trade is requiring a steady volume of both the cotton and silk No. 18.

Radio.—Jobbers report that the local demand has been more for standard well-constructed sets than for parts to construct a set. Stocks are in good shape.

Motors.—Demand is active with normal stocks.

Cleveland

Unusually Heavy Buying of Appliances —Improvement in Lamps—Steady Demand for Wire

Jobbers report unusually heavy buying of appliances and radio. The motor market is somewhat improved, the smaller sizes selling in better volume. Business in lamps is improved. Collections are slightly slower owing to the holidays. Fixtures for residences are moving more actively.

Wire.—Demand for rubber-covered is steady. Stocks are normal and prices generally are firm.

Conduit.—Scarcity of stocks is more acute, demand is increasing and prices are firm.

Industrial Equipment.—Demand remains steady. Stocks are normal and prices firm.

Fixtures.—Much improvement is evident. The industrials are taking most of the orders and there is a slight pick-up in residential business. Prices generally are firm.

Lamps.—Recently constructed residences and buildings are taking heavy stocks of the better grades. Some improvement in replacement business is reported. Stocks are ample, according to most of the jobbers.

Motors.—Demand for the smaller sizes is noticeably better. Prices generally are firm with normal stocks.

Radio.—Holiday buying has been most satisfactory. Prices on some inferior sets have been materially reduced because of keen competition. Stocks are ample.

Atlanta

Retail Trade Exceeds Expectations— Radio Moving Briskly—Dry Battery Prices Steady

Retail trade in all lines for the past week has exceeded all expectations. In the electrical business the sales of hollow ware, heating devices and portable lamps have been highly satisfactory and carry-overs from the holiday season will be comparatively light. Business in wholesale lines has also been good, particularly in the hardware and building supplies lines. It would appear that we will enter the new year with what will almost approach a business boom, with building permits in Atlanta the greatest in its history and bank clearings well in excess of those of 1921. A general spirit of optimism is apparent throughout the section, and this spirit is being encouraged by the large number of inquiries and investigations looking toward the opening up of new manufacturing and commercial establishments. Heavy rains have fallen throughout the section in the past week, and power curtailment which was feared in some sections and a fact in others is now a thing of the past.

Radio.—As a reflection of the recent radio show held in Atlanta, together with the holiday demand, this line is moving briskly and all jobbers have good stocks on hand. Prices are firm, but reductions are expected in March.

Wire.—Both weatherproof and rubber-covered wire are moving briskly and jobbers' stocks are only fair. Deliveries are reasonably satisfactory and stocks will be brought to normal after the inventory period. Prices are advancing.

Dry Batteries.—Stocks have been allowed to run down, but deliveries are good and jobbers are having no trouble filling the satisfactory orders.

Outlet Boxes.—A healthy movement continues with stocks reported as fair to good.

Pole-Line Hardware.—A brisk movement is reported, this having been the case for several weeks. Stocks are only fair and deliveries are not all that might be asked. Some price advances have been reported.

Lamp Cord.—A good movement is reported with fair to good stocks on hand. Deliveries are only fair and some price advances have been reported.

St. Louis

Stocks Generally Are Low—Meters Show Improvement—Porcelain Steady—Transformers Active

Jobbers and dealers devoted most of the time last week to handling the exceedingly attractive volume of holiday purchasing. Final figures are not yet obtainable, but without question total sales were considerably heavier than last year and it is possible that this is one of the best years ever experienced. Stocks were initially low, purchasing was continually on a conservative basis, and consequently the carry-over will be quite nominal. Immediate orders will have to be placed in some lines for stock replenishment. In the regular power and wiring lines there was little development during the week, though demand remained consistently steady, and improvement is noted in weatherproof wire and in meters.

Merchandise.—Short stocks exist in waffle irons, percolators and radiant heaters, and low stocks obtain in virtually all lines of heating appliances. Ample stocks remain in the larger items, such as ranges, washing machines and vacuum cleaners.

Conduit. — Shipments reported en route will materially build up the now depleted stocks. A steady demand continues and no great diminution is anticipated because of the continued large building program.

Porcelain. — Demand is steady with ample stocks and firm but competitive prices.

Schedule Material.—A decline in sales, thought to be of temporary nature, was experienced last week. A readjustment of prices, without materially affecting the average level, is anticipated.

Pole-Line Hardware. — Business is comparatively quiet, what demand there is being principally for interconnection of small power systems, but prospects are excellent for next year. Stocks are normal and prices firm.

San Francisco

Conduit Stocks Are Very Low—Rubber-Covered Wire Sales Good—Radio Improving

From present indications, the labor shortage will be the only hindrance to a wonderful building year for 1923. Those conversant with conditions predict 50 per cent increase over the building of this year. Even now every available man is working. Stocks generally are good. Conduit, however, is still several months behind. Seasonable crops are progressing nicely. Heavy rains, for instance, will cause a record-breaking rice crop, which will materially increase the prosperity of the Sacramento valley and reflect it upon Sacramento and San Francisco. Holiday business has been good but not exceptional. Better merchandising in windows and advertising by electrical dealers is perceptible to most casual observers. The California Electrical Co-operative Campaign has distributed sales helps at nominal cost and is endeavoring to popularize a distinguishing trade-mark for progressive dealers. New cooking and heating rates are, it is rumored, to become effective soon after the new year.

Wire.—Rubber-covered-wire sales are good. Threatening shortages have been avoided by timely shipments. Prices are fairly stable, but this condition is said to be a lull before an increase in business.

Conduit.—The existing situation will probably hold well into February; that is to say, five cars needed for every car received, particularly in the Los Angeles territory.

Poles and Cross-Arms. — Mill yards are well stocked, but car shortages have prevented assembly of more than adequate emergency stocks in California yards.

Radio.—A perceptible improvement in sales immediately followed broadcasting improvement. Several new stations are under construction. Retail holiday business was excellent, particularly in department stores.

Portland-Seattle

Jobbers' Business Very Active—Many Stocks Low or Exhausted—Hardware Advancing

Lumber production for the past week was 13 per cent below normal. This probably is a prelude to the usual holiday lull, but weather conditions at present indicate presumption of logging soon on an appreciable scale. This will further improve the employment situation, which, however, is in much better shape than it was a year ago. The very pleasant weather of the past week has stimulated buying, and retailers feel gratified over the result. This year's business in most cases will far exceed last year's for holiday trade. Jobbers report business very active and many stocks low or exhausted. The holiday demand appears heaviest in Christmas-tree outfits, radio material and heating appliances, such as air heaters, percolators and accessory materials, waffle irons, toasters, etc. In many cases the stocks are out because manufacturers could not fill the jobbers' orders.

Pole-Line Hardware.—Stocks are reported to be once more in good condition. An advance of 6 or 7 per cent is reported in some lines of wiring devices. In some cases an advance of 5 per cent is reported on weatherproof wire and rubber-covered wire in the smaller sizes.

Salt Lake City

Survey of Jobbers' Reports Shows that Few if Any of Them Have Made Large Money

A survey of jobbers' business charts for the year 1922 shows that few if any of them have really made large money. There has been a steady gain, however, in the past three months. If the rate of progress can be held, 1923 should show the jobbing business in electrical lines on a stable and paying basis. Retailers report good sales for December, while jobbers say there has been a noticeable let-down from November. This is accounted for by the fact that jobbers meet the holiday demand a month in advance of the retailers. Collections show slow but steady improvement and the money market is easier.

Panelboards and Switchboards.—Factories report business good both in the construction of new apparatus and in repairs. The building programs for the coming year foreshadow a big volume of work in this line.

Denver

Light Demand for Armored Cable Believed Temporary—Advance in Conduit Anticipated

Holiday business has been most satisfactory. Jobbers report depletion of appliance stocks and all Christmas merchandise dealers' shelves are practically emptied. With good business in heavier appliances, such as washing machines and vacuum cleaners, in some cases retail volume has been twice that of Christmas business a year ago.

Armored Cable.—Unusually light demand believed only temporary. Prices are stable with ample stocks.

Conduit. — Light buying prevails, although an advance is anticipated.

Wiring Devices.—Christmas business has strengthened demand, with prices and stocks normal.

Transmission Material.—No new developments or extensions are indicated. The month's business has been quiet.

Meters.—Slow demand with normal stocks.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders
and Contracts for Apparatus and Equipment

Automatic Electrical Devices Expands 300 per Cent

The Automatic Electrical Devices Company, manufacturer of electrical and automotive devices, Cincinnati, has expanded its manufacturing facilities 300 per cent during the past year. "The business outlook for the next six months is exceedingly promising," says C. E. Ogden, president and general manager of the firm, "and our December sales promise to be even greater than those of April, in which month our sales were over double those of the entire year 1921. We believe that the same volume of business is available for at least four more months, or until warm weather again affects buying in the radio industry."

◆

Hugo Reisinger Will Handle Conradty Carbons

Hugo Reisinger, 11 Broadway, New York City, importer for many years of "Electra" carbons, announces that he will handle in the future a complete line of carbon products manufactured by C. Conradty, Nürnberg, which consist of high-grade carbon and graphite brushes, also the "Bronskol" metal brush, which has been used in this country with great success, as well as furnace electrodes and "Ocelit" resistance material.

◆

Master Electric Company Gives Insurance to Employees

An insurance policy with premium paid is a Christmas gift which has been received by each employee of the Master Electric Company, Dayton, Ohio. The insurance policies given by this company range from $500 up and are with an old-line insurance company. A feature of the gift is that the policies will be increased each succeeding year to a limit of $2,000, and all premiums will be paid by the company while the employees remain with the organization.

In presenting the policies E. P. Larsh, president of the company, announced the initiation of a nursing service which will provide nurses free of charge to employees who are ill during their connection with the Master Electric Company.

Mr. Larsh said in discussing the gift "It is an expression from this company of our appreciation for the faithful service which all of our employees have rendered. Our growth has been unusually rapid, and we feel that much of what we have been able to accomplish we owe to the hearty co-operation of our employees. Therefore we are taking this Christmas season as a fitting time in which to express our appreciation in this way."

It was also announced that the business of the company for the last quarter of this year was four times greater than the volume for the same period last year. This increase in business made necessary the moving to a larger plant where it now has ample facilities for handling its growing business.

◆

Robbins & Myers Company Holds Sales Convention

The Robbins & Myers Company, Springfield, Ohio, manufacturer of electric motors, generators and fans, held an important sales convention in Springfield during the week of Dec. 11, when matters pertaining to its sales policies were discussed.

On Monday, Dec. 11, a general meeting was held in the offices of the company, where introductory talks were given by F. S. Hunting, president; W. J. Myers, vice-president, and H. E. Freeman, treasurer. In the afternoon a trip through the factory was made.

During the following days of the week addresses were given by the following members and officials of the company: H. R. Stuart, chief engineer; H. I. Smeltzer, in control of production; T. Groner, production manager; W. A. Lubbers, chief inspector; D. F. Alexander, chemist; W. L. Wood, cost department manager; C. H. Clark, advertising manager; W. W. Mumma, sales manager; F. M. Webber, assistant sales manager for motors; F. W. Burmeister, assistant sales manager for fans; E. Wilson, auditor; F. G. Ziegler, credit manager; F. H. Andrews, purchasing agent, and C. F. Hellwig, traffic manager.

◆

Line Material Company Holds Sales Convention

The Line Material Company, Milwaukee, held its annual sales convention Dec. 17 to 22, at the Hotel Martin, in that city. C. P. Wagner of the Minneapolis General Electric Company gave a talk on secondary and sectionalizing fuses and their use by his company. Arthur J. Sweet, consulting illuminating engineer and an officer of Traficon, Inc., lectured on street traffic control and regulation. Dan Wescott, president of South Bend Current Control Company, demonstrated RC-OC switches. Those in attendance were W. D. Kyle, president of the Line Material Company; L. E. Hendee, sales manager; J. D. Hoit, Albany; J. J. Desmond, Chicago; K. W. Kline, Kansas City; D. H. Millar, Des Moines, Iowa; A. L. Dunmire, Oakland, Cal.; I. W. Bolton, Milwaukee; L. A. Priester, Dallas, Tex.; C. A. Moore, Charlotte, N. C.; L. A. Greff, New York; H. E. Miller, Philadelphia; P. L. Reeves, Boston; E. R. McCoy, Indianapolis; P. O'Moore, Pittsburgh; E. W. Merriam, Hartford, Conn.; F. T. Otis, Richmond, Va.; F. T. Buckley, Little Rock, Kan., and P. R. Gossman, Dubuque, Iowa.

◆

Sundh Electric Company Changing Charter to New Jersey

For reasons of convenience in its corporate management, the Sundh Electric Company, 209 Parkhurst Street, Newark, N. J., is changing its corporate charter from the State of New York to the State of New Jersey. According to the company, this action is being taken with unanimous consent of the directors and stockholders, and it is stated that the New Jersey company will assume all the liabilities of the New York company. According to the announcement, there is to be no change whatever in the conduct of business.

◆

Royal Cleaner with Attachment Set Price Is Reduced

The P. A. Geier Company, Cleveland, manufacturer of electrical appliances, has perfected a new complete set of attachments for the Royal electric cleaner. The company says in a letter to the trade that the retail price of the Royal electric cleaner complete with this new set of attachments is $65 instead of $67.50, which was the former price. The price of the cleaner alone remains the same.

◆

The Power Specialty Company, builders of "Foster superheaters," economizers and oil heating and cooling equipment, announces the opening of new branch offices in Detroit, Dime Savings Bank Building, in charge of L. Lanyi, and in Boulder, Col., 2,324 Fourteenth Street, in charge of R. B. Nutting, who was formerly Chicago district manager.

The Robinson Electric Company, 1135 North Fortieth Street, Philadelphia, has acquired property at 807 Race Street and will use it for a branch establishment.

The Evans Lead Company, recently organized as a subsidiary of the Ohio Alloy Company, Fostoria, Ohio, with a capital of $1,000,000, has plans in progress for a new plant at South Charleston, W. Va., where 15 acres have been purchased. It will consist of two main units, of four stories and one story, each 50 ft. x 180 ft., for the manufacturer of lead products, and is estimated to cost $100,000. S. M. Evans is president of both organizations.

The Acheson Graphite Company, Buffalo Avenue, Niagara Falls, N. Y., manufacturer of electrodes, electrical specialties, etc., is planning for the erection of a one-story addition.

Foreign Trade Notes

ELECTRIC EQUIPMENT FOR BRANDFORT, SOUTH AFRICA. Tenders will be received by the Municipal Council of Brandfort, Orange Free State South Africa until Jan. 30, for water-tube boilers steam engines and alternators, switchboard, feeder and engine-house auxiliaries material for distributing system, transformers, meters, etc.

PROPOSED HYDRO-ELECTRIC PROJECT AT BURRINJUCK, AUSTRALIA.—Plans are being prepared for the proposed hydro-electric project at the Burrinjuck (N. S. W.) dam, which will supply electricity over a wide area including the towns of Jugiong, Cootamundra, Gundagai, Junee, Harden, Murrumburrah, Young and Yass. Preliminary work in connection with the scheme, including surveys for the transmission lines, has been completed. The initial work will include the construction of the tunnel from Burrinjuck to the power house and foundations for the power house, for which tenders will be invited. Separate tenders will be asked for equipment for plant.

PROPOSED HYDRO-ELECTRIC PROJECT IN BRAZIL.—The Brazilian government has approved the plans submitted for utilizing the falls of Mambucaba, situated on the frontier line between the States of Rio Janeiro and São Paulo. It is proposed to form a syndicate to install the proposed hydro-electric plant and distributing system. The reservation of an area of 12,300 hectares of land which can be devoted to any useful industrial purpose is included in the project.

IMPROVEMENTS TO THE LIMA (PERU) STREET RAILWAY AND ELECTRIC SERVICE.—A contract has recently been executed between the municipality of Lima, Peru, and the Empresas Electricas Asociadas, *Commerce Reports* states, whereby improvements will be made at once in the local street-railway system and electric power service. The capital which will finance the improvements, it is understood, will be furnished by the Latino-Lux, an Italian corporation.

NEW EQUIPMENT FOR THE KARACHI ELECTRIC PLANT.—To provide for the extension of its electric lighting service into the native quarters of the Karachi municipality, the Karachi Electric Supply Corporation, *Commerce Reports* states, will require additional electric generating units. On account of the proximity of the Persian oil fields it is probable that Diesel engine units, similar to those now installed, will be most favorably considered.

PROPOSED HYDRO-ELECTRIC PROJECT FOR NELSON, NEW ZEALAND.—Permission has been granted the Waimea Electric Supply & Manufacturing Company, Ltd., Nelson, South Island, New Zealand, according to *Commerce Reports*, to utilize 60 cu.ft. per second of the waters of the Wairoa River in the district of Nelson to generate electricity. The plant is to be completed within one year from the date of the license, July 31, 1922.

ELECTRICITY TO BE TRANSMITTED FROM SWITZERLAND INTO FRANCE.—Arrangements have been made for the transmission of electricity from Switzerland into France at 135,000 volts by a transmission line to start from Miécourt, Switzerland. This line is to be linked to the network of the Berner Kraftwerke, which owns the station of Olten-Gosgen, Muhlberg. The amount of energy to be transmitted will be 28,000 kw., which will supply the Mulhouse district (the transformer station being at Ile Napoléon), the districts of Colmar and Münster, and will be tied in at Wintzenheim-Turckheim to the existing 70,000-volt transmission line of the Société d'Electricité de Strasbourg. It will be continued to Sarrebourg-Creutzwald by a 70,000-volt transmission line to Solec, now under construction by the Société Alsacienne et Lorraine d'Electricité. Work has not yet started on the erection of the transformer stations but will be soon. A station will be erected at Kembs in the near future, and probably a pumping station will be built in the valley of Kaysersberg (Upper Rhine), the Commission du Rhin having agreed to the French utilizing the waters of the Rhine.

ELECTRIFICATION OF BRICKYARDS IN NORWAY CONTEMPLATED.—Experiments have been carried on in western Norway, near Sandnes, *Commerce Reports* states, in operating brick ovens by electricity. The oven used was of American type, adapted to this special use, and the trials are said to have been very successful. Besides burning brick it is said that the new electrical oven could be also used for the burning of lime and even in pottery works. At the brick yard near Sandnes, where about 10,000,000 bricks are manufactured annually, it is estimated that 10,000,000 kw.-hr. of electrical energy would be used, or about twice the quantity which is consumed in that community at present.

New Apparatus and Publications

ASH EJECTOR.—The Victor Engineering Company, Philadelphia, is distributing a booklet describing the "Victor" ash ejector.

COAL STORAGE.—"Storing Coal Safely" is the title of a booklet issued by the Protectometer Company, 154 Ogden Avenue, Jersey City, N. J., in which it demonstrates the use of the "Fedco Protectometer System" for temperature observations in connection with the storage of coal.

MOTORS AND GENERATORS.—The Burke Electric Company, Erie, Pa., is distributing a four-page pamphlet covering its various types of direct-current motors and generators.

ELECTRIC MOTOR TRUCKS.—The Commercial Truck Company, Philadelphia, has issued a catalog covering its two-motor and four-motor drive "C-T" electric trucks. Bulletin No. 21 issued by the company contains an article on the design and construction features of its two-motor concentric-gear-drive trucks and its four-wheel internal-gear-drive trucks. "Why You Should Use 'C-T' Electric Trucks" is the title of bulletin F-16, which gives some pertinent facts regarding its trucks. The company is distributing several other bulletins showing the use of its trucks in various industries.

HAND TACHOGRAPH.—O. Zernickow, 15 Park Row, New York City, is placing on the American market the "O-Z" hand tachograph, a new instrument for making graphic charts, which will make records of any speeds within the ranges manufactured.

HELICAL GEARS.—The Farrell Foundry & Machine Company, 344 Vulcan Street Buffalo, is distributing a booklet in which it announces that it has acquired all patent rights to the "Sykes" gear generating machinery and methods in the United States and Canada. A full equipment for producing the continuous double-helical gears by this new method will be put in operation at its Buffalo plant.

ADJUSTABLE LIGHTING FIXTURES.—The O. C. White Company, 17-21 Hermon Street, Worcester, Mass., has issued a catalog covering its complete line of adjustable fixtures.

TUBE CLEANERS.—The Roto Company, Hartford, Conn. is distributing a booklet describing the "Roto" tube cleaners, air steam or water driven, for fire-tube and water-tube boilers, fuel economizers, condensers, evaporators, feed-water heaters, etc.

STEAM-JET CONVEYOR.—The Victor Engineering Company Philadelphia, has issued a booklet covering the "Victor" steamjet conveyor.

SPOTLIGHT.—Bulletin No. 402 issued by the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, describes a new show-window spotlight brought out by the company.

GRAPHIC INSTRUMENTS.—"How to Make a Plant Survey" is the title of bulletin No. 1112 issued by the Esterline-Angus Company, Indianapolis Ind., which describes the methods and results obtained by the systematic use of graphic instruments in industrial plants.

New Incorporations

THE UPPER METHOW VALLEY LIGHT & POWER COMPANY, Winthrop, Wash., has been incorporated with a capital stock of $15,000 by R. E. Carl A. and L. G. Johnson and W. L. Chrysler.

THE EDGEWOOD LIGHT & POWER COMPANY Port Angeles, Wash., has been chartered with a capital stock of $5,000 by A. F. Eacrett, J. D. Moran, F. P. Fisher, G. W. Critchfield and C. A. Frostburg.

THE RAYMONDVILLE (TEX.) LIGHT, POWER, WATER & ICE COMPANY, Inc., has been granted a charter with a capital stock of $40,000. The incorporators are C. A. Cripe, R. E. Harding and S. K. Gill.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOOTHBAY HARBOR, ME.—The property and franchise of the Lincoln County Power Company, consisting of power plant at Damariscotta Mills and substation at Boothbay, transmission and distributions systems, etc., have been acquired by the Central Maine Power Company, Augusta.

PORTLAND, ME.—The Cumberland County Power & Light Company has applied to the Public Service Commission for permission to acquire the properties of the York County Power Company, York, and the Westbrook (Me.) Electric Company.

MEREDITH, N. H.—The Utilities Power Company has petitioned the Public Service Commission for permission to extend its service to Tuftonborough, Bristol, Ashland Center Harbor, New Hampton and Moultonborough.

RICHFORD, VT.—The Sweat-Comings Company, which owns the local electric lighting system, has sold its property and franchises to the Clyde River Power Company, Newport, Vt.

SPRINGFIELD, MASS.—An electric interlocking system for train control and other electric power equipment will be installed in the proposed local station of the Boston & Albany Railroad, Boston, to cost about $4,000,000.

WATERTOWN, MASS.—Electric power equipment will be installed in the new local plant to be erected by the Vose & Son Piano Company, Boston, to cost about $300,000. Densmore & LeClear, 88 Broad Street, Boston, are architects.

PAWTUCKET, R. I.—The Chamber of Commerce and the Business Men's Association have petitioned the City Council to appropriate funds for the installation of an ornamental lighting system in the business district. The Blackstone Valley Gas & Electric Company furnishes the street-lighting service.

STAMFORD, CONN.—The Stamford Gas & Electric Company contemplates improvements to its plant, including the installation of additional equipment, to cost about $40,000.

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North Atlantic States

BROOKHAVEN, N. Y.—The Public Service Commission has granted the Patchogue (N. Y.) Electric Light Company permission to install an electric lighting system in Brookhaven, including Middle County Road.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Flatbush Avenue Extension and Concord Street, Brooklyn, until Jan. 3 for installing electric wiring and fittings in the New Utrecht High School on Seventy-ninth and Eightieth Streets, from Sixteenth to Seventeenth Avenue.

LOCUST VALLEY, N. Y.—Electric power and pumping equipment will be installed in the proposed municipal water plant to cost about $300,000.

NORWOOD, N. Y.—The Norwood Electric Light & Power Company has arranged for an increase in capital in an amount of $145,000, part of the proceeds to be used for extensions and improvements.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Flatbush Avenue Extension and Concord Street, Brooklyn, until Jan. 3 for additions and alterations to electrical equipment, bell and fire signal systems, and fire protection work at Public Schools 11, 13, 28 and 36, Borough of the Bronx. Also for installing electric wirings and fittings in new Public School 65, Borough of the Bronx.

PLATTSBURG, N. Y.—The Plattsburg Gas & Electric Company has applied to the Public Service Commission for permission to exercise franchises granted by the towns of Beekmantown, Chazy, Schuyler Falls and Saranac to furnish electricity in those places.

SARATOGA, N. Y.—A power house will be erected at the Saratoga Hospital, to cost about $45,000. William H. Vaughan, 400 Broadway, is architect.

WATERTOWN, N. Y.—The directors of the Northern New York Utilities, Inc., have authorized an application to the Public Service Commission for permission to sell certain undeveloped water-power rights and its small plant at South Edwards to the Power Corporation of New York, which proposes to develop a large hydro-electric project at that location.

ELIZABETH, N. J.—Bids will be received by the board of education until Jan. 11, 1923, for construction of new additions and alterations in Public School No. 12. Separate bids to be submitted on electrical, plumbing, heating and ventilating work. C. Godfrey Poggi, 275 Morris Avenue, is architect.

HOLLAND, N. J.—Surveys are being made by the Pennsylvania-Edison Company, Reading, Pa., for the construction of a new generating plant at Holland, to cost about $5,000,000, with transmission lines. The ultimate cost is estimated at $10,000,000.

RUTHERFORD, N. J.—Steps have been taken by the Chamber of Commerce and other civic organizations for the installation of an ornamental lighting system on Park Avenue. The Public Service Electric Company furnishes the street lighting service.

TRENTON, N. J.—Plans are under consideration for the installation of an ornamental lighting system, using joint poles with the local traction company.

ALLENTOWN, PA.—The Pennsylvania Power & Light Company contemplates extending its transmission system in Upper Augusta Township and Snydertown. The company has acquired the Conyngham (Pa.) Power & Light Company and plans for extensions and improvements in the system. A transmission line will be erected to Shenandoah via Hometown, Tammenend and Delano.

BLOSSBURG, PA.—Gannett, Seelye & Fleming, Inc., engineers, 204 Locust Street, Harrisburg, and other Harrisburg interests have acquired the property of the Blossburg Electric Light & Power Company and also the electric plant at Mansfield, Pa., which they plan to consolidate, making considerable improvements and extensions. The item which was published in the issue of Dec. 23 stating that the property of the Blossburg Electric Light & Power Company had been purchased by E. L. Phillips & Company, New York City, was not correct.

PHILADELPHIA, PA.—The American Ice Company, Sixth and Arch Atreets, will install electric power equipment at its new ice-manufacturing plant at Washington and Seventeenth Streets, to cost about $75,000.

SUSQUEHANNA, PA.—The Susquehanna Light & Power Company is considering an issue of $100,000 in bonds, the proceeds to be used for extensions and improvements.

FREDERICK, MD. — Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system here.

HAGERSTOWN, MD.—Electrically operated pumps will be installed at the municipal waterworks station in connection with proposed extensions and improvements, to cost about $100,000.

LOGAN, W. VA.—The Kentucky & West Virginia Power Company contemplates extension and improvements to its local plant, to cost about $750,000. Francis R. Weller, Mills Building, Washington, D. C., is consulting engineer.

WESTON, W. VA.—The Weston Electric Light, Power & Water Company is preparing plans for extensions and improvements to its system, to cost about $40,000.

RICHMOND, VA.—Bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until Jan. 4, for a full magnet-control electric elevator at the local post office.

TAPPAHANNOCK, VA.—Bonds to the amount of $15,000 have been voted for an electric substation and distributing system.

North Central States

CARO, MICH.—The Consumers' Power Company, which has acquired the local electric plant, contemplates the erection of a transmision line from Zilwaukee to Caro for local service.

ST. CLAIR, MICH.—The Detroit Edison Company will make extensions and improvements to the local street-lighting system.

HAMMOND, KY.—The Big Four Coal Company, Whitesburg, contemplates the installation of electric equipment and other machinery at its properties at Candill, near Hammond.

LOUISVILLE, KY.—The Louisville Gas & Electric Company contemplates installing another generating unit and auxiliary equipment at its Waterside power plant.

LOUISVILLE, KY.—The City Council has engaged Gen. W. L. Sibert, engineer, to investigate the feasibility of developing water power on the Ohio River. The proposed plan includes raising dam No. 41.

MARION, KY.—A power house will be built by the Big Four Fluorspar & Ore Company, Farmers' Bank Building, Pittsburgh, Pa., at its proposed local mining and milling plant, to cost about $100,000.

CANNELTON, IND. — The Cannelton Sewer Pipe Company contemplates the erection of a new clay plant, consisting of eight kilns, radial stack and a new power plant, etc., to cost about $240,000.

EDWARDSPORT, IND. — The Indiana Power Company has contracted with the Knox & Sullivan Light & Power Company for power supply for local distribution. Extension to transmission line will be made.

LAPORTE, IND.—The Laporte Gas & Electric Company has submitted two proposals to the City Council offering to rebuild the electric transmission line between the city limits and the Kankakee pumping station.

CHICAGO, ILL.—The Ford Motor Company, Detroit, will build a power house in connection with a new assembling plant on Torrance Avenue, near 126th Street.

EFFINGHAM, ILL.—The Illinois Public Service Company, Springfield, will install electric power equipment at its proposed ice and cold-storage plants at Effingham and Charleston.

WINNETKA, ILL.—A power house will be built in connection with the proposed new manual training school to be erected by the New Trier Township School Board, to cost about $200,000. Perkins, Fellows & Hamilton, 814 Tower Court, Chicago, are architects.

WATERTOWN, WIS.—Contracts have been awarded by the Perfection Table Slide Company for the erection of a two-story factory, 60 ft. x 180 ft., with separate power plant, 30 ft. x 45 ft., and an office building, 21 ft. x 30 ft., work to start about March 15. Omer L. Gaston, Watertown, is general contractor.

GOTHENBURG, IOWA.—The State Railroad Commission has given its approval of the erection of an electric transmission line which will connect the villages of Maxwell and Brady with the electric plant in Gothenburg.

MAQUOKETA, IOWA.—The Maquoketa Hydro-Electric Power Company will take bids in January for the construction of a power plant on the South Fork of the Maquoketa River, to develop 2,000 hp., to cost about $175,000. Holland, Ackerman & Holland, 53 West Jackson Boulevard, Chicago, are engineers.

ST. LOUIS, MO.—Electric power equipment will be installed in the proposed addition to the plant of the Continental (Mo.) Portland Cement Company, near St. Louis, owned by the Alpha Portland Cement Company, Easton, Pa., to cost about $500,000.

ST. LOUIS, MO.—Bids will be received by the Board of Public Service, City Hall, until Jan. 2 for construction of two-story service building and power plant, 55 ft. x 225 ft., at the Training School for Feebleminded at Scott Farm, to cost about $150,000. The equipment will include two 200-hp. oil-burning water-tube boilers, electrical apparatus, ice and refrigerating equipment, etc. L. R. Bowen, City Hall, is architect and engineer.

PALMYRA, NEB.—The Nebraska City Utilities Company will extend its service to Palmyra and Julian to supply electrical service in both towns.

Southern States

ASHEVILLE, N. C.—L. B. Jackson and associates plan to install a street-lighting system at Linwood Park in connection with the development of a large tract of land for residential purposes.

BRICKHAVEN, N. C.—The Carolina Power & Light Company, Raleigh, is planning to construct a 15,000-kw steam-driven plant on the Cape Fear River, near Brickhaven. The plans provide for an ultimate development of 60,000 kw. Post office address Corinth.

ELLERBE, N. C.—Bonds to the amount of $15,000 have been authorized for the installation of an electric lighting system.

HICKORY, N. C.—Electric power and pumping equipment will be installed at the proposed municipal waterworks, to cost about $300,000. J. W. Bollen is city engineer.

ATLANTA, GA.—Electric power equipment will be installed in the proposed plant addition to be erected by the Southern Spring Bed Company, to cost about $100,000.

CAMDEN, S. C. — The Wateree Power Company contemplates extensions and improvements to its system. The company has increased its capital to $7,500,000.

MARIANNA, FLA.—G. N. Thomas and associates are planning to build a power plant on the Chipola River with initial capacity of about 3,500 hp.

PORT TAMPA, FLA.—The Atlantic Coast Line Railroad, Wilmington, N. C., contemplates the construction of a power house in connection with its proposed local shops to cost about $150,000.

FRENCH ROAD, TENN.—The Burnett Knitting Mills, Inc., will construct a steam-driven electric power plant in connection with its proposed local mill, to cost about $60,000.

JOHNSON CITY, TENN.—The Holston River Power Company has tentative plans under consideration for the construction of a hydro-electric power plant on the Holston River, with an initial capacity of about 60,000 hp.

MONTICELLO, MISS.—The McCormick Power Company, recently organized, plans to install a local distributing system Eugene and Charles McCormick head the company.

ORVISBURG, MISS.—The Nortac Manufacturing Company, Poplarville, contemplates the installation of a power plant in connection with its proposed lumber mill in this section, to cost about $150,000.

BASTROP, LA.—The Bastrop Pulp & Paper Company will begin work at once on construction of a power house at its plant.

SHREVEPORT, LA.—A committee has been appointed by the City Council to make an investigation and secure estimate of cost of a municipal electric power plant.

MUSKOGEE, OKLA.—The Yahola Sand & Gravel Company will install electric power equipment, motors and electric pumping plants in connection with an irrigation system, in the vicinity of Fort Gibson, to cost about $250,000. W. S. Dills is president.

OKLAHOMA CITY, OKLA.—The New State Ice Company will install electric power equipment in its proposed plant at 17 West Second Street, to cost about $40,000.

WEATHERFORD, OKLA.—Plans are under way for extensions and improvements in the municipal electric power plant and waterworks, to cost about $114,000. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

WYNNEWOOD, OKLA.—Plans are being prepared for extensions and improvements to the municipal electric plant and waterworks, to cost about $85,000. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

BALLINGER, TEX.—An ornamental lighting system will be installed in the business district.

LAREDO, TEX.—R. W. Morrison contemplates the construction of a new power dam, about 5 miles from Laredo, to develop about 5,000 hp.

MERCEDES, TEX. — The controlling interest in the Mercedes Water, Light & Power Company has been acquired by the Morrison & McCall syndicate.

ROCKDALE, TEX.—The Texas Power & Light Company contemplates erecting a 2,300-volt transmission line to Cameron and Hearne, Tex. Other transmission line extensions will be made, including new lines in Milam County.

SAN ANTONIO, TEX.—Plans are under way for the installation of a lighting system on the Fredericksburg Road for a distance of 11 miles. The Fredericksburg Improvement Club is interested in the project.

Pacific and Mountain States

EPHRATA, WASH.—The Washington Water Power Company contemplates extensions in its transmission system in Grant County.

PORTLAND, ORE.—A construction program involving an expenditure of about $6,500,000, it is reported, will soon be undertaken by the Pacific Power & Light Company. The work will include the construction of a 10,000-hp. hydro-electric plant on the Deschutes River, 15 miles from the mouth of the river. A high-tension transmission line, 60 miles long, will be erected this winter from Kennewyck across the lower Horse Heaven district, and during the following summer will be continued to the power site; further extensions will be made during the summer from the proposed plant to the new Oak Grove hydro-electric plant of the Portland Railway, Light & Power Company on Clackamas River, a distance of 85 miles. The cost of the transmission lines is estimated at $1,500,000.

RIVERSIDE, CAL.—The Nevada-California Electric Corporation, Symes Building Denver, Col., is arranging an appropriation of $8,000,000 for the construction of seven hydro-electric power plants in California during 1923, with a total capacity of 36,500 hp., with transmission-line extensions.

VAN NUYS, CAL.—Electric power equipment will be installed in the ice-manufacturing and cold-storage plant to be erected by the Los Angeles (Cal.) Ice & Cold Storage Company, cost about $60,000.

WILLITS, CAL.—The Central Mendocino County Power Company, which recently purchased the electric and water systems of the Willits Water & Power Company, will erect an electric transmission line at once to connect with the transmission system of the Snow Mountain Water & Power Company at the upper end of Potter Valley. A large dam will be built 2 miles north of here to provide an additional water supply for Willits and for irrigation purposes.

PAROWAN, UTAH.—Application has been filed by the City Council with the State Engineer for permission to divert 24 second-feet of water from Center Creek in Iron County to develop 600 hp. It is proposed to divert the water by means of an iron or wooden pipe line a distance of about 9,650 ft. to the power-house site at the base of the Parowan Mountain range.

SALT LAKE CITY, UTAH.—Application has been filed with the State Engineer by Clarence Snow of Salt Lake City for permission to divert 50 second-feet of water from Big Cottonwood Creek to generate electricity. The project includes a concrete diversion dam, headgate and pipe line. The plans call for a development of 4,800 hp.

PRESCOTT, ARIZ.—The Verde Valley Fruit & Produce Association plans to build a power house in connection with its proposed local fruit packing plant.

SUPERIOR, ARIZ.—Arrangements are being made by the Magna Copper Company for extensions and improvements during 1923, including a new mill with power house and the installation of considerable electrically operated mining machinery. The cost is estimated at about $3,500,000.

JORDAN, MONT.—John Harr and associates are planning to build an electric power plant in Jordan.

BERNALILLO, N. M.—The Sandoval Light & Power Company, recently organized, has arranged for the installation of a local power plant. Philip Joegels is president.

BERNALILLO, N. M.—The White Pine Lumber Company contemplates the construction of a new mill, with power house, to cost with machinery, about $500,000.

SANTA FE, N. M.—A permit has been granted by the State Engineer to Daniel L. Evans and associates to build a hydro-electric project at the mouth of White Rock Canyon, on the Rio Grande River, west of Santa Fe, to develop 15,000 hp. The cost of the project is estimated at $1,500,000.

SPRINGER, N. M.—The local electric light plant has been purchased by L. I. and Irwin Taylor. The new owners, it is understood, install new equipment and increase the service.

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Canada

HUNTSVILLE, ONT.—The Muskoka Wood Manufacturing Company is rebuilding its plant destroyed by fire last June. The factory will be 75 ft. x 250 ft., equipped throughout with electrically driven machinery. The power plant will have an output of between 700 hp. and 800 hp.

NORTH BAY, ONT.—The Town Council is considering the construction of a hydro-electric plant on the French River at Chaudière Falls. The plans provide for the construction of three plants to develop 30,000 hp., to be distributed in North Bay and surrounding towns, and 35 miles of transmission lines, to cost about $3,000,000.

TIMMINS, ONT.—The Hollinger Consolidated Gold Mines Company contemplates the construction of a hydro-electric plant on Abitibi River at Island Portage. The project includes a concrete dam, power house equipped with three 10,000-hp. turbo-generators, transformers, etc., and about 80 miles of high-tension transmission line from the plant to Timmins. The cost is estimated at $3,000,000.

WHEATLEY, ONT.—The installation of an electric lighting and power distribution system, to cost about $35,000, is under consideration.

Electrical Patents

Announced by U. S. Patent Office

(Issued Dec. 5, 1922)

1,437,827. X-Ray Dental-Film Package; A. F. Sulzer and H. G. Dewey, Rochester, N. Y. App. filed Aug. 16, 1920. Means for holding film in pack.

1,437,886. Starting Induction Motors; J. Bruncken, Cologne-Bickendorf, Germany. App. filed Dec. 2, 1920. Two stators with two armatures upon a common shaft carrying a squirrel-cage winding.

1,437,901. Automobile Signal Device; S. O. Martin, St. Louis, Mo. App. filed Feb. 3, 1922.

1,437,961. Section Insulation and Switch; H. E. Conrad, Newark, N. J. App. filed July 15, 1920. Trolley wire sectionalizer for mine service.

1,437,986. Storage Battery; S. M. Meyer and W. James, Brooklyn, N. Y. App. filed Oct. 27, 1921. Construction of storage batteries to withstand shocks.

1,438,003. Electrical Switch Device; R. Varley, Englewood, N. J. App. filed Nov. 15, 1920. For rectifying current from low-frequency generators.

1,438,065. Trolley-Line Support; G. D. Slaymaker, Detroit, Mich. App. filed Oct. 1, 1921. Strain plates for overhead wiring system.

1,438,084. Eletric Battery; R. C. Benner and H. F. French, Fremont, Ohio. App. filed Feb. 12, 1920. Zinc electrode separated from other elements until cell is used.

1,438,085. Electric Battery; R. C. Benner and H. F. French, Fremont, Ohio. App. filed April 15, 1920. Dry cells of deferred-action type.

1,438,086. High-Voltage Copper-Oxide Depolarizer; R. C. Benner and H. F. French, Fremont, Ohio. App. filed July 15, 1920. Copper oxide depolarizer batteries.

1,438,106. Telephone Set; F. E. Gallagher, Santa Clara, Cal. App. filed July 19, 1921. Receiver and hook covered with felt to reduce noise.

1,438,107. Telegraph Transmitter Attachment; C. F. Gruetter, San Francisco, Cal. App. filed Feb. 12, 1921. Spring contacts.

1,438,110. Dry Cell and Process of Assembling the Same; C. Hambuechen, New York, N. Y. App. filed March 29, 1922. Protective layer adherent to the inner surface of zinc container.

1,438,121. Immersion Heater; J. F. McCloskey, Wilmington, Del. App. filed Aug. 17, 1921. Exposed element.

(Issued Dec. 12, 1922)

1,438,170. Telephone System with Flickering Recall; H. D. Currier, Chicago, Ill. App. filed Sept. 19, 1914.

1,438,174. Motor Control; G. Fornaca, Turin, Italy. App. filed Jan. 12, 1920. Remote control for automobile starter.

1,438,217. Means for and Method of Regulating the Transmission Over Electric Circuits; A. B. Clark, Brooklyn, N. Y. App filed Sept. 10, 1918. Communication system.

1,438,218. Means for and Method of Regulating the Transmission Over Electric Circuits; A. B. Clark, Brooklyn, N. Y. App. filed Sept. 10, 1918. Four-wire signaling system.

1,438,219. Means for and Method of Regulating the Transmission Over Electric Circuits; A. B. Clark, Brooklyn, N. Y. App. field Sept. 10, 1918. Communication system.

1,438,220. Means for and Method of Regulating the Transmission Over Electric Circuits; A. B. Clark, Brooklyn, N. Y. App. filed Sept. 10, 1918. Communication system.

1,438,253. Electric Oven; F. W. Moffat, Weston, Ontario, Can. App. filed June 14, 1920. Connections all made outside oven structure.

1,438,270. Means for Regulating the Transmission Over Four-Wire Circuits. S. P. Shackleton, New York, N. Y. App. filed Sept. 10, 1918. Communication system.

1,438,290. Process and Apparatus for Wireless Telegraphy and Telephony; W. E. Beakes, New Orleans, La. App. filed July 1, 1918. Operative length of antenna varied for different wave lengths.

1,438,306. Electrical Sign; A. C. Heiny, Flushing, N. Y. App. filed April 20, 1916. For flashing news, telegrams, etc.

1,438,329. Method of Forming an Aërial Conduit, an Aërial Conduit and Aërial Cable Ring; H. W. Pleister, Westfield, N. J. App. filed Nov. 4, 1920.

1,438,344. Sectional Lighting Furniture; A. J. Sweet, Milwaukee, Wis. App. filed Feb. 10, 1919. Fixtures readily altered to meet changes in requirements.

1,438,347. Receiving Apparatus for Radio Signals; R. A. Weagent, Douglas Manor, N. Y. App. filed March 6, 1920. Central control for receiving from several antennas.

1,438,361. Electric Motor; G. B. Coleman, San Francisco, Cal. App. filed Jan. 3, 1921. Variation of speed produced by varying air gap between stator and rotor.

1,438,381. Electric Reverberatory Furnace; R. M. Keeney, Denver, Col. App. filed Dec. 5, 1919. Electric current passes through automatically maintained shallow bed of material in closed smelting chamber.

1,438,422. Method of Making Armatures; V. G. Apple, Dayton, Ohio. App. filed May 7, 1918. Rear ends of conducting bars welded together.

1,438,423. Armature; V. G. Apple, Dayton, Ohio. App. filed May 20, 1918. Means of attaching commutator segments to armature conductors.

1,438,445. Electric Heater for Water and Other Liquids; G. E. Loubiere, Buenos Aires, Argentina. App. filed Dec. 21, 1921.

1,438,454. Battery Yerminal; H. R. Mitchell, Seattle, Wash. App. filed May 29, 1922. Raveling of insulation adjacent to tapered plug prevented.

1,438,497. Means for Holding Electrodes Used in Soldering and Depositing Metals by the Electric Arc; E. H. Jones, London, England. App. filed Feb. 25, 1920.

1,438,499. Socket Suspension Means; M. Klein, New York, N. Y. App. filed Nov. 6, 1920. Socket attached to horizontal flixture provided with flexible joint.

1,438,500. Stereoscopic X-Ray Apparatus; L. R. McDonald, Montreal, Quebec, Can. App. filed March 3, 1921.

1,438,508. Identification Device; H. F. Waite, New York, N. Y. App. filed Nov. 20, 1920. Finger printing with X-ray machine.

1,438,516. Combination Electrical Heater and Cooker; M. Butcher, Fernie, B. C. App. filed Feb. 20, 1922. Used for either cooking or room heating.

1,438,531. Flashlight; C. C. Keller, Ysylanti, Mich. App. filed June 18, 1921.

1,438,545. Electric Welding; J. B. Murray, and T. E. Murray, Jr., Brooklyn, N. Y. App. filed Oct. 3, 1921. Method of securing good pressure weld over lengthy surface.

1,438,552. Direction Signal for Automobiles; R. H. Quackenbush, Baldwinsville, N. Y. App. filed May 6, 1920.

1,438,554. Electrical Connector; M. W. Robertson, Belle Harbor, N. Y. App. filed June 24, 1920. Brush "pigtail" bound and soldered.

1,438,555. Annunciator Setting Device; S. D. Rose, Seattle, Wash. App. filed July 31, 1920.

1,438,557. Automatic Telephone System; F. W. Scharf, Sioux City, Iowa. App. filed Aug. 4, 1913. Trunk pre-selector provides idle trunk line that is maintained in selective condition.

1,438,567. Wireless Signaling Apparatus; R. E. Winstanley, Jr., Boston, Mass. App. filed Feb. 1, 1919. Automatic equipment for small boats which dispenses with trained operator.

1,438,576. Signal; H. M. Browne, Washington, D. C. App. filed May 14, 1921. Automobile direction signal.

1,438,602. Waffle Iron; H. Kruesheld, Mansfield, Ohio. App. filed July 15, 1920. Electrically heated.

1,438,612. Pantograph Trolley; W. Schaake, Pittsburgh, Pa. App. filed Feb. 15, 1919. Extended and retracted at predetermined speeds.

1,438,616. Speed-Regulator System; S. A. Staege, Pittsburgh, Pa. App. filed April 9, 1919. Fly-ball governor maintains constant motor speed.

1,438,621. Detachable Circulating Water-Heater Unit; F. Thornton, Jr., Mansfield, Ohio. App. filed July 19, 1920. Semi-tubular resistor-supporting members.

1,438,624. System of Control; A. D. Webster, Wilkinsburg, Pa. App. filde May 14, 1921. Relay governs operation of circuit breaker that responds to overload conditions.

1,438,635. Temperature-Controlling System; O. A. Colby, Irwin, Pa. App. filed Aug. 18, 1921. Two heating elements connected for either series or parallel operation.

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220 Volt D. C. Motors

	Hp.		Speed
1	1	G. E., type RC, interp'le	1700
1	1	Westinghouse	1650
2	1	Western Elec	1300
1	1	G. E., type CQ	1275
1	1	Allis-Chalmers, type K	1200
4	1	G. E. type RC, comp., interpole	1150
1	1	Northern	1150
1	1	Emerson, 6-pole, comp	1100
1	1	Fairbanks-Morse	1050
1	1	Browning	995
2	1	Fairbanks-Morse, MP, comp	800
1	1	Peerless, interpole, variable speed	440-900
1	1½	Crocker-Wheeler, form L, comp	1175
1	1½	Watson, comp	900
2	1½	G. E., RC, interpole	850
2	2	Gen Elec, type CQ	2300
1	2	Westinghouse, type S	2200
1	2	G. E., RC, interpole	1700
1	2	G. E. type CQ	1650
1	2	Westinghouse	1200
3	2	Allis-Chalmers type K	1200
1	2	Crocker-Wheeler, form L comp	1200
2	2	G. E., type RC, interple	1150
1	2	G. E., type CE	1100
2	3	Peerless, MP	1880
2	3	G.E., type CVC, interp	1800
2	3	G. E, type RC, interpole	1700
5	3	G. E., type RC, new, comp	1700
1	3	G. E. type CQ	1100
1	3	Crocker-Wheeler, form L.	1050
1	3	Allis-Chalmers, type K	1025
2	3	G. E., type RC, new, interpole	850
4	3	Gen. Elec., type RF-9, shunt, interpole, adjustable speed	450-1350

220 Volt D. C. Motors

	Hp.		Speed
1	4	Fairbanks-Morse	1500
1	4	G. E., type RLC shunt, interpole, variable speed with comp starter	500-1500
1	5	Watson	1750
2	5	Peerless, comp	1740
1	5	G. E., type CVC, interp.	1650
1	5	Westinghouse	1600
1	5	Westinghouse, MP, type S	1400
2	5	Peerless	1170
1	5	G. E., type RC, inter pole 50°	1150
4	5	G. E., type CQ	1100
1	5	G. E., type CVC, interpole	1100
2	5	Allis-Chalmers, type K	1050
1	5	Crocker-Wheeler, form L	960
1	5	Northern	800
1	5	Peerless, comp	725
3	5	G. E., type LC, shunt, interpole, variable speed	475-1425
2	5	Gen Elec., type RF, interpole, adjustable speed with reversible drum type controller	450-1350
1	5	Northern, back-gd	850-158
1	6	Westinghouse, type S	1465
1	6	Fairbanks-Morse, comp.	1175
1	7½	G. E., type RC 50°, interpole	1700
5	7½	Westinghouse, type SK, interpole	1700
1	7½	G. E., MP, type CQ	1200
6	7½	Gen Elec., type RC, interpole	1150
2	7½	G. E., MP, type CE	875
6	7½	Northern	850
1	7½	Westinghouse, type SK, interpole	850
5	7½	G. E., type LC, shunt, interpole, variable speed	500-1000

220 Volt D. C. Motors

	Hp		Speed
3	7½	Electro-Dynamic, frame 58, shunt, interpole, variable speed	450-1350
1	10	Browning	1700
1	10	G. E., type RC, interpole	1700
1	10	Westinghouse, type S	1325
1	10	G. E., type CVC, intple.	1250
1	10	Fairbanks-Morse	1200
1	10	G. E., type CQ	1200
1	10	Ft Wayne, MP, type EF	875
3	10	Westghse., SK, interpole	850
1	10	Westghse., type SK, interpole, variable speed	850 1700
6	10	Northern, MP, type B, comp	750
1	10	Westghse., type SK, comp., interpole	725
1	10	G. E., comp., interpole, variable speed	625-1250

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1118-1120 Clinton Street, Hoboken, N.J.

A. C. MOTORS
3-Ph., 60-Cy.

No.	Hp.	Rpm.	Volts	Make
1	250	900	2200/550	Wstg. C.W. sl. rg.
2	200	900	220/440	G. E., L
1	200	720	220/440	Cr. Wh., sl. rg.
2	200	600	2200	Cr. Wh., sl. rg.
1	100	900	220/440	Westg., sl. rg.
1	100	600	2200	Westg., F, sl. rg.
2	100	720	220/440	G. E., K
1	75	900	220/440	Cr. Wh., sq. cg.
1	75	900	220/440	Allis-Chal., ANY
1	75	720	220/440	G. E., K
1	75	600	440	G.E. K.
3	50	900	220/440	Cr.-Wh. & G. E.
1	50	720	440	G. E., sl. rg.
2	35	900	220/440	G. E., sq. cage
1	30	900	220/440	Westg., MS
1	30	1800	220/440	Westg., CW
1	25	1200	220/440	West., CS
1	25	1200	220/440	G. E. K.
1	25	900	220/440	Cr.-Wh.
1	25	600	220/440	G. E.
1	10	1200	220/440	G. E., K. T.
6	2	1800	220	G. E. & West.

2-Phase Motors on request

A. C. Generators

No.	Kw.	Rpm.	Volts	Make
1	100	900	220/440/600	Cr.-Wh.

D.C. Motors, 230-Volt

No.	Hp.	Rpm.	Make
1	250	500	G. E.
4	50	1250	Allis-Chal.
1	50	700	West.
1	50	1075/230	G. E. RC
1	35	875	West.
1	25	1300	Sprague
4	25	600 1200	Allis-Chal.
1	15	1250	Allis-Chal.
1	10	1200	Allis-Chal.
5	10	275/1575	Allis-Chal.

D.C. Motors, 125-Volt

3	20	650	Allis-Chal.
1	15	775	SK. West.
2	7½	1100	G. E.
1	5	700	Diehl
3	3	1100	G. E.
2	3	1700	G. E.

D.C. Generators, 250-Volt

1	200	575	G. E.
1	100	675	G. E.
1	50	600	West.
1	30	1000	West.
2	15	900	Allis-Chal.

Turbo Generators

1—625-kva., 3600 r.p.m., 220/440-v., 60-cy. Gen. Elec. condensing bleeder type with direct connected exciter, excellent condition.
1—187-kva. Westg. non-cond., 2- or 3-ph., 220-440-v., 3600 r.p.m., in operation about 2 yrs.
1—150-kw., 900 r.p.m., 125/250-v., 3-wire De Laval Turbine Set.

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5, 10, 20, 25, 40, 50 Kw.

Engine Generator Sets

1—200-kw., 125/250-v., Gen. Elec. 3-wire, 200-rev. gen., 15 and 26 x 17 McIntosh & Seymour tand. cpd. engine.
1—200-kw., 250-v., Gen. connected to Allis-Chal., 18 x 36 right-hand Corliss Engine.
1—150-kva., Cr.-Wh., 220/440-v., 3-ph., 60-cy. Skinner tand. cpd. engine set.
1—125-kva., G. E. A.T.B., 2200/220 connected to Skinner 11 x 18½ x 16 Engine, complete.
1—100-kw., 125- or 250-v., 2-wire, D.C. Westinghouse, R.H. gen. conn. to Harrisburg std. tand. cpd., 11 x 18 x 13 engine, 275 r.p.m., complete.
1—100-kw., General Electric, 250-v., 260 r.p.m. gen., with Ball 13 x 16 non-condensing Eng.
1—50-kw., 125-v. Westghse., R.H., gen. con-r.p.m., compl'te with swbd. & steam separator.

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nected to Harrisburg 13 x 12 std. engine, 300
300-kw., 720-rev., 125/250-v., 3-unit set consisting of (2) 150-kw., 125-v., D.C., G. E. gen. (1) 450-hp., 440/2300-v. motor.
200-kw., 600-rev., 250-v., Gen. Elec Gen., 350-hp., 440/2300-v. syn.
100-kw., 250-v. Gen. Elec. Gen., 720 r.p.m., 220/440-v. syn. motor.
50-kw., 720-rev., 250-v. West. Gen., 75-hp., 220/440-v. motor.
10-20-25-40-kw., 125-v. Exciter Sets.

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Gen. **500-kw., 250-volt, 450-r.p.m. Gen. Elec., comp. wd., int'pole**
Motor, **900-hp., 2300-volt, 450-r.p.m., 3-phase, 60-cycle synchron.**

Note—Two of the above sets in stock.

(Each complete with starter, rheostat, etc.)

Gen. **250-kw., 250-volt, 900-r.p.m. Gen. Elec., comp. wd.**
Motor, **375-hp., 2300-volt, 900-r.p.m., 3-ph., 60-cy. Gen. Elec., syn.**

Gen. **250-kw., 250-volt, 720-r.p.m. Gen. Elec., interpole.**
Motor, **375-hp., 2300-volt, 720-r.p.m., 3-ph., 60-cy. Gen. Elec., synchron, with direct connected exciter.**

Gen. 185-kw., 550-volt, 600-r.p.m. Gen. Elec. "CLB", 6-pole.
Motor, 300-hp., 2300-volt, 600-r.p.m., 3-ph., 60-cy. Gen. Elec.,"ATI" syn

Gen. 50-kw., 250-volt, 900-r.p.m., comp. wd. "RC" Gen. Elec.
Motor, 75-hp., 440-volt, 900-r.p.m. Gen. Elec., 3-ph., 60-cy. "KT"

Gen. 50-kw., 125-volt, 900-r.p.m., comp. wd. Gen. Elec., "DLC"
Motor, 75-hp., 440/220-volt, 900-r.p.m., 3-ph., 60-cy. Gen. Elec. "KT"

Gen. 15-kw., 250-volt, 1140-r.p.m., comp. wd. Cr.-Wh., "CCD"
Motor, 25-hp., 440 220-volt, 1140-r.p.m., 3-ph., 60-cy., sq. cage

The above is a partial list; quotations covering other machines upon request

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Stock Nos. 1413, 1414. Two Practically New, 300-kw., 250-volt, 1200-r.p.m., 3-phase, 60-cycle, Allis-Chalmers, interpole, each complete with Field Rheostat, end play and speed limit devices, and each with three 125-kva., 13,200-volt, primary (also 2300-volt, primary), single phase, 60-cycle transformers and A.C. and D.C. Switch Board Panels.

60-CYCLE MOTORS

Stk. No.	*Hp.*	*Volts*	*Speed*	*Ph.*	*Cy*	*Make and Type*
608	500	2200	600	3	60	G. E., "M", slip ring, 3-bearing
Cons.	400	440	450	3	60	Westghse., "CW", slip ring, 2-bear.
Cons.	250	2200	900	3	60	Westghse., slip ring, "CW", 3-bearing
Cons.	250	550	900	3	60	Westghse., slip ring, "CW", 3-bear
6321	60	440 220	600	3	60	G. E., "M", slip ring.
1389	50	550	860	3	60	Westinghouse, "CCL", sq. cage
1387	50	550	1160	3	60	G. E., "KT," sq. cage
1388	40	550	1200	3	60	G. E., "KT", sq. cage
826	25	440 220	1200	3	60	Westghse., "CCL", sq. cage
1239	22	440 220	1200	3	60	G. E., "ITC", inter. duty
1025	10	220	1200	2	60	Allis-Chal., sq. cage
1273	10	440 220	1200	3	60	G. E., "KT", sq. cage
6721	7½	220	1200	2	60	G. E., "KT", sq. cage
(5)	6	440	1800	3	60	G. E., "KT", sq. cage (mult. speed) 600 900 1200 1800

The above is a partial list; quotations covering other machines upon request

25-CYCLE MOTORS

Stk. No.	*Hp.*	*Volts*	*Speed*	*Ph.*	*Cy.*	*Make and Type*
806	300	440	500	3	25	G. E., "M", slip ring, 3-brg.
1354	57	440/220	750	3	25	Westghse., sq. cage
822	40	440 220	750	3	25	Burks, sq. cage
1342	35	440 220	750	3	25	G. E., "K", sq. cage
1353	35	440 220	750	3	25	G. E., "K", sq. cage
1357	25	440 220	750	3	25	Westghse., slip ring
7231	20	440 220	750	3	25	G. E., 'M", slip ring
8231	20	440 220	750	3	25	G. E., "M", slip ring
9231	20	440 220	750	3	25	G. E., "M", slip ring
1344	20	440 220	750	3	25	Westghse., sq. cage
0331	20	440 220	750	3	25	G. E., "M", slip ring
1451	20	440 220	750	3	25	Westghse., "CX", sq. cage
1240	10	440 220	750	3	25	G. E., "MT", slip ring
835	10	440 220	750	3	25	Burke, "EM", sq. cage
1315	10	440 220	750	3	25	Westghse., sq. cage
1339	10	440 220	750	3	25	G. E., "KT", sq. cage
1340	10	440 220	750	3	25	Westghse., sq. cage

25-CYCLE MOTORS—Continued

Stk. No.	*Hp.*	*Volts*	*Speed*	*Ph.*	*Cy.*	*Make and Type*
1352	10	440 220	750	3	25	G. E., "KT", sq. cage
1358	10	440 220	750	3	25	Allis-Chal., sq. cage
1337	7½	440 220	750	3	25	G. E., "KT", sq. cage
1341	7½	440 220	750	3	25	G. E., "KT", sq. cage
1359	7½	440/220	750	3	25	G. E., "KT", sq. cage
836	7½	440 220	750	3	25	Burke, "EM", sq. cage
(3)	5	440 220	1500	3	25	G. E., "KT", sq. cage
(4)	5	440 220	750	3	25	Burke, "EM", sq. cage
(1)	5	440 220	500	3	25	G. E., "KT", sq. cage

The above is a partial list; quotations covering other machines upon request.

D. C. MOTORS

Stk. No.	*Hp.*	*Volts*	*Speed*	*Make and Type*
1360	500	230	440	G. E. (Spr.), "C", interpole, 3-brg.
1361	500	230	440	G. E. (Spr.), "C", interpole, 3-brg.
1631	250	115	210	G. E. (Spr.), "C", interpole, 3-brg.
0630	230	115	210 420	G. E. (Spr.), "C", interpole, 3-brg.
2631	75	115	600	G. E. (Spr.), "C", interpole
209	60	115	650	G. E., "DLC", interpole
1362	60	115	500/700	G. E. (Spr.), "C", interpole
902	50	115	650	G. E., "DLC", interpole
952	35	500	650	G. E., "CLB"
1124	30	230	725/1000	G. E. (Spr.), "LC", interpole
1011	30	230	1200	G. E. (Spr.), "LC", interpole
1125	25	230	750/1000	G. E. (Spr.), "LC", interpole
1126	20	230	1150	G. E., "RC", interpole
1127	20	230	1150	G. E., "RC", interpole
1128	20	230	1150	G. E., "RC", interpole
(2)	5	230	975	G. E., "RC", interpole

The above is a partial list, quotations covering other machines upon request.

D. C. GENERATORS

Stk No.	*Kw.*	*Volts*	*Speed*	*Make and Type*
9630	400	250	500	G. E. (Spr.), "C", interpole, 3-brg.
8631	200	125	230	G. E. (Spr.), "C", interpole, 3-brg.
7631	60	125	650	G. E. (Spr.), "C", interpole
2902	40	125	750	G. E., "DLC", interpole
839	30	550	750	G. E., "CLB"
2211	30	250	850	G. E. (Spr.), "LC", interpole
7122	25	250	825	G. E. (Spr.), "LC", interpole
6211	17½	230	1150	G. E., "RC", interpole
9211	15	230	1150	G. E., "RC", interpole
1311	12½	250	950	G. E., "RC", interpole
2311	10	250	975	G. E., "RC", interpole
7979	7½	125	950	G. E., "RC", interpole
879	5	125	950	G. E., "RC", interpole

The above is a partial list; quotations covering other machines upon request.

A. C. DIRECT CONNECTED UNIT

1 125-kva., 2300-volt (will reconnect for either 220 or 440-volt), 200-r.p.m., 3-phase, 60-cycle General Electric, Type ATB, revolving field Generator direct connected to 16 in. x 18 in., side crank Erie City Simple Engine, with accessories.

A. C. BELTED GENERATORS

Stk. No.	*Kva.*	*Volt*	*Speed*	*Ph.*	*Cy.*	*Make and Type*
Cons.	375	2300	450	3	60	G. E. "ATB"
1411	312	2300	600	3	60	G. E. "TRB"
1404B	187½	2300	720	3	60	G. E., "ATB", complete
1489	125½	2300	900	3	60	G. E., "ATB", complete
1405	125	2200	900	3	60	Allis-Chal., rev. field
1406	100	2200	900	3	60	Allis-Chal., rev. field
1016	60	240 480	1200	3	60	Westinghouse, complete
1424	60	2300	1200	3	60	Ideal revolv. field, complete

SYNCHRONOUS CONDENSERS

Stock Nos. 1503, 1503: (2) New, 700-kva., 900-hp., 2300-volt, 450-r.p.m., 3-ph., 60-cy. revolving field, self-starting, two-bearing Electric Machinery Co., each self-starting, and complete with starting apparatus

"New Motors in Pittsburgh Stock"

D.C. MOTORS

Qu.	Hp.	Rpm.	Volt	Make	Type	Wind	Tem
		115 Volt					
2	2	1180	115	Wghse.	CD	Cpd.	40
2	3	1725	115	Wghse.	CD	Cpd	40
2	15	1150	115	G. E.	RC	Cpd	40
		230 Volt					
1	1	1725	230	Wghse	CD	Cpd	40
2	1	1150	230	G. E.	RC	Cpd	50
2	1½	900	230	Wghse	CD	Cpd	50
1	2	1140	230	Wghse	CD	Cpd	40
2	2	1725	230	Wghse	CD	Cpd	40
7	2	1150	230	G. E.	MC	Cpd	40
1	2	1200	230	C.-W.	CCM	Cpd	40
6	3	1150	230	G. E.	MC	Cpd	40
2	3	1700	230	G. E.	MC	Cpd	40
2	3	1725	230	Wghse	CD	Cpd	40
2	3	1725	230	Wghse	CD	Cpd	40
		(Semi enclosed)					
6	3	1100	230	C.-W.	CCM	Cpd	40
3	3	1800	230	C.-W.	CCM	Cpd	40
1	5	960	230	C.-W.	CCM	Cpd	40
1	5	1700	230	G. E.	MC	Cpd	40
1	7½	850	230	G. E.	RC	Cpd	40
1	7½	1150	230	G. E.	RC	Cpd	50
4	7½	1425	230	C.-W.	CCM	Cpd	40
1	10	1150	230	Wghse.	SK	Cpd	40
1	15	1250	230	Wghse	SK	Cpd	40
1	15	400-1600	230	Reliance		Cpd	40
1	30	1700	230	Reliance		Shunt	40
1	35	1650	230	Reliance		Cpd	40
1	40	1700	230	Wghse.	SK	Cpd.	40
1	50	1100	230	Wghse	SK	Cpd.	40
1	50	1700	230	Wghse	SK	Cpd.	40
1	60	1700	230	Wghse	SK	Cpd.	50
		(Variable speed)					
2	75	1700	230	Wghse.	SK	Cpd	40
		550-Volt					
3	2	1250	550	G. E.	MC-2	Cpd	40
4	2	1350	550	Wghse	CD	Cpd	
				3 are 50; others are			40
1	3	1200	550	Wghse	SK	Cpd.	40
1	3	1800	550	G. E.	MC	Cpd	40
8	3	1250	550	G. E.	MC	Cpd	40
2	3½	900	550	Wghse	SK	Cpd	55
		(Totally enclosed)					
4	2	1490	550	C.-W.	CCM	Cpd	40
10	5	1200	550	C.-W.	CCM	Cpd.	40
12	3	1340	550	C.-W.	CCM	Cpd.	40
1	5	1925	550	C.-W.	CCM	Cpd.	40
2	5	1800	550	G. E.	MC-3	Cpd.	40
12	5	1250	550	G. E.	MC	Cpd.	40
1	5	1300	550	G. E.	RC	Cpd.	40
2	5	720	550	Wghse	SK	Cpd.	55
		(Totally enclosed)					
	5	850	550	Wghse.	SK	Cpd.	55
		(Totally enclosed)					
1		1150	550	Wghse	SK	Shunt	40
3	7½	1300	550	G. E.	RC	Cpd.	50
1	7½	950	550	C.-W.	CCM	Cpd.	40
3	10	1800	550	G. E.	RC	Cpd.	40
[illegible]	10	1150	550	Wghse	SK	Cpd.	40
[illegible]	10	1700	550	Wghse	SK	Cpd.	40
2	15	825	550	Wghse	SK	Cpd.	40
1	20	1020	550	Wghse	S	Cpd	40
		(Second Hand)					
1	25	820	550	Wghse	SK	Cpd	40
1	30	1700	550	Wghse	SK	Cpd	40
1	30	900	550	G. E.	RC	Shunt	50
1	40	875	550	G. E.	RC	Cpd.	50
1	40	1750	550	Reliance		Cpd	40
2	50	1750	550	Wghse	SK	Cpd	40
		(Rebuilt)					
1	50	1700	550	Wghse	S	Cpd	40
1	6-kw	1850	125	G. E.	ML	Shunt	
						Generator	

SINGLE PHASE

110 220-Volt, 60-Cycle, 40-Deg.

Qu.	Hp	Rpm	Make
3	⅓	1750	Century
2	½	1750	Century (Vertical)
1	½	1140	Wagner
2	½	1725	Wagner (one used)
2	¾	1165	Century
2	1	1165	Century
6	1	1725	Wagner
2	1	1165	Wagner
9	1½	1725	Wagner
2	1½	1165	Century
3	1½	1750	Century
10	2	1165	Century (one second hand)
1	2	1750	Century
9	2	1150	Wagner
1	2	1750	Wagner
6	3	1750	Wagner
4	3	1160	Wagner
11	3	1750	Century (one used)
1	3	1165	Century
1	5	1165	Wagner
6	5	1740	Wagner
1	10	1165	Century

A.C. MOTORS

3-Phase, 110-220-440-Volt, 60-Cycle

Qu.	Hp.	Rpm	Volt	Make	Type	Tem
1	25	1200	220	G. E.	KT	50
1	25	1750	220	Wghse.	CS	40
1	30	1160	220	Wghse.	CW	40
		(Slip ring)				
1	30	1800	220	G. E.	KT	50
1	30	865	220	Allis-C.		40
		(Slip ring)				
1	40	1800	220	G. E.	KT	50
2	50	1800	220	G. E.	KT	50
1	60	1800	220	G. E.	KT	50
1	100	1750	220	Wghse.	CS	40
2	1	1800	440	G. E.	KT	50
2	1	1200	440	G. E.	KT	50
3	3	1160	440	Wghse.	CS	50
2	3	1130	440	C.-W.	.	40
2	3	1800	440	Lincoln	.	40
1	3	1200	440	G. E.	KT	50
10	3	1800	440	G. E.	KT	50
1	5	1750	440	Wghse.	CS	50
3	5	1720	440	C. W.		40
14	5	1800	440	G. E.	KT	50
3	5	1200	440	G. E.	KT	50
9	5	900	440	G. E.	KT	50
4	7½	1750	440	Wghse.	CS	50
11	7½	1800	440	G. E.	KT	50
		(Three are 40 deg.)				
1	7½	1200	440	G. E.	KT	50
1	10	1800	440	G. E.	KT	50
1	20	1200	440	G. E.	KT	50
1	25	1200	440	G. E.	KT	40
1	30	1160	440	Allis-C.	. . .	40
		(Slip ring)				
1	35	720	440	G. E.	I-K	40
2	40	1200	440	G. E.	KT	50
1	60	1800	440	G. E.	KT	50
2	150	1800	440	G. E.	KT	50
1	200	1800	440	G. E.	I-K	40
		3-Phase, 2200-Volt, 60-Cycle, 3-Phase				
1	75	1800	2200	G. E.	I-K	40
2	150	1800	2200	G. E.	KT	50

2-Phase, 110-220-Volt, 60-Cycle

Qu.	Hp.	Rpm.	Volt	Make	Type	Tem
1	1	1200	110	G. E.	KQ	40
6	1	1800	220	G. E.	KQ	50
1	1½	1800	220	G. E.	KQ	50
1	2	1725	220	Wghse.	CSA	40
1	7½	1800	220	G. E.	KQ	40
1	15	1800	220	G. E.	KQ	40

(Rebuilt)

3-Phase, 110-220-440-Volt, 60-Cycle

Qu.	Hp.	Rpm.	Volt	Make	Type	Tem
1	1	1200	110	G. E.	KT	50
1	1	1140	220	C.-W.	. . .	40
2	1	1200	220	G. E.	KT	50
1	1	1750	220	R. & M.	. . .	40
9	1	1800	220	G. E.	KT	50
1	1	3600	220	G. E.	KT	40
2	1½	1800	220	G. E.	KT	50
1	2	1750	220	Swaby vertical		40
7	2	1200	220	G. E.	KT	50
1	2	1160	220	Wghse.	CS.	50
1	3	1200	220	G. E.	KT	40
4	3	1200	220	G. E.	KT	50
1	3	1160	220	Wghse.	CS	50
2	3	1710	220	C.-W.	. .	40
2	3	1800	220	G. E.	KT	50
12	5	1800	220	G. E.	KT	50

HARRIS PUMP & SUPPLY CO.

316-318-320-322 Second Ave.
319-321 First Avenue

Pittsburgh, Pa.

THE RANDLE MACHINERY COMPANY, *ESTABLISHED 36 YEARS*

1822 Powers Streets, CINCINNATI, OHIO

A. C. GENERATORS

Belted and Direct Connected

1—5000-kw. General Electric Vertical, 3-phase, 60-cycle, 4500-volt Turbo Generator Set, with condenser and accessories.
1—1200-kw. General Electric, 3-phase, 60-cycle, 250-volt Generator, direct connected to Filer & Stowell, cross compound, Corliss Engine.
1—600-kw. General Electric 3-phase, 60-cycle, 250-volt Generator, direct connected to an 18 x 42 x 36 Filer & Stowell Corliss Engine.
1—500-kw Westinghouse, 3-phase, 60-cycle, 2300-volt Generator, direct connected to a 26 x 42 Hamilton Corliss Engine
1—350-kw. Westinghouse, 3-phase, 60-cycle, 220-volt Generator, direct connected to a 26 x 42 Murray Corliss Engine.
1—300-kw. General Electric, 3-phase, 60-cycle 2300-volt Turbo Generator Set, condensing
1—250-kw Westinghouse, 3-phase, 60-cycle, 220-volt Alternator, direct connected to a 22 x 42 Murray Heavy Duty Corliss Engine.
1—250-kva. Allis-Chalmers, 3-phase, 60-cycle, 2300-volt, 600-r p m belted type Alternator
2—200-kw each, DeLaval-Bullock, 3-phase, 60-cycle, 220-440-volt Turbo Generator Sets, with condensers and accessories.
1—125-kva Ft Wayne, 3-phase, 60-cycle, 1150-2300-volt Generator, direct connected to a 15 x 16 Erie-Ball Automatic Engine, with accessories
1—100-kw General Electric, 3-phase, 60-cycle, 220-volt, 3600-r.p.m Turbo Generator Set, with condenser and accessories
1—62½-kw Lincoln, 3-phase, 60-cycle, 480-volt Generator, direct connected to an 11 x 12 Chandler & Taylor Automatic Engine.

D. C. GENERATORS

Belted and Direct Connected

1—510-kw Crocker-Wheeler, 300-volt, compound wound Generator, direct connected to a 19 x 40 x 36 McIntosh & Seymour Engine
1—300-kw Triumph, 250-volt compound wound Generator, direct connected to a 15 x 28 x 30 Hamilton Cross Compound Corliss Engine
1—250-kw Triumph, 125-volt Generator, direct connected to a 22 x 20 Skinner Automatic Engine (Can be rewound for 250 volts
2—150-kw. Westinghouse, 275-volt 200-r p m Generators, each direct connected to an 18 x 19 Fleming-Harrisburg Automatic Engine
1—125-kw Fort Wayne, 230-volt, compound wound Generator, direct connected to a 17 x 16 Skinner Automatic Engine.
1—100-kw. Triumph, 125-volt, 675-r.p.m., compound wound, belted type Generator.
1—75-kw Ft Wayne, 250-volt, compound wound Generator, direct connected to a Skinner Automatic Engine.
1—38½-kw Western Electric, 250-volt, compound wound Generator, direct connected to a 9 x 12 Skinner Engine.
1—35-kw. Triumph, 125-volt, compound wound, Generator, direct connected to a 9 x 12 Skinner Automatic Engine
1—22½-kw Allis-Chalmers, 120-volt, 187 5 amps 925-r p m. compound wound, belted type Generator
1—20-kw Western Electric, 1250-r p.m., 120-volt, compound wound, belted type Generator.
1—17½-kw Triumph, 125-volt, 140-ampere, 1250-r.p.m., compound wound, belted type Generator

BOILERS

6—1040-hp. Edgemore, ASME code, 200-lb. pressure
8—520-hp. Stirling, 175-lb pressure.
3—250-hp Franklin, Heine type, 150-lb pressure.
3—207-hp Geary, Heine type, 175-lb. pressure.
2—175-hp. Atlas, 150-lb. pressure.
1—175-hp., 78 x 18, high pressure, H.R.T.
4—150-hp., 72 x 18, high pressure, H.R.T.
5—125-hp., 72 x 16, high pressure, H.R.T.
2—100-hp., 66 x 16, high pressure, H.R.T.
2—100-hp., 66 x 16, standard, H.R.T.
1— 80-hp., 60 x 16, high pressure, H.R.T.
1— 60-hp., 54 x 14, high pressure, H.R.T.
1— 50-hp., 48 x 120, high pressure, Vertical.
1— 75-hp., high pressure, Fire Box.
1— 40-hp., high pressure Fire Box.
2— 25-hp., 42 x 95, new Vertical, 125-lb pressure.
1— 15-hp., 36 x 83, new Vertical, 100-lb pressure.
1— 10-hp., 30 x 83, new Vertical, 100-lb. pressure.

STEAM ENGINES

1—26 x 48 Vilter left-hand Corliss.
1—17 x 34 x 48 Hamilton, Corliss Comound, heavy duty, Corliss, designed for rope drive.
1—22 x 42 Hamilton heavy duty Corliss
1—22 x 42 Allis heavy duty Corliss
3—18 x 36 Allis-Chalmers, heavy duty, Corliss.
1—16 x 16 Lane & Bodley Slide Valve.
1—14 x 18 Erie City Iron Works Automatic.
1—13 x 16 Erie City Iron Works Automatic.
1—13 x 16 Chandler & Taylor Slide Valve.
2—10 x 12 Valley Iron Works Automatic.
1—10 x 12 Chandler & Taylor Slide Valve.
1— 9 x 12 Skinner Automatic.

Also many other sizes.

MOTOR GENERATOR SETS

2—500-kw. Westinghouse, 250-volt, D.C., 720-hp. 3-phase, 60-cycle, 2300-volt Synchronous Motor Generator Sets.

ROTARY CONVERTERS

2—200-kw. Westinghouse, 250-volt, D.C.; 3-phase, 60-cycle, Rotary Converters.

A. C. MOTORS

3-Phase, 60-Cycle

Squirrel Cage and Slip Ring

No.	Hp.		Make	Volts	Rpm.
12	7½	New	General Electric	220	1800
6	10	New	General Electric	220	1200
2	15	New	Fairbanks-Morse	440	1750
5	15	New	General Electric	220	1200
1	20	Used	Fairbanks-Morse	220	1200
5	20	New	General Electric	220	1200
5	25	New	General Electric	220	1200
1	25	New	G. E. (Slip Ring)	220	1200
3	30	New	General Electric	220	1200
4	40	New	General Electric	220	1200
[illegible]	50	New	General Electric	220	900
1	50	Rebuilt	General Electric	220	900
3	50	New	G. E. (Slip Ring)	440	900
3	75	New	G. E. (Slip Ring)	220	900
3	100	New	G. E. (Slip Ring)	220	900
1	100	Rebuilt	Westinghouse	220	1200
2	150	New	G. E. (Slip Ring)	440	720
1	200	Used	General Electric	2200	514
1	250	New	A.-C. (Slip Ring)	2200	514
1	275	Used	G. E. (Slip Ring)	240	600
1	960	New	G. E. Synchronous	550	720

Also many other sizes and types

Any of the above 220 volt motors can be furnished for 440 volt, or vice versa.

D. C. MOTORS

No.	Hp.		Make	Volts	Rpm.
1	50	Rebuilt	Allis-Chalmers	250	800
1	40	Rebuilt	Jantz & Leist	250	800
3	30	Used	Jantz & Leist	250	600
1	20	Rebuilt	Triumph	250	965
1	15	Rebuilt	Minneapolis	110	350
1	12½	Rebuilt	Minneapolis	220	950
1	7½	Rebuilt	Jantz & Leist	220	800
2	5	Rebuilt	Triumph	220	1350
1	5	Rebuilt	Jantz & Leist	220	900
2	4	Rebuilt	Triumph	110	1025

Also many other sizes and types.

OUR SHOPS AND EXPERIENCE ARE AT YOUR SERVICE

MAC GOVERN & COMPANY, INC.
POWER MACHINERY
114 Liberty St. New York, N.Y.

Offerings for Prompt Shipment

Turbo-Generator Units—60 Cycle

100 kw. General Electric-Curtis, non-condensing, 2200 volts, 3600 r.p.m., 150 lbs. steam pressure, with dir. conn. exciter and complete switchboard equipment.

187 kva. Westinghouse-Parsons, non-condensing 240 volts, 3600 r.p.m., 125 lbs steam pressure, with dir. conn. exciter.

500 kw. Allis Chalmers, non-condensing, 480 volts, 3600 r.p.m. 140 lbs. steam, 5 lbs. back pressure with dir. conn. exciter and complete switchboard equipment.

500 kw. Westinghouse-Parsons, condensing, 2400 volts, 3600 r.p.m., 170 lbs. steam, 28 in. vacuum with dir conn exciter, switchboard equipment and condenser with accessories.

500 kw. General Electric-Curtis, condensing 480 volts, 3600 r.p.m., 135-150 lbs. steam, with dir. conn. exciter.

1000 kw. Westinghouse-Parsons, condensing 2300 volts, 3600 r.p.m., 175 lbs. gauge at throttle.

1000 kw. Allis-Chalmers, condensing, 6600 volts, 1800 r.p.m., 150 lbs. steam parallel flow, reactance type with dir. conn exciter, switchboard, condenser and auxiliaries.

1200 kw. Allis-Chalmers, non-condensing, 480 volts, 3600 r.p.m., 150 lbs. steam, 5 lbs. back pressure with dir. conn. exciter.

1250 kw. Westinghouse-Parsons, condensing 480 volts, 3600 r.p.m. 150 lbs. steam, with surface condenser and auxiliaries.

Rotary Converters

2—300 kw. Westinghouse rotary converters 6 phase, 25 cycle, 250 volts, 750 r.p.m., self exciting 250 volts D.C., 1200 amps. D.C. With each rotary there is one 300 kva. Westinghouse transformer, 3 phase, 13,000/192 volts, complete with oil.

These machines have been used only six months.

1—300 kw. Westinghouse rotary converter, 6 phase 60 cycle compound wound, interpole, 250 volts D.C 1200 amps D.C 1200 r.p.m., with three 110 kva. Westinghouse type SKR transformers, single phase, 6600 6300 6000 to 189 61.5 volts.

A. C. Engine-Generator Units

100 kva. Westinghouse, 2 ph., 60 cy., 240 v., 277 r.p.m., dir. conn. to 13 in. x 15 in. Skinner side crank engine, with belted exciter and complete switchboard.

125 kva. Crocker-Wheeler, 3 ph., 60 cy., 2300 v., 257 r.p.m., dir conn. to 11 in. and 22 in. x 14 in. Watertown T. C. engine, with dir. conn. exciter and switchboard equipment

150 kw. Allis-Chalmers, 3 ph., 60 cy., 2300 v., 225 r.p.m., dir. conn. to 19 in. x 20 in. Skinner Universal uniflow engine.

312 kw. General Electric, 3 ph., 60 cy., 2300 v., 120 r.p.m., dir. conn. to 20 in. x 36 in. Murray-Corliss rolling mill type engine, with belted exciter.

500 kw. Westinghouse, 3 ph., 60 cy. 2300 v., 120 r.p.m., dir conn. to 26 in x 42 in. Hamilton-Corliss engine.

Also Boilers, Condensers, etc. ***Wire for Prices***

NOTHING BUT GOOD EQUIPMENT

New and Used—Guaranteed Condition—Ready to Ship

Slip Ring Motors—3-Phase, 60-Cycle

Hp.	*Volt*	*Speed*	*Make*	*Type*
500	2200	600	General Electric	M
300	2200	600	General Electric	M
250	2200	600	General Electric	M
200	2200	600	General Electric	M
200	220 440	600	General Electric	M
150	2200	720	General Electric	M
150	2200	600	General Electric	M
150	440/220	720	General Electric	M
100	440 220	720	General Electric	M
100	2200	720	General Electric	M
100	440/220	900	General Electric	M
75	550	900	General Electric	MT
75	550	600	General Electric	M
75	2200	720	General Electric	M
75	220 440	720	General Electric	M
75	440 220	900	General Electric	M
60	220/440	1200	General Electric	MT
60	440/220	900	General Electric	M
50	550	900	General Electric	M
50	440 220	1200	General Electric	MT
50	2200	900	General Electric	M
40	440 220	1200	General Electric	MT
30	440/220	1800	Westinghouse	HF

Squirrel Cage—3-Phase, 60-Cycle

150	2200	720	General Electric	K
100	2200	600	General Electric	K
100	440 220	900	General Electric	K
100	440 220	720	General Electric	K
100	2200	900	General Electric	K
75	440 220	900	General Electric	K
50	440 220	1200	General Electric	K
50	440 220	900	General Electric	K
50	550	900	General Electric	K
35	220 440	720	General Electric	K
25	440 220	900	General Electric	K
25	440 220	600	General Electric	K
25	440 220	600	Allis-Chalmers	AN
25	220 440	720	General Electric	K
25	440 220	1200	Westinghouse	CS
20	440 220	1200	General Electric	I

3-Phase, 25-Cycle

500	2200	500	General Electric sl rg
300	440	500	General Electric, sl rg
200	440	500	General Electric, sl rg
50	220 440	750	General Electric, sq ca.
25	220 440	750	Westinghouse, sl. rg.

DIRECT CURRENT MOTORS

Hp	*Volt*	*Speed*	*Make*	*Type*
200	230	600	Westinghouse	
175	115	525	Crocker-Wheeler, Interp.	
125	115	500	Westinghouse, Interpole	
100	115	300	Westinghouse, Compound	
90	115	660	Crocker-Wheeler	D
75	115	400	Crocker-Wheeler	D
75	230	1100	Westinghouse	S
75	115	475	Westinghouse	SA
75	500	750	Westinghouse	• M
50	550	565	Westinghouse	SK
35	230	800	Westinghouse	S
30	230	300	Westinghouse	M
30	230	700	G E -Sprague	D
25	230	750	Crocker-Wheeler	I
15	230	1250	Allis-Chalmers, Interpole	
15	230	575	Westinghouse	S

DIRECT CURRENT GENERATORS

Kw.	*Volts*	*Speed*	*Make*	*Type*
175	250	690	Westinghouse	
150	125	580	Crocker-Wheeler,	Interpole
125	125	580	Westinghouse,	Interpole
70	125	575	Westinghouse	SA
50	250 125	1150	Westg Interpole	SA
45	125	975	General Electric	CLB
35	125	725	General Electric	Sprague
30	250	850	G. E. Sprague	D
30	125	800	Crocker-Wheeler	D
23	125	1175	Crocker-Wheeler	I

MOTOR GENERATOR SETS

1—150 Kw. 280 140-v., 900 r.p.m., Gen. Electric, Type D L C Interpole D.C. Generator direct connected to 225 H.P. 4000 2300-v., 3-ph., 60 cy., Gen. Elec. Form L. motor, complete with D.C. and A. C. panels.

1—100-kw., 250-volt, 900 r.p.m., Whse. Type SA Interpole Generator, coupled to 100 kva., 2300 440 220, 3-ph., 60 cy., Whse. Syn. Motor

2—75-kw., 125-volt, 1150 r.p.m., Gen. Elec. Type DLC Generator connected to 115-hp., 440 220 volt, 3-ph., 60-cy. Gen Elec. S Cage motor.

1—70-kw., 125-volt, 690-r.p.m. Westinghouse SA Interpole Generator, coupled to 100-hp., 2200 440 220-volt, 3-phase, 60-cycle Gen. Elec. S Cage motor

1—50 Kw., 250 125-volt, 1150 r.p.m., 3-wire, Westg Interpole Generator coupled to 75 H.P. 440, 220 v., 3-ph., 60-cy G. E. sq. cage motor.

ALTERNATING CURRENT GENERATORS

1—225-kva. Westinghouse, 220-volt, 514-r.p.m., 2- or 3-phase, 60-cycle, R. F. Generator, with belted exciter.

1—200-kw Allis-Chalmers, 2300-volt, 600-r.p.m. 3 or 2-phase, 60-cycle, RF Generator with direct connected Exciter

1—100-kva Westinghouse, 2300 480/240-volt, 900-r.p.m., 3-phase, 60-cycle, R. F. Generator, with belted exciter, complete.

ENGINE GENERATOR SETS

1—80-kw., 250 125-volt, 3-wire Sprague G E., D C., Generator connected to Ridgway 13x14, 280 r.p.m. side crank engine.

1—75-kva. 240-volt 277-r.p.m., 60-cy., 2 or 3-ph. Westinghouse A.C. Generator direct connected to 12 x 14 Erie Ball side crank engine with exciter and switchboard panel

1—75-kw., 125-volt, 275-r.p.m., Crocker-Wheeler, direct current Generator, direct connected to 14 x 14 Erie Ball side crank engine.

TURBO GENERATOR SETS

1—650-kva Westinghouse Parsons 480 240-volt, 3-ph., 60-cy., 3600 r.p.m., with Westinghouse Le Blanc jet condenser and exciter.

1—75-kw. 125-V., 2400 r.p.m., G. E. 2-stage, direct current turbo generator.

If your requirements are not listed, write us, as we do not attempt to list our entire stock.

STEPHEN HALL & CO., Inc., 7th and Adams Streets, Hoboken, N. J.

TELEPHONES: New York Direct Wire: Rector 3891; HOBOKEN 3750

Power Machinery Exchange

1 Montgomery Street Jersey City, N.J.

A. C. Direct Connected Units

3-Phase. 60-Cycle

Kva	*Generator*	*Engine*
500	Westghse	Parsons Hor. Turbine
400	Allis-Chal	Allis-Chal.-Corliss
360	Gen. Elec	Harris Comp. Corliss
340	Westghse	Harrisburg, 4-valve
300	Gen. Elec	Allis-Chal.-Corliss
250	Allis-Chal	Hamilton Non-releasing
250	Westghse	Chuse, 4-valve
240	Gen. Elec	Harrisburg 4-valve
200	Westghse	Erie Ball, side crank
187	Westghse	Parsons Hor. Turbine
165	Westghse	Erie Ball
150	Gen. Elec	Harrisburg, 4-valve
135	Westghse	Harrisburg, 4-valve
125	Gen. Elec.	Curtis Hor. Turbine
100	Westghse.	Harrisburg, 4-valve
100	Cr.-Wheeler	Harrisburg
75	Gen. Elec	Skinner
50	Westghse	Skinner

A. C. Belted Generators

3-Phase, 60-Cycle

Kva	*Make*	*Speed*
800	Allis-Chal., 3 Brg	360
500	Allis-Chal	600
375	Gen. Elec	450
360	Westghse	360
350	Gen. Elec 3 Brg	514
312	Gen. Elec	450
275	Westghse	450
250	Gen. Elec	600
200	Westghse	600
150	Gen. Elec	600
120	Westghse	900
100	Gen. Elec	900
75	Gen. Elec	900
50	Gen. Elec	1200
40	Elec. Mchy	1200
35	Cr.-Wheeler	1200
30	Westghse	1200
20	Fairbanks-Morse	1800
15	Fairbanks-Morse	1800

Direct Current Units

220-250-Volt

Kw.	*Generator*	*Engine*
400	Gen. Elec	Buckeye Comp.
300	Cr.-Wheeler	Watts-Campbell-Corliss
300	Westghse	Lane Bodley Corliss
250	Ridgway	Ridgway, side crank
250	Cr.-Wheeler	Harrisburg
200	Gen. Elec	Erie, 4-valve
150	Gen. Elec	Ames Uniflow
150	Westghse	Hewes-Phillips-Corliss
150	Ridgway	Ridgway
100	Allis-Chal.	Skinner
100	Ridgway	Ridgway, 4-valve
75	Gen. Elec., 3-wire	Ridgway
60	Gen. Elec.	Ball
60	Gen. Elec., 3-wire	Skinner Uniflow
50	Gen. Elec.	Harrisburg
37½	Westghse.	Skinner
40	Gen. Elec. 3-wire	Skinner Uniflow

Send for complete list of Generators, Motors, Engines, Boilers, etc.

TRANSFORMERS

60 CYCLE

- 2—1000-kw. Westg., O.I.W.C., 33,000 v. prim., 2300 secy., Scott conn.
- 6—600-kva. G. E., single ph., O.C. Type H, 33,000 v. prim., 13,200 secy.
- 3—500-kva. G. E., O.I.S.C., Type H, single ph., 2200 v. prim. 550 secy., Scott connected.
- 4—500-kw. Westg., O.I.W.C., 33,000 v. prim., 2300 secy. Scott conn.
- 2—500-kw. Westg., 33,000 v. prim., 2670 secy., Scott connected.
- 4—500-kva. G. E., Type A, Form L., sgle. ph., outdoor type, 12420/13800 v. prim., 230/460 secy.
- 3—400-kva. Allis-Chal., single ph., indoor type, 6600 v. prim., 440 secy.
- 4—400 kva. Pittsburgh, single ph., 6600 v. prim., 440/220 secy.
- 3—150-kva. G. E., Type H, single ph., 6000/6300/6600 v. prim., 120/240 secy.
- 3—110-kw. G. E., Type H., single ph., 14500/13050 v. prim., 430/286/-143 secy.
- 3—100-kw. G. E., single ph. 9200 v. prim., 2300 secy.
- 3—100-kw. Westg., single ph., Type S., 440 v. prim., 220 secy.
- 3—100-kva. G. E., Type H., indoor type, 6600 v. prim., 605/545 secy.
- 2—100 kva. Pittsburgh, outdoor type, single ph., 6600 v. prim., 2300 secy.
- 3—75-kva. Allis Chal., single ph., O.I.S.C., outdoor type, 6600 v. prim., 440/110 secy.
- 3—75-kva. G. E., Type H., single ph., 11,000/9900 v. prim., 6600 secy.
- 3—50-kva. Westg. O.I.S.C., Type SK, single ph., 6600/6300/6000 v. prim., 440/220 secy., outdoor type.

25 CYCLE

- 1—1500-kw. G. E., 3 ph., 13.200 v. prim., 6600 secy., O.C.
- 6—500 kva. Westg., O.I.S.C., indoor type, single ph., 13,200 v. prim., 6600 secy.
- 3—150-kva., G. E., O.C., single ph., 13200/6600 v. prim., 220/440 secy.
- 3—50-kva. G. E., single ph., O.C., 13,800 v. prim., 115/230 secy.
- 3—25-kva., Kuhlman, single ph., 7200 v. prim., 440 secy.

ARCHER & BALDWIN, INC., 114-118 Liberty St., N. Y. C.

LONG DISTANCE TELEPHONES 4337-4338 RECTOR

Brand New Units

For Shorter Delivery

1—120 kva., 60 cyc., 3 ph., 2300 v., 225 r.p.m., Western Electric Alternator, directly connected to a CHUSE Non-releasing Corliss engine. With belted exciter.

1—312 kva., 60 cyc., 3 ph., 480 v., 200 r.p.m., Western Electric Alternator, directly connected to a CHUSE condensing Uniflow or Non-releasing Corliss engine. With belted exciter.

1—450 kva., 60 cyc., 3 ph., 2300 v., 150 r.p.m., General Electric Alternator, directly connected to CHUSE condensing Uniflow or Non-releasing Corliss engine. With belted exciter.

1—400 kw., 250/275 v., 150 r.p.m., General Electric D.C. Generator, directly connected to a CHUSE Non-releasing Corliss engine. With standard, single panel switchboard.

USED UNIT

1—150 kw., 250 v., Westinghouse D.C. Generator, directly connected to a CHUSE single valve, side crank engine. With single panel switchboard.

Chuse Engine & Manufacturing Company

Mattoon, Illinois

Rebuilt ELECTRIC MOTORS in Stock

Send for Complete List and Prices

210-220-*Volt D C Motors*

	HP	R P M	MAKE
1—	2	1200	Westinghouse, R
1—	2	1150	Western Elect RC
1—	3	1650	G. E. C.V.C.
1—	3	1050	Crocker-Wh. MC
1—	5	1150	Westinghouse S.
2—	5	1650	G. E. C.V.C
1—	5	950	Crocker-Wheeler
1—	7½	1525	G. E. C.V.C.
1—	7½	1200	Robbins & Myers
1	10	850	Crocker-Wheeler
1	10	1050	Westinghouse, S
1—	15	800	Crocker-Wheeler
3—	15	825	West. Elec., E
1—	20	600	Peerless
1	20	1300	Westinghouse S.
1	20	800	Westinghouse, S
1	25	875	Crocker-Wheeler
2	27½	600	Northern
1	30	650	Bullock

220-440-*Volt*, 3-*Phase*, 60-*Cycle*, *A.C Motors*

	HP.	R.P.M.	MAKE
1—	3	1800	Wagner
1—	3	1200	G. E., Slip-Ring
6—	5	1800	Lincoln (new)
2—	5	1800	Wagner, B.P.
1—	5	900	Howell
11—	7½	200	Lincoln
1—	7½	1200	G. E. (new)
1 -	7½	1200	Gen. Elec., KT
1	10	1200	Western Elec
1 -	15	1800	Crocker-Wheeler
1—	15	1200	Westghse., C.C. L
1—	15	720	Crocker-Wheeler
2—	20	1800	Howell
1—	30	875	Allis-Chalmers
2	40	1150	Allis-Chalmers
1—	50	1150	Gen. Elec. K.T.
1—	50	514	Lincoln, Slip-Rg.

WE BUY SELL REPAIR EXCHANGE and RENT

THOMPSON & JAMESON, Inc., 366 W. Superior St., CHICAGO, ILL.

TRANSFORMERS

50,000 Kilowatts—All Sizes

Government Apparatus—Little Used

Motors—Dynamos

5,000 To Select From

GEORGE SACHSENMAIER CO.

928 N. Third St., Philadelphia, Pa.

LET US KNOW WHAT YOU WANT ELECTRICALLY.

R. SCHEINER Co.

123 North 3rd St.
PHILADELPHIA

110-volt, Direct Current Motors and Generators

Qu.	Hp.	Make	Type	Speed		Price
1	1/25	General Electric	SDA	1700	Shunt	$6 00
1	1/20	Westinghouse		1700	Shunt	6 00
1	1/10	General Electric	SD	1700	Shunt	8 00
2	1/8	Westinghouse, new	CDH	1725	Comp	18 00
1	1/8	Janette	D18	1750	Shunt	10 00
1	1/8	Robbins & Myers		2000	Shunt	8 00
1	7/10	Electric Specialty Co.	R	2277	Shunt	30.00
1	1/6	Crocker-Wheeler	. . .	1720	. . . .	10 00
1	¼	Sturtevant	B	850	Shunt	20 00
1	1/3	Paragon	BRO	3000	.	18 00
1	½	kw. Eck		1150	Comp.	28 50
1	½	Robbins & Myers		1800	Shunt	28 00
1	½	Diehl		1850	Shunt	28 00
1	¾	Robbins & Myers		1100	Shunt	28 00
13	¾	General Electric, new	SD	1100	. . . .	40 00
35	¾	General Electric, new	SD	1700	. .	35 00
5	1	General Electric	RC	1800	Shunt	40 00
4	1	General Electric	RC	1850	Comp.	40 00
1	1	Western Electric	RC	1200	Shunt	40 00
3	1	General Electric, new	RC	1150	Shunt	60 00
1	1	General Electric	CA	1175	Shunt	35 00
1	1	Diehl	G	1800	Shunt	35 00
1	1	General Electric	RC	1850	Shunt	40 00
1	1	General Electric	CQ	1275	Shunt	40 00
1	1	Robbins & Myers		1750	Comp	35 00
3	1	Diehl		1800	Shunt	35 00
1	1	General Electric	DSD	1700	Shunt	35 00
2	1½	Robbins & Myers		1800	Comp.	50 00
1	1½	General Electric, new	RC	1700	Shunt	60 00
1	1½	Eck	2BB	1575 1895	Shunt	50 00
2	2	General Electric, new	RC	1700		65 00
1	2	General Electric	RC	1700	Comp	55 00
2	2	Crocker-Wheeler	CM	1625	Shunt	50 00
1	2	Rochester	SV2	1650	Shunt	45 00
2	2	Northwestern	KI	1600	Shunt	60 00
1	2	Eck		1750	Comp.	60 00
1	2	General Electric	CVC	1100	Shunt	65 00
1	2¼	General Electric	RC	970 1075	Shunt	70 00
1	2½	General Electric	CVC	1650	Shunt	65 00
3	2½	Eck	3BB	1135 1420	Shunt	75 00
1	3	General Electric	CR	700 1125	Comp.	100 00

Qu.	Hp.	Make	Type	Speed		Price
10	3	Star	SB5	750	Shunt	$85 00
1	3	Sprague	. . . .	800	. . . . .	85 00
1	3	General Electric	RC	1800	Shunt	75 00
1	3	General Electric	RC	1700	Shunt	75 00
1	3	Robbins & Myers, new	I	1150	Shunt	125 00
1	3	General Electric	.	1750	Shunt	65 00
1	3	Westinghouse	SK	1150	Shunt	90 00
1	3	Crocker-Wheeler	CM	1800	Shunt	75 00
1	3	Robbins & Myers		1750	Shunt	65 00
1	3	General Electric	RC	1800	Shunt	75 00
1	3	Crocker-Wheeler	CM	1050	Shunt	90 00
1	3½	Crocker-Wheeler	SM	1000	Shunt	85 00
1	3½	Sturtevant	H	660	. . .	110 00
1	3½	Northwestern	K3A	1116	Shunt	85 00
1	3½	Crocker-Wheeler		1800	Shunt	80 00
1	4	Star	SB7	650	Shunt	115.00
1	4	Burke	A	1100	Shunt	80 00
1	5	Electro Dynamic	4C	810	. . . . .	125 00
1	5	General Electric	CQ	1100	Comp.	100 00
1	5	Western Electric	E	2075	Shunt	85 00
1	5	Robbins & Myers		1400	Shunt	90 00
1	5	Fairbanks-Morse	CP	1750	Shunt	80 00
1	5	Star	SB7	750	. . .	100 00
1	5¼	Roth	. . .	615 810	Shunt	125 00
4	5¼	General Electric	RC	855 950	Shunt	115 00
2	7½	General Electric	CQ	825	Shunt	150 00
1	7½	General Electric	CE	1525	Shunt	125 00
1	7½	General Electric	RC	1150	Shunt	150 00
1	7½	Crocker-Wheeler		1150	Shunt	125 00
1	7½	Westinghouse	SK	1200	. . . . . .	150 00
1	7¾	Diehl	K	820	Shunt	150 00
1	9 kw.	General Electric	MP	1400	Shunt	125 00
1	10 kw.	Electro Dynamic	. . . . .	1150	Shunt	130.00
2	10	Ilg	.	500	Shunt	160 00
1	20	Diehl	. . . .	950	Comp.	200 00
1	25 kw.	C & C	S	1000	Comp	250 00
1	30	General Electric	RC	1100	Shunt	300 00
1	30	General Electric	CLB	1025	Shunt	300 00
1	37½ kw	Westinghouse	M	900	Comp.	350 00
1	50	Western Electric, new	RC	1075	Shunt	600 00
1	100 kw.	Westinghouse	M	550	Comp.	650.00

POWER

BELTED STEAM ENGINES

7 x 8 Sturtevant vertical, throttling type.
8 x 8 O & S vertical, throttling type.
11 x 12 Ames, Una-Flow.
12 x 12 Erie Ball automatic, center crank.

13 x 12 Harrisburg, 4 valve.
14 x 12 Ames automatic, center crank.
14 x 16 Erie City, automatic, center crank.
15 x 14 Ames automatic, center crank.

Steam Engine Driven Generators, Feed Water Heaters and Air Compressors in Stock

COLEMAN-SHOEMAKER, Inc., Office, Plant and Siding 20th and Clearfield Sts., PHILADELPHIA

"HONESTLY REBUILT" ELECTRICAL MACHINERY

MILLER-OWEN ELECTRIC CO., Inc.

LEXINGTON AVE. AND THOMAS BOULEVARD PITTSBURGH, PENNA.

3-Ph., 60-Cy., 220 440-Volt Motors

Qu.	Hp.	Make	Type	Speed
	5	General Electric	KT	1200
	5	Wagner	BM	1720
6	7½	General Electric	KT	1800
2	10	Allis	AN	1200
	10	General Electric	KT	1800
2	10	General Electric	KT	900
50	15	General Electric	KT	900
75	20	General Electric	KT	900
45	25	General Electric	KT	900
3	30	Westinghouse	CX	1200
1	30	Westinghouse	CCL	1800
55	30	General Electric	KT	900
40	35	General Electric	KT	900
21	40	General Electric	KT	900
1	50	Westinghouse	CCL	900
5	50	General Electric	KT	1200
6	60	General Electric	KT	1200
1	60	Westinghouse	CS	900
1	75	General Electric	KT	1200
	100	General Electric		1200

Direct Current Motors

Make	Kw.	Rpm	Volts
General Electric	105	665	250
General Electric	100	290	250
Crocker-Wheeler	100	900	250
General Electric	75	1200	250
General Electric	75	1200	500
General Electric	75	850	250
General Electric	70	700	250
General Electric	55	845	250
Westinghouse	50	850	250
General Electric	50	550	500
Westinghouse	50	550	250
General Electric	35	550	250
General Electric	30	1700	250
General Electric	25	750	250

3-Ph., 25-Cy., 220 440-Volt Motors

Qu.	Hp	Make	Type	Speed
2	10	General Electric	KT	750
7	25	Westinghouse	CS	750
1	35	General Electric	CS	750

Direct Current Generators

Make	Kw.	Rpm	Volts
General Electric	500	360	250
General Electric	400	450	250
Allis-Chalmers	200	425	250
General Electric	150	550	250
General Electric	100	550	250
Crocker-Wheeler	75	1200	250
General Electric	60	900	250
Westg Erie City	100	250	250
Allis Skinner	100	250	125
G E Buckeye	150	200	250
Westg. Bal	200	200	250
Westg Buckeye	300	150	250
G E McIntosh	450	150	250
G. E. Hamilton	500	150	250

Also a number of very attractive offerings in Alternating Current, Belted and Engine Driven Generators

Motor Generator Sets

Make	Kw.	D.C. Volt	A.C. Volt
General Electric	200	250	2300
General Electric	150	250	2300
Allis	150	500	2300
General Electric	100	250	2300
Burke	75	500	2300
Crocker-Wheeler	75	250	220 440
Allis	75	250	2300
General Electric	65	250	220 440
General Electric	50	250	220 440
Westinghouse	50	125	220 440

A. C. Motors

Make	Hp	Rpm.	Cycles
General Electric	750	514	60
General Electric	750	750	25
Crocker-Wheeler	600	514	60
Westinghouse	400	450	60
General Electric	300	500	25
General Electric	275	600	60
General Electric	200	450	60
General Electric	150	720	60

"25 CYCLE"
MOTORS, TRANSFORMERS
MOTOR GENERATOR SETS

Over 1200 25 cycle motors three phase totalling 15,000 hp in sizes from 1 to 750 hp various speeds
Single and three phase 25 cycle transformers from 1 to 200 kw
Frequency Changer Sets 25 to 60 cycle

2—500 kva G E.	each $6,300
1—500 kva G E direct connected exciter . .	6,750
1—1000 kva Allis-Chalmers	8 800
2—1250 kva Westinghouse	each 11 800

Prices quoted F O B. cars Kansas City, Mo
All 6600 volt on 25 cycle end and 4150 volt or can be reconnected 2400 volt on the 60 cycle end
Prices subject to change without notice and subject to prior sale. Many items almost new and all were in operating condition when removed from service
This equipment on hand due to a recent change from 25 to 60 cycle distribution

For details and prices, address

KANSAS CITY POWER & LIGHT COMPANY
Kansas City, Mo.
Attention: W. C. Blair, Industrial Engr.

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and other Electrical Equipment, always available.

Send us Your Inquiries

BROWN-HUNKELE CORPORATION
New Jersey's Electrical Clearing House
24-26 Mechanic St., Newark, N. J.

MOTORS—GENERATORS
New and Rebuilt

We Buy, Sell and Exchange

DAVIS MACHINE & MOTOR CO.
59 Mechanic Street, Newark, N. J.
Phone: Market 8580.

MOTORS AND GENERATORS

2—200 hp., 450 r.p.m., 3-ph., 440-v., 60-cy., new G. E. Motors.
2—150 hp., 500 r.p.m., 3-ph., 440-v., 25-cy., W. H. & Allis-Chalmers.
2—75-hp., 900 r.p.m., 3-ph., 440-v., 60-cy., F. M. & Allis-Chalmers.
13—10 hp., all speeds, 3-ph., 220- or 440-v., 25- or 60-cy.
1—30 kw., 1050 r.p.m., 125-v., D.C., G. E. Belted Generator.
1—30-kw., 110-v., D.C., Western Elec. Eng. Generator Set.
1—20-kw., 1050 r.p.m., 125-v., D.C., F. M. Belted Generator.
1—6-kw., 75- or 125-v., D.C., G. E. Kerosene Eng. Generator Set.
Large Stock A.C. and D.C. Motors and Generators. All sizes.

V. M. NUSSBAUM & COMPANY, Fort Wayne, Indiana.

MOTORS - DYNAMOS

Write us what you want to buy or sell

L. J. LAND
207 Centre Street New York

2—150 kw. Ridgway Steam Engine Generator sets, complete with Switchboard, and all fittings.

1—500 kw. Ridgway, 2300-250 v., Motor Generator set.

W. A. CARRELL & COMPANY
211-213-215 Second Avenue, Pittsburgh, Pa.

IT'S NOT TOO EARLY

to reserve space for your "Searchlight" advertisement in the

ANNUAL PROGRESS and STATISTICAL NUMBER
January 6, 1923

Complete Circulation—Special Attention
Special Advertising Sections

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New and Used Dodge Equipment for Immediate Delivery

Shafting—Cold rolled steel—All sizes and lengths.
Shaft Hangers—All types and sizes
Bearings—Capillary, Ring and Standard Oiling.
Pillow Blocks
Friction Clutches—Dodge Split, Solid and Jaw
Collars—Solid, Split and Thrust
Pulleys—Split and Solid—Cast Iron, Steel and Wood
Bushings
Grease Cups

Our Bulletin No. 15 will give you complete information

Nashville Industrial Corporation
Jacksonville, Tennessee.

ELECTRICAL SUPPLIES

1—300-kw. G. E. Rotary Converter, 25 cy.
1—250-kw. G. E., 230-440 v., 3 ph., 60 cy., dir. conn. to McEwan compound engine.
1—210-kw. G. E., 2300-440 v., 3 ph., 60 cy., dir. conn. to cross compound engine.
6—Westinghouse Induction Alternating Type CCL, 250-hp. Motors, 440 v., 3 ph., 60 cy., speed 514 r.p.m.
1—50-hp. Allis-Chalmers, Induction Motor continuous duty, 440 v., 3 ph., 60 cy., speed 965, 40 deg. Complete with Cutler Hammer starting controller, oil circuit breaker, base, and 14-in. x 9-in. belt pulley.

Send for a free copy of Bulletin No. 205, describing our complete stocks of machinery and equipment

HARRIS BROS. CO.
35th and Iron Sts., Chicago, Ill.

Synchronous Motor

1—435 hp., 3 ph., 60 cy., 2300 v., G. E. Type ATI-Form B, 450 r.p.m., 3 Bearing Belted, Type Complete.

"Honestly Rebuilt"

Miller-Owen Electric Co.
Pittsburgh Penna

Ridgway Motor Generator Set

400 kw., 250 v., D.C. Interpole Generator, direct connected to a 625-hp., 2300-v. 3-ph., 60-cy., 1200 r.p.m. Ridgway Slip Ring Motor and Auto Voltage Regulator. In use 6 mos., original cost $18,600. Our price, $6,000.

THE GLOW ELECTRIC COMPANY
Cincinnati Ohio.

FOR SALE

ENGINE

1—Buckeye Cross Compound 14 x 24 x 28.

also

GENERATOR

1—200 Kw. G. E. Type A.T.B., Form P.A.C., 3 ph., 60 cy., 2300 v., with belted exciter.

Both can be inspected in operation, replacing with larger unit

Board of Public Works
Water, Light and Sewer Department
City of South Haven, Michigan.

FOR SALE

TRANSFORMERS

Real bargains in slightly used transformers as furnished to War Department for use at Camp McClellan. Guaranteed to be in good condition and may be inspected at Camp Site. Five Pittsburgh Transformer Company's 333 kva., 6600-2300 v., single phase, 60 cy., Nos 691096-097098-099101, priced at $400 each, f.o.b. Camp McClellan. One Westinghouse Electric Company's 250 kva., 22,000-2300 v., single phase, 60 cy., No 526474 priced at $600 f.o.b. Camp McClellan. For further information, address

J. GOLDBERG & SONS
812 East 18th Street, Kansas City, Mo.

BRAND NEW

50 hp. General Elec. 3-ph., 60-cy., 220/440 volts, slip ring, 1200 r.p.m. motor.
50 hp. General Elec 3-ph., 60-cy., 220/440 volts, slip ring, 690 r.p.m. motor.
Will sell at big bargain.

FS-312, Electrical World
10th Ave. at 36th St., New York City.

Motor Generator Set

For Immediate Delivery

1—50-kw. G. E. Motor Generator, type DLC, Form 4, 200 amp., 230-v., direct connected to a 75-hp. G. E. Motor, 3 ph 60 cy., 19 amp., 2200 v., 12000 r.p.m., type I, with Starting Compensator.

Price f.o.b. Jacksonville, Fla. $800.00

1—20-hp. G. E. Motor, type DLC-20, Form A, 230 v., 800 r.p.m., with Slide Rails and Starting Box

Price f.o.b. Jacksonville, Fla. $200.00

Above in A-1 condition and so guaranteed

Consolidated Engineering Company
215-219 E. Bay Street, Jacksonville, Fla.

Surety Motors

Performance Guarantee
Backed by
Surety Bond

BONDED

The Motor Man Says—

You can take a used motor, providing you have the equipment, materials and men who know their business, and make it as good as new.

This is exactly what happens to a motor that is renewed up to the standard set before it can carry the Surety Label.

Only good used motors, with no inherent defects, are accepted for renewing. Expert workmen with every modern facility renew them.

Of course, there is a saving in the cost of a Surety Renewed Motor, and the Surety Label guarantees the workmanship, materials and the motor. It must satisfy you. A Bond assures that.

The New Combined Motor List shows a number of additions to the motor stocks of the licensees of the Surety Motor Bonding Co. Write to them for your copy. *MOTOR MAN.*

Duquesne Elec. & Mfg. Co.........6426 Hamilton Ave., Pittsburgh, Pa.
Elliott Electric Co...........813 Superior Ave., N. W., Cleveland, Ohio
Miller-Seldon Electric Co................1259 Park Pl., Detroit, Mich.
Willey-Wray Electric Co............118 W. Third St., Cincinnati, Ohio

Surety Motor Bonding Company

SURETY RENEWED MOTORS BONDED
SURETY MOTORS (BONDED)

133 W. Washington St., Chicago, Ill.

Water Tube Boilers

250 to 1000 H.P.—Immediate Delivery!

New Water Tube Boilers, built for pressures of 200 lbs. and 225 lbs., ready for immediate delivery from Chicago, Dumont, New Jersey, opposite New York City, or Slidell, Lousiana, near New Orleans.

Our low prices present a saving of from 25% to 50%. We will take in your old equipment on a liberal exchange basis.

Write for our new catalog fully describing our boilers.
Your copy will be mailed on request.

HARRIS BROTHERS COMPANY

West 35th and Iron Sts., Chicago

D. C. ENGINE GENERATOR SETS

1—50-kw., 250-v., 280 r.p.m., General Electric, D.C. generator, mounted on sub-base and dir. conn to 1—11½ x 12 Skinner automat. steam engine, complete with switchboard.

1—100-kw., 250-v., D.C., 250 r.p.m., Bullock cp. wd. generator, dr. conn. to 1—A. L. Ide & Sons, 14 x 14, simple automat steam engine, complete with switchboard.

1—150-kw., 280 r.p.m., 250-v., D.C., cp. wd., Burke, 3-wire generator set, consisting of 2—75-kw., 125-v., D.C., 280 r.p.m., cp. wd., Burke generators, dir conn to 1—240-hp., 14 x 16 Fleming Harrisburg steam engine, complete with all accessories including switchboard.

MOTOR GENERATOR SETS

1—100-kw., 250-v., D.C., Gen. Elec., synch. converter with 2200-v., high tension, 3 ph., 60-cy. transformer, complete with switchboard and all accessories.

1—150-kw., 125/250-v., D.C., cp. wd., Westinghouse rotary converter, complete with transformer for 2200-v., high tension, 3-ph., 60-cy., 187-v., low tension, with starting taps, complete with starting equipment and standard D.C. generator panel.

We also carry a large stock of A.C. and D.C. Motors up to 200 HP.

Send Us List of What You Have to Sell

Duquesne Electric & Mfg. Co.
Pittsburgh, Pa.

SURETY RENEWED MOTORS BONDED
SURETY MOTORS (BONDED)
LICENSEES

Willey-Wray Electric Company

SURETY RENEWED GENERATORS

3 Ph. 60 Cy. Alternators

1—37½ kva., 2300 v., 1200 r.p.m. Western, Type ATB with switchboard.
1—90 kva., 230/460 v., 900 r.p.m., Fairbanks-Morse Type AB.
1—135 kva., 240/480 v., 900 r.p.m., G.E., Type ATB.

Direct Current Generators

1—50 kw., 125 v., Jantz & Leist Generator with Ideal Engine.
1—75 kw., 125 v., Jantz & Leist Generator with Ames Engine.

SURETY RENEWED MOTORS BONDED
SURETY MOTORS (BONDED)
LICENSEES
118 W. Third St., Cincinnati, Ohio

Motors—Generators

15 kw. Sturtevant 125 volt D.C., 400 r.p.m generator direct connected to steam engine.

15 kw. Holtzer-Cabot 125 volt D.C., 650 r.p.m. generator, direct connected to gasoline engine.

Large lot of 110 and 220 volt D.C. motors and generators.

Exceptionally Low Prices on A.C. Equipment. Send Us Your Inquiries.

A. WERBY & CO.
47 Beverly St., Boston, Mass.

Roots Rotary Positive Blowers

5—No 3 Roots High Pressure, Style D, Blowers top discharge, with a displacement of 2⅜ cu ft. per revolution single geared with double out board bearings on bed plates, 30-in x 8-in driving pulleys Constructed for maximum pressure of 10 lbs to the sq. inch

Send for complete specifications

Nashville Industrial Corporation
Jacksonville Tennessee

Motor Generator Set

SYNCHRONOUS

1—300 kw., 250 v., D.C., 435 hp., 3 ph., 60 cy., 2300 v., G. E. ATI-Form B., Synchronous Motor, Complete Equipment.

"Honestly Rebuilt"

Miller-Owen Electric Co.
Pittsburgh Penna

1/6 H. P. Motors

110 v. single phase, 60 cy., 1725 r.p.m., with double end shafts for immediate delivery

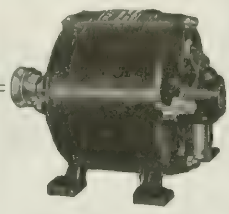
- 200 G. E. 145 frame type S.A. $11.00 each
- 175 Westinghouse, 544 frame type C.A.H. Price $10.50 each
- 100 Robbins & Myers 17 frame type P. $10.00 each
- 250 Ellington type E.I. frame 62, with single end shaft $8.50 each
- 25 Robbins & Myers 1/6 hp., 220 v., type P, frame 17 with double end shaft **$12.50 each.**
- 50 Robbins & Myers, 1/6 hp. 110 v. 25 cy. single phase, type P, 17 frame with double end shaft $12.50 each

We have dismantled each motor, going over them thoroughly testing every part, also gave them a coat of paint

We guarantee every motor listed above

ARRAS EQUIPMENT CORP.
291 Greenwich St., New York, N. Y.
Telephone Barclay 4168

A Guaranteed Bargain in a Guaranteed Motor



Strictly first-class, 40 deg., 1/6 hp. Motors, developing 2½ times full load 110 v. 60 cy. 1750 r.p.m. Fully guaranteed.

Also have some bargains in 30 40 and 50 cy.

We guarantee if you will compare this 1/6 H.P. Reynolds Motor, specification by specification, with any other motor of similar capacity, you will be convinced that it is the biggest $10 buy in the motor field. Price for single motor $10—less in quantities.

Cancellations are the cause of the low price. The quantity is limited. How many do you need? Write us for price, and get your order in.

1/6 H.P. $10

REYNOLDS ELECTRIC COMPANY
2644 West Congress St.
CHICAGO, ILL.

FOR SALE

BOILERS and GENERATING SETS

Surface Condensers

- 4—Wheeler Condensers, each 2800 sq. ft. surface with water and vacuum pumps.
- 1 72-in. x 19-ft. 6-in. Keeler return tubular, 157-lb. pressure. Usual fittings.
- 1 367-hp. Heine water tube, 3669 sq. ft. heating surface, working pressure 180 lb.
- 4 New 72 in. x 20 ft. triple riveted Keeler return tubulars, 125-lb. pressure, complete boiler fittings.
- 2 501 hp., Class S, No. 25 Stirling water tube boilers, 160-lb. pressure A.S.M.E.; Detroit stokers, Detrick arches, Foster superheaters.
- 1 Brand new smokestack, ¼-in. iron, 54-in. dia., 80 ft. high.
- 2 150 kw. Terry turbos, 2000 r.p.m., condensing, 140-lb. steam pressure, dir. conn. to 125-v., D.C. Crocker-Wheeler generators.
- 1 50 kw. Bullock turbo, 275 r.p.m., 125-v., dir. conn. Watertown compound engine.
- 1 500-kw. G. E., 3600 r.p.m., 3ph., 60 cy., 480 v., Curtis turbo unit, condensing.
- 2 500-kw. Westgh., Bleeder type, new, will build generator to suit.
- 1 1250-kw. G. E. non-condensing, 600 v., 3 ph., 60 cy.

TECHNICAL ECONOMIST CORP.
2 Rector Street, New York City.
Phone Whitehall 5243-4

Immediate Delivery

Steam Turbos, 60-cy., 3-ph., etc.

NEW 12,500-kva., 11,500-2300-v. Turbo.
7000-kw., 2300-v. Turbo—80% P.F.
1560 kva., NON COND., 600-480 v.
250- & 625 kva. Non. Cond., 240-480-2300 v.
780-kva., 480-2300 v. MIXED PRESS. TURBOS
800- and 1000-kw., D.C., 250 125 v. Turbo.
1560-1250 625-kva. FREQ. CHANGERS
400 150 75 50 kw. Eng. Sets, 275 v., D.C.
437-625 kva. SIMPLE CORLISS—240-480 v., 3 ph.
NEW 25 & 35-kw. TURBO EXCITERS, Bargains.
927 kva., 2300-v., 3 ph., 60-cy. Comp. Eng. Set.
2 NEW 1000-hp. STERLING BOILERS, 275 lb.
3 1043 hp. EDGEMOOR BOILERS, 200 lb.
2 400 hp. Edgemoor, 175 lb., with Stokers.
4 NEW 290 hp. B. & W. BOILERS, 200 lb.
NEW 1468 cu. ft., 5320-ft. 2 Stage AIR COMPS.
20 Boiler Feed Pumps, Turbo & Motor drive.
ROCK CRUSHERS, CONTRACTORS' EQUIP., BELTED GEN., ETC. *Send us your inquiries*

ROSS POWER EQUIPMENT CO.
Indianapolis, Ind.

WANTED

WANTED

INDUCTION FEEDER VOLTAGE REGULATOR

1—200 kva., 60 cycle, 2300 volts primary, 230-115 volts secondary, oil immersed, self-cooled, with or without auxiliaries.

ORANGE & ROCKLAND ELECTRIC CO.,
Monroe, N. Y.

---

300 K. W. 250 Volt D.C. Belted Type 450 R.P.M. 8 Pole Compound Wound Generator

Pedestal Bearings, Commutator ¾ Full

"Honestly Rebuilt"

Miller-Owen Electric Co.
Pittsburgh, Penna

WANTED

ELECTRIC OVEN

220 v., 3 ph., 7 to 10 kva., size 36 x 40 in.

ELECTRIC MOTOR REPAIR CO.
92 Northern Blvd., Long Island City, N. Y.

WANTED

1 TO 6 OIL SWITCHES

For use on 44,000-v., 3-pole, electrically operated outdoor, preferably G. E., Type K O 26.

VERMONT HYDRO ELECTRIC CORP.
Rutland, Vermont.

FOR SALE

160 K. W. Engine Drive Exciter

1—160 Kw., 125 v., 230 r.p.m. General Electric Type M.P. form L direct current generator mounted on common bed plate with and direct connected to Phoenix 14½ x 15 engine good for 150 to 190 pounds steam pressure.

Set now in use being removed to provide space for dual drive set.

FS-470, Electrical World
1570 Old Colony Bldg. Chicago, Ill

POWER PLANT

Complete power plant, consisting of Two (2) Used Curtis Turbine General Electric Generator Sets 600 kw. Unit each, 2300 volts A.C. with Exciters Transformers, Switch Boards, etc.

3—500 hp. Keeler Water Tube Boilers complete with Stokers Soot Blowers, Ash Conveyors Feed Water Heater, Condensing equipment and spray for cooling.

In excellent condition at an exceptional price.

Crawford Machinery Co.
1201 House Bldg., Pittsburgh, Pa.

WANTED

TRANSFORMERS

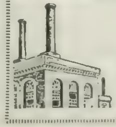
One or two 25 kw., 2300 volt, 60 cycle, 6.6 ampere, constant current, indoor type. Must be in first class condition and of G. E. or Westinghouse manufacture. Mail complete information with price to

VIRGINIA-WESTERN POWER COMPANY.
Clifton Forge, Va

Rebuilt and New Electric Motors, Generators and Transformers

All standard makes sold bought and exchanged. Our rebuilt motors stand every test of new motors; 8000 always in stock; send for stock list. Write what you want or have to sell

FUERST-FRIEDMAN CO., Cleveland, Ohio.



In Trouble

MOTORS RENTED

Any size or kind up to 550 hp. Largest stock of its kind in America

NATHAN KLEIN & CO.
208 Centre St. N. Y.

Notice to Advertisers

Owing to the holiday—New Years—the *"Searchlight"* pages of January 6th issue of *Electrical World* will close for press earlier than usual. Copy should reach us as follows.

Display Ads—Copy required by 10 A.M., Saturday, December 30th.

Want Ads—Copy required by 10 A. M., Tuesday January 2nd

SEARCHLIGHT SECTION

EMPLOYMENT-BUSINESS OPPORTUNITIES-EQUIPMENT

UNDISPLAYED—RATE PER WORD:

Positions Wanted, 4 cents a word, minimum 75 cents an insertion, payable in advance.

Positions Vacant and all other classifications, 8 cents a word, minimum charge $2.00.

Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of any of our offices count 10 words additional in undisplayed ads.

Discount of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

1 to 3 inches	$5.00	an inch
4 to 7 inches	4.80	an inch
8 to 15 inches	4.60	an inch

An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

E.W.

POSITIONS VACANT

BILLING and ledger clerk; salary $150 per month. State experience and references in first letter. Virginia Western Power Co., Clifton Forge, Va.

ELECTRICAL Designer experienced in power and substation design. Permanent position and chances for advancement with large power company. State age, education, experience and salary expected in first letter. Location New York State. P-425, Elec. World, 10th Ave. at 36th St., New York City.

ELECTRICAL engineer wanted for Western New York public utility who is familiar with power and sub-station design for interior layout of electrical apparatus in proposed new power plants and substations. State age, education, experience and salary expected. P-466, Elec. World, 10th Ave. at 36th St., New York City.

ELECTRICAL engineer, with experience on power plant, electrical equipment, substations and transmission lines for construction design work and technical problems connected with the operation of a large public utility system. Technical ability together with experience on similar work necessary. Replies must give details of education, experience, personal characteristics, references and salary desired. Send photograph if possible. P-465, Elec. World, Leader-News Bldg., Cleveland, Ohio.

ELECTRICIAN wanted—Head electrician for manufacturing plant located in Central New York State. Main plant operated by steam; about 5,000 rated horse power in small and medium size motors, 440 volt A.C., 3 phase, 60 cycle, cranes 110 volts D.C., lighting, 110 volt A.C. Also electrical recording and controlling instruments. Steady job with advancement for right man. Reply stating experience, age, etc. P-467, Elec. World, 10th Ave. at 36th St., New York City.

ELECTRICIANS wanted for power construction, switchboard, remote control, and bus bar construction in New Jersey. Apply, giving experience and wages earned previously. P-427, Elec. World, 10th Ave. at 36th St., New York.

EXECUTIVE for electric light and power utility serving population of about 50,000, experienced in operation, construction and public relations. Must possess initiative, ambition, imagination, ability to recognize and willingness to shoulder responsibility and merit rapid promotion. Location, Middle Atlantic States. In reply state fully education, past experience, present salary and salary expected. P-442, Elec. World, Real Estate Trust Bldg., Phila., Pa.

FIRST-CLASS all-round electrician wanted, capable of rewinding all kinds of motors and armatures; repairing and rebuilding of all kinds of commutators; shooting trouble on all kinds of electrical apparatus. Must have had not less than five years' experience in small jobbing shop where every kind and class of electrical work is done; necessary technical education; between the ages of 25 and 35; fast and accurate worker. References required for past 10 years. Wages $8.00 per day with opportunity for advancement. Hambrick Electric Co., 1502 E. Front St., Fort Worth, Texas.

WANTED

Electrical Engineer

Young graduate engineer to specialize in testing of incandescent lamps. Write

ELECTRICAL TESTING LABORATORIES
80th St. and East End Ave., New York City.

In Replying to "Blind" Ads

be careful to put on envelope the key number in the ad and also local address of office to which reply is sent.

10th Ave. at 36th St., New York.
509 Real Estate Trust Bldg., Phila.
533 Leader-News Bldg., Cleveland.
1570 Old Colony Bldg., Chicago.
531 Rialto Bldg., San Francisco.

Important

Original letters of recommendations or other papers of value should not be enclosed to unknown correspondents — send copies.

0195

POSITIONS VACANT

GRADUATE electrical engineer wanted by large street railway in eastern Pennsylvania for manager's office; should be about thirty years of age, experienced thoroughly in street railway motors, feeder lines and substations; preferably a man with shop experience. P-454, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

LARGE Central Station in middle west requires services of technical graduates in mechanical and electrical engineering. Give outline of education in first reply. Experience not necessary. P-417, Elec. World, Old Colony Bldg., Chicago, Ill.

METERMAN wanted for testing and installing single and polyphase watt-hour meters. In reply, state age, experience and salary desired. References required; location northern West Virginia. P-461, Elec. World, Leader-News Bldg., Cleveland, Ohio.

RADIO engineer wanted by large electrical manufacturing company. Applicant should be technical college graduate in electrical engineering, with experience in experimental radio development problems involving both transmitting and receiving. None but high grade development engineers need apply. State age, education and experience. Address P-988, Elec. World.

REPAIR shop foreman, a thoroughly first-class man to assume charge of our electrical repairs department operating fifteen men. Must be fully experienced and practical man competent to operate shop along modern lines. None considered except those holding or having held position as shop foreman or assistant foreman in some good, recognized repair shop. position is absolutely permanent with good prospects for advancement to the right man. Kindly reply, giving in your first letter age, experience, salary expected and how soon you can report for work. The Electric Service Company, 212 Walnut Street, Cincinnati, O.

POSITIONS VACANT

TWO experienced armature winders wanted for A.C. and D.C. work in a large industrial plant located in central Pennsylvania. One sub-station operator, experienced in high tension switching and the operation of rotary converters and motor generator sets. Give full information in reply. P-459, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000 upward; executive, technical, administrative, engineering, manufacturing, professional, managing, financial, etc., all lines. If you are qualified and receptive to tentative offers for a new connection, you are invited to communicate in strict confidence with the undersigned, who will conduct preliminary negotiations for such positions. A method is provided through which you may receive overtures in confidence without jeopardizing present connections and in a manner conforming strictly to professional ethics. Send name and address only. Preliminary particulars will be sent without obligating or compromising you in any way. R. W. Bixby, Inc., 410 Lockwood Bldg., Buffalo, N. Y.

POSITIONS WANTED

ACCOUNTANT, auditor, thoroughly competent, twenty years' experience electric, gas, water and street railway. Go anywhere. Address PW-430, Elec. World, 10th Ave. at 36th St., New York City.

AS GENERAL line foreman, American, married, now with large corporation, wishes to make change. Have had 20 years' practical experience, 15 years of that time having full charge electrical construction and maintenance department; available within 30 days. PW-446, Elec. World, 10th Ave. at 36th St., New York City.

AS LINE foreman, first class electric light or trolley construction and maintenance man; can take full charge electric distribution or construction department; married. Only regular maintenance job considered. PW-458, Elec. World, Real Estate Trust Bldg., Philadelphia, Pa.

AS RAILWAY substation operator by an ambitious student of the International Correspondence Schools; at present employed; age twenty-two, married. PW-457, Elec. World, Leader-News Bldg., Cleveland, Ohio.

EXECUTIVES

Qualified men Technical, Commercial and Manufacturing—seeking new positions find our effective and confidential service extremely satisfactory. Our Mr H. H. Harrison can negotiate a suitable connection for you as he has done for thousands of others since 1909. Inquiries invited; confidences respected.

THE NATIONAL BUSINESS BOURSE, Inc.
Confidential Negotiators
Association Building, Chicago

BE A METER ENGINEER

Get in the new profession. We can teach you meter engineering *by mail* at your own home during spare time. Successful graduates everywhere.

Earn $3,600.00 a Year.

Central stations *must have Electrical Meter Engineers*. They pay high salaries. *Write today.* Put your name and address on a postal and we will send you full particulars free. Ft Wayne Correspondence School, Dept 16, Ft Wayne, Ind.

POSITIONS WANTED

AUDITOR. Broad experience as chief accounting officer with representative utility interests, now engaged on important work for Federal Government, desires connection with progressive utility, as auditor, secretary or treasurer. PW-419, Elec. World, Real Estate Trust Bldg., Phila., Pa.

BY YOUNG married man; technical education; ten years' experience on line, sub and central station, construction steam and hydro; will go anywhere. PW-469, Elec. World, 10th Ave. at 36th St., New York City.

ELECTRICAL engineer and executive, married; age thirty-three; seven years' experience in power plant engineering, design, construction and sales; best of references; available 30 days; minimum salary $3,300. PW-460, Elec. World, Old Colony Bldg., Chicago, Ill.

ELECTRICAL foreman, in charge installation and operation substations, mining and milling equipment, industrial motors, available after Jan. 1; age thirty, single; references to any past employer. PW-456, Elec. World, Rialto Bldg., San Francisco, Calif.

GRADUATE mechanical engineer, thirty-four years old, with good operating, construction and executive experience desires position as superintendent of power, or mechanical superintendent in medium sized works; or that will lead to similar position in large company. Would consider public utility. Assoc. Mem. A. S. M. E. Northeast preferred. PW-426, Elec. World, Real Estate Trust Bldg., Phila., Pa.

POSITIONS WANTED

EXECUTIVE with initiative, tact and proved administrative ability solicits correspondence, 20 years with some of most progressive gas and electric organizations in America and hence in touch with most approved practice in both fields. Special studies and extended experience in advertising, publicity, organization, systematizing, salesmanship, managing sales campaigns, contract drafting, rate designing, cost analysis, security sales and plant management. Also familiar with utility commission practice. Character, record and references an "open book." PW-468, Elec. World., 10th Ave. at 36th St., New York City.

SALES engineer and executive, thirty-two, technical training, available Jan. 1; fourteen years' experience on manufacturing, statistics and selling batteries, railway electric equipment, electric motors and generators and machine tools; good merchandiser and salary secondary item. PW-462, Elec. World, 10th Ave. at 36th St., New York City.

SUPERINTENDENT Public Utilities; technical, 20 years installing and operating various station equipments, railway, electric, water and gas utilities. PW-421, Elec. World, Old Colony Bldg., Chicago, Ill.

REPRESENTATIVES WANTED

New England District Representative

A responsible long established firm making a complete line of direct and alternating current control apparatus wants an active experienced salesman as representative in the New England territory with headquarters in Boston. Position offers permanent connection with very good opportunities. RW-441, Elec. World, Old Colony Bldg., Chicago, Ill.

EDUCATIONAL

Keystone Institute

"The service school." A fully equipped school organized to give intensive instruction in 2-year courses electrical engineering, mechanical engineering, accounting and business administration, 16 weeks' course in automotive engineering. Day and night classes. Graduates sought by industrial establishments in all sections of country. Write for information on subject that interests you, to Keystone Institute. Address Associate Principal, 133 North 4th Street, Reading, Penn.

FOR SALE

An exceptional opportunity is offered to acquire the

Completely Equipped Plant and Good Will of an Established Electrical Manufacturing Company

with a national reputation for making the highest grade of product, and known to practically every large public service company in the country.

The entire business may be purchased outright or a portion of the capital stock.

Address: BO-471, Electrical World, 10th Ave. and 36th St., New York.

Make Replaced Equipment Help Pay For The New

- ***Engines***
- ***Generators***
- ***Motors***
- ***Transformers***
- ***Boilers***
- ***Transmission Equipment***
- ***Pumps***
- ***etc. etc.***
- ***Single items or complete plants***

You can find quick buyers for your replaced equipment, if it still is in good operating condition, through the

Searchlight Section
of
Electrical World

Careful buyers recognize that the *Searchlight Section* is the best medium for locating good used equipment of all kinds.

Let "Searchlight" Help You

EW-1

INVESTMENT BANKERS are offered
POWER and LIGHT SECURITIES

issued by companies with long records of substantial earnings.
We extend the facilities of our organization to those desiring detailed information or reports on any of the companies with which we are identified.

ELECTRIC BOND AND SHARE COMPANY
(Paid-up Capital and Surplus, $29,000,000)
71 Broadway, New York

Public Utility and Industrial Financing

SECURITY issues of Public Utility and Industrial companies underwritten and distributed in any amount. We are pleased to consult with established companies requiring money for the purpose of expansion, the acquisition of new properties or the reduction of obligations. Address correspondence to Mr. Burton French.

HOAGLAND, ALLUM & CO.
Incorporated
(*Established* 1909)
NEW YORK, 115 Broadway
14 So. La Salle St., CHICAGO

Utility and Industrial Financing

We underwrite and distribute securities in any amounts on the properties of public utility and industrial corporations. Our extensive facilities insure promptness and complete service.

Ray & Company, Inc.
108 South La Salle St.
Chicago, Ill.

PUBLIC UTILITY
and
Industrial Financing

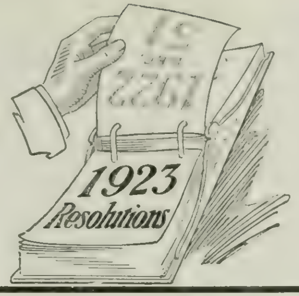
companies will find that their advertisements in the pages of the Electrical World reach a responsive reader.

The
COAL & IRON
NATIONAL BANK

143 Liberty Street
New York

Capital and Surplus
$2,500,000.00

Member
N. Y. Clearing House
Federal Reserve Bank



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Is a good one for Wire Users

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Manufacturing Company

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2300 South Western Avenue
Chicago

Magnet Wire and Tape Departments
4625 West Vanburen Street
Chicago

Eastern Office and Warehouse, Metuchen, N. J.

Americore

RUBBER COVERED WIRE
for INTERIOR WIRING

Highest Standard of Excellence
Send for descriptive book

American Steel & Wire Company
Chicago - New York

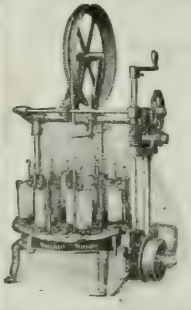
Uniform Gauge

of Enamel or Cotton Insulation.

Thorough Inspection
Each spool carries an individual inspection number.

Shipment from Stock
Quick delivery of American Magnet Wire is assured. Write for prices.

The American Enameled Magnet Wire Co.,
Muskegon, Mich.



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For Covering Wires

Machinery for INSULATING

Wires and Cables With Rubber or Tape

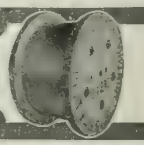
Cabling, Stranding, Twinning, Polishing, Taping, Winding and Measuring Machines.

New England Butt Co.
Providence, R. I.

SEAMLESS RUBBER SAFETY INSULATIONS

SAFETY INSULATED WIRE & CABLE CO.

114 Liberty Street. NEW YORK
CHICAGO BOSTON
SAN FRANCISCO



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Copper Wire
111 W. Washington St., Chicago

INTERIOR CONDUITS

American Circular Loom Co.

AMERICAN CIRCULAR LOOM CO. TRADE MARK

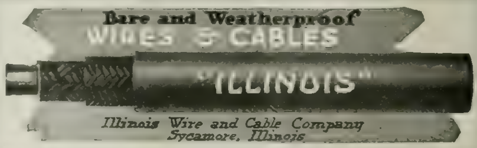
90 West Street
New York

Boston Los Angeles Seattle
Chicago San Francisco Toronto

SILK

For Electrical Purposes
Silk for Insulating Finest Wire
ALL KINDS BRAIDING SILK

William Ryle & Co., 225 Fourth Ave., Cor. 18th St.
New York City



Illinois Wire and Cable Company
Sycamore, Illinois

EST. 1855 AIMCo INC. 1915

"American" Insulating Machinery Company

REG. U.S. PAT. OFF.

Philadelphia Pennsylvania U.S.A.

MACHINES FOR

DRAWING
MEASURING
RESPOOLING
SATURATING
RECLAIMING
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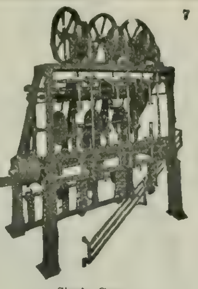
VULCANIZING
TAPING
TWINNING
CABLING
STRANDING
INSULATING

OF WIRE



Single Cover TAPING MACHINE for 3 Lines of Wire.

"American Brand"

Weatherproof Wire and Cables,
Bare Copper Wire and Cables

has no equal for long, satisfactory economical service.

TRADE MARK
"AMERICAN BRAND"
WEATHERPROOF WIRE AND CABLES
HAS NO EQUAL

American Insulated Wire and Cable Co.
21st, Sangamon and Morgan Sts., Chicago

DUDLO *Magnet Wire and Windings*

DUDLO

have for over twelve years been standard among electrical manufacturers due to their dependable quality and reasonable price. Find out the economy and improvement we can effect for you.

Write today for prices and samples.

Dudlo Manufacturing Company, Fort Wayne, Indiana

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"COPPERWELD"

TRADE MARK REG. U.S. PAT. OFF.

MADE BY THE MOLTEN WELDING PROCESS

WIRE and STRAND
(Bare and Weatherproof)
TWISTED PAIR
GROUND RODS
NAILS

Technical data and Wire Tables on request.

COPPER CLAD STEEL COMPANY

NEW YORK SALES OFFICE
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MAIN OFFICE AND WORKS BRADDOCK P.O. RANKIN, PA

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Blake Insulated Staples

Unequalled for telephone and bell wiring. The fibre insulation prevents troublesome short circuits and grounds. 4 sizes. Pat. Nov., 1900. Write for Samples.

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Boston, Mass.

VULCANIZED FIBRE

Be Sure to Specify

"Wilmington Fibre"

Sheets Rods Tubes
Special Shapes for Insulation Purposes
"FYBEROID"

Wilmington Fibre Specialty Company
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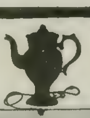

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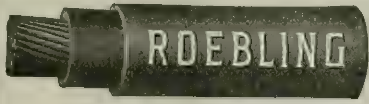

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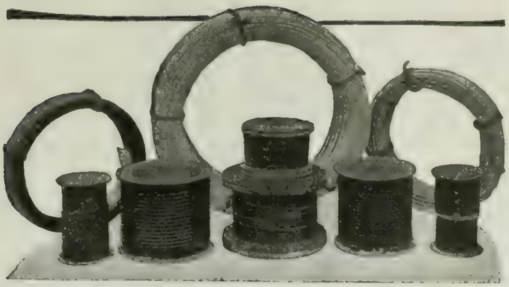

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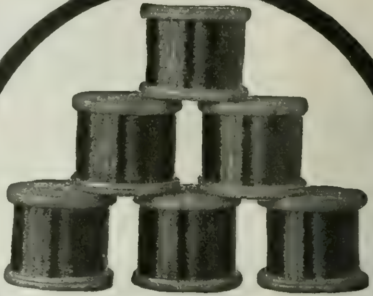

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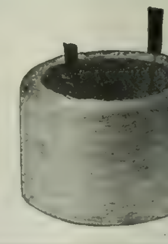

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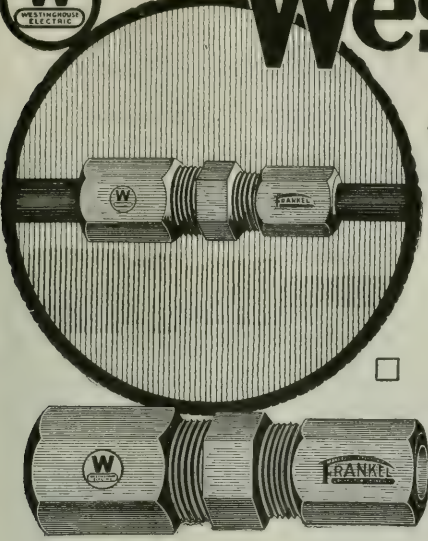

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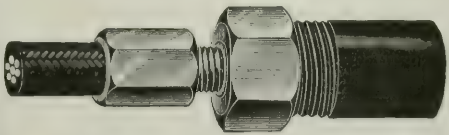

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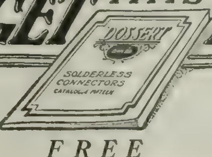

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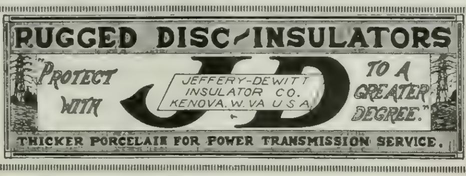

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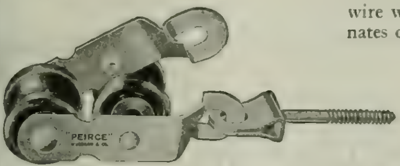

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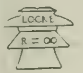

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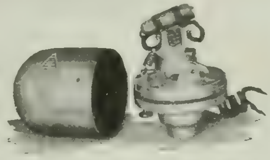

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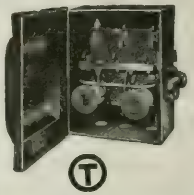

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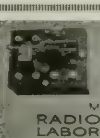

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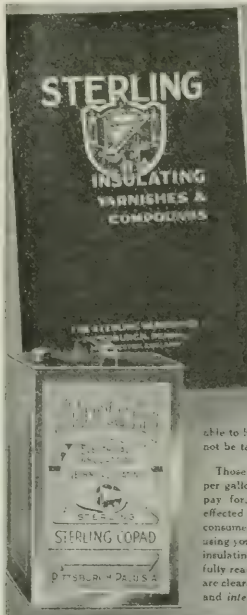

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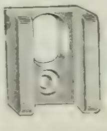

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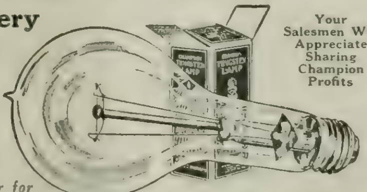

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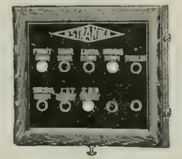

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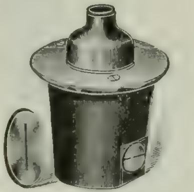

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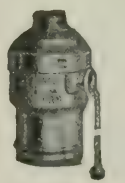

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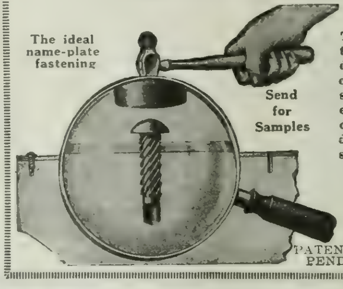

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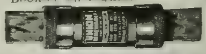

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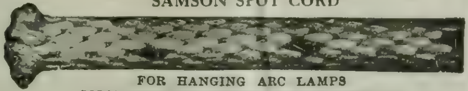

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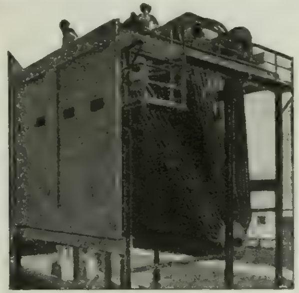

This picture shows a 1058-H.P. unit at Andrews Steel Co., Newport, Ky.

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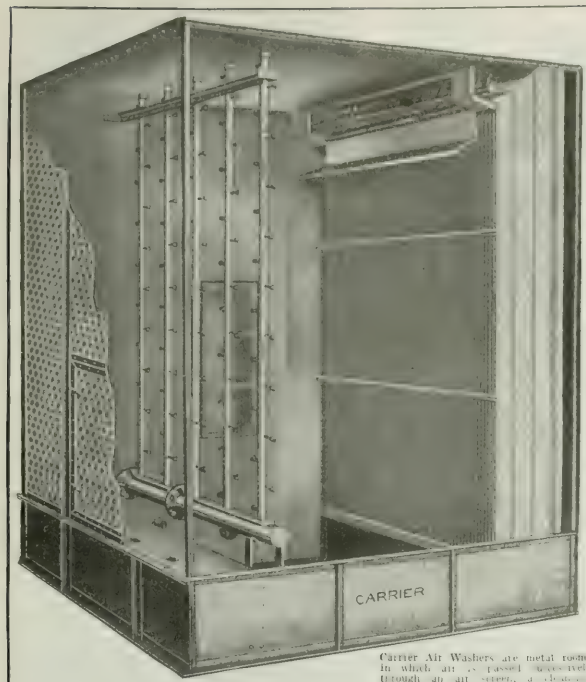

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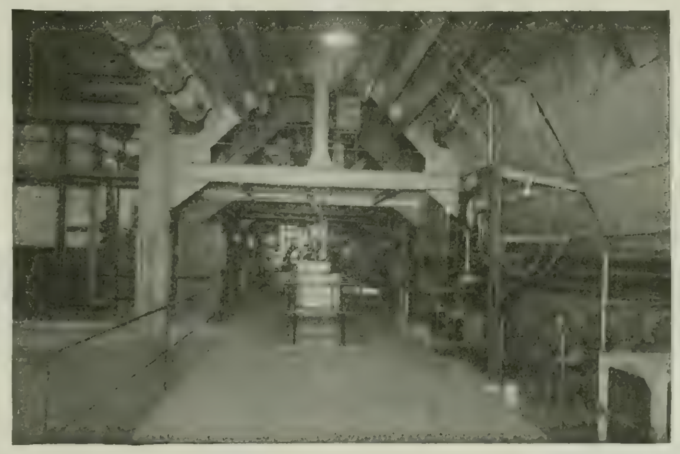

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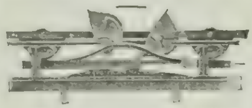

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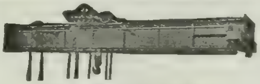

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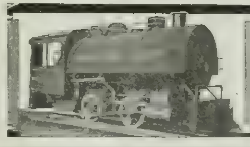

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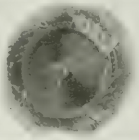

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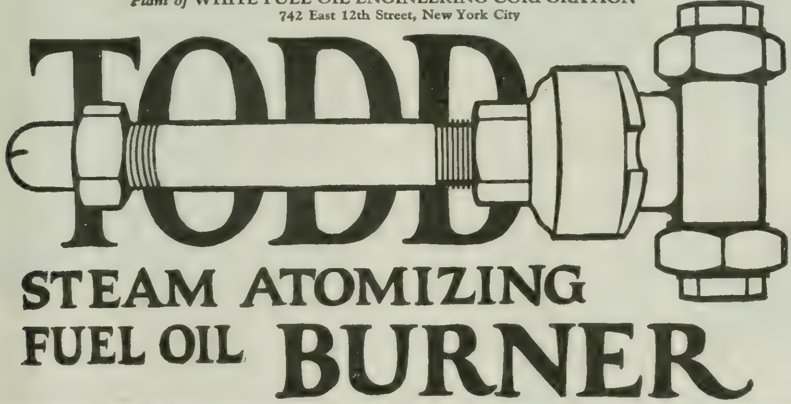

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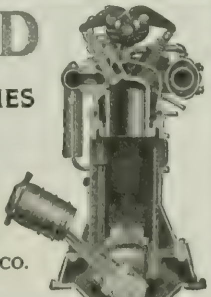

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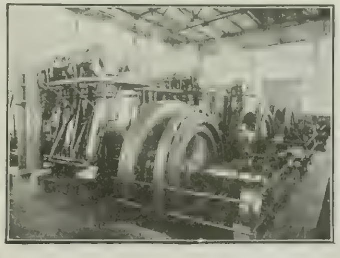

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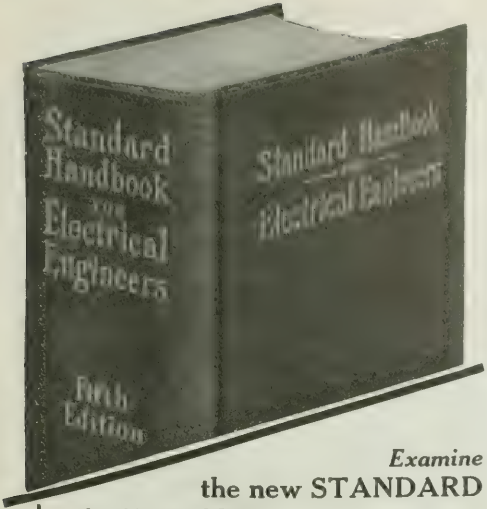
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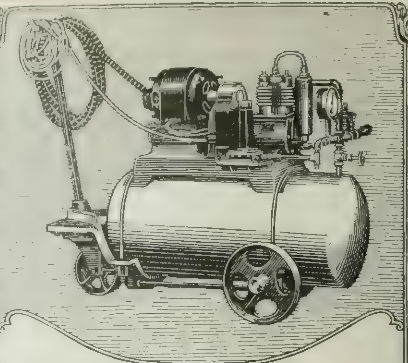

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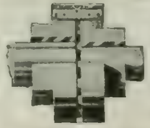

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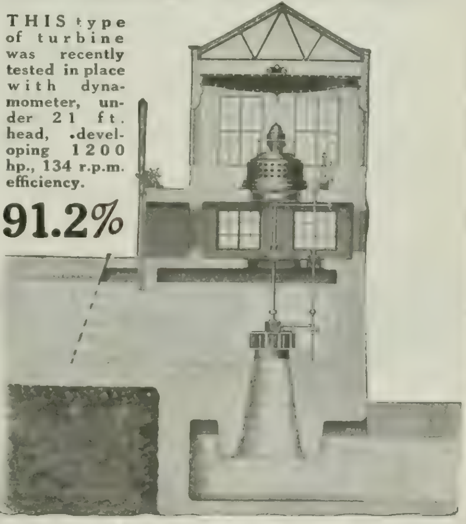

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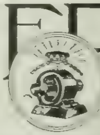

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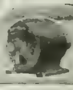

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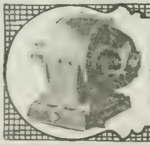

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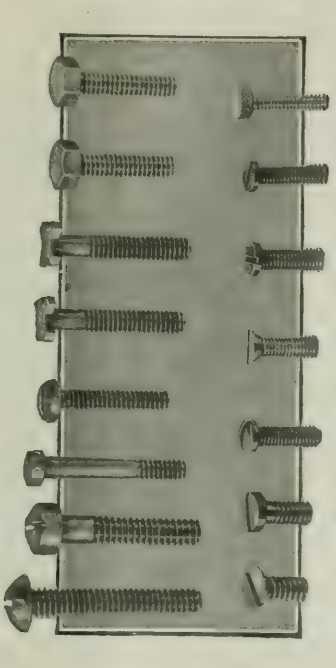

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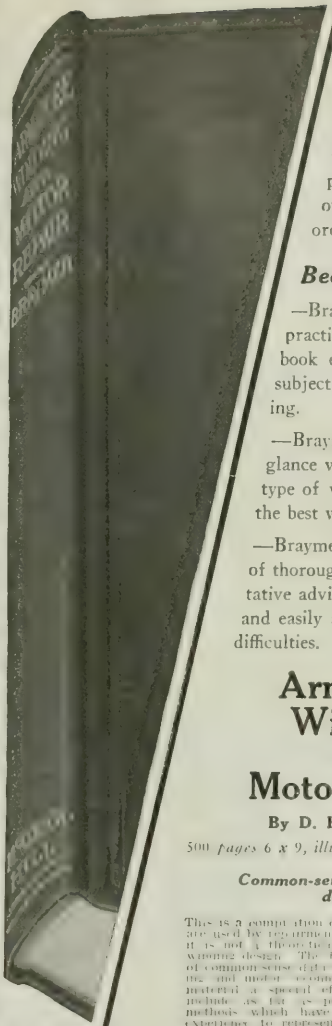

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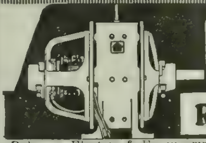

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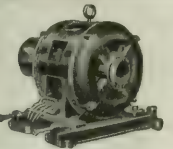

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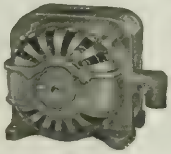

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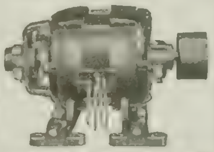

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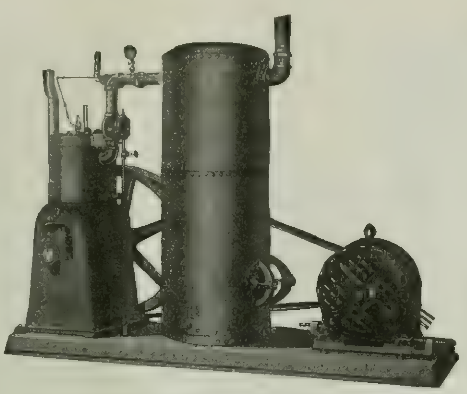

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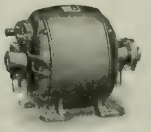

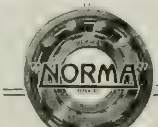

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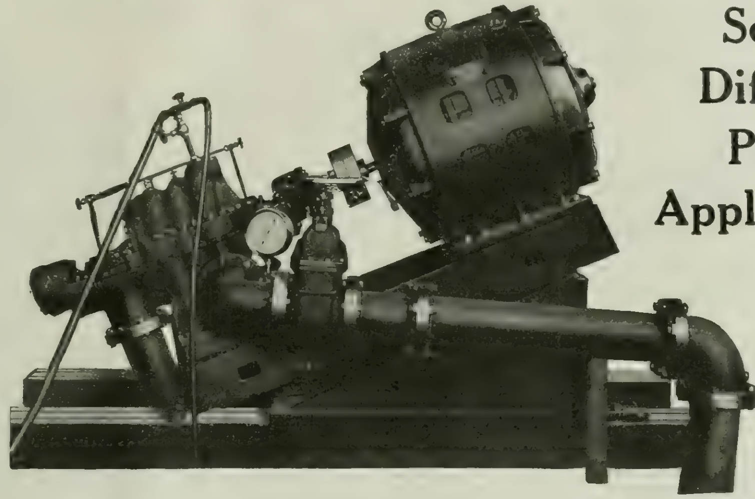

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